IJUDUDL
International Journal for Universal Design and Universal Design for Learning

From education to the workplace: Designing for Inclusive Learning through Partnerships

April
Volume 1
Issue 2

From Education to the Workplace: Designing for Inclusive Learning through Partnerships

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Editor's Foreword

DOI: https://doi.org/10.34874/PRSM.ijududl-vol1iss2.10158

Welcome to the second issue of Volume 1 of the *International Journal of Universal Design and Universal Design for Learning*, with the title of "From Education to the Workplace: Designing for Inclusive Learning through Partnerships." This fully open-access journal is made possible through generous in-kind contributions from the Ministry of Education of Morocco, Ibn Zohr University (Morocco), University of Worcester (UK), and the INCLUDE Collaboratory. We offer education professionals around the world the opportunity to submit and publish works focused on the integration of universal design and universal design for learning, without the barrier of cost. This opens up opportunities for professionals from developed **and** developing countries worldwide to share their research, best practices, and professional opinions with the field. It also removes the barrier of cost that so many educators face when trying to access well-researched professional content. If we are truly going to achieve equal access to education worldwide, the move to expand open-access content must continue – and we are so pleased to be a part of this movement.

In this second issue, many themes have emerged.

In research, we discover how professional learning communities in Northern Ireland and the Republic of Ireland supported UDL implementation, with considerations for scaling to other contexts. We also consider the results of a survey study of inclusive practices by Irish higher education staff and the impacts of implementing UDL in an Irish primary classroom. We explore considerations for implementing artificial intelligence and other assistive technologies to promote educational equity in Morocco, as well as the perceptions of neurodivergent Moroccan university students regarding their use. We learn about the process of the recently updated UDL Guidelines 3.0 and their applications to research and practice. We delve into the use of visualisation strategies for sensemaking and knowledge co-construction, and how UDL strategies can support students with Attention-Deficit/Hyperactivity Disorder (ADHD). Finally, we consider a qualitative inquiry into UDL implementation in the West Midlands of England.

In best practice, we learn much more about recent UDL applications in education around the world. From Australia, we learn how UDL has been used to enhance educators' inclusive, reflective teaching practices through strengths-based audits. From Ireland, we discover the student-centred teaching methodology of Drama in Education as a medium supporting the practical implementation of UDL in the classroom. From USA and international colleagues, we learn numerous ways in which UDL can and has informed project-based makerspace education. Finally, again from the Emerald Isle, we are introduced to an innovative approach from the field of nursing for co-designing UDL-

informed learning guidelines to enhance the experiences of nursing students in their practice placements.

Our professional opinion articles offer the views of experienced educators as they consider the relationship of UD and UDL across the field of education. In this issue, these professional views help us consider the relationship between UDL and AI for those with special educational needs, the relationship between UDL and project management across fields, and the potential of a UDL-informed approach to better guide our peer review processes.

We hope that you will enjoy reading this collection of articles, all of which strive to enhance and elevate knowledge and understanding of UD and UDL internationally across the field of education. We extend a special thanks to our dedicated team of Co-Editors and Associate Editors, who have made valuable contributions through their guidance and insights in growing this journal. We are also grateful to the *IJUDUDL* reviewers for their thoughtful feedback and evaluations of the manuscripts, which have improved the quality and clarity of the work presented in this issue.

Thank you for your readership.

Mustapha Aabi, Seán Bracken, Elizabeth Dalton, and Susie Gronseth

Editors of the *International Journal of Universal Design and Universal Design for Learning*

IJUDUDL
International Journal for Universal Design and Universal Design for Learning

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Amplifying Global Messages from a Small Island: Building Capacity for Inclusion with Universal Design for Learning (UDL) and Teacher Professional Learning

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DOI: https://doi.org/10.34874/PRSM.ijududl-vol1iss2.6694

ABSTRACT

This paper examines the role of structured professional learning communities in facilitating the implementation of the Universal Design for Learning (UDL) framework and digital technology in Northern Ireland and Republic of Ireland. Using a cross-border professional learning initiative, this research explored how collaborative and flexible professional learning structures developed educators' professional competence and confidence to embed UDL effectively within their classrooms. The study investigates how these professional development structures supported teacher engagement, fostered digital competence, and promote reflective practices that address the diverse needs of learners. Recommendations for policymakers and educational leaders are provided, alongside a discussion on the challenges and implications of scaling these structures within diverse educational contexts within and beyond Ireland.

Keywords:
universal design for learning (UDL), teacher professional learning, digital tools and competence, teacher collaboration

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There is a longstanding transformative potential for digital technologies to bridge educational divides and promote collaborative learning across the island of Ireland and beyond (Austin & Anderson, 2008). In their analysis of digital education on the island of Ireland Austin and Anderson underscored how technology could create networks that enable cross-border cooperation and foster inclusivity. Building on their foundation, this paper examines a structured, professional learning programme that leveraged Universal Design for Learning (UDL), communities of practice (CoPs) and digital technologies to extend inclusive practices into classrooms across Northern Ireland and the Republic of Ireland.

UDL provides a framework for designing accessible and flexible learning environments that respond to the variability of all students (CAST, 2018; Meyer, Rose, & Gordon, 2014). Beyond a technical guide, it is increasingly framed as an equity-oriented pedagogy, offering principles and guidelines that support proactive rather than reactive approaches to inclusion (Florian, 2015; Rao et al., 2023). By integrating digital technologies into UDL-aligned practice, educators can enhance engagement and inclusion, ensuring that all learners can participate in meaningful and challenging educational experiences (King-Sears et al., 2023). Professional learning opportunities that develop understanding, competence, and confidence in UDL are therefore essential in enabling teachers to move from espoused values of inclusion to embedded, sustained classroom practice (Opfer & Pedder, 2011).

Collaboration and cross-cultural professional learning also play a vital role in sustaining teacher change. Professional CoPs (Wenger, 1998) create spaces where teachers co-construct knowledge, challenge assumptions, and build collective responsibility for inclusion (Bolam et al., 2016; Kennedy, 2014). In divided or cross-jurisdictional contexts, such as the island of Ireland, collaboration is both pedagogical and political, requiring teachers to navigate systemic and cultural differences while working towards shared professional goals (Austin & Anderson, 2008; Clarke, 2008).

In this paper, digital technology refers to mainstream information and communication technologies, including general-purpose devices and applications such as computers, mobile devices, and online applications, used to support teaching and learning (Bates, 2015; Selwyn, 2016). This is distinct from assistive technology, which comprises specialised devices and applications designed specifically to enhance the functional capabilities of learners with disabilities (World Health Organization, 2022).

Recent research shows that digital technologies can break down traditional educational barriers, enabling connection between educators and learners across

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geographic and cultural divides, promoting educational equity and global access (Timotheou, 2022; Gottschalk & Weise 2023; Mohiyeddini, 2024). Similarly, UDL is a framework for teaching and learning that guides educators in the creation of accessible and flexible learning environments that address the variability of all students. By integrating digital technologies into the UDL framework, educators can enhance engagement and inclusion (King-Sears, 2020), ensuring that all learners can access and participate in meaningful educational experiences.

The structured, UDL professional learning programme included workshops, collaborative learning communities, and reflective practices to equip educators with the tools and strategies necessary to foster inclusive classrooms. By embedding the UDL framework within a professional learning framework, the programme realised Austin and Anderson's (2008) vision of leveraging digital education to create connected, equitable learning spaces.

Through an analysis of this professional development initiative, this study highlights how structured and collaborative learning opportunities encouraged teachers to shift their preconceived values about learner variability to orientations that lend to the integration of UDL guidelines and digital tools. This shift shows how the principles of digital connectivity and professional collaboration can be leveraged to encourage teachers to embrace variability in education. This work also offers insights into scaling such initiatives, ensuring that inclusive education moves from theoretical ideals to practical applications across the island of Ireland.

Teacher Professional Learning in UDL

UDL is increasingly recognised as a cornerstone for inclusive pedagogy, offering educators a proactive framework for addressing learner variability. Originating from CAST (2018), UDL comprises principles and guidelines that support flexible curriculum design to ensure that all learners can access and engage with meaningful learning opportunities (Meyer, Rose, & Gordon, 2014). Scholars highlight that effective professional learning in UDL requires teachers to shift from viewing inclusion as differentiation for some learners to understanding it as anticipatory design for all (Florian & Black-Hawkins, 2011; Rao et al., 2023). This reorientation demands not only technical knowledge of UDL but also confidence and competence to embed inclusive practices within daily teaching in collaboration with others.

Professional development that centres on UDL is most impactful when iterative, reflective, and situated in teachers' contexts. Opfer and Pedder (2011) emphasise that teacher change is shaped by the interaction between beliefs, knowledge, and practice; thus, UDL-focused professional development (PD) must simultaneously

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challenge teachers' assumptions about learner variability and equip them with strategies to act upon these beliefs. Such approaches echo Schön's (1983) notion of the reflective practitioner and Mezirow's (2000) theory of transformative learning, both of which stress the importance of critical reflection in enabling teachers to reconsider their professional identities.

Without these elements, teachers' knowledge of UDL often remains superficial, framed as ad hoc accommodations that are tied to the UDL principles and guidelines, rather than an orientation to toward teaching and learning that is committed to structural and equitable curricular design (Florian, 2015). Crevecoeur et al. (2014) described UDL as transdisciplinary in nature and affords integration of other professional development innovations and initiatives, such as teaching practices, learning sciences, and technology tools, to be better organised for easier implementation.

Teacher Professional Learning in Technology for Inclusive Practices

The integration of digital technologies is widely recognised as a mechanism for advancing inclusion, providing diverse learners with multiple means of engagement, representation, and expression that align with UDL principles (Meyer et al., 2014). Broader scholarship positions technology not merely as a tool but as a catalyst for transforming inclusive pedagogies (Darling-Hammond & Richardson, 2009). Teacher professional development initiatives in technology are most effective when grounded in pedagogical frameworks (Chugh et al., 2023; Lamtara, 2023), for example UDL, ensuring that digital tools enhance rather than replicate traditional practices.

Research shows that iterative, needs-based PD supports teachers (King, 2016; Eteläpelto et al., 2013) in building both technical competence and inclusive dispositions, helping them, through agency, to reconceptualise variability as an opportunity for innovation. Moreover, digital professional learning environments enable teachers to engage in flexible, blended forms of training, extending opportunities for experimentation and reflection (Bolam et al., 2016). In this way, technology-rich UDL PD serves a dual function: advancing digital competence and cultivating more inclusive mindsets.

Collaborative, Cross-Cultural Professional Learning

Collaborative professional learning has long been identified as a driver of sustainable pedagogical change (Wenger, 1998). Wenger characterised CoPs using three elements that come together to characterise the work within communities: (a) mutual engagement, (b) joint enterprise, and (c) a shared repertoire. CoPs

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allow teachers, through joint conventions and pooled resources, to co-construct knowledge, share expertise, and collectively address the challenges of inclusion (Kennedy, 2014; Bolam et al., 2016). Darling-Hammond, Hyler, and Gardner (2017) argued that effective PD is collective, practice-focused, and sustained over time. These features are central to CoPs and are how professional development leads to practice that is known, shared, and changed through social interactions that are embedded in collaborative learning structures. (Little, 2002).

Cross-cultural and cross-border professional learning adds further depth by exposing teachers to alternative systems, practices, and values, prompting reflexivity and broadening professional horizons. Clarke (2008) demonstrated how such encounters can reshape teacher identity, while Austin and Anderson (2008) highlighted how digital collaboration across the island of Ireland fosters inclusivity by bridging socio-political divides. International evidence suggests that when teachers engage in cross-cultural inquiry, they not only acquire new strategies but also develop professional agency to lead change and advocate for inclusive education (Eteläpelto et al., 2013; Florian, 2015). Such collaborations provide teachers with a shared language, often grounded in transdisciplinary frameworks like UDL, that enables them to connect across subject areas, contexts, and national boundaries.

Methods

Design

The aim of this research was to explore the research question: to what extent does collaborative, cross-cultural teacher professional learning on UDL and digital technologies facilitate teacher change in knowledge, practice and attitudes of inclusive practices? Ethical approval for this study was obtained by XXX University's Center for the Protection of Human Subjects. Convenience sampling was used as most of the group of teacher participants were pre-selected based on their participation in a previous cross-border CoP project and interest in continuing in another programme. Participants were informed about the research in advance of the programme start date via email through information and consent forms. Consent was also reconfirmed at the beginning of the programme and as different aspects of data were collected. It was explicitly stated at these times that not participating or withdrawing from the research would not impact the participant's outcomes in relation to the programme.

There were twelve teacher participants, six teaching in schools in Northern Ireland and six teaching in the Republic of Ireland. Five participants were primary school mainstream teachers, four were secondary mainstream teachers, one was a

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primary school principal and two were special education teachers, one of whom taught in a special school.

This purposeful composition of the participant group reflected the initiative's emphasis on inclusivity and diversity, enabling insights into how UDL and digital pedagogies might be enacted across different school types and roles. It also ensured that findings would capture multiple perspectives on professional learning, reflecting Opfer and Pedder's (2011) assertion that teacher change is shaped by the interaction of beliefs, knowledge, and practice across varied professional contexts.

The research question and aims of this research warranted a case study approach with the goal to evaluate, explore, and explain the impact of this cross-border collaborative professional development initiative on teacher participants knowledge, beliefs, and attitudes. Data were collected sequentially throughout the duration of the professional development and included surveys, participant reflections, and artefacts (see Figure 1).

Figure 1: *Data collection sequence*

Pre- and post-surveys on teachers' attitudes and practice in relation to UDL (Flood, 2025), technology (Taggart & Roulston, 2024) and a non-normed collaboration skills survey used to gather quantitative and qualitative data on changes in teachers' attitudes and practice because of the programme. Teacher participants' weekly reflections through the professional learning programme served the purpose of observing progress and of supporting teacher participants through feedback on their reflections. At the end of the programme teacher participants submitted their artefacts in response to their final project, also presenting on this to their peers.

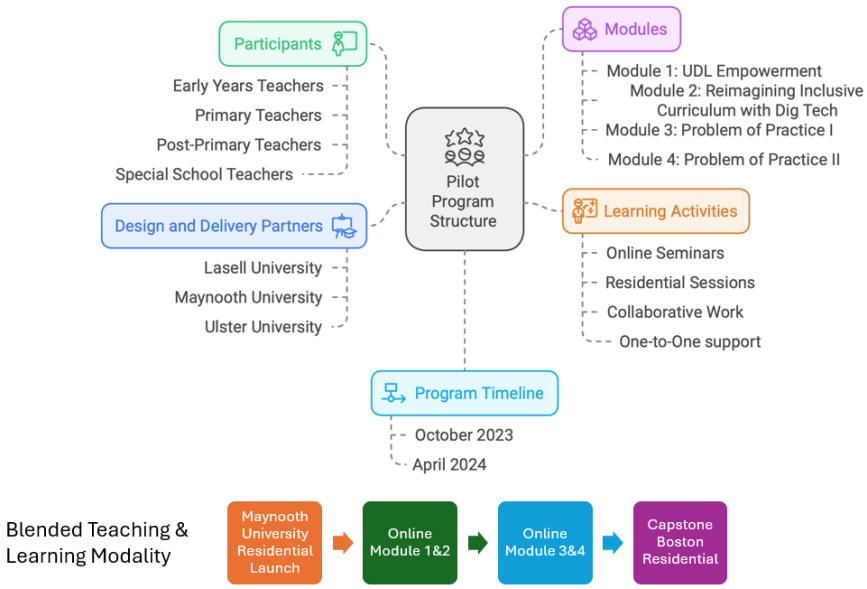
Professional Development Pilot Programme Design

Planning for professional development can improve teachers' outcomes (King, 2016). This pilot programme (see Figure 2) was designed based on teacher

participants' expectations and needs, thus taking an iterative approach. For example, the teachers in the pilot met with the faculty leading the programme prior to launch to discuss their professional development needs, the characteristics of their schools and students, and the challenges they wanted support to improve. The nature and design of the programme took into consideration the following key research and frameworks:

- Collective professional inquiry to learning (Kennedy, 2014)
- The characteristics of professional learning communities (Bolam et al., 2016)
- The three elements of belief, knowledge, and practice (Opfer & Pedder, 2011)
- The teacher professional development planning framework. (King, 2016)

Figure 2: *Pilot Programme Structure and Components*



The programme design was led by the authors of this manuscript, representing three institutes of higher education in three countries: Republic of Ireland, Northern Ireland, and the United States, in collaboration with additional governmental and non-profit stakeholders. The professional learning programme began in September with a three-day intensive residential session convening the teachers and programme designers learning together in-person.

After the residential component, the programme leveraged online technologies, such as a learning management and video conferencing software, to support professional learning. All participants and leaders met weekly online using video conferencing for one hour, the majority of time was spent in CoPs discussing

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application of the key ideas to teaching practice. The teachers also engaged in collaborative and individual learning using the learning management platform between each synchronous video session.

The programme was organised into four online modules of 10 weeks in length. The first two modules introduced the teachers to goals focused on UDL implementation, inclusive education, curricular innovation, and digital technologies. The programme implemented the UDL framework 2.2 because it began before the launch of UDL 3.0. Each week the teachers engaged with various learning media related to module concepts prior to the weekly video meeting. After the video meeting the teachers were asked to submit a reflection that connected the key ideas, concepts, and frameworks to their practice using digital technologies and individual or collaborative means. For example, four teachers who bonded during the first residential session decided to compose weekly podcast reflections, carefully crafting questions, and rotating responsibilities for keeping track of time and recording responsibilities.

The last two modules of the programme shifted from learning about UDL, inclusive education, and digital technologies, to applying and implementing what had been learned in a final project or problem of practice. A teacher problem of practice in this programme was defined as an instructional issue related to equity and digital tools in their school, that the teacher genuinely wanted to learn more about and didn't know how to address (Henriksen et al., 2020).

Through structured problem of practice protocols, synchronous and asynchronous dialogues, data collection, analysis, action plans, and dissemination, the teachers employed principles of design thinking with their emerging understanding of UDL in their schools to address the learner variability of their students. For example, teachers were encouraged to define their problems of practice by using a UDL lens that empathised the needs of their learners and carefully defined the barriers they faced, prior to ideating solutions. The programme concluded with a 5-day residential in the United States and featured multiple opportunities for the teachers to reflect, collaborate, refine, and present their problems of practice in a symposium format.

Flexibility and iterative design were built-in to each component of the programme to ensure sessions reflected the teacher participants' needs and their professional learning goals were met.

Teacher participants were encouraged, multiple times throughout the program, to provide formative feedback to the professional development team leading the pilot programme on how to improve it and was used to iterate in real time. A hallmark

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of the programme was the explicit modelling of UDL implementation and digital technologies .

Data Collection

Data were collected sequentially throughout the programme to capture both developmental processes and outcomes. Three main sources of data were employed:

- Pre- and post-programme surveys assessed changes in teacher knowledge, practices, and attitudes relating to UDL. The surveys provided quantitative indicators of teacher change.
- Weekly reflective journals encouraged teachers to document their evolving mindsets, challenges, and classroom applications of UDL and digital strategies. These reflections served both as data and as tools for formative feedback and professional dialogue.
- Final artefacts and presentations demonstrated how teachers had addressed their identified problems of practice, which were then shared with peers to support collective reflection and knowledge exchange.

This multimodal approach to data collection was designed to provide both breadth (through surveys) and depth (through reflections and artefacts), aligning with recommendations for triangulation in educational research (Creswell & Plano Clark, 2019).

Data Analysis

Analysis of survey responses, teacher reflections, and artefacts indicated clear evidence of change across five dimensions (1) UDL knowledge; (2) UDL practice; (3) UDL dispositions; (4) technology integration; and (5) collaborative leadership. The data analysed in this study reflect a nuanced picture of professional development among teachers engaging with the UDL framework (guidelines version 2.2) in a cross-border context. Drawing on responses from 11 pre- and 10 post-survey participants, as well as a subset of eight matched individuals, the findings point to both widespread shifts in inclusive practices and more personalised journeys of professional growth. These two layers, general trend and individual trajectory, work in tandem to illustrate how structured professional learning can enable teachers to reframe not only their strategies, but their role and identity as inclusive educators.

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Findings

Changes in UDL Knowledge

Error! Reference source not found. presents an overview of participants' self-reported knowledge of UDL prior to the study. Out of the 11 participants surveyed, the majority (54.5%, or 6 participants) reported having limited knowledge of UDL. A smaller group (27.3%, or 3 participants) indicated that they had no knowledge of UDL at all. Two participants (18.2%) described their understanding as building knowledge, suggesting they had some familiarity with UDL principles, though not at an advanced level. Notably, none of the participants reported having proficient or expert knowledge of UDL, as both categories had a frequency of 0%. The data reflects a general lack of in-depth knowledge about UDL within the group, with 81.8% of participants (9 out of 11) falling into the "No Knowledge" or "Limited Knowledge" categories. Only 18.2% (2 out of 11) were in the "Building Knowledge" category, indicating a relatively low baseline understanding of UDL before the study began.

Table 1*:* 1*Pre study self-reported knowledge of UDL*

	Frequency	Percent	Valid Percent	Cumulative Percent
1 - No Knowledge	3	27.3	27.3	27.3
2 – Limited Knowledge	6	54.5	54.5	81.8
3 – Building Knowledge	2	18.2	18.2	100.0
4 – Proficient Knowledge	0	0.0	0.0	100.0
5 – Expert Knowledge	0	0.0	0.0	100.0
Total	11	100.0	100.0	

In total, 10 participants were assessed post-study, and the results show a marked improvement in UDL knowledge. In comparison to the pre-study data, where 27.3% (3 out of 11) of participants had "No Knowledge" and 54.5% (6 out of 11) had "Limited Knowledge," the post-study data shows a shift. No participants reported having "No Knowledge," and the "Limited Knowledge" category is entirely absent. This indicates that every participant gained at least some level of understanding of UDL by the end of the study, with a significant portion of them advancing to a more developed understanding. Notably, 60% of participants (6 out of 10) reported having "Building Knowledge" of UDL, a substantial increase from 18.2% (2 out of 11) observed in the pre-study data. Additionally, 40% of participants (4 out of 10) reported having "Proficient Knowledge" of UDL, a category that was previously absent in the pre-study data. The post-study data shows that no participants (0%) reported having "Expert Knowledge" of UDL,

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which aligns with the pre-study results, where no one had expert-level knowledge either.

Changes in UDL Practice

Analysis of the full dataset shows a general movement from low- and mid-frequency engagement with UDL strategies toward more consistent, embedded practices. Across the six UDL-aligned items, ranging from multimodal expression to metacognitive scaffolding, the number of "Never" and "Rarely" responses declined to zero in the post-survey. Simultaneously, "Often" and "Very often" became the most frequently selected options. This trend was not limited to any one domain but occurred across all six surveyed areas, indicating a comprehensive change in UDL practice, rather than piecemeal impact of the professional learning experience.

The eight teachers whose data could be matched across both survey timepoints offer a more detailed lens into the shape and character of pedagogical development. Among these participants, five demonstrated improvement in at least four of the six areas. Growth was not uniform, but this is to be expected in meaningful professional learning, where individual context, confidence, and starting point shape both pace and direction of change. In some cases, participants with relatively low pre-survey responses made significant gains, particularly in supporting executive functions like goal setting and planning. Others, who began at moderate levels, maintained or improved their frequency while expressing deeper intentionality in their written comments. Importantly, no matched participant showed regression in any area, indicating that the programme supported both entry-level adoption and more experienced consolidation of UDL practice.

Changes in UDL Attitudes

Analysis of UDL attitudes was found throughout the full data set and showed changes in dispositions toward inclusion and equity. The teachers' weekly reflections revealed an emergent understanding of UDL not as an interventionist strategy for 'some' learners, but as a baseline for high-quality teaching for all. One participant observed that their shift in mindset occurred when they "stopped designing for the average" and instead began asking, "what range of needs is this task ready to support?" The matched participants offered professional narratives by the end of the programme. The teachers' spoke of "trusting students to navigate choices," of "letting go of control to give room for expression," and of "being intentional about designing for everyone, not just those who struggle."

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Technology Integration

Analysis of artefacts found that all teachers offered concrete examples of technology supporting inclusion. One secondary teacher used digital platforms to enable choice in how students demonstrated understanding, while a nursery teacher adapted tools to enhance oral language development in young children. Another participant experimented with artificial intelligence to personalise learning pathways. One participant remarked in an artefact, "The [technology integration] strategies I've learned have made my classroom more inclusive and engaging for all learners, not just those with additional needs." Others noted that the programme had "completely changed" their approach to lesson design, with digital tools enabling greater flexibility in meeting diverse learner needs.

Collaborative Leadership

Analysis of teacher reflections at the end of the programme found evidence of teachers developing collaborative mindsets and developing self-efficacy in leadership capabilities. One participant observed during a collaborative reflection, "I now really enjoy discussing my progress and results with my colleagues during our weekly sessions and evaluating how far we have come together." Another added, "I love that I now have the confidence to voice my problems and obtain solutions from my colleagues who have had similar experiences. This has been both reassuring and helpful."

For many, the idea of leading professional development or advocating for change within their schools initially seemed daunting. One participant described their pre-programme experience, stating, "Before this course, I viewed myself as an inexperienced teacher. I was not confident sharing my opinions as I did not feel I had earned it or that my knowledge was deep enough to advise those more senior than me." By the programme's conclusion, this perspective had shifted, with the same participant asserting, "Now I realise the value of my experiences. Every teacher is a leader, but every teacher is also a learner." Participants also highlighted the importance of leading through collaboration and dialogue. One educator noted, "I feel that as I am learning through this course, I am building my confidence in leading training for staff and sharing ideas and best practices." This collaborative approach marked a departure from more isolated professional practices. One teacher reflected, "Before this course, I would have individually reviewed my own personal outcomes but was slower to share these and collaborate with colleagues in respect of any difficulties I came across."

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Discussion

The descriptive results of this study can be organised using four programme outcomes (1) reframing inclusion; (2) transforming practices; (3) fostering collaborative leadership through professional communities; and (4) professional identity and risk-taking.

Reframing Inclusion

2The programme catalysed a paradigm shift in how teachers understood and approached inclusivity. Many participants began with little or no awareness of UDL principles and expressed apprehension about their ability to address the diverse needs of learners. One participant candidly admitted in a pre-programme interview about their knowledge of inclusive education, “I had no clue at all!” and in their post interview went on to describe the programme as “mind-blowing.” Another remarked, “I now see all my students in a different light. They are having more opportunities and experiences thanks to UDL.”

The teachers' largest gains appeared in areas traditionally underemphasised in conventional pedagogical models: goal-setting, planning, and self-monitoring. These elements are central to UDL’s emphasis on fostering learner agency, yet can be absent in teacher education or relegated to specialist provision. That participants reported significant increases in these areas speaks to the power of the UDL framework to surface overlooked but essential dimensions of inclusive design. This cohort-level transformation suggests that UDL functioned not only as a set of pedagogical techniques, but as an organising schema through which teachers could interpret and reconstruct their practice. Prior to the intervention, many participants reported that while they “believed in inclusion,” they struggled to operationalise this belief beyond differentiation. After the programme, inclusion was increasingly framed as a question of design, a proactive process of constructing learning environments that anticipate and embrace variability.

This transformation was underpinned by UDL’s emphasis on moving beyond traditional, standardised teaching practices that are designed for an average learner at the expense of teaching all students well. As one participant explained, “It links very closely to what we do day in, day out; however, it is much more. I have loved learning about UDL.” Another noted, “This programme has completely changed my focus in the classroom.” These reflections suggest that UDL not only resonated with participants’ existing practices but also inspired a more nuanced understanding of learner variability and the need for flexible, inclusive pedagogies.

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Transforming Practices

The practical implementation of UDL principles was a defining feature of the programme, with participants successfully applying these strategies across diverse educational contexts. Teachers described how UDL enabled them to design more inclusive learning environments, often using innovative tools and approaches. For example, one teacher integrated artificial intelligence tools to personalise instruction and support student engagement, while another adapted UDL strategies to help biology students prepare for the Irish Leaving Certificate. A nursery teacher reflected on using UDL principles to address oral language development in young children, demonstrating the framework's adaptability across age groups and subject areas.

This group's reflections revealed an emergent understanding of UDL not as an interventionist strategy for 'some' learners, but as a baseline for high-quality teaching for all. One participant observed that their shift in mindset occurred when they "stopped designing for the average" and instead began asking, "what range of needs is this task ready to support?" This conceptual move, from normative design to variability-ready design, represents a paradigm shift with profound implications for teaching, planning, and assessment. Moreover, even where numerical change was modest, the matched participants offered richer professional narratives by the end of the programme. Teachers spoke of "trusting students to navigate choices," of "letting go of control to give room for expression," and of "being intentional about designing for everyone, not just those who struggle." These are not merely operational shifts, but epistemological ones: evidence that participants were beginning to think differently about what it means to teach inclusively.

The practical outcomes of these efforts were transformative. One participant reflected, "The strategies I've learned have made my classroom more inclusive and engaging for all learners, not just those with additional needs." Another noted, "This programme has been fantastic in further developing my own knowledge and understanding of UDL. It has completely changed how I approach my classroom and my students." Such reflections underscore the programme's ability to bridge theoretical frameworks and practical applications, equipping teachers with the tools to meet diverse learner needs.

Another key theme emerging from the data was the development of teachers' digital competence and their ability to align technology use with inclusive pedagogies. While pre-programme surveys revealed varying levels of confidence with digital tools, post-programme reflections highlighted more intentional use of technology to support UDL-aligned strategies. Teachers described how digital tools

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were no longer seen as add-ons but as integral to designing flexible and engaging learning environments.

These outcomes illustrate how technology, when integrated with UDL principles, bolstered teacher confidence and extended opportunities for learner engagement, and agency. In addition, these outcomes resonate with findings in the literature that digital competence, when framed by inclusive pedagogy, enhances both practice and professional identity.

Fostering Collaborative Leadership through Professional Communities

Collaboration emerged as a central feature of the programme, with the CoP providing a vital space for reflective dialogue and collective learning. Participants consistently praised the CoP as a supportive environment where they could share experiences, seek advice, and co-develop solutions to challenges. One participant observed, “I now really enjoy discussing my progress and results with my colleagues during our weekly sessions and evaluating how far we have come together.” Another added, “I love that I now have the confidence to voice my problems and obtain solutions from my colleagues who have had similar experiences. This has been both reassuring and helpful.”

This collaborative approach marked a departure from more isolated professional practices. One teacher reflected, “Before this course, I would have individually reviewed my own personal outcomes but was slower to share these and collaborate with colleagues in respect of any difficulties I came across.” Through the CoP, participants cultivated a culture of shared accountability and mutual support, enabling them to draw on the collective expertise of their peers to address challenges more effectively.

Participants also highlighted the importance of leading through collaboration and dialogue. One educator noted, “I feel that as I am learning through this course, I am building my confidence in leading training for staff and sharing ideas and best practices.” The programme’s emphasis on professional reflection and communal learning appeared instrumental in enabling teachers to step into leadership roles, fostering a sense of empowerment and agency in their professional contexts, reflecting the ultimate goal of UDL implementation. The programme’s emphasis on professional reflection and communal learning appeared instrumental in enabling teachers to step into leadership roles, fostering a sense of empowerment and agency in their professional contexts, reflecting the ultimate goal of UDL implementation. Through the CoP, participants cultivated a culture of shared accountability and mutual support, enabling them to draw on the collective expertise of their peers to address challenges more effectively.

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Professional Identity and Risk-Taking

The programme encouraged participants to reflect critically on their professional identities as both educators and learners. Teachers frequently noted how the experience inspired them to embrace risk-taking and innovation in their practices. One participant reflected, "If I am to really uphold the principles of action and expression (a UDL principle), I am going to have to get messy and loud. Their energy in producing the work must now be matched in my energy of gathering their work from all the different platforms!" This willingness to experiment and adapt was echoed by others, who described the programme as an opportunity to reimagine their roles within the classroom and beyond.

The programme played a critical role in fostering leadership capabilities among participants that led to changed professional identities. For many, the idea of leading professional development or advocating for change within their schools initially seemed daunting. One participant described their pre-programme experience, stating, "Before this course, I viewed myself as an inexperienced teacher. I was not confident sharing my opinions as I did not feel I had earned it or that my knowledge was deep enough to advise those more senior than me." By the programme's conclusion, this perspective had shifted, with the same participant asserting, "Now I realise the value of my experiences. Every teacher is a leader, but every teacher is also a learner. It's important to communicate our experiences, both what worked well and what did not, so that we can learn from each other."

Taken together, the findings illustrate a multi-layered picture of professional learning. At a cohort level, teachers demonstrated measurable gains in UDL knowledge and self-efficacy, as well as more consistent implementation of inclusive practices. At an individual level, reflections revealed deeper changes in mindset, confidence, and professional identity.

The integration of technology, grounded in UDL principles, emerged as a powerful enabler of inclusion, while the collaborative, cross-cultural structure of the CoP provided the conditions for sustained professional growth. These findings suggest that it was not UDL, technology integration, or CoPs in isolation that drove change, but rather their integration within a structured and supportive professional learning framework. Teachers developed new repertoires of practice, greater confidence in their professional agency, and more nuanced understandings of inclusion as design rather than differentiation as a response.

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Limitations and Reflexive Positioning

It is essential to reiterate the limitations of this study. The small sample size, the inability to match all participants across both surveys, and the reliance on self-reported measures mean that findings should be interpreted as illustrative rather than conclusive. Furthermore, the increased post-survey scores may reflect growing awareness and optimism more than entrenched practice. However, by foregrounding teachers' voices and embedding their words within the analysis, the findings gain contextual richness. The data serve not to prove impact, but to demonstrate the ways in which professional learning can provoke reflection, encourage experimentation, and reorient pedagogical values.

This programme demonstrated impacts on teacher engagement, professional growth, and the adoption of inclusive educational practices. Over a seven-month period, participants engaged actively in programme activities, with a notable emphasis on the collaborative interactions fostered by the cross-border Community of Practice (CoP). The CoP became a cornerstone of the initiative, facilitating the exchange of ideas, problem-solving, and the co-construction of knowledge among educators and facilitators from Ireland, Northern Ireland, and the United States. Key emergent themes highlight transformative shifts in professional identity, collaboration, leadership, and pedagogical approaches.

Conclusion

This study examined the impact of a cross-border professional learning initiative that integrated Universal Design for Learning (UDL), digital technologies, and collaborative inquiry through a Community of Practice. Findings demonstrated robust changes in teachers' knowledge, practice, and attitudes toward inclusive education, with participants reporting increased competence and confidence in applying UDL principles, more intentional use of technology to support learner variability, and strengthened professional identities fostered through collaboration.

The significance of the programme lies in the integration of its components. UDL provided a common framework and language for inclusion, digital technologies expanded teachers' capacity to design flexible learning environments, and the cross-border Community of Practice created the collaborative conditions for sustained reflection, risk-taking, and professional agency. Crucially, it was the synergy of these elements, rather than any one in isolation, that enabled teachers to move from espoused values of inclusion to embedded practices of design for variability.

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For the local context of Northern Ireland and the Republic of Ireland, the study illustrates how cross-jurisdictional collaboration can contribute to inclusive education by bridging systemic and cultural divides. Teachers described how their engagement with colleagues across borders challenged assumptions, expanded repertoires of practice, and fostered a shared professional identity grounded in inclusion. This resonates with Austin and Anderson's (2008) call to harness digital and collaborative networks to amplify global messages from small systems, positioning the island of Ireland as a microcosm for wider international debates.

Globally, the findings contribute to research on teacher professional learning by showing how integrative models of PD can address persistent gaps in the literature. They highlight the value of aligning inclusive pedagogy with technology-focused PD, and the importance of cross-cultural collaboration in fostering teacher agency and professional identity. The study responds to calls for more situated, practice-based evidence of UDL and technology-focused professional learning (Florian, 2015; Darling-Hammond et al., 2017), while also pointing toward the scalability of such initiatives in diverse educational systems.

The UDL Leadership Programme demonstrated significant success in fostering professional growth, enhancing collaboration, and transforming classroom practices as evidenced by the data collected by the participants before, during, and after their learning. By reframing approaches to inclusivity, promoting collective learning through the CoP, and supporting the practical application of UDL principles, the programme empowered participants to become more reflective, adaptive, and inclusive practitioners. Moreover, the development of leadership capacities and a renewed sense of professional identity underscored the programme's broader impact on the educational landscape. The collaborative, cross-cultural teacher professional learning on UDL and digital technologies facilitated teacher robust changes in knowledge, practice and attitudes of inclusive practices.

These findings highlight the potential of the UDL framework, when paired with digital technologies and a CoP programme, as a scalable model for professional development, with implications for policy and practice in inclusive education globally. The UDL framework provided an overarching structure for the integration of best-practices and research on digital technologies, teacher professional development. The teachers found value in the shared repertoire of the UDL guidelines because it allowed them to connect across grade-levels, content areas, and international systems of education. More importantly, it encouraged them to be critical of their practice, and the practice of others in a positive and respectful manner.

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As one teacher remarked, "As a teacher I found my voice – I know how to talk to other teachers." But UDL alone wasn't what led to these robust professional changes in knowledge, skill, and dispositions, it was the UDL framework paired with the digital technologies and CoP structures. Further research is warranted to explore the programme's long-term effects on both teacher practices and student outcomes.

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Bridging the Gap: Technology-Driven Equity and Inclusion in Higher Education

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DOI: https://doi.org/10.34874/PRSM.ijududl-vol1iss2.6096

ABSTRACT

Neurodivergent students, particularly those with Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorder (ASD), and DYS-related learning differences, remain largely overlooked within Moroccan higher education. Standardized pedagogical models, combined with the massification of universities, continue to limit equitable participation, leaving many students undiagnosed and insufficiently supported. At the same time, the growing availability of Artificial Intelligence (AI) and assistive technologies introduces new possibilities for more adaptive and inclusive learning environments.

This study explores how Moroccan universities currently engage with neurodivergence and examines instructors' perceptions of the potential role of AI-based and assistive tools in promoting educational equity. Drawing on an exploratory mixed-methods survey administered to instructors across multiple disciplines and institutions, the findings reveal strong normative support for inclusion alongside persistent structural gaps. These include limited formal training on neurodiversity, the absence of institutional guidelines, uneven access to assistive technologies, and pedagogical constraints linked to overcrowded classrooms.

The analysis further highlights the ethical and governance challenges associated with deploying AI in under-regulated contexts, particularly concerning data privacy, algorithmic bias, and the risk of techno-solutionism. The paper argues that technological innovation alone cannot ensure inclusion. Rather, meaningful and sustainable change requires coordinated institutional reform, faculty capacity building, infrastructural investment, and a shift toward equity-oriented pedagogical cultures. Integrating AI within such a broader framework is essential for advancing inclusive higher education in Morocco and comparable Global South contexts.

Keywords:
Inclusive Higher Education, Neurodiversity, Digital Equity, Artificial Intelligence in Education, Policy and Pedagogy

Introduction

Over the past two decades, inclusion in higher education has shifted from a marginal concern to a central axis of educational reform. No longer framed solely as a moral imperative, it is increasingly understood as a structural challenge linked to pedagogical equity, institutional responsibility, and social justice. This shift is particularly salient when addressing neurodivergence, an umbrella concept encompassing cognitive profiles such as Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorder (ASD), and DYS-related learning differences, including dyslexia, dysgraphia, dyspraxia, and dysorthography. These forms of cognitive diversity, often invisible and insufficiently recognized within academic spaces, significantly shape how students engage with learning, assessment, and academic life.

Despite growing awareness, higher education institutions continue to operate largely within logics of standardization: fixed lecture formats, rigid evaluation modalities, and normative expectations regarding attention, productivity, and communication. Such structures implicitly assume a narrow model of the "typical" learner and create persistent barriers for students whose cognitive functioning diverges from these norms. In the Moroccan context, where inclusive higher education policies remain emergent and unevenly institutionalized, these barriers are further reinforced by the absence of clear frameworks for recognizing and supporting neurodivergent learners. As a result, many students remain undiagnosed or unsupported, and their academic difficulties are frequently misinterpreted as disengagement or lack of rigor rather than as manifestations of unacknowledged cognitive diversity.

At the same time, the rapid digital transformation of higher education introduces both new possibilities and renewed tensions. The growing integration of Artificial Intelligence (AI) and assistive technologies opens promising venues for rethinking accessibility, personalization, and learner autonomy. Adaptive learning platforms, intelligent tutoring systems, speech-to-text applications, and executive function support tools can reduce cognitive overload and diversify access to academic content. For neurodivergent students, such technologies may offer environments better aligned with their cognitive needs, challenging pedagogical models built on uniformity.

However, this technological promise cannot be approached uncritically. In contexts characterized by uneven infrastructure, limited digital literacy, and underdeveloped regulatory frameworks, conditions common in many Global South higher education systems, the deployment of AI raises significant ethical and governance concerns. Issues of data privacy, algorithmic bias, unequal access, and the risk of techno-solutionism complicate narratives that position technology as a self-sufficient driver of inclusion. Sustainable equity therefore requires more than innovation; it depends on coherent institutional policies, faculty training, infrastructural investment, and a cultural shift toward recognizing cognitive diversity as a legitimate dimension of academic life.

It is within this context that the present study situates itself. Drawing on a national questionnaire administered to university instructors across Moroccan higher education institutions, this research explores how neurodivergence is conceptualized and addressed in academic practice, as well as how instructors perceive the role of assistive technologies and AI in supporting inclusion. The study addresses three research questions: (1) How do instructors conceptualize neurodivergence and assess their familiarity and training in this area? (2) What pedagogical practices, accommodations, and institutional constraints are reported in relation to neurodivergent students? (3) How are AI-based and assistive technologies perceived as tools for equity, and what ethical concerns accompany their potential use?

Neurodiversity in Higher Education

ADHD, ASD, and DYS Disorders in Adult Learners

Understanding the lived realities of neurodivergent students in higher education requires moving beyond diagnostic awareness to examine how cognitive diversity interacts with institutional structures and pedagogical norms. Neurodivergence is a lifelong cognitive profile that continues to shape how individuals engage with academic and social environments (Fletcher-Watson & Happé, 2019).

Research has historically focused on primary and secondary education, leaving the experiences of neurodivergent adult learners underexplored (Ramus, 2014). Many university students arrive with undiagnosed or unsupported conditions, accumulating self-doubt and academic fatigue. Their difficulties stem less from intellectual ability than from navigating systems that fail to acknowledge cognitive variability, positioning higher education as a space of both aspiration and negotiation rather than full inclusion (Luckin, et al., 2016).

ADHD in the Context of Higher Education

Attention Deficit Hyperactivity Disorder (ADHD) is a prevalent yet frequently misunderstood neurodevelopmental condition among adult learners. Childhood-centered representations of hyperactivity often obscure its higher-education manifestations, which more commonly include disorganization, cognitive fatigue, impulsivity, and chronic procrastination (Smith & Barkley, 2020). These characteristics are particularly misaligned with academic systems structured around sustained attention and self-regulation.

For students with ADHD, academic difficulties rarely reflect limited intellectual ability but rather disruptions in executive functioning, including planning, attentional control, and time management. Many demonstrate strong conceptual understanding while struggling with deadlines and sustained focus, a mismatch associated with frustration and self-stigma and linked to atypical dopaminergic and noradrenergic regulation (Morin, 2016).

Traditional pedagogical formats: long lectures, delayed feedback, and rigid temporal structures, remain poorly aligned with these cognitive profiles. More inclusive approaches require adaptive pedagogical structures and organizational supports, including digital tools, grounded in recognition of cognitive diversity as compatible with academic rigor.

Autism Spectrum Disorder in Adult Learning Environments

Students on the autism spectrum encounter a distinctive configuration of challenges and strengths within higher education. Autism Spectrum Disorder (ASD) involves differences in social communication, sensory processing, cognitive flexibility, and focused interests, which are not deficits but often conflict with academic environments privileging spontaneous interaction, implicit instruction, and high sensory tolerance (Fletcher-Watson & Happé, 2019).

Typical university settings: crowded lecture halls, fluctuating schedules, and group-based assessments, can generate cognitive and emotional overload, further intensified by sensory stimuli and unspoken social norms. At the same time, autistic learners bring significant strengths, including analytical reasoning, precision, persistence, and pattern recognition, which frequently translate into academic excellence when learning environments are structured and predictable.

Inclusive practices such as clear written guidance, consistent routines, sensory-aware spaces, and flexible assessment formats have been shown to enhance both performance and retention. However, their implementation remains uneven and is often contingent on individual instructors rather than institutionally embedded frameworks.

The DYS Spectrum: Dyslexia, Dysgraphia, Dyspraxia, and Related Disorders

The DYS spectrum, encompassing dyslexia, dysgraphia, dyspraxia, and other related learning differences, constitutes a significant yet frequently overlooked dimension of neurodiversity in higher education. Although well documented in primary education, these conditions often persist into adulthood in ways that remain underestimated, as many students rely on compensatory strategies that become insufficient within the cognitively demanding university context (Ramus, 2014).

In higher education, where academic success relies heavily on rapid text processing and written production, dyslexia may hinder reading efficiency and written expression despite strong conceptual understanding, while dysgraphia and dyspraxia can complicate note-taking, handwriting, and coordinated tasks. Without appropriate accommodations (such as extended time, speech-to-text tools, or alternative assessment formats) students with DYS profiles risk being evaluated on form rather than substance.

Recognizing these conditions as differences in information processing rather than

deficits is therefore essential. Universities that integrate assistive technologies and flexible assessment practices not only support DYS learners but also contribute to a broader culture of inclusive academic practice.

Intersectionality, Invisibilization, and the Challenge of Late Diagnoses

A major barrier to inclusion in higher education lies in the underdiagnosis and invisibility of neurodivergent students, particularly among women, low-income learners, and those from under-resourced regions. These intersecting factors shape how neurodivergence is recognized, interpreted, and supported within academic spaces.

Gendered expectations often obscure the presentation of conditions such as ADHD, which in women may manifest through internalized stress or perfectionism rather than overt impulsivity (Chiu & Chai, 2021). Similarly, students from disadvantaged backgrounds frequently lack access to diagnostic resources and are more likely to interpret learning difficulties as personal failure. Cultural stigma surrounding disability and mental health further discourages disclosure and help seeking.

Late or absent diagnoses carry lasting consequences, including accumulated academic frustration, self-blame, and reduced confidence, which can hinder engagement and persistence despite high intellectual potential. Addressing this invisibility requires not only improved access to diagnosis, but also institutional awareness initiatives that affirm neurodivergence as a legitimate form of diversity rather than a deficit to conceal.

From Deficit to Diversity: Toward a New Educational Paradigm

ADHD, ASD, and DYS conditions share not a common pathology but a shared experience of navigating educational systems structured around narrow definitions of ability. Historically, neurodivergence has been approached through a deficit model, prioritizing remediation and normalization over recognition of cognitive diversity, thereby limiting both learners' opportunities and institutions' intellectual potential.

The neurodiversity paradigm reframes these conditions as natural variations in cognitive functioning that enrich academic communities. As Luckin et al. (2016) argue: meaningful inclusion begins with recognition of multiple legitimate ways of learning, processing, and communicating knowledge.

Universities adopting this paradigm must therefore move beyond individualized accommodations toward systemic redesign, including flexible curricula, multimodal instruction, and inclusive assessment practices. Inclusion is not a lowering of standards, but a redefinition of academic excellence grounded in diversity rather than conformity.

The Role of AI and Assistive Technologies in Higher Education

The increasing integration of artificial intelligence (AI) and assistive technologies in higher education marks a significant shift in approaches to educational equity. Whereas inclusion has long relied on policy commitments and isolated accommodations, AI-driven learning systems extend this agenda toward more structural forms of pedagogical transformation, reshaping how institutions respond to learner diversity.

For neurodivergent students whose cognitive, sensory, and emotional profiles often conflict with conventional academic norms, AI offers more than technical innovation. Adaptive platforms, personalized feedback systems, and assistive applications can reduce exclusionary barriers and support fuller participation, enabling engagement within learning environments intentionally designed to accommodate cognitive diversity.

Adaptive Learning Systems and Personalized Educational Trajectories

One of the most transformative potentials of AI lies in its capacity to support adaptive learning systems that analyze learners' behavior, pace, accuracy, and engagement in real time. Unlike traditional pedagogical models grounded in linear progression, these systems dynamically adjust content, sequencing, and difficulty according to individual learner interactions.

Platforms such as DreamBox Learning and Smart Sparrow illustrate how such micro-adaptations can be automated, enabling personalization without increasing instructors' workload (Luckin et al., 2016). While educators define overarching learning objectives, AI algorithms modulate instructional mode, intensity, and pacing to accommodate diverse needs.

For neurodivergent students, adaptive systems offer a concrete mechanism for aligning pedagogy with cognitive diversity. Learners with ADHD may benefit from flexible pacing and feedback-rich environments, while those with dyslexia or ASD can engage with multimodal content that supports comprehension and reduces cognitive overload.

Literacy Support Tools and the Redefinition of Academic Access

Text-based communication remains the dominant mode of knowledge production in higher education, yet it poses persistent barriers for students with DYS conditions such as dyslexia and dysgraphia. By implicitly equating literacy with intelligence and performance, traditional academic systems overlook the cognitive diversity underlying reading and writing processes.

AI-powered assistive tools challenge this bias by decoupling intellectual ability from written fluency. Applications such as Dragon NaturallySpeaking (speech-to-text) and Read&Write (text-to-speech) enable multimodal access to information and expression, transforming assessment from a test of mechanical skill into a more accurate measure of understanding.

Beyond accessibility, adaptive literacy technologies promote academic equity by legitimizing diverse forms of communication. By enabling students to dictate, listen, or annotate digitally, AI supports fuller academic participation and redefines engagement beyond normative text-based standards.

Executive Function and Organizational Support

For many neurodivergent learners, particularly those with ADHD or dyspraxia, academic challenges stem less from comprehension than from difficulties in executive functioning, including planning, organization, and self-regulation (Smith & Barkley, 2020). Conventional academic expectations of time management, sustained focus, and linear task completion therefore constitute significant barriers.

AI-enhanced planning and productivity tools help externalize these cognitive demands. Intelligent calendars, adaptive task managers, and learning applications can structure tasks, generate personalized reminders, and reduce cognitive load, fostering greater autonomy and control over learning.

For students with ADHD, such systems function as essential scaffolds rather than optional supports, redirecting cognitive resources from logistical management to conceptual engagement. Effective organizational support, whether technological or pedagogical, thus plays a critical role in bridging the gap between academic potential and performance.

Intelligent Tutoring Systems and Cognitive Scaffolding

AI has also given rise to Intelligent Tutoring Systems (ITS), digital environments capable of tracking learners' progress, identifying conceptual gaps, and providing immediate, personalized feedback. Unlike static e-learning modules, ITS employ adaptive questioning and scaffolded guidance to promote active reflection and deeper understanding (VanLehn, 2011).

For neurodivergent students, particularly those on the autism spectrum, these systems offer structured, low-pressure alternatives to traditional classroom interaction. They deliver predictable sequences, allow self-paced learning, and minimize the social ambiguity that can accompany peer-based instruction. By combining repetition, immediate correction, and consistent feedback, ITS environments help sustain engagement while reducing anxiety.

Tools such as Cognitive Tutor or MATHia exemplify this approach, supporting both academic achievement and emotional well-being. When thoughtfully integrated into inclusive pedagogical design, intelligent tutoring systems become not a replacement for human instruction but a complementary scaffold, one that empowers diverse learners to succeed through individualized, data-informed support.

Emotion-Aware Technologies: Toward a Responsive Pedagogy

A recent development in educational technology is the emergence of emotion-aware systems, or affective computing, designed to interpret and respond to learners' emotional states. By analyzing facial expressions, eye movement, vocal tone, or engagement patterns, these tools aim to detect frustration, confusion, or fatigue in real time (Holmes et al., 2019).

For neurodivergent students, many of whom find it difficult to communicate discomfort or overstimulation verbally, such technologies can provide subtle, non-intrusive support. For instance, an adaptive platform that recognizes declining focus may pause a task, suggest a break, or alert an instructor to intervene. When implemented ethically, this responsiveness fosters a more humane and adaptive learning environment.

However, the use of affective AI also raises significant ethical and privacy concerns. Without transparent consent and strict data governance, emotion-tracking tools risk becoming instruments of surveillance rather than empowerment. Their purpose should be to acknowledge emotion as an integral part of learning, not to normalize, monitor, or control it. A genuinely responsive pedagogy, therefore, balances technological sensitivity with respect for student autonomy and dignity.

Beyond Accommodation: Toward a Redefinition of Educational Equity

The promise of AI and assistive technologies extends beyond compensating for disability; it invites a fundamental rethinking of educational equity itself. Traditional inclusion frameworks often rely on reactive accommodations: extra time, separate testing spaces, or individual exceptions. In contrast, AI enables a shift toward universal design, where flexibility and accessibility are embedded into the learning process from the outset. This approach reframes diversity not as an exception to be managed but as a foundation for pedagogical innovation. Adaptive systems, multimodal materials, and real-time feedback mechanisms benefit all learners, not only those with diagnosed conditions. For neurodivergent students, these tools provide genuine parity of participation rather than provisional support.

Achieving this transformation, however, requires more than technological integration. Universities must align innovation with ethical principles, inclusive pedagogy, and institutional accountability. Equity in the digital age is thus not achieved by "fixing" learners but by redesigning environments so that cognitive diversity is recognized as central to academic excellence. This conceptual framework informs the analytical lens of the present study, guiding the interpretation of instructors' representations, pedagogical practices, and perceptions of technological support for neurodivergent students.

Research Methodology

This study adopts a mixed-methods approach combining quantitative and qualitative data to explore how Moroccan higher education institutions engage with neurodivergent students and integrate assistive technologies. The design aimed to capture both the breadth of instructors' awareness and the depth of their perceptions and practices regarding inclusion. These methodological choices were designed to address RQ1–RQ3 by documenting instructors' knowledge and attitudes, reported practices and institutional constraints, and perceptions of AI-based and assistive supports.

Research Instrument

Data were collected through a structured questionnaire comprising closed- and open-ended items, developed through a review of international literature on neurodiversity, inclusive pedagogy, and technology-assisted learning. Closed items captured instructors' self-reported familiarity, attitudes, practices, and technology use, while open-ended prompts elicited concrete experiences, perceived barriers, and improvement proposals. This design supported descriptive analysis alongside thematic interpretation, consistent with an exploratory mixed-methods approach.

As presented in Table 1, the questionnaire was composed of six key thematic sections.

Table 1

Questionnaire Constructs

Questionnaire Block	Item Focus	Main Construct	Linked RQ
Background	Discipline, rank, experience, level, class size	Teaching context	Context for all
Knowledge	Definitions, disorders associated, prior training	Conceptual familiarity/misconceptions	RQ1
Practices and support	Experience, strategies, institutional resources	Inclusion practices & institutionalization	RQ2
Attitudes	Likert items on potential, inclusivity, training	Beliefs about inclusion	RQ1/RQ2
Tech and AI	Knowledge and use of tools, interest in AI	Digital readiness & perceptions	RQ3
Open reflections	Cases, obstacles, suggestions	Barriers and recommendations	RQ2/RQ3

We chose to develop the questionnaire in French, reflecting the dominant language of instruction and administration in Moroccan universities. It was carefully pre-tested with a small group of instructors across disciplines to ensure semantic clarity, cultural relevance, and terminological accessibility. The resulting feedback allowed for refinement of several items, especially those related to definitions and examples of neurodivergence, to ensure accurate understanding regardless of disciplinary background.

Target Population and Sampling Strategy

The target population included higher education instructors across Moroccan public universities, representing diverse disciplines such as humanities, sciences, and engineering. A purposive sampling strategy was employed to ensure disciplinary and geographic diversity across Moroccan public universities. The final sample comprised N = 28 instructors drawn from four public universities, representing twelve disciplinary fields across the humanities, social sciences, sciences, and professional programs. Participants taught at both undergraduate (Licence, years 1–3) and graduate levels (Master 1 and Master 2), providing perspectives across multiple stages of higher education.

Given the exploratory scope of the study, the sample was not intended to be statistically representative, but to capture a range of institutional contexts, disciplinary cultures, and pedagogical experiences. The depth of qualitative responses, which provide insight into instructors' lived experiences, institutional constraints, and reflective practices, offsets the relatively small sample size.

Ethical Considerations

All participants were informed of the study's objectives and procedures before participation. Anonymity and confidentiality were guaranteed, and informed consent was obtained electronically. Data were stored securely and used solely for academic purposes. The study adhered to ethical principles of voluntary participation, transparency, and respect for participant privacy, in alignment with national research ethics guidelines and international standards for social science research.

Data Analysis

Data analysis followed exploratory mixed-methods logic, combining descriptive analysis of closed-ended items with thematic analysis of open-ended responses. This approach was intended to capture both overarching tendencies in instructors' responses and the qualitative depth of their experiences, perceptions, and institutional realities.

Findings

Quantitative Trends

Analysis of closed-ended items highlights an emerging yet fragile awareness of neurodivergence within Moroccan higher education. Only 4 out of 28 instructors (14%) reported having received formal training on neurodiversity in educational contexts, indicating that pedagogical engagement with cognitive diversity remains largely unsupported institutionally. Nevertheless, exposure to neurodivergent students appears relatively common: 36% of respondents reported having knowingly taught neurodivergent students, while an additional 32% expressed uncertainty, suggesting that neurodivergence is present in classrooms but often remains informal, implicit, or unrecognized.

Attitudinal responses reveal a strong normative commitment to inclusion. The majority of instructors agreed that neurodivergent students possess academic potential comparable to that of their peers when appropriate support is available and emphasized the importance of targeted training for academic staff. This openness contrasts sharply with more critical assessments of existing pedagogical models, which many respondents perceived as insufficiently flexible or inclusive.

With regard to technology, awareness of assistive and AI-based tools was moderate, yet pedagogical integration remained limited. While respondents were generally familiar with tools such as text-to-speech software or digital organizational aids, only a small minority reported having actively used or recommended applications such as Dragon NaturallySpeaking or Read&Write, pointing to a persistent gap between perceived potential and practical implementation.

Qualitative Patterns

Thematic analysis of open-ended responses further clarifies these tensions by illuminating how inclusion is enacted in everyday academic practice. Instructors frequently framed inclusion as an individual responsibility rather than as an institutionally supported mandate, with accommodations implemented informally and negotiated on a case-by-case basis. While often motivated by goodwill, such practices were described as fragile and contingent, dependent on personal initiative rather than guided by clear institutional protocols.

Many participants expressed uncertainty when working with neurodivergent learners, citing the absence of formal guidelines, targeted training, or referral mechanisms as a source of hesitation. This uncertainty was particularly pronounced in large or heterogeneous classrooms, where instructors reported limited capacity to adapt pedagogical approaches without compromising course requirements. Structural constraints: most notably overcrowded classrooms, rigid curricula, and restricted access to assistive technologies, were recurrently identified as major obstacles to inclusive practice, reinforcing the perception that inclusion remains constrained by

systemic conditions rather than individual intent.

Respondent Profile and Contextual Diversity

The sample comprised 28 instructors from four Moroccan public universities, representing twelve disciplinary departments grouped across humanities and social sciences, sciences and technology, and professional or applied fields. Teaching contexts ranged from first-year Licence to second-year Master programs, with reported class sizes varying from small groups to large lecture-based cohorts. This diversity provides insight into how inclusion-related challenges are shaped by disciplinary cultures and institutional conditions rather than individual disposition alone.

Emerging Priorities

Across both quantitative selections and qualitative narratives, three priority areas consistently emerged: (1) capacity building through context-sensitive training on neurodiversity and inclusive pedagogy; (2) investment in accessible technological infrastructure accompanied by user training; and (3) policy reform aimed at formalizing institutional inclusion frameworks and accountability mechanisms.

Taken together, these findings depict a higher education landscape characterized by goodwill and growing awareness, yet constrained by structural inertia and limited institutional support. The gap between individual commitment and systemic provision underscores the need for coordinated reforms that align pedagogical practice, technological innovation, and institutional policy.

Discussion and Ethical Considerations

The findings of this exploratory study reveal a higher education landscape characterized by growing awareness of neurodiversity alongside persistent structural limitations. Instructors across Moroccan public universities express strong normative commitment to inclusive education and recognize the academic potential of neurodivergent students. However, this commitment remains largely unsupported by institutional frameworks, resulting in a reliance on individual initiative rather than coordinated, systemic action.

Inclusion Between Individual Goodwill and Institutional Inertia

The results highlight a recurring tension between instructors' willingness to accommodate cognitive diversity and the absence of formal mechanisms to support such efforts. While many participants reported implementing adjustments such as flexible deadlines or multimodal materials, these practices were typically informal and unevenly applied. This finding echoes broader critiques of inclusion models that depend on personal empathy rather than institutional responsibility, leaving students' experiences contingent on individual instructors rather than guaranteed by policy.

The limited access to formal training further reinforces this dynamic. With only a small minority of respondents reporting prior exposure to neurodiversity-related training, instructors are often required to navigate complex pedagogical and ethical situations without guidance. This contributes to uncertainty, hesitation, and inconsistent practice, particularly in massified teaching contexts where class size and rigid curricula constrain differentiation.

Assistive Technologies and AI: Potential and Limits

Instructors' responses reflect cautious optimism toward assistive technologies and AI-based tools. While awareness of such tools is relatively widespread, actual pedagogical integration remains limited, primarily due to infrastructural constraints, lack of institutional guidance, and insufficient digital training. This gap between perceived potential and implementation suggests that technology alone cannot drive inclusion; its effectiveness depends on the surrounding pedagogical and institutional ecosystem.

When appropriately embedded, AI and assistive technologies may function as enablers of equity by supporting executive functioning, multimodal access to content, and flexible assessment. However, the findings underscore that technological innovation must complement pedagogical reflexivity and institutional accountability. Without such alignment, there is a risk that AI adoption reproduces existing inequalities rather than alleviating them.

Ethical Considerations in the Deployment of AI

The integration of AI into inclusive higher education raises critical ethical concerns that extend beyond technical efficiency. Issues of data protection and privacy are particularly salient in AI systems that track engagement, performance, or behavioral patterns. Transparent data governance, informed consent, and clear limitations on data use are essential to prevent the normalization of surveillance under the guise of personalization.

Moreover, algorithmic bias presents a significant risk when AI systems are trained on neurotypical norms, potentially misinterpreting neurodivergent behaviors as errors or disengagement. Ethical deployment therefore requires not only technical safeguards but also critical literacy among educators regarding the sociotechnical assumptions embedded in digital tools. Finally, the temptation of techno-solutionism must be resisted: inclusion cannot be outsourced to technology but must remain grounded in relational pedagogy, care, and respect for academic dignity.

Toward Systemic Inclusion

Taken together, the findings suggest that Moroccan higher education is at a transitional stage, marked by openness to inclusion but constrained by policy ambiguity, resource disparities, and institutional inertia. Moving from isolated accommodations to systemic

inclusion will require coordinated investment in faculty training, assistive infrastructure, and formal inclusion frameworks that recognize neurodiversity as a fundamental dimension of educational equity. In this sense, AI and assistive technologies should be understood not as standalone solutions, but as tools whose inclusive potential depends on ethical governance and institutional commitment.

Conclusion

This study set out to examine how neurodivergence is understood, addressed, and supported within Moroccan higher education, with particular attention to instructors' practices and perceptions of assistive and AI-based technologies. The findings reveal a landscape marked by growing awareness and strong normative commitment to inclusion, yet constrained by limited training, weak institutional frameworks, and uneven access to technological resources. While many instructors demonstrate willingness to adapt their pedagogical practices, inclusion remains largely informal and dependent on individual initiative rather than systemically embedded support.

The results underscore the gap between pedagogical intent and institutional capacity. Neurodivergent students are present across academic disciplines and levels, yet their needs are often addressed reactively, in the absence of formal recognition, structured guidance, or coordinated policy. Assistive technologies and AI-based tools emerge as promising levers for equity, particularly in supporting executive functioning, multimodal access to content, and flexible assessment. However, their impact remains contingent on institutional investment, faculty training, and ethical governance frameworks that prevent exclusionary or surveillance-oriented uses.

By adopting an exploratory mixed-methods approach, this study contributes empirical insight into an underexplored context and highlights the importance of aligning technological innovation with pedagogical responsibility. The findings suggest that meaningful inclusion cannot be achieved through isolated accommodations or technological adoption alone. Rather, it requires systemic reform that integrates faculty development, accessible infrastructure, and formal inclusion policies recognizing neurodivergence as a legitimate and enduring dimension of learner diversity.

Several limitations should be acknowledged. The exploratory nature and size of the sample preclude statistical generalization, and the study reflects instructors' perspectives rather than students' lived experiences. Future research would benefit from larger-scale studies, longitudinal designs, and direct engagement with neurodivergent students to further examine how institutional practices shape academic trajectories.

In sum, advancing inclusive higher education in Morocco calls for a shift from individual goodwill to institutional accountability. By embedding neurodiversity within policy, pedagogy, and ethical technological use, higher education institutions can move toward

learning environments that value cognitive diversity not as an exception to be managed, but as a resource for academic and social transformation.

Acknowledgement:
This work has been supported by the CNRST through the scholarship program known as the “PhD-ASsociate Scholarship –PASS”.

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IJUDUDL
International Journal for Universal Design and Universal Design for Learning

International Journal for Universal Design and Universal Design for Learning (IJUDUDL) Vol. 1, No. 2, April 2026 ISSN: 3119-6055

UDL Guidelines 3.0: A Community-Driven, Research-Based Process Toward Fulfilling the Promise of Universal Design for Learning

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DOI: https://doi.org/10.34874/PRSM.ijududl-vol1iss2.6592

ABSTRACT

The UDL Guidelines were conceived of as a living, dynamic tool that would develop over time based on research and feedback from the education community. The launch of Version 3.0 in 2024 represents the most significant expansion in the evolution of the UDL Guidelines. It also marks the most extensive updating process to date—a four-year, community-driven, research-based approach that prioritised learning from practitioners, researchers, and young people themselves, as well as engaging with areas of the education literature that had never before been included in previous iterations. This article offers a window into the updating process as a way to enhance transparency and honour the contributions of participants from across the UDL community. We trace the origins and commitments of Guidelines 3.0, describe the process and research design, and highlight how findings were used to directly inform expansions. Finally, we reflect on the current and future applications of Guidelines 3.0 to practice and research.

Keywords

Universal Design for Learning (UDL), UDL Guidelines 3.0, participatory process, research-based process

Introduction

The UDL Guidelines are widely known as a tool to support the application of the Universal Design for Learning (UDL) framework to learning spaces. To practitioners and researchers across the UDL community, they also represent the enactment of a paradigmatic shift in teaching in learning, one that situates barriers in the design and centres the variability of student learning. The roots of this shift can be traced back to UDL's founding organisation, CAST, in 1984, as it sought to accomplish its original mission of supporting students with disabilities to access and participate in the learning process. CAST co-founders, clinicians, and educators collaborated with students to imagine innovative ways to utilise new technologies to support students who faced barriers in traditional classroom settings. Yet, as the CAST team deepened their collaboration with schools, students, and families, their thinking began to shift. They came to understand that the barriers students were experiencing were not inherent within the students themselves, but within the learning environment.

This relocation of the barrier marked a fundamental shift in the goals of the organisation; instead of focusing predominantly on the individual student, CAST increasingly turned its attention to the design of the learning environment. Specifically, CAST began to investigate how new technologies might help to redesign goals, assessments, methods, and materials so that they were accessible and motivating for every learner. This shift not only ultimately led to the development of the UDL framework but also established a foundational commitment that has remained central to CAST's core since these early days in the 1980s: a commitment to learning from new perspectives and a willingness to shift and iterate in order to more effectively reduce barriers for learners.

The evolution of CAST's UDL Guidelines—a tool to support educators, researchers, and practitioners to apply the UDL framework to practice—exemplifies CAST's commitment to learning and growing (CAST, 2024). From their first introduction in 2008, the Guidelines were intended to function as a dynamic tool that continually evolved based on research and feedback from the education community. Purposefully called "Version 1.0," this original version symbolised the beginning of an iterative process. Since then, CAST has shared four other iterations—Version 2.0 in 2011, Version 2.1 in 2014, Version 2.2 in 2018, and most recently Version 3.0 in 2024 (refer to "Downloads" page on the UDL Guidelines website for all versions, https://udlguidelines.cast.org/more/downloads/).

Version 3.0 represents the most significant expansion of the UDL Guidelines since the first version in 2008. It also marks the most extensive updating process to date—a four-year, community-driven, research-based approach that prioritised learning from a diversity of practitioners, researchers, and young people themselves, as well as engaging with areas of the education literature that had never before been included in previous iterations of the Guidelines. In this article, we come together as a co-founder of CAST (Rose), co-chairs of the Guidelines 3.0 updating process (Gravel and Tucker-Smith),

current and former CAST Guidelines 3.0 team members (Fornauf, Hughes, Lester, & Singer), and research advisors on the UDL Guidelines 3.0 Advisory Board (Rao & Waitoller) to offer a window into this participatory, inclusive process as a way to enhance transparency and honour the contributions of participants across the UDL community who shared their perspectives and experiences. We trace the origins and commitments of Guidelines 3.0, describe the process and research design, and highlight how the findings from this process were used to directly inform expansions included in Guidelines 3.0. Finally, we reflect on the applications of Guidelines 3.0 in current and future contexts. We share this article through our own positionalities that collectively represent a breadth of identities, generations, lived experiences, and practice- and research-based understandings—a breadth that is reflective of the UDL community itself.

Responding to the Call to Update the UDL Guidelines

In the early 2000s, the UDL framework was gaining initial momentum. While educators were intrigued by the three principles and their potential for reducing barriers, CAST received feedback from educators that these principles were too vague. Educators sought more concrete support for applying the principles to practice. In response to this feedback, CAST began the process of developing a set of "guidelines" for educators and other practitioners and published the first iteration of the UDL Guidelines, Version 1.0, in 2008. By 2018, three more iterations of the UDL Guidelines had been shared with the UDL community, and the Guidelines had grown from just an idea to a tool that was used in schools and districts across the country and around the world (Rao et al., 2023).

Yet, alongside this growing momentum, there were strong calls from both researchers and practitioners to more fully develop the Guidelines as a tool to design more accessible, inclusive, and equitable learning environments. Scholars critiqued the Guidelines for its limited attention to the multifaceted dimensions of learner variability, including identity, along with the types of barriers caused by individual and systemic biases (Alim et al., 2017; Fritzgerald, 2020; Waitoller & Thorius, 2016). These critiques called for UDL to more explicitly expand notions of expertise, prompt educators to interrogate assumptions of curricular neutrality, and address the roles of power and privilege as they relate to the intersection of ableism and racism (Waitoller & Thorius, 2016). There were also increasing calls from practitioners to reimagine the Guidelines to more fully and more explicitly align with other asset-based approaches (e.g., culturally sustaining pedagogy (Paris & Alim, 2014)) that centre and honour learners' multiple and intersecting identities (Fritzgerald, 2020). Many educators shared that they did not see themselves, their students, or their school communities reflected in the Guidelines.

As a co-founder of CAST, these calls from the research and practitioner communities prompted me (Rose) to reflect on the increasingly apparent "cracks" in the foundation of the UDL Guidelines (Rose, 2021). CAST was founded in a children's hospital whose strength was in the diversity of its research and clinical expertise—from child neurology,

psychiatry, and educational psychology to speech pathology, physical therapy, and social work. In contrast, however, the entire professional staff was geographically, socially, racially, ethnically, economically, educationally, and linguistically largely homogeneous. Ultimately, that lack of diversity led to the development of guidelines whose foundation was very strong but also very narrow and brittle, a foundation that cracked under the dual demands of expansion and designing for equity. These cracks exposed the need for the Guidelines to play a stronger, more explicit role in disrupting the most pervasive of barriers—the biases, prejudices, low expectations, and differential access to agency that fundamentally limit their full promise.

In response to this call from both the practitioner and research communities, CAST launched a community-driven, research-based process in 2020 to reimagine the UDL Guidelines (Gravel & Tucker-Smith, 2024). CAST committed to collaborating with the UDL community—especially community members whose voices may not have been included in previous iterations—to learn from their perspectives and lived experiences. Complementary to this community-based work, CAST committed to a process of updating the research with a specific focus on expanding the voices of scholars who were not included in previous iterations. This approach reflects principles of Participatory Design and design justice, which emphasise shifting power toward communities most affected by design decisions (Bang & Vossoughi, 2016; Costanza-Chock, 2020). These traditions position learners, educators, and communities as co-designers and treat design as a relational, political act that interrogates whose knowledge counts (Fine & Torre, 2021). Integrating these commitments into the revision process meant that CAST's work extended beyond consultation to include sustained opportunities for co-creation, shared sensemaking, and collective theorising with practitioners, researchers, and young people.

A Community-Driven, Research-Based Process

In this section, we weave together the story of our four-year updating journey as well as our research design to offer a transparent window into our community-driven, research-based process. As co-chairs and members of the CAST Guidelines 3.0 Team, we (Gravel, Tucker-Smith, Hughes, Fornauf, Lester, and Singer) share the design of our systematic and participatory process that explored the following overarching research questions:

- How might the UDL Guidelines be more fully developed to address barriers rooted in biases and systems of exclusion to support the design of more just and equitable learning environments? What gaps and biases exist in the current version?
- What ideas do practitioners, researchers, and young people have for reimagining the UDL Guidelines as a tool for designing more equitable and just learning environments?

International Journal for Universal Design and Universal Design for Learning (IJUDUDL) Vol. 1, No. 2, April 2026 ISSN: 3119-6055

- What are the gaps and biases in the research base used to inform the current version of the UDL Guidelines? How can we update and expand the research base to address those gaps and biases to more fully develop the UDL Guidelines as a tool for designing more equitable and just learning environments?

Engaging the Community

Exploring these questions required connecting with a diversity of practitioners and researchers. We established several advisory groups to guide and inform the updating process: an Advisory Board made up of external scholars and practitioners from the U.S. and international contexts whose work focused on equity through a variety of dimensions (refer to https://www.cast.org/udl-guidelines-3-0-advisory-board/); a UDL Guidelines Collaborative made up of CAST staff and representatives from the UDL community (refer to https://www.cast.org/udl-guidelines-3-0-collaborative/); and a Young Adult Advisory Board made up of young people ages 18-22 who shared their ideas for designing learning spaces where they felt valued, supported, and challenged (refer to https://www.cast.org/udl-guidelines-3-0-young-adult-advisory-board/). Across all three groups, 42 advisory meetings were held from 2021 to 2024.

To connect with potential focus group participants, we employed a purposive sampling strategy (Palys, 2008) to gain insights from practitioners who were actively utilising the UDL Guidelines and who could reflect on both the strengths and weaknesses of the tool. The initial recruitment strategy focused on recruiting participants from the two largest UDL conferences in the field at the time: the 2022 and 2023 UDL-IRN International Summits and the 2021, 2022, and 2023 UDL Symposia. We also connected with smaller groups to learn from their perspectives, such as Special Interest Groups associated with the UDL-IRN and groups of educators internationally. We recruited 181 total focus group participants. During the drafting phase of the process, we also administered two feedback surveys to learn from the UDL community's perspectives and reactions to the proposed updates. These surveys generated 239 responses from 28 countries.

Across both the focus group and survey participants, there was representation from 39 states, 2 U.S. territories, and 30 countries. While not every participant chose to share information in terms of race/ethnicity, gender/sexuality, and disability, the data collected revealed varying ways in which participants identified (Table 1). Further, participants held a diversity of roles across varying educational contexts (Tables 2-3). All participants were consented through CAST's Institutional Review Board.

Table 1

Selection of the Different AI Tool Answers

Aspect of Identity	Percentage of Participants Who Shared Ways of Identifying
White	66%
Latinx or Latine or Hispanic	10%
Asian or Pacific Islander	4%
Black or African American	4%
Multiracial	4%
Native American or Indigenous	1%
Identifies racially/ethnically in another way	11%
Female	82%
Male	13%
Nonbinary	2%
Queer	1%
Person without a disability	53%
Disabled person or person with a disability	22%
Identifying as having a disability, depending on context	24%
Temporarily non-disabled	2%

Table 2

Educational Roles (for those participants who chose to respond to the prompt)

Role	Percentage of Participants Who Shared Roles
Professional development leader	17%
Curriculum developer	11%
Faculty member	10%
Instructional coach	10%
Technology-related (e.g., tech administrator, educational tech, coach, assistive tech, etc.),	8%
Researcher	7%
Special education teacher	6%
General education teacher	5%
School-based administrator	4%
District-based administrator	3%
Specialist teacher (e.g. art, music, PE, library/media, etc.)	3%

Instructional designer	1%
Student	1%
Career and technical education teacher	1%
Workforce development	1%
Psychologist/Counsellor	1%
Related Service Provider (OT, SLP, PT, etc.)	1%
Another role	10%

Table 3

Educational Settings (for those participants who chose to respond to the prompt)

Setting	**Percentage of Participants Who Shared Settings**
College/university	23%
High school/9th grade to 12th grade (ages 14-18 years old)	13%
Elementary school/Kindergarten to 5th grade (ages 5-11 years old)	11%
Middle school/6th grade to 8th Grade (ages 11-14 years old)	11%
Adult education	7%
District leadership	6%
Early childhood	5%
Research organization	5%
Business/non-profit organisation	5%
Self-employed	4%
State leadership	2%
Workforce development	2%
After-school/community-based	1%

Our Process and Research Design

Data collection, literature reviews, and drafting took place from July 2021 to July 2024 and included the following phases: 1) Listening and Learning, 2) Reviewing the Literature and Drafting, and 3) Feedback and Iteration.

Phase 1: Listening and Learning (July 2021-December 2023): A total of forty-two semi-structured focus groups were conducted (both in-person and virtually) across Phase 1. Focus groups were audio and/or video-recorded, transcribed, and documented via field notes. Any artefacts that participants created during the focus groups (e.g., drawings, diagrams) were collected. Alongside the focus groups, initial literature reviews

on research that connected to and extended the Guidelines began, which ultimately led to Phase 2.

Phase 2: Reviewing the Literature and Drafting (January 2023-July 2024): Phase 2 focused explicitly on reviewing, updating, and expanding the previous research base for the UDL Guidelines and drafting proposed updates for Guidelines 3.0. Reviewing the literature occurred in two stages. During the first stage, we examined the literature base for previous iterations of the UDL Guidelines to understand the balance of different dimensions, including (but not limited to): publication date, methodological approach, research setting/target population, theoretical framework, and alignment with asset-based research. This review included 1,156 unique titles. Overall, findings revealed a narrowness in terms of each dimension. Findings indicated:

- An outdated literature base, with a range of publication dates from 1967 to 2020 and the majority of the research dated in the early/mid 2000s;
- Narrow methodology, with focus predominantly on quantitative research;
- Narrow age representation, with elementary students most frequently the target population, representing twice as many articles in the literature base as those that targeted high school students;
- Theoretical preference, with cognitive load theory, self-determination theory, and schema theory employed most frequently; and
- A vast majority of the literature base was not aligned with asset-based pedagogy (e.g., culturally responsive (Gay, 2000) and culturally relevant (Ladson-Billings, 1995) pedagogy).

This overall narrowness echoed feedback from practitioners and researchers and demonstrated compelling reasons to update and expand the Guidelines research base.

The second stage focused on expanding the research base. We employed a systematic literature review process guided by Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) to incorporate a broader range of voices, perspectives, and research that was asset-based in nature and centred on populations that have been historically marginalised. This review was a three-prong process involving: creating search terms, conducting searches, and comprehensive to purposive article screening. More than 420 individual searches were conducted as part of this process. Throughout the process, we also explored research outside of the systematic reviews that was shared by the UDL community, advisory members, and our own explorations (refer to https://udlguidelines.cast.org/more/research-evidence/ for updated research base).

Alongside the literature reviews, we began the process of synthesising the feedback and using emerging themes to inform the drafting process. First drafts for all nine UDL

guidelines and associated checkpoints were created throughout 2023. Each draft included: 1) current guidelines and associated checkpoints, 2) proposed updates to guidelines/checkpoints, 3) examples of individuals' feedback (illustrative quotes/themes) that inspired each proposed update, and 4) examples of research that inspired each proposed update. By January 2024, we completed initial drafts of updates for all nine guidelines.

Phase 3: Feedback and Iteration (January 2023-July 2024): Given the iterative nature of the process, Phase 3 overlapped with Phase 2. As we completed the first draft of each updated guideline, we solicited three different rounds of feedback: 1) feedback from CAST staff, 2) feedback from the Advisory Board, and 3) feedback from the Guidelines Collaborative. High-level themes from each draft were also discussed with the Young Adult Advisory Board.

As we got closer to a full draft, we created a "Summary of Proposed Updates for UDL Guidelines 3.0" to represent the overarching themes of proposed updates across the first drafts (https://bit.ly/GuidelinesUpdatesSummary). We then held a CAST Free Webinar in March of 2024 to launch the Full Draft of Guidelines 3.0 for public comment (https://bit.ly/GuidelinesFullDraft). We created surveys for individuals to share their feedback on the summary and/or the full draft. At this point, our Guidelines 3.0 newsletter had grown to more than 6,327 individuals across 120 countries, and both surveys were shared with all newsletter subscribers. The surveys generated 239 responses from 28 countries. We also facilitated feedback sessions with individuals and groups such as authors who published with CAST Publishing and the National Education Association Disability Rights Resource Cadre. All feedback was synthesised and analysed to uncover themes and patterns to inform the final version of UDL Guidelines 3.0 (refer to section below). After a four-year process, UDL Guidelines Version 3.0 was launched on July 30, 2024, with a celebration at CAST's UDL-Con: International in Sacramento, CA.

Surfacing Themes and Patterns

Data analysis was ongoing throughout the three-year data collection period. All focus group and survey data were synthesised and analysed to identify themes and patterns that informed the final version of UDL Guidelines 3.0. Analysis used a set of etic codes (Maxwell, 2013) based on previous iterations of the UDL Guidelines and included codes such as "expert learner," "access row," and "UDL Guideline 1: Provide options for perception." The analytic strategy also drew from open coding (Saldaña, 2016) to uncover new themes and patterns from the data.

For each theme or pattern that surfaced among focus group data, we explored it alongside the themes and patterns that emerged from meetings with the Advisory Board, Guidelines Collaborative, and Young Adult Board, as well as literature reviews, to determine inclusion in one of the drafts. For each theme or pattern that surfaced from surveys on the "Summary of Proposed Updates for UDL Guidelines 3.0" and the "Full

Draft of Guidelines 3.0," we explored it alongside the themes and patterns that emerged from the focus groups, meetings with the Advisory Board, Guidelines Collaborative, and Young Adult Board, and literature reviews to make a final determination for incorporation in Guidelines 3.0.

To establish the trustworthiness of our data, we employed "member checking" to test our emerging themes with focus group participants (Lincoln & Guba, 1985). We also shared emerging themes with our Guidelines 3.0 Advisory Board, our Guidelines Collaborative, and our Young Adult Advisory Board.

Guidelines 3.0 Expansions and Rationale

Appreciation for the benefits of the UDL Guidelines as a tool to identify and address barriers surfaced across the multiyear updating process. Yet, findings from the literature reviews, focus groups, and surveys also revealed gaps and concerns within previous iterations of the Guidelines. This article focuses specifically on the findings that led to some of the most significant expansions in UDL Guidelines 3.0: the expansion from "expert learner" to "learner agency"; the reframing of the engagement guideline "Recruiting Interest" to "Welcoming Interests and Identities"; and the repositioning of Executive Function to more accurately align with practitioner feedback and the latest neuroscience perspectives.

Expansion from Expert Learner to Learner Agency

Previous iterations of the UDL Guidelines defined the goal of UDL as supporting learners to develop as "expert learners who are purposeful and motivated, resourceful and knowledgeable, strategic and goal-directed" (Ertmer & Newby, 1996; Meyer et al., 2014). This goal has prompted educators and researchers to reflect on the importance of students coming to know themselves as learners and of engaging students in challenging learning goals. Yet, the updating process also exposed "cracks" in this goal—cracks that presented barriers to educators and researchers in terms of fully applying the Guidelines to their contexts. Across community feedback and reviews of the literature, the conceptualisation of "expert learning" seemed too limiting. Themes from the feedback from focus groups and survey participants revealed a concern that the term "expert" implied exclusivity and hierarchy. One participant reflected, "*For me, expert implies the other, which is lack of expertise. It's very hierarchical: so there are experts and people who aren't experts.*"

Participants also expressed concern that the conceptualisation of "expert learning" de-emphasised the importance of collectively generating knowledge. When reflecting on the importance of their students' learning in community, one participant shared, "*[My students] talk about their own confidence, their own stretching, and their own growth. In addition, it really is because of the community, you know. . . . A lot of it is about who they are in a community and how feeling value in that community helped them to grow.*"

Finally, participants expressed concern that the notion of "expert learning" failed to recognise and honour the brilliance inherent in every learner. A participant shared, *". . . I believe we all come to the table as experts in our own lived experiences already. In addition, I do not feel like I am in the position to make you an expert on yourself. I kind of feel like you already are and you have that innate ability."*

This updating process demonstrated that the expansion from "expert learner" to "learner agency" was imperative to provide a current version of the UDL Guidelines that would support removing barriers in today's learning environments, which are replete with both opportunity and contradiction (see Figure 1). Advancements in Artificial Intelligence (AI), instant access to information, and multiple, conflicting and competing realities all vie for learners' attention. Learners in this complex world require more than expertise about their own learning processes. They require the capacity to make meaningful choices as they interact with the ever-changing world around them and pursue their learning goals. Agency reflects this dynamism; expertise, while important, can also become static. The expansion to learner agency recognises the importance of creating communities of learners who support one another and learn from the brilliance inherent in each learner. Shifting the emphasis from the individual learner to their agency recognises how needs shift and change across contexts and over time, and underscores the criticality of interrogating the design of learning environments.

One of the main goals of the 3.0 updating process was to update the foundational research base, and the literature reviews showed a significant shift among scholars toward emphasising learner agency. Yet agency does not occur in a vacuum; it requires attention to the power dynamics of learning environments (Sullivan et al., 2020), which are often unacknowledged. Learners' abilities to act as powerful agents toward meaningful goals relate to the structure of the learning community and the extent to which all members, regardless of perceived status, are valued and able to contribute (Restani, 2021). Achieving the goal of learner agency requires examining systemic barriers within learning environments that undermine co-designing with learners (Mick, 2011). Since its inception, UDL has emphasised that barriers are in the environment, not the learner. Working toward the full potential of the Guidelines requires recognising updated research and addressing real-life practitioners' concerns around expertise, individualism, and dynamics of power, and acknowledging that educators and learners are always evolving. Thus, the community-driven updating process responded to this call by expanding the goal of UDL to "learner agency that is purposeful and reflective, resourceful and authentic, strategic and action-oriented" (CAST, 2024).

Figure 1

The goal of UDL, UDL Guidelines, Version 3.0

Reframing the Guideline "Recruiting Interest" to "Welcoming Interests and Identities"

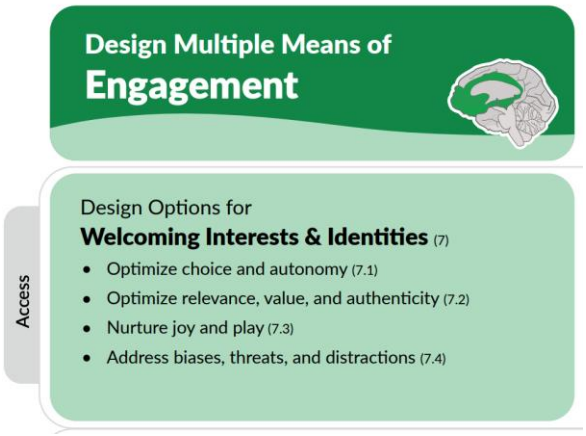
The UDL Guidelines have always emphasised the critical role that affect plays in the learning environment (Meyer et al., 2014). Themes from the focus groups and literature reviews pointed to a revised framing of UDL Engagement Guideline 7 "Provide options for Recruiting Interest" to more successfully design learning environments that honour and sustain learners' multiple and intersecting identities. Participants across the study expressed the need to more explicitly honour learners' whole selves and the many assets they bring to the learning environment. For example, one participant shared, "*...I don't see anything in the Guidelines to point to consider[ing] the students' backgrounds. It's not explicitly pointed at. How do you address all of the variabilities that the learner brings?*" Another participant reflected, "*Sometimes we treat students as if they have to earn the learning environment . . . you have to come a specific way . . . in a very compliant, buttoned up kind of way. I wonder if the Engagement Guidelines can be broadened to allow for more than one way of being . . . ?*"

This call to more explicitly centre learners' multiple and intersecting identities surfaced in our reviews of the literature as well. For example, González, Moll, and Amanti's (2006) research on funds of knowledge highlights the importance of honouring the cultural practices and bodies of knowledge embedded in the daily lives of students and their families. Ladson-Billings' (1995) research on culturally relevant pedagogy emphasises the importance of affirming students' cultural identities and supporting them in developing critical perspectives that challenge inequities. Finally, Paris and Alim's (2014) research on culturally sustaining pedagogies builds upon culturally relevant pedagogy to emphasise the importance of sustaining and perpetuating cultural and linguistic repertoires, while Waitoller and King Thorius (2016) propose a cross-pollination of Culturally Sustaining Pedagogy (CSP) and UDL to design and implement curricula to dismantle the interactions of racism and ableism. The strong call from the focus groups mirrored this robust thread of research that has mapped culture and identity as inseparable from learning (e.g. Nasir et al., 2014) and led to the updated guideline: "Welcoming Interests and Identities" (UDL Guideline 7). This expansion emphasises the need to recognise, sustain, and value learners' unique interests as well as their unique identities, including intersecting dimensions such as race/ethnicity, culture, gender, language, and disability. Ultimately, this reframing from *recruiting* learners'

interests to *welcoming* their interests *and* identities more fully recognises learners' whole selves and supports guidance for designing learning environments that remove barriers to emotional access (see Figure 2).

Figure 2

UDL Guideline "Design Options for Welcoming Interests & Identities," Version 3.0



Reframing and Centring Executive Function

The reframing and centring of the notion of executive function is another significant expansion in Guidelines 3.0. Previous iterations of the Guidelines have emphasised the importance of supporting learners' executive functions, the processes of goal-setting, choosing effective strategies, and monitoring progress (Meyer et al., 2014). In these previous iterations, individual differences in executive function capabilities were explicitly addressed in a single place, Guideline 6: "Provide options for Executive Functions" under the UDL principle of Action and Expression. However, most contemporary neuroscience and psychological literature now assume a broader, more interconnected concept of executive function. That contemporary view typically recognises that executive functions are not limited to the strategic control of action and expression, but also to the strategic control of attention in perception and knowledge-building as well as the control of values and emotion in prioritising both attention and action (Amodio & Cikara, 2021; Berridge & Armsten, 2015; Molenberghs & Louis, 2018). That same trio of executive functions is familiar as it echoes the three UDL principles.

When applied to the UDL Guidelines, this contemporary research and theory suggests that addressing executive function should not be limited to a single guideline but should extend to the other two guidelines that made up the bottom row of previous iterations of the UDL Guidelines: Guideline 9: "Provide Options for self-regulation" is an essential design practice to address individual differences in executive capability, and Guideline 3: "Provide options for comprehension" is equally essential to ensure that students have supports for developing executive capacity. Thus, in providing support for executive function, all three neural networks are highly interconnected.

Confusion around compartmentalising executive function to a single guideline in previous iterations also surfaced in feedback from participants. For example, one participant reflected how it is "*confusing for teachers to see Executive Function and then Self-Regulation in Engagement. A lot of the language is confusing, posing a barrier.*" Another participant shared, "*How do we convey the message that although the thing you're doing might be part of action & expression, it's also very much a part of engagement?*"

This combination of new learning from the neuroscience research and from participants led to a reframing of executive function in UDL Guidelines 3.0. "Options for Executive Function" was updated to "Options for Strategy Development" as a way to more specifically focus on the aspects of executive function that align with the principle of Action and Expression. And to elevate the role of Executive Function across all three networks, the bottom row of the graphic organiser was relabelled from "Internalize" to "Executive Function" (see Figure 3)

Figure 3

The "Executive Function" row of the UDL Guidelines, Version 3.0

UDL Guidelines Applications to Practice and Research

The update to Guidelines 3.0 is generating exciting applications to practice and research. In the sections below, we reflect on the ways that the expansions in this latest iteration can bring us closer toward fulfilling the promise of UDL.

Applications to Practice

Since the first iteration in 2008, the UDL Guidelines have been supporting practitioners to reduce barriers and increase access to inclusive and accessible learning environments. Educators in schools and institutions of higher education across the United States and around the globe have worked to apply UDL to their practice (Rao et al., 2023). For these educators, Guidelines 3.0 can offer more specific support for designing learning environments that more fully challenge, support, and honour every learner. The specific expansions and updates at the guideline and consideration levels (some of which are described above) support this overall effort, and here we reflect on two broader applications.

First, Guidelines 3.0 make stronger connections to other asset-based pedagogies and frameworks. For educators who draw from approaches such as culturally relevant pedagogy (Ladson-Billings, 1995) or culturally sustaining pedagogy (Paris & Alim,

2014), Guidelines 3.0 make the intersections and complementary nature with UDL more explicit. And for those educators new to other asset-based pedagogies, Guidelines 3.0 have the potential to prompt them to reflect on the importance of valuing and sustaining students' assets in new ways. By placing UDL in conversation with other asset-based approaches, Guidelines 3.0 can become more relevant and useful to educators around the world who seek to design learning spaces that recognise and embrace intersecting facets of learner variability.

Second, the shift in Guidelines 3.0 from educator-centred to learner-centred language invites new forms of collaboration and co-design between educators and learners. Across the focus groups, a concern surfaced previous iterations of the Guidelines could be perceived as a set of approaches that educators "do" without learner input. To address this concern, Guidelines 3.0 uses the word "design" as opposed to "provide" across the principle and guideline levels as well as other verbs that can be used interchangeably among and between educators and learners. These updates to language more explicitly position Guidelines 3.0 as a tool that can be used by educators as well as learners *themselves*. Depending on the learning goal, Guidelines 3.0 has the flexibility to prompt educators and students to work together to imagine and design spaces in which students explore and construct their own learning.

Finally, it has been exciting to observe these broad applications extending to practice in international contexts. Guidelines 3.0 launched in 2024 with six languages available. Since then, seventeen translations have been generously donated by members of the international UDL community—a compelling symbol of the growing momentum for Version 3.0 and the importance of continued reflection around meaning across languages and contexts.

Applications to Research

Over the past three decades, the research base on UDL has been steadily expanding. The existing UDL research base does not attempt to validate the framework as a whole; instead, research on UDL examines specific applications of the UDL Guidelines in varied ways and contexts. As researchers move forward with Version 3.0, the outcomes of previous research studies will remain valid, and we can build off this robust existing work as we continue to grow a UDL research base into the future.

The essential aspects of UDL that have been the focus of research will continue to be examined through applications of Guidelines 3.0. The shifts in the language of the UDL Guidelines present core ideas in updated and expanded ways, with the essence of the framework remaining intact. Guidelines 3.0 continue to be a tool to support proactive, intentional design of accessible and inclusive environments. Version 3.0 retains most of the basic structure and foundations of the original version (and subsequent revisions). At the principle level, the Guidelines are unchanged, and the changes at the guideline and consideration levels represent expansions grounded in our research-based, participatory

process to better align the Guidelines with the fundamental aim of reducing barriers and increasing access to meaningful learning environments. Researchers and practitioners can use the UDL Reporting Criteria (Rao et al., 2018) to articulate the alignment of interventions and practices with UDL, denoting how Guidelines 3.0 are applied for specific aspects of a study. Clear reporting of key UDL elements will continue to provide transparency, allowing researchers to replicate procedures and processes and continue to expand the existing research base.

Finally, as described above, a significant goal of the updating process was to expand the research base to include areas of the education literature and voices of scholars whose work was not incorporated into previous iterations. Our review of the previously existing research base surfaced concerning limitations; particular guidelines and checkpoints had been derived from promising practices within a largely narrow research base (e.g. mostly quantitative, mostly intervention studies, etc.). Bringing a UDL lens to the expansion of the research base itself, Guidelines 3.0 builds upon, updates, and extends the previous research to include a greater diversity of perspectives and epistemological views from the areas of sociocultural perspectives on learning, disability studies, and asset-based pedagogies. These expansions offer generative opportunities for researchers to explore the intersections of UDL and these expanded areas of the literature in future work.

Concluding Thoughts

UDL Guidelines 3.0 represents a pivotal milestone in the evolution of the UDL Guidelines. As conversations about UDL continue to evolve, questions about evidence, clarity, and the role of design frameworks in education are both expected and vital to its continued progress. The UDL Guidelines have always been grounded in empirical research, but—like other design frameworks—they function as a synthesis of evidence, professional consensus, and practitioner wisdom, rather than as a prescriptive intervention to be tested through controlled studies. Because the Guidelines are designed to reduce barriers and elevate learner agency, they must evolve alongside education research, accessibility advancements, global educational practice, and technology innovations, including Artificial Intelligence. The 3.0 update reflects this reality: a systematic, participatory approach that blended research synthesis, broad community input and iterative design. Grounded in participatory design, the shift to learners, practitioners, and researchers serving as co-designers of the Guidelines strengthens the framework by reflecting lived experience, practitioner wisdom, and shared interpretation into its development. We hope this article encourages continued conversation and shared learning as we collectively work toward fulfilling the promise of UDL “until learning has no limits.”

Acknowledgements

We would like to acknowledge the hundreds of educators and researchers from across the UDL community who participated in the updating process. Thank you for your time, wisdom, and trust. UDL Guidelines 3.0 are a stronger tool because of you.

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IJUDUDL
International Journal for Universal Design and Universal Design for Learning

International Journal for Universal Design and Universal Design for Learning (IJUDUDL) Vol. 1, No. 2, April 2026 ISSN: 3119-6055

Is the Juice Worth the Squeeze? Academic Perspectives of Inclusive Practice and Universal Design for Learning (UDL)

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DOI: https://doi.org/10.34874/PRSM.ijududl-vol1iss2.6988

ABSTRACT

This paper examines teaching staff's perception of inclusive practices and UDL in one Higher Education Institution (HEI) in Ireland. This research forms part of a wider mixed-method study exploring staff and students' perceptions of inclusion as well as staff knowledge and implementation of inclusive practices, including UDL. This paper begins with a discussion around inclusive practice before exploring the development of UDL in higher education in Ireland. The data for this research were gathered through a survey administered to all teaching staff at a mid-sized Irish university, resulting in 200 responses. The survey instrument focused on staff training on inclusive practice and staff attitudes towards inclusive practices, including UDL. Findings echoed previous research regarding staff perceptions of barriers to UDL implementation, which include the time required to implement UDL and concerns about staff workload. However, findings also suggest that additional barriers to implementing UDL exist, including a lack of understanding and knowledge about UDL, as well as other institutional challenges, such as large class sizes. The findings also reveal that staff have undergone training, and many are interested in additional training, not just in UDL, but also in how to support neurodiverse students and provide formative feedback to large groups.

Keywords

Universal Design for Learning, Inclusive Practice, Staff Perceptions and Attitudes, Higher Education

Introduction

In the context of this study, inclusive practices refer to the day-to-day, intentional actions that form part of the higher education ecosystem. Inclusive practices are actions that support the removal of barriers to participation (Ainscow, 2005). They are designed to ensure all students, not just disabled students, succeed and flourish (Shaw, 2024). These actions also form the basis for understanding how inclusive education is perceived (Moriña, 2020). This means educators need to actively consider the reasoning and actions behind the decisions they make and how they can be more inclusive (Quirke et al., 2023). However, to implement inclusive practices, educators require a mindset that embraces diversity in education and acknowledges the potential of all learners (Guðjónsdóttir & Óskarsdóttir, 2016). Moreover, to implement these practices successfully in higher education, inclusive practices need to be enshrined in institutional policies (Finch et al., 2024). However, promoting and fostering inclusive practices in higher education can be a challenging task. For example, challenges can arise when it comes to the delicate balance between the demands of teaching and the pursuit of research, each vying for attention and dedication (Hakel & Magin, 2024). Despite this, inclusive practices continue to be encouraged across higher education. In Ireland, inclusive practices such as Universal Design or Learning (UDL) have been employed in recent years to address the diversity and student variability that are present across the Irish educational landscape (Flood & Banks, 2021).

UDL is an inclusive approach that is increasingly recognised worldwide as a way for educators to accommodate the needs of various learners (Smith et al., 2019; Craig et al., 2022; Flood & Banks, 2021). Created in the 1990s by the US non-profit organisation CAST, UDL offers a holistic framework for educators to strategically design their curriculum and instructional methods by anticipating diverse student needs and making education more universally accessible to all (Healy et al., 2024a). This framework for curriculum design is grounded in neuroscience studies and the earlier concepts of Universal Design (UD) (Buckland Parker, 2012; Dalton, 2019). UDL focuses heavily on removing barriers within the curriculum and the learning environment, representing a shift away from a medical model that highlights learner deficits (Basham & Blackerorby, 2021; Fovet, 2020) and a shift in focus from purely technological approaches that are designed to enhance the participation and success of students with diverse learning needs (Classen et al., 2021). However, technology can still play a significant role in implementing UDL, given its flexibility and the ability to provide choice (Bray et al., 2023).

UDL is built on three core principles; these principles advocate for offering various ways for learners to engage, providing different modes of representation, and allowing multiple methods for action and expression (CAST, 2024). In addition to these core principles, CAST has developed a set of guidelines designed to drive its inclusive agenda

and address barriers related to these core principles. The version of these UDL guidelines is currently 3.0, released in 2024 (CAST, 2024; Gronseth et al., 2025). Using UDL guidelines, educators can establish instructional objectives, strategies, resources, and evaluations that minimise unnecessary barriers to learning (Hall et al., 2024).

The UDL framework emphasises the teaching experience and the various supports and scaffolding that can be incorporated to help students achieve mastery of content and skills (Smith et al., 2019). The concept of a standard learner is non-existent in UDL. Instead, UDL acknowledges that learner variation reflects the realities of the population and society, and the UDL framework provides principles and guidelines for creating instruction that caters to this variation (Craig et al., 2022; Dalton, 2019; Smith et al., 2019). Its principles aim to empower learners by providing them with agency, autonomy and the resources for self-directed learning. UDL has the potential to support a learner-centred approach that aligns with international human rights principles on inclusive education and Goal 4 of the United Nations' Sustainable Development Goals (SDGs).

Okolo et al. (2021, p. 139) contend that UDL is "*a simple yet profound idea*". However, there are still misunderstandings regarding what constitutes UDL. For example, Hollingshead (2021) suggests that some educators may incorrectly believe they are already implementing UDL, or that UDL is merely a form of differentiation in disguise, which could contribute to this misunderstanding. It is crucial to understand that UDL goes beyond merely effective or good teaching; fundamentally, it centres on intentionality and the proactive design for diversity (Edyburn, 2010; Hollingshead, 2021; Smith et al., 2019). Interestingly, Fovet (2021) suggests that UDL represents not just a new trend but a resurgence of fundamental inquiries by educators and instructional designers regarding engagement, social justice, and their role in teaching.

UDL advocates for a more systematic inclusion approach that would reduce the need for individualised accommodations from areas such as disability support services (Healy et al., 2024; Kumar & Wideman, 2014; Lyner-Cleophas, 2019). Although UDL offers advantages for disabled students by promoting accessibility and flexible approaches to the curriculum, its scope extends beyond this group, aiming to address the diverse needs of all learners (Izzo, 2012; Fovet et al., 2014). However, given its potential to support the independent learning of disabled learners, it is perhaps not surprising that Disability Services units are being called upon to advocate for more UDL practices (Sejdic, 2021). However, placing the responsibility for implementing UDL campus-wide solely on disability services may result in struggles due to financial limitations, a lack of sufficient pedagogical knowledge, and inadequate relationships with faculty (Fovet, 2021; Hills et al., 2022). While it is essential for disability services to contribute to a broader institutional approach to universal design (UD), concerns have been raised about UDL being isolated within the disability agenda and disability discourse (Healy et al., 2024). UD in education and UDL have similar synergies. The concepts overlap in

their pursuit of the same goal of equity (Galvin, 2024). However, UD in education examines universal practices in a broader context, organised into four pillars within postsecondary ecosystems. These pillars included teaching, learning and assessment; supports, services, and social engagement; the physical environment; and the digital environment (Banks et al., 2024).

UDL's ability to address diversity and promote inclusive practices is paramount in contemporary higher education in Ireland. This importance stems from the acknowledged growing diversity in the student populations of Irish higher education institutions (HEIs) (O'Dwyer et al., 2025). In Ireland, the number of disabled students enrolling in higher education has increased by 319% since the academic year 2008/09 (Association for Higher Education Access & Disability, 2024). This greater diversity means that the number of individual accommodations required also increases (Capp, 2017). Higher Education in Ireland is also witnessing growth in areas such as international students who may benefit from the rollout of more inclusive practices, with numbers increasing by 13,000 in 2007/08 to 44,535 in 2024/25 (Higher Education Authority, 2022a; ICEF Monitor, 2026). In fact, the current level of diversity within Ireland's student cohort means that there is no longer a universally accepted view of what constitutes a traditional student in higher education (Healy et al., 2024b). These figures underscore the need for more universally designed rights-based approaches to education, such as UDL and UD, that address these concerns and serve a broader, diverse student population and design out accommodations in the development of the curriculum (UDL) and non-curriculum-based supports and services (UD). The benefits of UDL have led some researchers to argue that UDL is a utopian solution that supports the needs of all disabled students (Suwannawut, 2019). However, others caution that disabled learners with more complex needs may still require tailored and individualised accommodations regardless of UDL practices (Slaughter et al., 2024; Quirke & McCarthy, 2020).

National access policies have begun to address UDL in Ireland over the last decade. It began with the National Plan for Equity of Access to Higher Education 2015-2019, a national access and widening participation policy designed to increase the number of underrepresented students in higher education (e.g., disabled, socio-economic disadvantaged, and mature). This policy contended that assistance for these target groups should be provided through UDL without negatively labelling them (Higher Education Authority, 2015). In the following iteration of this policy, the language shifted from UDL to UD, as it adopted a broader view of more inclusive practices and advocated for mainstreaming of services through UD (Higher Education Authority, 2022b). This inclusion of more universal approaches is also evident in the literature across all levels of education in Ireland (O'Shaughnessy, 2021; Flood & Banks, 2021). Ireland is also witnessing a growing collaboration in UD across tertiary education, with Education

Training Boards and Higher Education Institutes (HEIs) working together through joint Higher Education Authority (HEA) funding to develop the whole of institution approach to UD known as the ALTITUDE Charter, which also advocates for UDL within its Teaching, Learning and Assessment Pillar (see Banks et al., 2024). Although currently in its relatively early stages, the Charter, which promotes UD and inclusive practices such as UDL, has the potential to have a strong impact on inclusive practices across the tertiary level in Ireland.

However, questions have been raised about staff knowledge of inclusive practices. For instance, Moriña et al. (2017) argue that higher education should focus on training faculty in their specific disciplines and on inclusive, effective teaching methods. Moreover, it has been suggested that HEIs should offer regular training sessions for faculty on concepts related to disability and universal design in instruction (see, for example, Dallas et al., 2016). Researchers have argued that academic staff participation in UDL training increases their teaching effectiveness, heightens their understanding of student diversity, and improves their skills in developing inclusive learning settings (Dell'Anna et al., 2024; Moriña et al., 2025). Despite this support for training on disability and universal design for learning , there appears to be a lack of clarity regarding the effectiveness of professional development for staff (Craig et al., 2022). For example, Davies et al. (2013) suggest that as little as five hours of group training for college educators on applying UDL principles and teaching methods significantly enhances their use of these strategies. However, another study highlighted the benefits of five-day training programmes on implementing UDL (Craig et al., 2022). Interestingly, some have argued that longer training significantly increases the likelihood of participants continuing to use UDL, and engaging in conversations with others about UDL greatly enhances its application (Hakel & Magin, 2024). However, some suggest that it is not the duration of the professional development that matters, but rather the advancement of knowledge regarding inclusive teaching practices that was the crucial factor influencing instructors' implementation of these methods (Addy et al., 2021). Interestingly, others highlight how self-study and engagement in communities of practice can increase faculty knowledge of UDL (Flood, 2025).

Many instructors struggled to implement inclusive principles into their practices (Marquis et al., 2016). While a lack of knowledge and limited access to relevant training can hinder inclusive teaching practices, additional barriers appear to impede the implementation of UDL in practice. For example, barriers noted by faculty involve time and resource limitations, insufficient institutional backing, staff resistance to change and a lack of understanding of UDL (Dell'Anna et al., 2024; Flood, 2025; Hills et al., 2022). Others lament the lack of consistency around technology as a barrier to implementing UDL (Kilpatrick et al., 2021; Howery, 2021). Notably, Lynch (2024) claimed that finding a middle ground between the desire for inclusivity and the realistic

limitations of time and resources demands careful manoeuvring, and addressing the human aspect of this transformation has turned out to be a considerable challenge. Concerns have also been raised about the difficulties in implementing real changes in organisations that are inherently intricate, multi-dimensional, and broad (Fovet, 2021). Other challenges were also noted. For example, some have argued that implementing UDL at many universities can also depend on individual faculty pursuing training and applying UDL principles in isolation rather than embedding inclusive practices across the culture of their HEI (Hills et al., 2022). This may suggest a need for a more institution-wide and collaborative approach to drive the UDL agenda.

UDL also has its critics. For instance, questions have been raised regarding its application and the underlying neuroscience (Murphy, 2020; Boysen, 2024; Anastasiou et al., 2024). There are also additional concerns regarding evidence-based research in UDL, including what constitutes a UDL intervention, the difficulty of research in defining the components required to make UDL effective, and the extent to which UDL interventions need to achieve access, engagement, and success (Edyburn, 2020; Murphy, 2020). Furthermore, Anastasiou et al. (2024) maintain that the rationale for UDL should be grounded in cognitive science rather than in neuroscience, as is the current practice. Worryingly, others claim that UDL has also presented scientific assertions that can't be substantiated (Boysen, 2024; Edyburn, 2024). Some have also questioned the rationale of implementing UDL in higher education when more fundamental inclusive supports are not being addressed (Creavan, 2024). Concerns have also been raised regarding the language used when discussing discourse on UDL (Howrey, 2021). A commonality in the language is important for UDL for congruency. Hollingshead (2021) argues that this consistency is crucial to achieving uniformity in how researchers approach the UDL framework, including how they articulate it in their published studies. Some have suggested that commonality in language can be achieved through purposeful communication and advocacy efforts (Lynch, 2024). Regardless of the language concerns, the need for more research in UDL from a teaching and learning perspective is evident, given the limited research in this area and the incremental progress of UDL in Irish and international educational spheres.

To that end, this paper aims to address the following research questions:

- RQ1 What training, if any, have staff undertaken in relation to inclusive practice?
- RQ2 What training, if any, have staff undertaken in relation to UDL?
- RQ3 What are faculty members' perceptions and attitudes towards UDL?
- RQ4 Are staff interested in doing more training to make their practice more inclusive?
- RQ5 Is there any other type of support or training not mentioned that staff would find useful?

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Methodology

This section provides an overview of how the research was designed, how the survey instrument was developed, ethical considerations, the recruitment of participants, and how data was analysed.

Research Design

The research described in this paper was undertaken as part of a broader study that examined staff members' understandings, perceptions, and practices of inclusion more broadly, and UDL specifically, as well as students' understanding and experiences of inclusion. The impetus for this broader study came from a need to establish a baseline on inclusive practices and gain a wider understanding of the need for professional development in this space, with a view to informing future practices in terms of embedding UD within the institution.

The broader research study employed an Appreciative Inquiry approach (Cooperrider et al., 2008), which was underpinned by focus groups, in-depth interviews, and a survey The rationale behind using a mixed-methods approach (Johnson, Onwuegbuzie, & Turner, 2007) was to capture general perceptions and views using s survey , while the Appreciative Inquiry approach would provide a richness and depth not possible using a survey alone.

This paper presents specific survey findings only, as they relate to the research questions presented at the end of the introduction. Further details on how the survey instrument was developed, and which survey sections are relevant to this paper, are provided in the next section.

Development of the Survey Instrument

The broader survey was designed to capture staff understanding, attitudes, and perceptions of inclusive practice and to identify any specific strategies they employ to make their teaching more inclusive. The survey also endeavoured to explore UDL perceptions and attitudes, as well as professional development achievements and requirements around UDL.

The survey instrument was developed using the following five-stage process to ensure relevance:

1. The first draft of the inclusive practice survey was initially informed by instruments from previous studies that explored educators' knowledge of UDL and inclusive practices (e.g., Capp, 2020; Hills et al., 2022; Griful-Freixenet et al., 2021).
2. The survey instrument was then further refined to address the authors' specific research questions and to reflect relevant internal structures, policies and

professional development opportunities, to ensure all questions were institutionally relevant.

3. Using the Qualtrics survey platform, the survey was shared with six internal colleagues working in Equality, Diversity and Inclusion (EDI) roles across the institution to determine if any questions needed to be added, modified or removed.
4. Three of the authors then undertook the survey independently to determine if there were any problematic questions and/ or branching scenarios. Questions were once again reviewed for clarity to ensure they were not leading or confusing. The survey was modified accordingly.
5. The revised survey was then piloted with 15 external colleagues who work in education, disability, and inclusion roles. Colleagues were asked to highlight any issues they identified with the survey and to note how long it took to undertake. Based on feedback received, the survey was modified accordingly.

The survey comprised multiple-choice questions, Likert scales, and some open-ended questions. Based on feedback received from external pilot participants (step 5 above), the authors determined that the survey would take on average 10-12 minutes to undertake.

The study described in the remainder of this paper focusses on a subset of questions from the broader survey—specifically, questions about the background demographics of respondents, what training (if any) staff had undertaken in the areas of inclusive practice and/ or UDL (Research Questions (RQs) 1 and 2), their perceptions and attitudes towards UDL (RQ 3), and what staff think they need—from a professional development and other supports perspective—to facilitate greater inclusivity in the classroom (RQs 4 and 5).

Ethics and Recruitment of Participants

The authors received ethical approval to undertake a survey of teaching staff across the institution. Ethics approval number: 2023-11-01-AHSS. An email was circulated to each of the four faculties in late February 2024, inviting all teaching staff to participate in the survey, which was accessible via a Qualtrics link. An information letter was included at the start of the survey, explaining the purpose of the survey, participants' rights to anonymity and confidentiality, and their right to withdraw from the research should they wish to do so. Participants were informed that if they were willing to participate in a follow-on interview or focus group, they would have to provide their email address, thereby forgoing anonymity. In some faculties, a reminder email was sent out one week later, to encourage additional responses.

Data Collection and Analysis

According to official statistics, there were 1,073 full-time equivalent staff in academic roles and 969 staff in professional, management or support roles in the institution, as of September 2024 (Higher Education Authority, 2024). The authors received 200 responses to the survey within a two-week period, which represents a 19% response rate if we consider only staff employed full-time in academic roles. However, it is possible that part-time and hourly paid teaching staff, as well as postgraduate students who teach, also responded. Each respondent consented to having their data used in this research study, although some respondents chose not to answer certain questions.

As much of the survey comprised quantitative multiple-choice questions and Likert scales, tables and visuals were automatically generated for these questions by Qualtrics, the survey tool. The collected data was also exported to Excel to facilitate further analysis. Section 3 presents and discusses the quantitative findings with the aid of relevant visuals.

For questions comprising free text , these qualitative responses were analysed in Excel by one author to identify relevant quotes that could be mapped to themes identified in the literature. Where quotes were deemed relevant but not directly aligned with previously identified themes, these were also noted for discussion, as presented in the next section.

Findings and Discussion

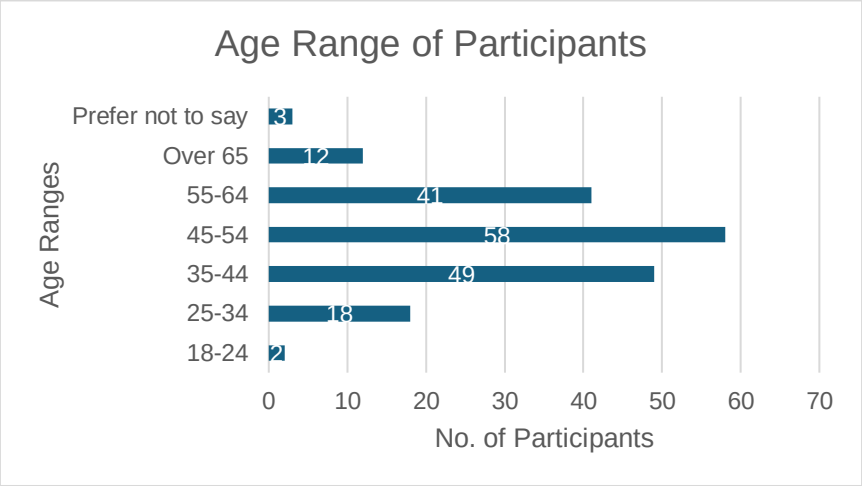
This section presents background demographic information for respondents before presenting the findings that directly relate to the five research questions outlined at the end of the introduction. It is essential to note at this stage that some respondents did not answer every question—to improve transparency, the authors provide the number of respondents for each question.

Background Demographics of Respondents

The ages of the participants varied from 18-24 to over 65, with 3 participants choosing not to disclose. Figure 1 presents the age range of respondents, with 81% of all respondents to this question (148/183) falling into the 35-64 age bracket.

Figure 1

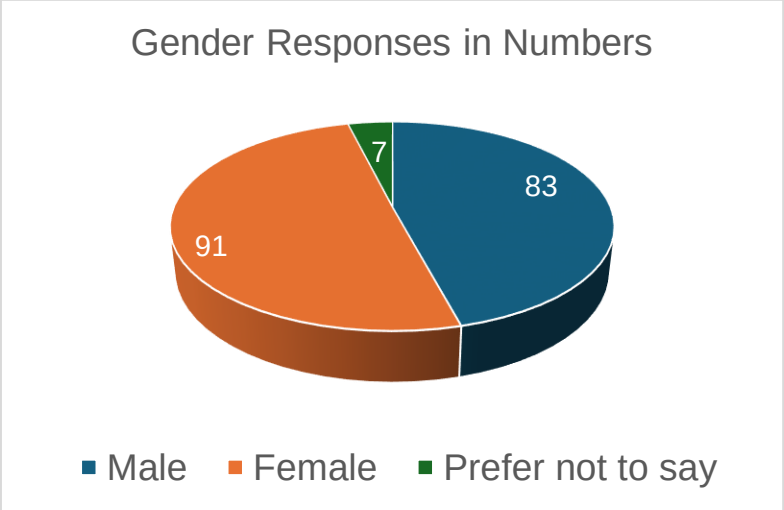
Age Range of Participants (183 Respondents)



When asked about their gender, 181 respondents provided an answer. Results show that 91 females and 83 males responded, with 7 participants choosing not to disclose (see Figure 2).

Figure 2

Gender of Participants (181 Respondents)



When participants were asked how long they had been teaching in higher education, 47 of the 80 respondents (59%) indicated that they had been teaching for 6 years or more (see Figure 3). Unusually, we received a low number of responses to this question (n=80) compared to most other questions.

Figure 3

Number of Years Staff have Been Teaching (80 Respondents)

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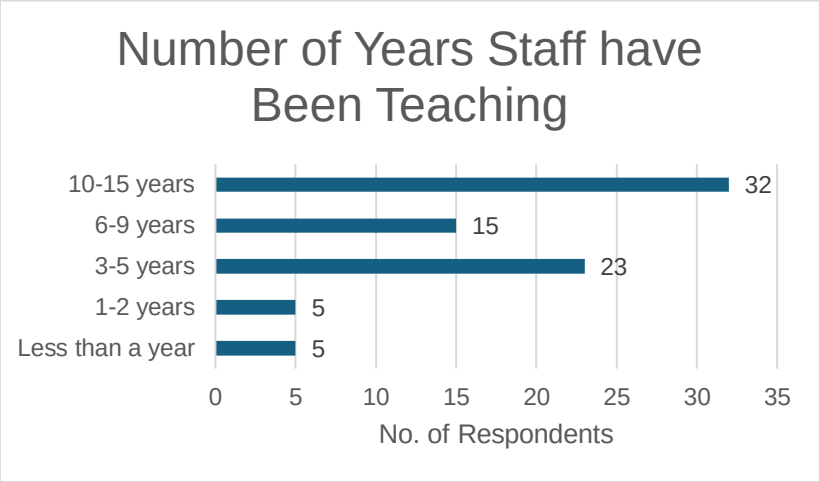
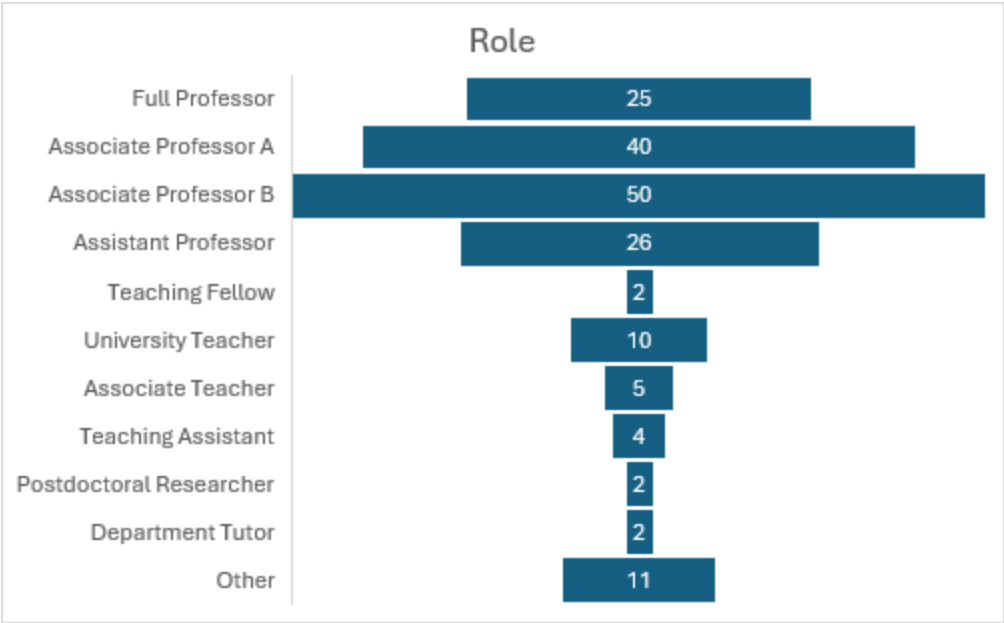


When asked to confirm their role in the institution, 166 of the 177 respondents (94%) identified as having academic/ teaching roles, with the remaining 11 selecting 'other' (see Figure 4). 'Other' roles likely include hourly paid teaching staff and postgraduate students who teach but don't hold teaching positions.

Figure 4

Participants' Roles Within the Institution (177 Respondents)



The majority of responses came from academic faculties (n=180/181), although not all faculty respondents necessarily work in teaching roles. One respondent identified as being from a support division, department or unit. Responses were evenly distributed across the four faculties, ranging from 20% to 28%.

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When asked if they had a teaching qualification and to select all that apply, 76 of the 182 respondents (42%) reported having no teaching qualification, while 94 (52%) reported having one or more qualifications (see Figure 5). Interestingly, 22 respondents (12%) selected 'Other' as a response, referring to prior experience, other qualifications that included teaching modules, clinical teaching, higher education degrees (bachelors, masters, and doctorates), and professional practice. Given the variety of these 'other' responses, it is possible that some respondents consider higher education qualifications in *any* discipline to be teaching qualifications.

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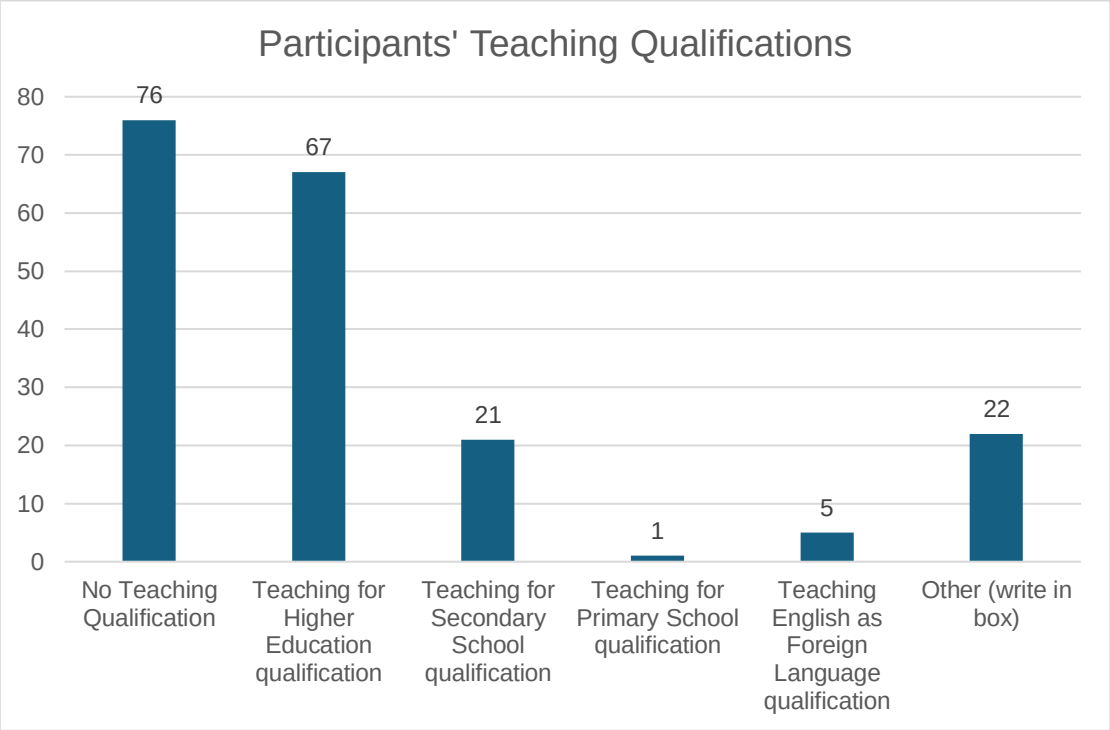
Figure 5

Participants' Teaching Qualifications (182 Respondents).



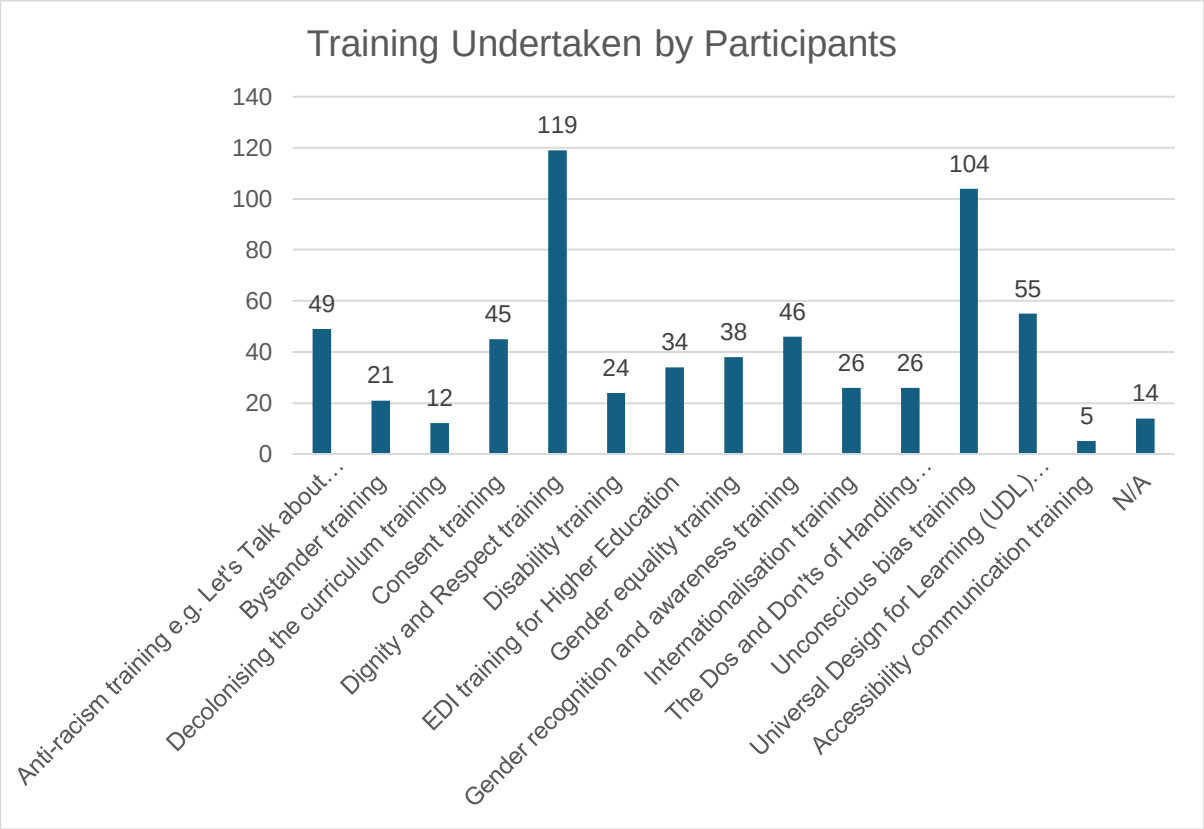
Training Undertaken in the Area of Inclusive Practice and/or UDL

This section discusses the training that staff have undertaken in relation to inclusive practice and in relation to UDL specifically.

What training, if any, have staff undertaken in relation to inclusive practice?
Participants were asked if they had undertaken any training on inclusive practice and to select all forms of training that apply. Of the 164 respondents who answered this question, 119 (73%) indicated that they had undertaken dignity and respect training, 104 had undertaken unconscious bias training (63%), 55 had undertaken Universal Design for Learning (UDL) training (34%), and 49 had undertaken anti-racism training (30%) (see Figure 6).

Figure 6

Training Undertaken by Participants (164 Respondents)



What training, if any, have staff undertaken in relation to UDL? When participants were asked if they had received any training in UDL, and to select all forms of training that apply, 61 of the 125 respondents to this question said they had *not undertaken any UDL training* (49%), 35 had undertaken a *UDL digital badge* (28%), 27 had attended *workshops or seminars* (relating to UDL) (22%), and 18 had selected 'other' training (14%).

Of those who selected 'other training', qualitative responses included courses on *decolonising the curriculum* and attending *other courses where UDL was embedded* (e.g. teaching and learning programmes). Interestingly, in response to this question, five of the 'other' respondents said they were *currently undertaking the UDL digital badge* or hadn't yet finished it; three said they had undertaken other UDL training (not the UDL digital badge), and two said they were self-taught on UDL.

Perceptions and Attitudes Towards UDL and UDL Training

This section aims to uncover faculty members' perceptions and attitudes towards UDL, whether they are interested in undertaking more training to make their practice more

inclusive, and if there is any other type of support or training that they would find helpful.

What are faculty members' perceptions and attitudes towards UDL? To determine faculty members' perceptions and application of UDL (RQ3), respondents were asked to rate their level of agreement based on a 5-point Likert scale of strongly disagree, somewhat disagree, neither agree nor disagree, somewhat agree, and strongly agree with respect to the following five UDL-specific statements:

1. I apply UDL principles regularly in my teaching.
2. I would like to apply UDL principles regularly in my teaching, but I don't have the time.
3. I would like to apply UDL in my teaching, but I am not sure how to do this.
4. I think UDL is a passing fad.
5. UDL only benefits disabled students.

We received responses from 142 participants to the statements in this question out of 200 (a 71% response rate). For practical reasons, this paper first discusses responses to statements 1, 2, and 3 as they relate directly to the application of UDL to teaching.

Statement 1: I apply UDL principles regularly in my teaching.

- 54% of respondents to this question strongly agreed (n=24) or somewhat agreed (n=53) that they *apply UDL principles regularly in their teaching*.
- Almost one third of respondents (31%, or n=44) neither agreed nor disagreed with this statement.
- The remaining 15% (n=21) somewhat disagreed or strongly disagreed with the statement.

It was encouraging to see that over half of the respondents to this question reported regularly applying UDL principles in their teaching. This high level of application may have been bolstered by the offering of UDL digital badges through national and local rollouts and having a dedicated UDL Lead within the institution. The institution also coordinates various peer groups that promote UDL. However, it is also likely that advocates for inclusive practice were more likely to have responded to the survey, potentially skewing the results. It should also be noted that these are self-declarations and may not reflect actual practices. It is concerning that 31% neither agreed nor disagreed with this statement, possibly suggesting a lack of understanding among faculty about what constitutes UDL. This lack of understanding could stem from confusion around the language, as noted in the literature (Howrey 2021; Smith et al., 2019) and warrants further investigation.

Statement 2: I would like to apply UDL principles regularly in my teaching, but I don't have the time.

- 46% of respondents to this question strongly agreed (n=18) or somewhat agreed (n=48) that they *would like to apply UDL principles regularly in their teaching, but they don't have the time*
- 28% of respondents (n=40) neither agreed nor disagreed with the statement.
- The remaining 25% (n=36) stated that they somewhat disagreed or strongly disagreed with that statement.

The high level of agreement regarding the desire for more time to apply UDL in teaching practices is unsurprising. Heavy workloads are a real issue for academic staff working in higher education (Dlamini & Dlamini, 2024). Moreover, time has been a theme in previous literature regarding staff ability to engage in UDL Practices (Flood, 2025; Hill et al., 2022). It is difficult to determine whether the 25% somewhat disagreed or strongly disagreed with the statement because time wasn't an issue for them or because they would still choose to not engage with UDL-based practices even if they had additional time.

Statement 3: I would like to apply UDL in my teaching, but I am not sure how to do this.

- 38% (n=54) strongly agreed or somewhat agreed with this statement.
- One quarter of respondents to this question (26%, or n=36) neither agreed nor disagreed with this statement.
- The remaining 36% (n=51) somewhat disagreed or strongly disagreed with this statement.

The responses to this question were somewhat intriguing, with 38% of respondents wanting to incorporate more UDL into their practices but feeling uncertain how to go about doing this. This lack of knowledge may also align with the previously discussed concerns about the time required to implement UDL (statement 2).

36% of respondents disagreed or strongly disagreed with this statement, which could suggest there are staff with a strong understanding of both UDL and the practices that support it but, for whatever reason, choose not to apply it.

The next statement addressed questions related to the veracity of UDL and whether UDL was merely an educational fad (Murphy, 2021).

Statement 4: I think UDL is a passing fad

- 62% (n=88) strongly disagreed (n=58) or somewhat disagreed (n=30) with this statement.
- Only 11% (n=16) strongly agreed or somewhat agreed with this statement.
- Just over one quarter (26% or n=37) neither agreed nor disagreed with the statement.

While 62% of respondents strongly disagreed or somewhat disagreed with the statement that UDL is a passing fad, 11% agree that it has a relatively short shelf life and 26% are still unsure about the longevity of UDL in higher education. This level of uncertainty might explain some of the responses to earlier statements i.e. the 36% of respondents who claim to know how to apply UDL but are choosing not to apply it (statement 3) and the 53% who don't agree that time is the issue when it comes to applying UDL (counting neutral and disagree answers) (statement 2).

Despite UDL benefiting more than just disabled students, there is a tendency for HEIs to position UDL with the disability agenda or within disability services (Fovet, 2021; Healy et al., 2024). Therefore, the final statement below was included to ascertain how academic staff felt about it.

Statement 5: UDL only benefits disabled students

- While only 1% of respondents (n=2) somewhat agree that UDL only benefits disabled students, 23% (n=33) neither agreed nor disagreed with this statement.
- The majority, 75% (n=107), somewhat disagreed or strongly disagreed with this statement.

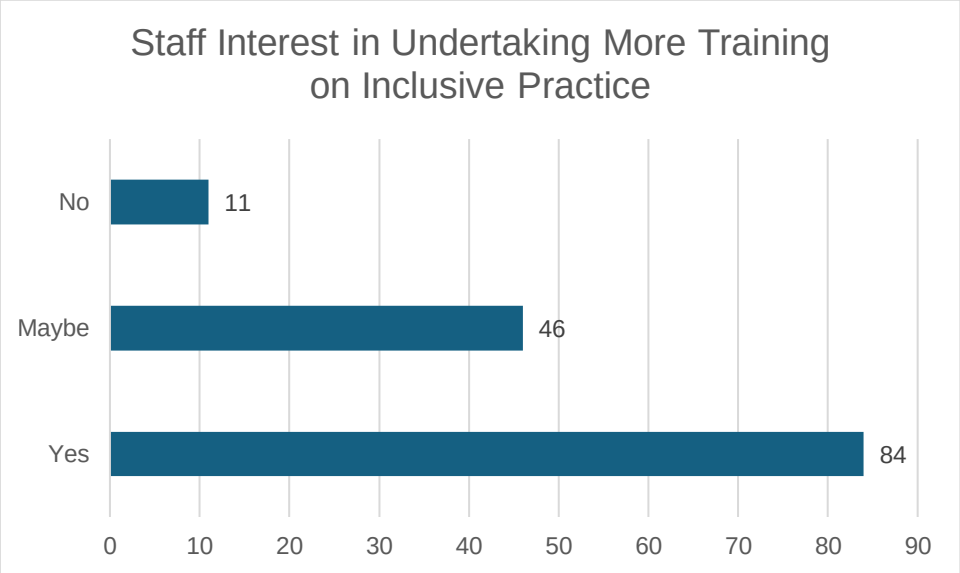
These findings suggest that the alignment between UDL and disability may be shifting. However, the answers to the previous statements suggest that many respondents are already quite knowledgeable about UDL, so this group may not accurately reflect practices across the wider institution and institutions more broadly. It should also be reiterated that the respondents may have been more likely to take the survey if they had experience in UDL, and therefore their views may not accurately reflect the true perspective of staff on the intersection of UDL and disability.

Are staff interested in doing more training to make their practice more inclusive?

Of the 141 respondents who answered this question, 60% (n = 84) indicated that they were interested in additional training. Interestingly, 33% (n=46) said maybe, and 8% (n=11) said no (see Figure 7). The lack of interest from some respondents may be due to their feeling that they already know enough about inclusion or simply not having the time to undertake further work in the area (as noted in the responses to statement 2).

Figure 7

Staff Interest in Undertaking More Training on Inclusive Practice (141 Respondents)



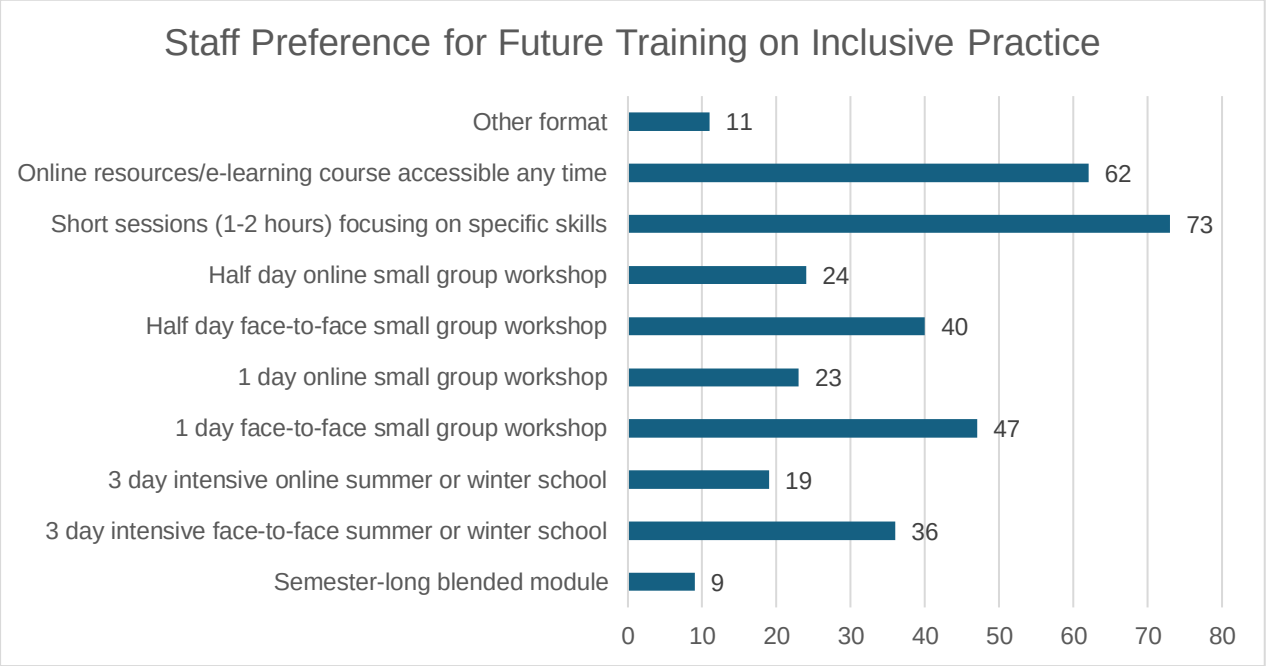
Is there any other type of support or training not mentioned in the previous question that staff would find helpful? To answer this research question, we asked respondents two related questions:

5a) If you were to undertake more training on inclusive practice, which formats would you prefer?

We then outlined several options, including a semester-long blended module, 3-day intensive face-to-face or online workshops, and half-day workshops. 136 people responded to this question with 'short sessions (1-2 hours) focusing on specific skills' selected by 54% of respondents (n=73), 'online resources/e-learning course accessible any time' selected by 46% (n=62), and '1-day face-to-face small group workshop' selected by 35% of respondents (n=47). Figure 8 presents a summary of their responses.

Figure 8

Staff Preference for Future Training on Inclusive Practice (136 Respondents)



To facilitate other options that might not have been considered during the survey design stage, respondents had the option of suggesting alternative formats and topics for training. Eleven of the 136 respondents (8%) offered suggestions.

Several of these responses referred to time and workload constraints**,** rather than training formats specifically, as evidenced in the following quotes:

- "**[T]raining sessions when we are not lecturing**. It is very sad that we have to miss so many training [sic] because it clashes with our teaching. This is an issue that should be addressed."
- "I think the model of **in-service days** would be interesting to explore. If staff had a compulsory day(s) set aside in our calendar that were held and protected specifically for training, this would be hugely helpful for me."
- "I **need time with my students,** not ticking boxes that will look nice in my promotion portfolios but not actually affect most of students learning abilities or research/career opportunities."
- "3-day (or even 1-day) training courses...are you kidding?? If you're organising training, please keep it, **as short as possible and laser-focused** - absolutely no waffle."

These comments from participants are intriguing. Time is clearly a significant issue for staff, as noted in the literature (Flood, 2025; Hill et al., 2022). Flexibility when it comes to training is in keeping with UDL practices and may address issues related to time. The

potential for mandatory in-service days is an interesting concept, and this may be an avenue worthy of further exploration. The comment pertaining to short, focused training perhaps reflects the time pressures academics are under in contemporary HE, but it doesn't account for the fact that some faculty may require more time to process the information they are given. It may also suggest that some staff view training related to inclusive practices as less important than other activities.

Some staff offered useful suggestions in terms of how the training might be facilitated:

- "**co-design/participatory training** where students or alumni share the impact UDL had in their development and careers."
- "**Levelled content**: Beginner, Intermediate, Advanced (see below)"
- "I would only do such a training workshop if it were with **trainers who were experts** and who [sic] training themselves in the creative arts and/or the neurosciences."
- "I would like an **equally interested buddy / ally** to keep me motivated and have these conversations."

It was perhaps unsurprising to witness some staff comment on the need for co-design or participatory training with students and alumni. This type of training, which amplifies students' voices, aligns with more UDL-based approaches. The call for more tiered training is interesting and would facilitate the variance in staff expertise, and those who have completed the UDL badge, for example. It is interesting to note that one staff member claims that they would only attend training if it was delivered by experts in UDL with a background in the creative arts or neuroscience. In terms of a buddy system the university already had a UDL community of practice that fosters support, and the UDL badges are offered in groups, allowing for peer support.

5b) We then asked staff if there were other forms of support or training not mentioned in the previous question (5a) that they would find helpful.

Responses were varied. While two responses were positive in terms of the range of supports that are provided (including the Learning Educational Needs Summary (or LENS)), the majority of responses related to areas where improvement is needed. A themed selection of responses is presented below.

Several comments focused on the allocation of time and space to work on more inclusive practices:

- "As I mentioned in a previous comment box, this is something that should not just be an additional work for faculty (who already do not have enough time in the day, week, year)... Really (and this pertains not only to this but to the design of academic job more broadly) there are a finite amount of hours in the day, there is only so fast an individual can work and so there is an absolute limit on what people can do. Yes inclusivity is extremely important but adding this (and everything else that gets added) makes and

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unsustainable workload more unsustainable (hence why everyone is burned out and resistant to what should be positive initiatives like this)."

- "More incentives in the form of annual awards / recognitions, specific time allotted [sic] to the faculty allowing them to respect the gold standards in inclusive practices."
- "Practical assistance with things like marking, it is very time consuming to give formative feedback to large student numbers in a timely manner. Short technical training sessions that can be slotted into a very full diary."
- "...ensure that people are not teaching demanding lecture hours / postgraduate seminars one after the other without a break ... this doesn't foster the kind of energy necessary for dynamic classroom pedagogy of any kind."
- "Transparent WAM [Workload Allocation Model] to allow time for training & recognition of inclusive practices".

There was also evidence that some academic staff felt that there was too much emphasis on research being the sole responsibility of academic staff:

- "Reduced focus from UL management on research as only role for UL lecturers."
- "Those of us trying to do this for a long time should be given some recognition - if it isn't recorded, it isn't rewarded (with promotions or even some praise and encouragement)."

The following comment relating to the physical infrastructure falls under the pillar of Universal Design (UD) rather than UDL (see Banks et al., 2024 or Burgstahler, 2009), suggesting some confusion among staff about what UDL actually entails:

- "I work within constraints imposed by Registry and Buildings. I would like to see them being held more accountable for facilitating UDL rather than leaving everything up to the academic."

Other respondents felt rigid regulations and rules inhibit their ability to promote more inclusive practices:

- "Information on how much freedom a module lead has in adapting existing assessments to be more inclusive. How to adapt within regulations etc."
- "Set rules regarding what can and cannot be done. Eg in my department, we are prevented from doing certain things that are inclusive practices because of departmental rules. So if there were University standards as to what had to be done we could be more inclusive."

One respondent replied with the following quote: *"It came to my attention that staff with the position of "hourly paid" and "teachers" or "associate teachers" don't receive or are encourage [sic] to take any training on inclusive education beyond the UDL badge. This must be addressed, as I have witnessed situations in which these staff did the opposite to inclusivity in their teaching. All staff with at least 1 hour of teaching per week must take UDL, EDI, etc. Training."* This perceived policy gap is interesting as it highlights possible inconsistencies in expectations between those on longer term contracts versus those on

shorter term contracts, which may impact engagement with professional development. Respondents also provided several recommendations in terms of delivery options for future training, including an online forum for sharing advice, a UDL drop-in clinic, subject-specific support on how to implement UDL, in-depth reviews of courses with an expert, and workshops where UDL theory is covered in the first half and module reviews take place in the second half of the workshop.

In terms of specific topics, respondents suggested *training on gender issues, invisible whiteness, consciousness-based support, and how to support neurodiverse students.* In addition, respondents provided the following useful suggestions:

- "I'd be interested in more proactive content with a specific focus on online engagement, live teaching, assessment, etc."
- "Training for students to encourage them to engage in lectures and give constructive feedback."
- "Brightspace [VLE] specific, such as captions, tags, display options."

Conclusions, Limitations, and Recommendations for Future Research

This section summarises our findings and draws connections with the literature. It also outlines the limitations of our research and offers recommendations for future research.

Conclusions

It is evident from the responses to the research questions that staff have undertaken a variety of training in topics related to Inclusive Practice (IP) and UDL. At the authors' institution, training topics in these areas have increased significantly in recent years, with some IP training becoming mandatory in certain instances (e.g., unconscious bias training for staff on interview selection boards and, more recently, dignity and respect training for all staff).

The findings demonstrate some level of buy-in into UDL; however, many participants still seem to be unsure of UDL or don't feel they are applying it regularly enough. Many participants also said that they are unsure how to apply UDL in their teaching, suggesting a need for more training.

One third of respondents provided neutral or agree responses when asked if UDL is a passing fad, and nearly one quarter of respondents provided neutral responses when asked if UDL only benefits disabled students. As discussed earlier, UDL aims to address the diverse needs of *all* learners (Izzo, 2012; Fovet et al., 2014), so any assumption that UDL should only be addressed by the disability agenda is likely to lead to other issues, including lack of finance, lack of pedagogical expertise, and lack of buy-in among the faculties (Fovet, 2021; Healy et al., 2024; Hills et al., 2022).

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While the majority of respondents indicated that they were interested in undergoing additional training to make their teaching more inclusive, one-third remained undecided, and the remainder did not wish to pursue further training. These findings, coupled with the fact that survey respondents are more likely to be interested in being inclusive (simply by taking the time to respond), suggest that much more work needs to be done to gain buy-in from teaching staff about the importance of UDL and its benefits.

Staff offered many useful suggestions about delivery formats that they feel would work well (shorter training sessions were generally preferred). Other useful suggestions include seeking advice from experts, attending workshops where staff work on making their modules more inclusive, conducting peer observations, participating in UDL buddy initiatives, and holding collaborative, co-design workshops that involve staff and students.

Staff also offered suggestions regarding topics they would like to see addressed in future training, including gender, supporting neurodiverse students, invisible whiteness, and providing formative feedback to large groups. They also suggested incorporating more marginalised voices and co-creating with students.

The findings in this paper suggest that there is an interest in learning more about inclusion and UDL specifically. However, various factors (including time, workload, and other institutional factors) are impacting and influencing staff engagement. As outlined in the literature (see, for example, Dell 'Anna et al., 2024; Flood, 2025; Hills et al., 2022), these factors need to be addressed at an institutional level to achieve national agendas and targets for inclusive practice. Table 1 presents a summary of the key themes that emerged in the free text responses, as well as possible solutions offered by respondents.

Table 1

Key Themes and Solutions from Free Text Responses Regarding Professional Development Needs and Inclusive Practice Challenges

Theme	Possible Solutions Offered by Respondents
Time and workload constraints	Training outside of lecturing time; in-service days; need time with students; short and laser-focussed training.
How training might be facilitated	Co-design or participatory training with students and alumni; levelled content; training with UDL experts; buddy/ally system.
Need time and space to work on inclusive practices	More incentives for engagement (awards, recognitions, time); practical assistance with marking and feedback; short technical training sessions; less demanding teaching schedules; transparent workload models to allow time for training and recognition of inclusive practices.

Too much emphasis on research as sole responsibility of teaching staff	Reduce focus on research as only role; recognise those who have been inclusive for a long time (through promotions, praise, encouragement).
Physical infrastructure [more of a UD issue]	Registry and buildings to be held more accountable for (building/ infrastructure-related) constraints
Regulations and rules	Information on how much flexibility there is in adapting assessments to make them more inclusive and how to work within regulations; university standards rather than department-specific rules.

Limitations of the Research

Despite the overall strong response rate, this study was limited to a single university; therefore, the findings are not generalisable to the wider population. In addition, as the authors received more responses to some questions than others, some findings are more generalisable than others; to help counteract this issue and ensure transparency, the authors have highlighted how many responses were received for each question. Although the authors secured respondents from diverse disciplines, the responses may have come from individuals who actively engage in and take an interest in UDL activities. Furthermore, the responses were self-reported and thus susceptible to potential bias due to socially desirable outcomes. While the relevance and comprehensiveness of survey questions was ensured by employing a five-stage process involving internal and external pilot reviewers, the reliability and validity of the Likert constructs using Cronbach's Alpha were not determined before the survey was distributed.

Recommendations for Future Research

The findings of this self-reported study suggest that there is a need for further research to measure the implementation of UDL in the curriculum. There is a need for more robust evidence of implementation, particularly at individual course level, as well as across disciplines and faculties. The findings also suggest that professional development offerings may need to be more rigorously evaluated to ascertain which offerings are most beneficial to staff wanting to learn and engage with more inclusive practices such as UDL and what might be preventing those who did not respond to our survey and have not engaged with inclusive professional development to-date.

In addition, a longitudinal study on engagement with inclusive practice and UDL may yield richer data, possibly demonstrating how longer-term engagement with different types of professional development results in improved learning outcomes and student experiences. Studies could also examine how other forms of institutional support (e.g. workload recognition and improved infrastructure) improve staff experiences.

Finally, there is a need for large inter-institutional studies of inclusive practices using robust methods that would generate more generalisable results. The lack of established methodologies and individualist approaches to UDL may be impeding the development and acceptance of UDL across HE.

Disclosure/ Funding Acknowledgement

The Higher Education Authority (HEA) of Ireland funded this research project under their PATH 4 funding stream for research on inclusion.

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IJUDUDL
International Journal for Universal Design and Universal Design for Learning

International Journal for Universal Design and Universal Design for Learning (IJUDUDL) Vol. 1, No. 2, April 2026 ISSN: 3119-6055

Beyond Words: Exploring Visualisation as an Inclusive Practice in Postgraduate Research Supervision

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DOI: https://doi.org/10.34874/PRSM.ijududl-vol1iss2.6032

ABSTRACT

This qualitative study explores how visualisation strategies are conceptualised, enacted, and valued within MA and PhD research supervision. Drawing on the theory of practice architectures and Universal Design for Learning (UDL), it examines the cultural-discursive, material-economic, and social-political arrangements that enable or constrain inclusive supervisory practices. Through semi-structured interviews with four postgraduate students, the study reveals that visualisation serves as both a cognitive tool for sense-making and a dialogic stimulus for co-constructing knowledge. Participants described how collaborative engagement with visual materials helped navigate conceptual uncertainty, reduce power asymmetries, and legitimise diverse modes of expression. However, the findings also highlighted significant barriers such as concerns about professionalism, limited institutional recognition, time constraints, and resistance from colleagues who view multimodal approaches as deviating from academic norms. The study argues that embedding visualisation practices requires not only relational openness between supervisors and students but also broader institutional commitment to recognising supervision as a pedagogical practice. Rather than prescribing visualisation universally, the research emphasises creating conditions where multiple modes of engagement become possible and valued within supervisory partnerships.

Keywords

research supervision, visualisation strategies, practice architectures, Universal Design for Learning

Introduction

Undertaking research as a master's or PhD student is often a heuristic journey, leading to unexpected discoveries, a metaphor echoed in the literature as a voyage marked by complexity and challenge (Su et al., 2010; Wellington, 2015). Research supervision has frequently been conceptualised through an individualistic lens that emphasises the skills, attributes, and behaviours of supervisors and students. However, as Trowler (2021, p.1745) argues, this perspective leads to recommendations for the enhancement of supervision practices that "are frequently normative and aspirational without a pathway to achievement other than self-help." When supervision is framed solely as a dyadic relationship, it risks becoming detached from the broader cultural, social, and political forces that sustain it. In contrast, understanding supervision as a practice highlights its contextual complexity: practices are enacted across time and space, influenced by networks of people, tools, and discourses (Rönnermann & Kemmis, 2016; Schatzki, 2002).

The theory of practice architectures (Kemmis & Grootenboer, 2008; Kemmis et al., 2014) provides a useful lens here. It conceptualises practices as 'sayings', 'doings', and 'relatings' hanging together in three intersubjective domains. These are the semantic space (encompassing language, discourses, and cultural meanings), physical space-time (material resources, technologies, and temporal arrangements), and social space (relationships, power dynamics, and solidarity). These dimensions are shaped by cultural-discursive, material-economic, and social-political arrangements located in or brought to a practice site. This framework enables examination of how supervision practices are sustained not only through individual interactions but through broader contextual conditions that enable or constrain what becomes possible.

Within this constellation of supervisory practices, the role of visualisation remains largely unexplored. Little is known about how it is understood and enacted within supervisory relationships, or how it might contribute to more inclusive supervision. In this study, visualisation is conceptualised as the use of multimodal tools that combine visual elements and textual language, such as sketching, mapping, collage, and diagramming. Inclusive supervisory practice here refers to different ways of thinking and communicating, particularly for students who find it difficult to articulate emerging ideas through text alone.

This may include supporting students with different cognitive styles, accommodating neurodiversity, and creating conditions where uncertain thinking can be expressed without judgement. Within supervision, visualisation strategies, when collaboratively enacted, may open up alternative pathways into meaning making by making tacit processes visible, and creating shared objects around which dialogue can be more equitably distributed.

Alongside the theory of practice architecture, the framework of Universal Design for Learning (UDL) (CAST, 2024; Meyer, Rose, & Gordon, 2014) provides a complementary lens for examining visualisation practices in research supervision. UDL's emphasis on multiple means of representation, action, and expression resonates with the pedagogical flexibility required to support diverse learners. While the theory of practice architectures highlights how supervision is shaped by interwoven cultural-discursive, material-economic, and social-political arrangements, UDL reinforces the need for accessibility and responsiveness within these arrangements. Together, the two frameworks provide a means to consider both the situated practices of supervision and the broader conditions through which inclusive approaches can be enacted.

This small-scale qualitative study explores how visualisation strategies were perceived and embedded in research supervisory practices at different stages of the students' journey. The study does not claim to provide generalisable findings about inclusive supervision; rather it offers insights into the conditions under which visualisation practices might contribute to more inclusive and responsive supervisory relationships. The findings illuminate both possibilities and constraints, suggesting directions for further inquiry and practice development. It is guided by the following research questions:

1. How are visualisation strategies conceptualised and valued within the context of MA and PhD research supervision?
2. How are visualisation strategies embedded into supervisory practices?
3. What are the opportunities and challenges for embedding inclusive visualisation strategies within research supervision?

The paper begins by outlining relevant literature in relation to visualisation in research supervision, followed by a description of the methodology, presentation of findings interwoven with participant-generated visualisations, and a discussion reflecting on implications for inclusive supervisory practice.

Literature Review

Although visualisation as a research method is increasingly acknowledged in research guides (Wellington, 2015), its use within supervision meetings is less visible. Visual modes may be seen as secondary to written forms of expression, and their analytical rigour questioned. The perceived value of visualisation is shaped by the practice architectures (Kemmis & Grootenboer, 2008; Kemmis et al., 2014) that hold practices in place: the cultural-discursive, material-economic, and social-political arrangements that vary across disciplines and contexts. In architecture education, for example, drawing is integral to disciplinary traditions and is therefore "unlikely to be exposed to in-depth epistemological scrutiny" (Lyon, 2020, p.xx). However, when transposed into contexts where visualisation is unfamiliar, it may be dismissed as infantile (Lyon, 2020) or incompatible with institutional norms.

When visual methods are referenced, albeit indirectly, in the supervision literature, several recurring themes emerge. Visualisation is often framed as a cognitive tool, supporting students to structure research and make sense of emerging concepts. Acknowledging complexity in sense-making in the research process is considered a critical component of any research study (Barrett & Hussey, 2014; Hunt, 2001; Su et al., 2010). While students must find their way through this conceptual uncertainty, supervisors can play a critical role in helping them "overcome sticky points" (Wisker et al., 2003, p.390) and develop their thinking (Su et al., 2010). However, articulating tacit understandings is often difficult for students (Hunt, 2001). Hunt (2001, p.351) likens this multimodal shift to "climbing out of a void", highlighting the supervisor's role in mediating this challenging transition. From an idealised perspective of this role, the supervisor acts as a co-problem solver, prompting students to talk through muddles and refine their emerging ideas (Wisker et al., 2003).

Academic dialogue is central to this process of emerging meaning making. Mind mapping, for instance, has been identified as a way of tackling the iterative complexities of data analysis, with the supervisor supporting the student in recognising themes, making connections, and recording shifts in understanding (King, 2020). King (2020, p.5) describes how sharing cartoons with their supervisor became an empowering means of self-expression, leading to deeper reflection and the development of a stronger voice of authority in their research. Similarly, Barrett and Hussey (2014) describe how visualising central concepts helped one student reconnect with her work and clarify its conceptual thread.

Taken together, these studies suggest that visualisation offers alternative modes of expression that can help students navigate the emotional and cognitive challenges of a postgraduate research study. This perspective resonates with principles of UDL which advocate providing multiple means of engagement, representation, and expression. Visualisation allows students to communicate understanding in varied ways: through maps, collage, diagrams, or drawings, rather than relying solely on traditional text. Such practices can scaffold engagement, stimulate reflection (Barrett & Hussey, 2014; King, 2020), and provide ways of tracking progress (King, 2020).

However, the literature rarely examines how and why visualisation practices are taken up, normalised, or resisted within supervision contexts. By bringing together the theory of practice architectures and UDL, this study examines not only how visualisation strategies are conceptualised and enacted within supervision, but also how they might contribute to more inclusive supervisory practices.

Methodology

Data Collection and Analysis

This study adopted a qualitative exploratory design. The intention was not to produce

generalisable findings but to generate rich insights into how visualisation strategies are conceptualised and enacted within local supervisory relationships.

Participants and Recruitment

Four participants were involved in the study. Three were enrolled on the MA in Academic Practice (MAAP), a programme aimed at supporting and enhancing the professional development of educators working in higher education at a large London university. One participant was also a PhD student with two supervisors.

Recruitment was carried out through an invitation circulated to students on the MAAP programme. Participation was voluntary, with clear reassurance that involvement would not impact their studies or relationships with the researcher. The decision to work with four participants was informed by the study's exploratory aims and the nature of the data collection method. Rather than seeking breadth or statistical generalisability, the study prioritised depth of engagement with participants' lived experiences. The four participants provided different supervisory relationships to examine, with each generating visual artefacts and rich narrative accounts. The use of visual artefacts as elicitation tools provided concrete anchors for discussion and facilitated access to tacit dimensions of practice that verbal accounts alone might not capture.

However, it is important to note that the MAAP context, a programme explicitly focused on pedagogical development for educators, likely attracted participants predisposed to reflect on teaching and learning practices. The findings of the study, therefore, may be most transferable to contexts where supervision is understood as a pedagogical practice and where participants have some familiarity with educational theory and reflective practice. The study does not claim to represent visualisation practices across all disciplines or supervision contexts. Instead, it offers insights into conditions that enable or constrain such practices within particular sites of practice.

The characteristics of the participants are summarised in Table 1. To protect anonymity, pseudonyms have been assigned.

Table 1

Biographical Data of Participants

Participant's Pseudonym	**Discipline**	**Experience of MA/PhD Supervision**
Evie	Nursing	MAAP student with one supervisor
Lorraine	Speech and Language	MAAP student with one supervisor; PhD student with two supervisors
James	Employability	MAAP student with one supervisor
Maria	Law	MAAP student with one supervisor

Data Collection

Individual semi-structured interviews were conducted with each participant, lasting between 30 and 45 minutes. An interview guide was used to prompt discussion of participants' experiences of supervision, their perceptions of visualisation strategies, and the opportunities or challenges of embedding these within supervisory practices. Participants were invited to bring visual artefacts created during their research process to the interview. All four participants brought at least one visual artefact, ranging from mind maps and diagrams to collages.

During the interviews, participants were encouraged to talk through their visualisation explaining when and why they were created, whether they had been shared with supervisors, and what role they played in their research process. This elicitation approach positioned participants as interpreters of their own visual texts, while also allowing me to observe how they navigated between visual and verbal modes of explanation.

Ethics and Reflexivity

The study adhered to robust ethical review procedures, with approval being granted by the University Research Ethics Committee. All participants gave explicit informed consent, including permission for the inclusion of their visual artefacts in the research. To preserve anonymity, participants were assigned pseudonyms, and any identifying information within the visual artefacts such as names or recognisable handwriting was removed. Visual artefacts were stored securely in password-protected files accessible only to the researcher. Importantly, at the time of data collection, none of the participants were currently being assessed by me.

Given my role as a MAAP lecturer, reflexivity was crucial. This dual role of lecturer–researcher required careful navigation across all phases of the research. During recruitment, I relied on voluntary self-selection rather than direct invitation to individual students, minimising pressure to participate. At the beginning of each interview, I explicitly separated my research role from my teaching role, emphasising that participation was entirely voluntary, that responses would not influence assessments, and that withdrawal would have no consequences. To counter potential social desirability bias, I stressed confidentiality and framed the interview as an opportunity to explore diverse experiences and challenges rather than demonstrate successful practice. I also acknowledged my own use of visualisation in my teaching, positioning myself not as an advocate but as someone exploring how and why these practices emerged across different contexts. This transparency helped create space for participants to articulate both enabling factors and constraints without feeling judged.

Data Analysis

Interview recordings were transcribed verbatim by me, the sole researcher, and

analysed using thematic analysis (Braun & Clarke, 2006).

I was also attentive to how my theoretical frameworks, the theory of practice architectures (Kemmis et al., 2014) and Universal Design for Learning (CAST, 2024), could illuminate the data. The frameworks oriented the analysis toward cultural-discursive, material-economic, and social-political arrangements, offering a flexible lens through which to explore practice without predetermining what should be found.

The analysis proceeded through Braun and Clarke's six phases. First, I familiarised myself with the data by reading and re-reading transcripts while making initial observational notes. During the second phase, I generated initial codes through line-by-line coding of the transcripts, capturing both what the participants said and latent meanings, underlying assumptions or implications. Codes were developed inductively, remaining close to participants' language, such as "making thinking visible." In the third phase, I searched for themes by grouping related codes into broader conceptual categories. For example, codes relating to uncertainty, exploration, and iterative revision were clustered into a preliminary theme of "visualisation as sense-making." The fourth phase involved reviewing themes against coded extracts and the full dataset to ensure coherence and distinctiveness. I revisited transcripts multiple times to confirm that themes accurately represented participants' accounts and to check for overlooked patterns. In the fifth phase, I refined and named themes, defining their scope and relationship to the research questions and theoretical frameworks. Finally, I selected illustrative extracts for the findings and embedded these into mini vignettes within each of the main themes.

Presentation of Findings

The thematic analysis revealed three interconnected themes that illuminated how visualisation strategies were conceptualised, enacted, and constrained within research supervision. These themes address the three research questions and show how visualisation practices were shaped by cultural-discursive, material-economic, and social-political arrangements.

Theme 1: Visualisation as Cognitive Scaffolding for Conceptual Uncertainty

Participants consistently described visualisation as a cognitive tool for navigating the conceptual messiness and uncertainty inherent in postgraduate research. Rather than documenting completed thinking, visualisation actively shaped and structured emerging understanding.

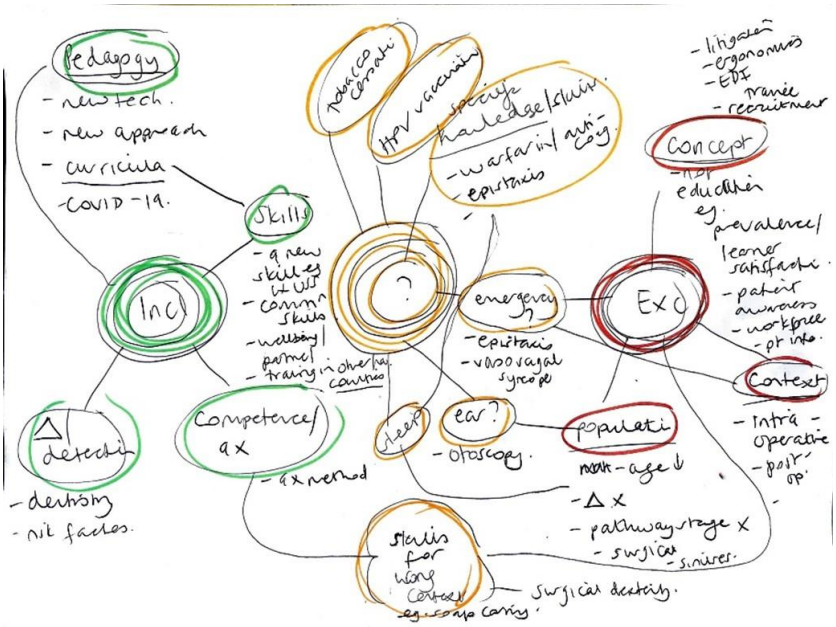
Lorraine's experience illustrates this mediating function. Working within Speech and Language therapy, where visualisation supports reading comprehension, she explained: "We use it to talk about strategies…..why you're reading and try to visualise what's happening."

For Lorraine, mind mapping served as embodied cognition to capture the evolving process of making sense of her scoping review (Figure 1). The colour coding (green for inclusion, red for exclusion, orange for "maybes") acted as cognitive scaffolding and making tacit thinking visible. She described the iterative nature of this sense-making:

> I find it helpful to begin putting things into these different sorts of bubbly categories so that I'm making sense of it as I'm going along. Some of them might end up being put together as one category or being broadened out if things become too full.

Figure 1

A Colour-Coded Mind Map Externalising Tacit Decision-Making and Making the Iterative, Non-Linear Nature of a Scoping Review Visible



This highlights how visualisation functioned not as a record of thinking but as a tool through which thinking developed. The visual artefact helped to capture this conceptual uncertainty, allowing students to work through ambiguity in a tangible, manipulable form.

Maria similarly articulated visualisation as essential to her cognitive style and as supporting neurodiversity:

> I need to be able to see what I'm thinking in images. It's much easier for me if I draw something and I can then work on the different layers from something that makes sense. My brain doesn't work in any other way.

Maria's account foregrounds how visualisation can legitimise diverse ways of thinking and communicating, aligning with Universal Design for Learning principles of multiple means of representation and expression. What is significant here is that visualisation is

not simply an optional enhancement but a fundamental mode of engagement for some students, particularly those who find linear, text-based thinking constraining.

Collectively, these accounts reveal how visualisation helped to make abstract concepts tangible. This scaffolding function addresses the "insecurity and conceptual uncertainty" (Su et al., 2010, p.87) inherent in postgraduate research, offering an alternative pathway through the complexity.

Theme 2: Visualisation as Dialogic Mediating Object

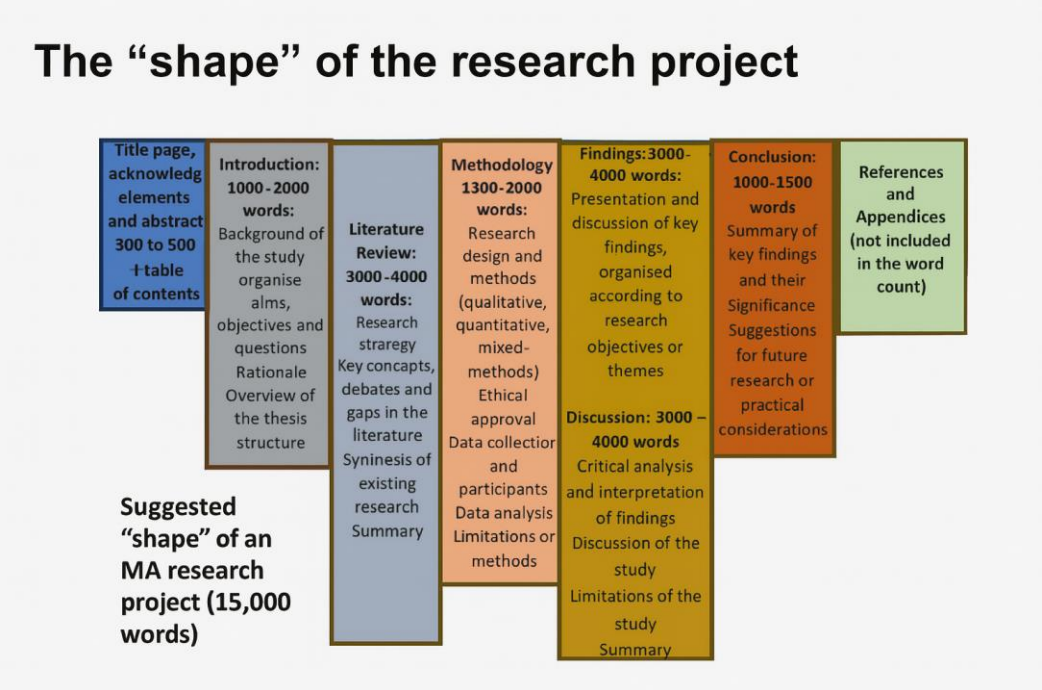
When shared in supervision, visual artefacts functioned as mediating objects around which collaborative meaning-making occurred. Rather than simply communicating pre-formed ideas, visualisations became sites where knowledge was actively co-constructed through dialogue.

Evie described how co-constructing a diagram with her supervisor helped her understand the interplay between research components. Together with her supervisor, they constructed a diagram of the different components of her MA project (Figure 2). She used a metaphor to explain the collaborative process:

> It was a bit like a cake. I could visualise all the different ingredients of the project, but it was only when I talked it through with my supervisor that I could see how these blended together to produce something more coherent.

Figure 2

Co-constructed Diagram of an MA Project, Showing How Collaborative Visualisation Transformed Components into a Coherent Whole



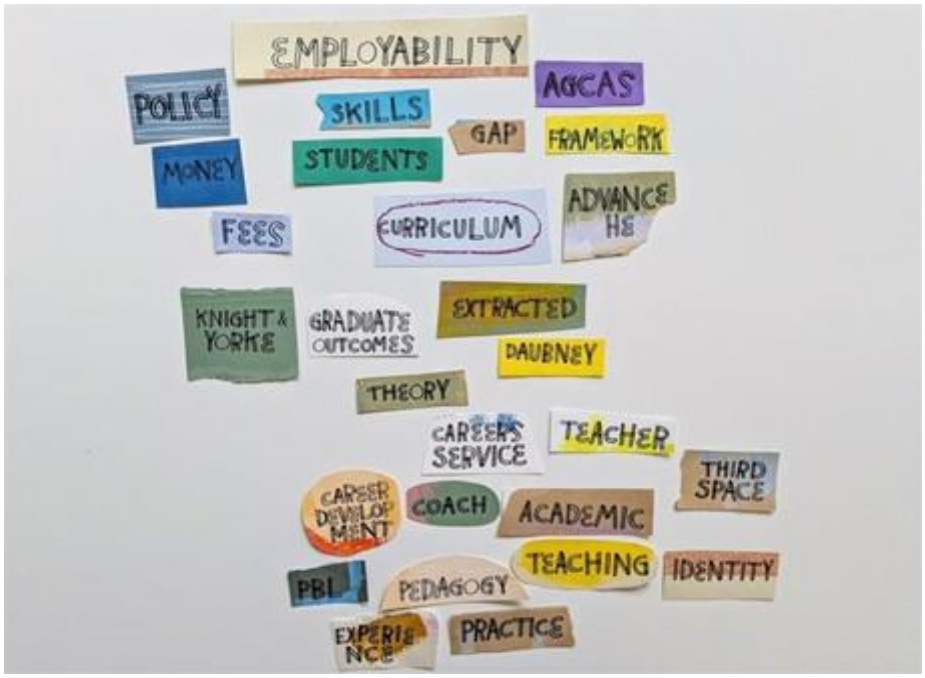
Through co-constructing this map, Evie and her supervisor negotiated a shared understanding of what the project entailed and how responsibility would be distributed across the supervision process. Significantly, Evie experienced the collaborative visualisation as reducing asymmetry in the supervisory relationship, creating space for ideas to be externalised and discussed: "From the beginning, I knew my supervisor was there to help me. It was out in the open. I already had some idea of how meetings would be managed and my role in the research process."

Whether her supervisor experienced the interaction similarly, as genuinely collaborative rather than as a pedagogical strategy to scaffold Evie's understanding, cannot be determined from this data. However, for Evie, the collaborative visualisation created a sense of partnership and transparency that shaped her ongoing relationship with her supervisor.

The dialogic potential of visual artefacts emerged even more clearly in James's account of using collages. James created a series of collages at different stages of his research journey, some of which were used as a stimulus for discussion in supervision meetings. Figure 3 shows an example designed to support his literature review.

Figure 3

An Example of a Literature Review Collage, Functioning as a Dialogic Mediating Object



The materiality of the collage, its physical, manipulable nature, supported iterative and dynamic meaning-making. James explained:

> I didn't go through in order necessarily. I'll be thinking about different things like employability at the top and then down to curriculum in the middle. This was a

way of whittling down to what it is I'll actually be looking at down to my research questions. It made me realise whilst researching the literature on employability that I need to be focusing on who's teaching it.

Through dialogue with his supervisor, both parties pieced together the narrative embedded within the collage such as the significance of circling the word 'curriculum' and the spatial relationships between elements. James explained how repositioning elements (Figure 4) created space for new insights:

We discussed how sometimes things are being overshadowed by something else like academics being at the bottom and career services at the top. As I move elements and talk about them, I visualise how much my perception of things have changed.

Figure 4

Repositioned Collage Elements, Tracing How Physical Manipulation of the Artefact Surfaced Shifting Relations Between Concepts

Crucially, James deliberately left space for meaning making to unfold in dialogue. He would create the collage before the supervision meeting but "didn't already come with this idea about what they [the collages] meant. I would just let that happen." This approach shifted the focus from his need to provide coherent answers to both parties exploring emergent ideas together. The collage became a mediating object that allowed him to bring "messy" thinking to the meeting.

Lorraine's experience further demonstrates the generative potential of collaborative visual interpretation. When she eventually shared her mind map with her supervisors having initially been reluctant, one supervisor noticed that the 'maybes' shared more connections with exclusion criteria than inclusion criteria, a pattern Lorraine had not

recognised. The supervisor's alternative reading, therefore, generated insights that Lorraine alone had not arrived at.

These examples show how visualisations may redistribute epistemic authority in the supervisory relationship. The visual artefact becomes a third point of reference that both supervisor and student can examine together, potentially reducing power asymmetries and creating space for more equitable knowledge construction. Rather than the supervisor judging the student's thinking, both engage as co-interpreters of a shared object.

Theme 3: Vulnerability, Risk, and Institutional Constraints

Although all participants valued visual strategies for their potential to provide flexibility and legitimise the complexity of research, they also spoke about the challenges of sustaining such practices. Three interconnected constraints emerged, outlined below.

Vulnerability in sharing visual work. There was a sense of vulnerability in sharing visualisations with others, particularly the concern that they might be dismissed as childish scribblings rather than taken seriously. Both Maria and Lorraine initially hesitated to share their visualisations. Lorraine feared that "a more polished output might be preferred" and was conscious of "sanitising" her work to make it "more palatable to an external audience." Maria was wary of imposing her cognitive style onto her supervisor: "I'd be worried that I'm imposing my brain plan on them."

James, despite being an artist as well as an educator who used visualisation extensively, expressed anxiety about how his creative approaches would be received: “[In my supervision meetings] I’m lucky to be encouraged but I’m a bit worried about how creativity is valued within my own team. I'm already feeling a little nervous about it being taken seriously.”

These accounts suggest that for visualisation to be sustained, both parties need to feel comfortable with uncertainty and open to co-interpretation. However, this may be a particularly demanding condition requiring not only individual dispositions toward exploratory practice but also relational trust and institutional practices and arrangements that value process over polished product.

Institutional invisibility and resistance. Visualisation tends not to be codified in institutional supervisory policy language. The focus on procedural clarity in supervision practices such as meeting targets and adhering to ethical standards means that pedagogical approaches are often not explicitly outlined. They may be perceived as assumed or less relevant than procedural guidance. Evie observed:

> I’m lucky in that my supervisor embraces visualisation techniques but I think this is quite rare. Most students I know talk about how they get feedback on their work, but they don’t talk about how they might do something differently.

James noted the tension between academic conventions and more creative, multimodal approaches:

> Within my research and within my teaching, the more I use visualisation the more validation I get, I suppose, but you still find that people don't take visual methods seriously. You have to explain the approach you're taking to give it that validation because it's not commonplace.

This cultural-discursive arrangement, where visualisation is positioned outside "proper" academic work, was reinforced by Maria's experience of resistance in her teaching practice. She often used whiteboards in preference to "static PowerPoints" to capture students' emergent thinking. A senior colleague challenged this approach: "She basically thought that what I was doing wasn't fair on the rest of the staff because if they couldn't do it that way, then I shouldn't do it that way."

This resistance illustrates how any practice that deviates from the perceived norm may be seen as risky rather than legitimate. In higher education, the focus on efficiency and standardisation such as the use of assessment criteria and rubrics may pressure practitioners to prioritise streamlined, predictable approaches over experimentation or ambiguity. Visualisation practices in research supervision, therefore, do not exist in a vacuum; they are inextricably linked to broader situated educational practices and shaped by "codes of signification" (Trowler & Cooper, 2002). These are the implicit cultural and symbolic systems through which meaning is constructed and interpreted within academic contexts.

Material and temporal constraints. Embedding visualisation in research supervision depended not only on relational dynamics and institutional recognition but also on practical temporal and material arrangements. Evie observed:

> I think it depends a lot on how much time you have, not only in your meetings but also to do your research. Do you have time to discuss anything which isn't immediately clear? I'm not sure this is always the case.

Contextual priorities such as the need to be efficient in meetings may consequently take precedence over embracing ambiguity, limiting the space for the reflective and exploratory engagement that inclusive visualisation practices require.

However, where enabling material conditions existed, they amplified the dialogic potential of visualisation. Lorraine reflected on the affordances of digital space, which allowed her to share her mind map online with her supervisors: "This meant that we could look at the same drawing whereas if were all crowded around one A4 sheet, it might be a bit more challenging."

The online discussion was anchored in a shared image, transforming the visualisation from a private sense-making tool into a shared artefact. Both student and supervisors

could direct themselves to the same conceptual uncertainties rather than Lorraine wrestling with these alone.

Similarly, Maria highlighted the value of whiteboards and writeable walls to mediate understanding through dialogue in real time and space. Evie echoed this point, adding that contributing to a shared artefact enabled the visualisation to remain open and negotiable: "We could bounce ideas off one another and make changes as we went along. It was nice to have that flexibility."

What emerges across these accounts is how visualisation practices were held in place or constrained by interconnected arrangements. The cultural-discursive, material-economic, and social-political dimensions of practice architecture operated together to enable or constrain inclusive supervisory practice. Table 2 synthesises these arrangements, showing how they relate both to practice architectures and to principles of Universal Design for Learning.

Table 2

Opportunities and Challenges for Inclusive Visualisation in Supervision

Practice Architecture Dimension	**Enabling Arrangements (Opportunities)**	**Constraining Arrangements (Challenges)**	**UDL Connection**
Cultural-Discursive (sayings, language, discourse)	• Supervisor openness to multimodal approaches • Visualisation framed as legitimate academic practice • Disciplinary traditions that value visual methods	• Perceptions of visualisation as unprofessional or "childish" • Expectations to present polished rather than provisional work • Lack of explicit recognition in institutional supervision policy	Multiple Means of Representation Alternative modes challenged text-based norms but faced legitimacy barriers
Material-Economic (resources, time, space, technologies)	• Access to shared physical spaces (whiteboards, writable walls) • Digital platforms enabling joint viewing of artefacts • Time allocated for exploratory thinking and dialogue	• Time constraints in supervision meetings • Pressure for efficiency over exploration • Limited physical resources • Difficulty accessing suitable spaces	Multiple Means of action and expression Materiality enabled negotiation of ideas, but time pressures limited iterative processes

Social-Political (relationships, power, solidarity)	• Relational trust between supervisor and student • Visualisation as shared object reducing power asymmetry • Willingness to engage with provisional, uncertain thinking	• Vulnerability in sharing "messy" work • Fear of judgement • Supervisor unfamiliarity with visual approaches • Concern about imposing cognitive styles	Multiple means of engagement Visual artefacts fostered dialogue and reduced hierarchy, but required relational safety

Discussion

The findings reveal that while visualisation practices align with UDL principles of multiple means of representation, action, and engagement, their enactment is mediated by the practice architectures within which supervision occurs. The following analysis examines how cultural-discursive, material-economic, and social-political arrangements enable or constrain the inclusive potential that visualisation offers.

Cultural-Discursive Arrangements

As Table 2 illustrates, cultural-discursive dimension arrangements such as the language, ideas, and discourses surrounding research supervision significantly shaped participants' perceptions of visualisation as legitimate academic practice. Visualisation was largely viewed as a "cognitive tool" or support mechanism, less acceptable and riskier than written outputs. This reflects broader hierarchies in which writing is considered more rigorous than multimodal forms (Mulligan et al., 2023), a perception reinforced through research discourse and institutional expectations.

UDL challenges these hierarchies through its principles of providing multiple modalities for representation and expression. It asks educators to consider how we might design learning environments that value different forms of expression including those that have been "historically deprioritised" (CAST, 2024). However, as Duncan et al. (2025) note, without critical engagement with disciplinary norms and institutional expectations, UDL risks being co-opted into existing hierarchies rather than challenging them. Its principles need to be intentionally applied, not adopted superficially. It is also worth interrogating what inclusivity means in this context, and for whom. The concept of inclusivity is not monolithic. Some students may find visualisation strategies alienating or inaccessible, and mandatory use could paradoxically create new forms of exclusion. Visual practices are themselves culturally mediated. The meanings attributed to colour, spatial arrangement, or collage are not universal, and students from educational traditions where such modes carry different epistemological weight may find them constraining rather than enabling. This highlights a key tension in any pedagogical intervention: tools designed to enhance accessibility can, when

universalised or decontextualised, reproduce the very hierarchies they aim to disrupt. What matters, then, is not whether visualisation is used, but how it is offered as one possibility among many, negotiated within the specific relational and contextual conditions of each supervisory partnership.

Material-Economic Arrangements

Material-economic arrangements, including resources, technologies, space, and time, are entangled in the performance of supervisory practices. In this study, visualisation's temporal nature emerged as particularly significant.

The time it took to produce a visual artefact shaped both its form and purpose within the supervision process. Lorraine's mind map and James's collage were iterative, provisional artefacts, flexible tools for reflection and dialogue. Their value lay in ephemerality: parts could be deleted, added, or manipulated, keeping ideas fluid. By contrast, Evie's co-created diagram required more time, giving it permanence and transforming it from an emergent thinking tool into a formal artefact. Thus, time actively shaped how visualisation unfolded in practice.

The materiality of visualisation was also entangled with participants' personal identities. As Maria and Lorraine's accounts suggest, sharing work-in-progress visuals risked exposing vulnerability; "messy" mind maps revealed not just unfinished thinking but ways of thinking that might be judged unprofessional. This connects to UDL's principle of multiple means of engagement and recognition of individual agency (CAST, 2024). However, it also reveals a tension: even when both supervisor and student embrace visualisation, the time investment in incorporating it into existing supervisory practices must be acknowledged. If meetings are tightly scheduled or focused solely on productivity, exploratory engagement becomes difficult.

Thus, whether visualisation practices are sustained in research supervision depends on their compatibility with multiple factors: with organisational norms and routines; physical resources; technological access; but also embodied know-how. Without recognition or institutional support, for both parties, visualisation practices risk being marginalised within supervisory discourse and practice.

Social-Political Arrangements

The social-political arrangements of supervision include the relational dynamics, hierarchies, and ‘rules’ that shape how supervisors and students engage with one another. The respective roles of the practitioners largely predispose supervisory dialogues, with the supervisor steering the conversation and the student following the script (Knowles, 2004). How practitioners position themselves in their institution, agree with its ethos, and feel valued all shape and are shaped by practice relatings (Kemmis et al., 2014).

Evie's and James's examples suggest visual artefacts can act as mediating objects, opening space for dialogue and possibly reducing prefigured asymmetries. However, these are student perceptions, not observations of interactions themselves. Additionally, micro-level practices like discussing visualisation relate to broader supervision systems (Trowler, 2021). Trowler refers to these as "nested" practices, how the site of practice is susceptible to wider structural influences. Thus, the power of influence does not only flow from the interactions between the supervisor and student: it is also channelled through external practices such as research methods training and providing feedback on chapter drafts.

UDL guidelines (CAST, 2024) acknowledge "individual, institutional, and system level barriers to learning", advocating "building inclusive communities". Although these aspects are not fully explored in the guidelines, one way of exploring alternative modes of communication in the relationship might be to establish peer networks. Supervisors could discuss pedagogical approaches to supervision, including the possible incorporation of visualisation strategies. This would raise awareness of different approaches and enhance supervisors' pedagogical content knowledge (Shulman, 1986). In this way, the pedagogical role of supervisors would be acknowledged in institutional policy, moving away from a more technical-rationalistic approach which prioritises efficiency and measurability.

Limitations of the Study

As a small-scale exploratory study, this research offers situated insights rather than generalisable claims. The study focuses on students' perceptions of visualisation strategies, with supervisors' voices only present through these accounts. In addition, observing actual supervision meetings would have aligned more closely with a practice ontological methodology, providing richer data about how visualisation practices evolve in space and time. Unfortunately, this was not feasible within the ethical and practical constraints of the study but remains a possible area for future longitudinal research.

The study also draws on participants from a single UK institution, and the visual practices discussed reflect particular cultural and disciplinary assumptions. The meanings associated with specific visual conventions, such as colour coding, spatial arrangement, collage, cannot be assumed to translate across different cultural or educational contexts.

A final possible limitation was that the visual artefacts discussed in the paper were those that the participants chose to share. There may have been others that they deemed too personal or messy to divulge. What participants selected to show me was itself shaped by their perceptions of what would be appropriate for this study.

Conclusion

This study has explored how visualisation strategies are conceptualised, enacted, and

valued within MA and PhD research supervision, using the theory of practice architectures and Universal Design for Learning (UDL) as complementary analytical lenses. Drawing on participants' accounts and visual artefacts, the findings illuminate both the pedagogical potential of visualisation and the situated conditions under which that potential is enabled or constrained.

The study found that visualisation functioned in three interconnected ways within this context. First, it operated as a cognitive scaffold through which students worked with conceptual uncertainty, enabling emergent thinking to be externalised. Second, when shared in supervision, visual artefacts acted as dialogic mediating objects, supporting collaborative sense-making and, in some cases, softening perceived power asymmetries.

Third, visualisation practices were experienced as sites of vulnerability and risk, shaped by concerns about professionalism, legitimacy, and the value accorded to "messy" or provisional thinking within academic cultures.

Across participants, visualisation was rarely a neutral or taken-for-granted practice. Its movement from private sense-making to shared supervisory dialogue was contingent on supervisors' openness to multimodal engagement, disciplinary norms, and the material-temporal conditions of supervision. These findings emphasise that visualisation does not simply add another technique to supervisory repertoires; rather, it reconfigures how thinking, dialogue, and authority are enacted within supervision.

Implications for Practice and Policy

For practice and policy, the study suggests several sensitising propositions rather than prescriptive solutions. Visualisation appears most productive when offered as one possible mode of engagement, negotiated within each supervisory relationship rather than imposed as a universal approach. Recognising supervision as a pedagogical practice is critical here. Creating institutional spaces where supervisors can discuss and experiment with different ways of mediating thinking, including multimodal approaches, may be more important than codifying specific techniques. Material-economic arrangements also matter. Time, space, and access to appropriate resources shape whether exploratory, dialogic practices are feasible or marginalised in favour of efficiency and polish.

At the same time, the study cautions against treating visualisation as inherently emancipatory. As the findings show, the same artefact that functions as a dialogic opening in one relationship may feel exposed and risky in another. Its value is not located in the artefact itself but in the conditions that allow it to operate as a shared, provisional object of inquiry.

In summary, visualisation strategies offer potentially inclusive ways for postgraduate students to make sense of their research with others. What this study highlights is that their value cannot be separated from the conditions that make them possible. By

foregrounding these practice architectures, the study argues for a more situated, reflexive approach to inclusion: one that values negotiation and pedagogical judgement over the pursuit of standardised, one-size-fits-all supervisory models.

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IJUDUDL
International Journal for Universal Design and Universal Design for Learning

International Journal for Universal Design and Universal Design for Learning (IJUDUDL) Vol. 1, No. 2, April 2026 ISSN: 3119-6055

Universal Design for Learning In Higher Education: A Proactive Learning Environment for Students with Attention-Deficit Hyperactivity Disorder

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DOI: https://doi.org/10.34874/PRSM.ijududl-vol1iss2.6985

ABSTRACT

Students with Attention-Deficit/Hyperactivity Disorder (ADHD) in higher education have unique learning needs related to self-regulation and executive function. Universal Design for Learning (UDL) strategies help faculty members create educational experiences accessible to diverse learners through three main design principles: multiple means of engagement, action and expression, and representation (CAST, 2018). In this study, we examined how faculty members at a large university in the Southwestern U.S. used UDL-aligned strategies to support students, particularly those with ADHD. We focused on the UDL principle of multiple means of engagement. Specifically, we explored student perceptions of faculty members' implementation of UDL's principle of multiple means of engagement and the benefit of using these strategies. We examined the relation between reported use of UDL strategies and their perceived benefit to students' academic success. Survey results showed no statistically significant difference between the perceptions of students who identified with having ADHD and other students. Findings suggest students believe that UDL strategies are beneficial to their learning success, regardless of disability status. Results of the study may help faculty members better understand student needs and increase student academic benefit within a higher education environment.

Keywords

Universal Design for Learning, higher education, Attention-Deficit/Hyperactivity Disorder, student engagement

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The adolescent educational experience is a time marked with change, from youth to adulthood. This period of change is prominent, especially during post-secondary or higher education. University can be a challenging experience for students (Elmore et al., 2018), broadening their worldview as they complete their degrees, and offering a variety of life changes. Students may change where they live, moving out of their childhood homes and towns, finding new friends and developing social networks with colleagues, and growing into their roles as adults in society. However, as Elmore et al. (2018) noted, the experience for students at university is often remarkably different for students with Attention-Deficit Hyperactivity Disorder (ADHD).

ADHD is a neurodevelopmental disorder that affects attention and hyperactive-impulsive behaviors (American Psychiatric Association [APA], 2022). It is characterized by difficulty sustaining attention on tasks for prolonged periods, weakness in the organization of projects and completion of tasks, and being easily distracted (APA, 2022). Individuals with ADHD may also experience symptoms such as fidgeting, described as “on the go”- type behavior, and difficulty in social situations (Keller & Tillery, 2000). The prevalence rate of ADHD in children and youth is about 8.0% globally (Ayano et al., 2023). While often studied and diagnosed in children, it may also affect up to 4.5% of the adult population, though this figure may be lower due to factors such as late diagnosis (Maul & Advokat, 2013).

The American College Health Association reported 15.5% or more university students self-identified as having a diagnosis of ADHD during the 2024-2025 academic year (American College Health Association, 2026); although this number could be higher due to underreporting (Aquino & Bittinger, 2023). These higher reported rates may reflect increased identification during adolescence or early adulthood and more apparent recognition of ADHD symptoms when students encounter increased executive functioning and self-regulation demands associated with higher education (Kwon et al., 2018).

In the U.S., the Americans with Disabilities Act (1990) provides federal protections to students with ADHD, including the right to accommodations for their disability. However, students with ADHD often struggle with the independent aspect of university coursework (Canu et al., 2021). For example, time management and task completion, as well as procrastination and executive dysfunction, prove challenging for students with ADHD as compared to their peers (Canu et al., 2021; Elmore et al., 2018).

In a study of initially 456 students, with the sample split evenly between students with and without ADHD, DuPaul and colleagues (2018) found statistically significant differences for students with ADHD compared to their nondisabled peers for grade point average (GPA), credits attempted, and measured motivation to study, suggesting a need for resources and

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instructional strategies designed proactively to support students with ADHD. When faculty members implement effective strategies to support students who struggle to be successful in university learning environments due to ADHD, they can create more accessible learning environments for all students. UDL provides a framework offering proactive strategies to design with intention the instructional experiences to reduce barriers before they arise. The purpose of this study is to examine university students' perceptions of their faculty members' use of UDL strategies, their perceived benefit, and how these perceptions relate to their learning.

Universal Design for Learning

UDL stems from universal design principles from the fields of architecture, engineering and design; however, UDL specifically focuses on addressing and removing potential barriers to educational success by proactively planning instruction and environments to make learning more accessible to all (Rose et al., 2006). Foundational to UDL is that learner variation is the norm and expected; thus, variation should be at the heart of instructional planning. Using UDL principles, educators can integrate inclusive instructional practices to cultivate learners to be "purposeful and motivated, knowledgeable and resourceful, and strategic and goal-oriented" in the ways they interact with their educational environment (CAST, 2017).

UDL includes three principles: (a) multiple means of engagement, (b) multiple means of action and expression, and (c) multiple means of representation (Rose et al., 2006). The principle of multiple means of engagement addresses the variety of interests and motivations that may influence a learner (CAST, 2017); therefore, it is essential that choices for engagement are thoughtfully planned (F. C. Durgungoz & Durgungoz, 2025). For instance, Rose and colleagues (2006) noted that while some students may feel inspired by spontaneity, other students become disengaged easily by novel ideas within the classroom. This principle emphasizes the goal for students to grow into purposeful and motivated learners.

The principle of multiple means of action and expression acknowledges that students may encounter a variety of challenges with the potential to limit their ability to demonstrate effectively their learning. By forming scaffolded measures, support systems, and multiple delivery methods for students to express themselves and their knowledge, educators can better enable students to be strategic and goal-oriented learners.

The final principle in the framework is multiple means of representation, which provides options for how students learn by giving choices in the delivery methods of learning content (Posey & Novak, 2020). For example, some students may benefit from verbal

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instruction alone; others within the classroom may struggle with only verbal instruction, finding greater benefit from additional written instruction. When an instructional goal is set, students may be provided with opportunities to engage with the content in a variety of ways to show they have achieved the goal; choices in instructional delivery allow students of a variety of interests, skills, experiences, and ability levels to access educational opportunities and demonstrate learning. The goal of this principle is for students to be knowledgeable and resourceful in their learning.

University support systems in the U.S. and worldwide often involve established offices such as a disability resource center for students to access individual accommodations (Americans with Disabilities Act, 1990; UNESCO and the Right To Education Initiative, 2022); however, when educators use the UDL framework to guide the design of instructional experiences, an inclusive learning environment leveraging student variation is created instead of one framed by student deficiencies (Beck Wells, 2022). Many educators are turning to UDL-aligned instructional design to benefit all students (Rose et al., 2006). While Davies and colleagues (2013) noted that students report seeing benefits of UDL-aligned strategies within classrooms, little is known about how universities are currently implementing UDL standards within universities and in schools within universities (Davies et al., 2013).

Purpose

The purpose of this study is to explore how students experience the engagement principle of UDL in their university courses at one large institution of higher education in the Southwestern U.S. In this exploratory study, we surveyed students on 10 UDL checkpoints (described subsequently).[1] These checkpoints illustrate and give detail to three main guidelines: recruiting interest, sustaining interest and persistence, and self-regulation (CAST, 2018), emphasizing the importance of creating curiosity and drive to learn, facing challenges that can be accomplished with vigor, and finding ways to engage students emotionally while learning. Through this study, we explored the following questions:

1. At what frequencies do students report university faculty members implement instructional strategies aligned to UDL's principle of multiple means of engagement?
2. Which UDL-aligned engagement strategies do students, both with ADHD and without ADHD, find most beneficial to their academic success?
3. What is the comparative relationship between students' responses of UDL engagement occurrence and agreement of helpfulness by disability status (i.e., with ADHD and without ADHD)?

[1] The UDL principle of Multiple Means of Engagement has been updated to 13 checkpoints as of UDL 3.0, July 2024.

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By answering these questions, we seek to better understand how university faculty members are proactively designing educational strategies in alignment with UDL. In addition, findings may offer initial insights as to recommendations for higher education faculty members. By surveying the students utilizing instructional strategies aligned to the checkpoints of the engagement principle of UDL, we can better understand their experiences and preferences within the classroom, creating a more fulfilling university experience and more inclusive practices within the university.

In this study, we primarily use person-first language (e.g., "students with ADHD") consistent with conventions in educational and psychological research; however, we acknowledge that identity preferences within neurodivergent communities vary, and we respect that individuals may identify with different terminology (American Psychological Association, 2023). Additionally, the term "disability" is used in alignment with educational accessibility frameworks, recognizing that disability often emerges from the interaction between individual differences and environmental barriers. Within this context, ADHD is described as one form of learner variation, rather than framing students in a deficit-oriented manner.

Method

Setting

Arizona State University (ASU) is a public research university in the Phoenix metropolitan area. Its charter notes that it is unique for whom it includes and how they succeed, and its mission and goals include accessibility, student retention, academic quality, and local impact, as well as advancing progress through innovation (ASU, n.d.; Faller, 2023). Nearly 150,000 students were enrolled at ASU in 2023. Learner variation is the norm at the university. As of 2023, 33% of students were reported as Pell Grant (i.e., U.S. federal funding allocated to support students who qualify with financial need) recipients or first-generation university students, and ASU is recognized as a Hispanic-Serving Institution, with approximately 7,300 degrees received by Latino students in 2023 (ASU, 2023). In 2023, nearly 80,000 students were enrolled in immersion-based learning programs, attending in-person courses and completing coursework at one of the many ASU campuses. ASU also features Student Accessibility and Inclusive Learning Services (SAILS), the disability resource center for students, which provides federally regulated accessibility services for students with disabilities (Young, 2020).

SAILS reported that in the Fall 2023 semester, 4,794 students requested accommodations through SAILS's accommodation services; this number does not include all students who are registered with the department who may not be receiving accommodations in the Fall

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2023 semester (E. Schneider-Pollack, personal communication, March 29, 2024). ASU's richly diverse learner population may see benefit from the implementation of UDL strategies, particularly engagement strategies. By implementing UDL, not only can the university succeed in fulfilling its charter, but ASU could also innovate new learning experiences that can greatly benefit the diverse learner population it seeks to serve.

Participants

Participants were university students at least age 18, of both undergraduate and graduate levels of study. Seventy-nine students participated in this survey study. Of the 79 participants, 23 only partially completed the survey. We conducted data analysis with results from the 57 completed surveys. Participants answered demographic questions about their education level, as well as their area of study at the university (see Table 1). Participants were asked about their disability status, specifically if they self-identified as having ADHD, if they have any other disability, or if they have no disability. Thirty-eight students (n = 66%) identified as having no disability, nine students (n = 15%) identified as having ADHD, 7 students (n = 12%) identified as having another disability, and 3 students (n = 5%) preferred not to share (see Table 1). Students also reported their level of study by credit accrual and their area of study, which allowed us to better understand the range of student experiences the survey captured. Most students who completed the survey were studying liberal arts and sciences, as well as education at the university.

Table 1

Participant Characteristics (N = 57)

Variable/ Level	Participants with ADHD % (*n*)	Total sample % (*n*)
Disability status		
No disability	-	66.67 (38)
ADHD	15.79 (9)	15.79 (9)
Other disability	-	12.28 (7)
Prefer not to share	-	5.26 (3)
Education level attained		
Freshman (0-30 credits)	1.75 (1)	8.77 (5)
Sophomore (31-60 credits)	0 (0)	21.05 (12)
Junior (61-90 credits)	5.26 (3)	22.81 (13)
Senior (91-120 credits)	5.26 (3)	40.35 (23)
Doctoral student/candidate	3.51 (2)	7.02 (4)

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Area of study		
Education	8.77 (5)	40.35 (23)
Science and liberal arts	5.26 (3)	31.58 (18)
Engineering and computer sciences	0 (0)	10.53 (6)
Business studies	0 (0)	5.26 (3)
Design and arts	0 (0)	5.26 (3)
Interdisciplinary/Futures-oriented programs	1.75 (1)	3.51 (2)
Public service and policy	0 (0)	1.75 (1)
Not reported	0 (0)	1.75 (1)

Note. - = not applicable. The variable disability status was used to determine the subsample of participants with disabilities.

Procedures

After securing university institutional review board approval, the first author sent invitations to students to complete the survey through various circulation methods broadly across multiple areas of study at the university, in an attempt to get a wide scope of student voices. The first author prepared the survey using a secure survey system (i.e., Qualtrics) for digital distribution. The survey was shared through emails, university-sponsored messaging channels, private messaging, Learning Management System (LMS) announcements, and word of mouth. When the recipient clicked on the study link, they accessed the consent form first; if they agreed, they then proceeded to the one-time survey.

The survey was open for completion for two weeks in November 2023. As a small thank you, participants who chose to register, separate from the survey, were entered in a drawing for a $10 Starbucks gift card. Twenty recipients were randomly drawn and received Starbucks gift cards digitally.

Measures

Participants were asked to complete one survey with three sections: demographic questions, frequency of occurrence questions, and agreement-based questions aligned to UDL engagement checkpoints. In section one, participants responded to demographics questions. After, the participants were led to the items of two UDL constructs in sections two and three.

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Survey Development. The survey instrument was developed by operationalizing the UDL engagement checkpoints outlined by CAST (2018). Each checkpoint was translated into student-facing statements describing an instructional strategy that may be used in courses (e.g., offering improvement-oriented feedback, creating choice in course materials). Two items were created for each checkpoint: one measuring the frequency of occurrence of the strategy and one measuring the perceived helpfulness of the strategy for academic success. A survey design was deemed appropriate because the study aimed to capture student perceptions of instructional practices across multiple courses and disciplines. The survey design aimed to efficiently collect quantifiable data from a broad participant group while still addressing the research questions for this exploratory study. This approach enabled researchers to obtain more responses, thereby strengthening the validity of the collected data.

We selected the engagement principle as the core focus of this study because its techniques, recommendations, and checkpoints target learning barriers commonly experienced by students with ADHD. Students with ADHD often experience challenges related to sustained attention, executive functioning, task initiation, and motivation (APA, 2022; Canu et al., 2021). The instructional strategies aligned to the checkpoints within the engagement principle, such as providing clear learning objectives, offering structured agendas, allowing opportunities for revision, and delivering improvement-oriented feedback may help scaffold executive function and support motivation and persistence in the classroom. Additionally, strategies that provide autonomy and choice in learning materials may increase engagement and reduce attentional fatigue. By focusing on checkpoints within the principle of multiple means of engagement, we designed the survey to capture instructional practices that may address barriers frequently reported by students with ADHD.

Within this context, the study was designed as an exploratory investigation intended to capture early insights into how students perceive UDL engagement strategies within a specific higher education environment. Exploratory research is particularly valuable when examining heterogeneous learning experiences, such as those involving ADHD, where individual variation and contextual factors shape how instruction is experienced (Rosenthal et al., 2025).

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Demographic Measures. In the demographics section of the survey, participants responded to 5 items assessing the participant's level of study based on credit accrual, area of study, and self-identified disability status (i.e., no disability, ADHD, other disability, prefer not to share).

Frequency of UDL Engagement Practices. In the first UDL construct section (10 items, measurement questions 1-10), respondents were asked to rate the frequency of occurrence of the engagement-based strategy within their university coursework using a 5-point Likert-type scale (0 = never, 1=rarely, 2=sometimes, 3=often, 4=always). As an example, respondents selected the frequency that best fit the question: My professor (never, rarely, sometimes, often, always) offers choices in materials (e.g., reading a chapter, listening to a video, listening to the textbook (see Table 2 for the full set of questions). Higher scores indicated higher reported frequency of occurrence of UDL-aligned engagement strategies during instruction. Item mean scores for Frequency of Occurrence were computed by averaging the responses across the 10 items, yielding possible mean scores ranging from 0 to 4 for each guideline (e.g., 7.1, 7.2), with higher scores reflecting greater reported use of engagement-aligned practices.

Perceived Helpfulness of UDL Engagement Practices. In the second UDL construct section (10 items, measurement questions 11-20), respondents were asked to rank the level of agreement related to their perceived helpfulness of engagement-aligned strategies within the university setting using a 5-point Likert-type scale (0 = strongly disagree, 1= somewhat disagree, 2= neither agree nor disagree, 3= somewhat agree, 4= strongly agree). As an example question, respondents selected their level of agreement with the following statement: I find it helpful when my professor offers choices in materials (e.g., reading a chapter, listening to a video, listening to the textbook; see Table 2 for the full set of questions). Higher scores indicated greater perceived helpfulness of the UDL engagement strategy for their academic success. Item mean scores for Perceived Helpfulness were computed by averaging the responses across the 10 items, producing possible mean scores ranging from 0 to 4 for each guideline (e.g., 7.1, 7.2, etc.), with higher scores reflecting stronger agreement regarding their perceived academic benefit of engagement-aligned practices.

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Table 2

UDL Engagement Guidelines and the Corresponding Survey Questions

UDL Engagement Checkpoint (CAST, 2018)	UDL Engagement Strategies	
	Frequency of Occurrence	Perceived Helpfulness
7.1 Optimize individual choice and autonomy	My professor ___ offers choices in materials (e.g., reading a chapter, listening to a video, listening to the textbook)	I find it helpful when my professor offers choices in materials (e.g., reading a chapter, listening to a video, listening to the textbook).
7.2 Optimize relevance, value, and authenticity	My professor ____ offers assignments valuable to my career interests.	I find having relevant assignments valuable to my career interests helpful to my academic success.
7.3 Minimize threats and distractions	My professor ____ offers an agenda for the classroom activities.	I find having my professor offer an agenda for the classroom activities helpful to my academic success.
8.1 Heighten salience of goals and objectives	My professor ___ offers learning objectives on materials in the classroom.	I find it helpful when my professor offers learning objectives on materials in the classroom.
8.2 Vary demands and resources to optimize challenges	My professor ____ offers the ability to resubmit assignments to demonstrate improved understanding.	I find it helpful when my professor offers the ability to resubmit assignments to demonstrate improved understanding.
8.3 Foster collaboration and community	My professor ____ offers ways to vary cooperative participation (e.g., rotating groups/partners).	I find it helpful when my professor offers ways to vary cooperative participation (e.g., rotating groups, partners).
8.4 Increase mastery-oriented feedback	My professor ___ offers improvement-oriented feedback on the assignments I put into the classroom.	I find it helpful when my professor offers improvement-oriented feedback on the assignments I put into the classroom.
9.1 Promote expectations and beliefs that optimize motivation	My professor ____ offers effective rubrics/checklists that allow me to assess my learning progress in the course.	I find it helpful when my professor offers effective rubrics/checklists that assess my learning progress in the course.

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9.2 Facilitate personal coping skills and strategies	My professor ____ offers information on how to access academic and mental health resources (e.g., university counseling, tutoring services, crisis hotlines, emergency support services).	I find it helpful when professors offer information on how to access academic and mental health resources.
9.3 Develop self-assessment and reflection	My professor ____ offers ways to assess my own progress within the course.	I find it helpful when my professor offers ways to assess my own progress within the course.

Note. Frequency of Occurrence items rated on a scale of *never, rarely, sometimes, often, always*. Perceived Helpfulness items were rated on a scale of *strongly disagree, somewhat disagree, neither agree nor disagree, somewhat agree, and strongly agree.*

Data Analytic Procedures

Survey data were screened for completeness prior to analysis. Only fully completed surveys (N = 57) were included in the final analytic sample. Descriptive statistics were computed using Microsoft Excel formula functions for all study variables, including means and standard deviations, to summarize students' reported Frequency of Occurrence and Perceived Helpfulness of UDL engagement strategies measured in the survey. We computed an average mean score for each UDL checkpoint for total students, students without ADHD (n = 48), and students with ADHD (n = 9) to better understand and compare both the ways students were seeing UDL in action and what students found most helpful in the classroom (Table 3).

Mean scores were calculated for each UDL engagement checkpoint separately for the Frequency of Occurrence items and Perceived Helpfulness items. These scores were computed by averaging item responses from each completed survey corresponding to each UDL checkpoint, with higher scores indicating greater perceived frequency or helpfulness, respectively. To examine differences in perceptions by disability status, we computed independent-samples t-tests comparing students who self-identified as having ADHD and students who did not identify with ADHD. Separate t-tests were performed for Frequency of Occurrence and Perceived Helpfulness scores for each UDL engagement guideline. Statistical significance was evaluated using an alpha level of .05.

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Results

Frequency of Occurrence of Multiple Means of Engagement UDL Strategies

An independent samples t-test indicated no statistically significant differences between students with ADHD and students without ADHD for Frequency of Occurrence scores across all UDL engagement checkpoints measured (see Table 3). Mean differences between the groups were small, and all comparisons were nonsignificant at the $\alpha = .05$ level. Students with ADHD generally rate the frequency that UDL checkpoints occurred within the classroom between sometimes and often ($M = 2.56$, $SD = 1.12$). Students without ADHD similarly rated frequency of occurrence between sometimes and often ($M = 2.44$, $SD = 1.11$). Figure 1 displays the mean Frequency of Occurrence scores across UDL engagement checkpoints by disability status. The t-test results are illustrated in Figure 2.

Perceived Helpfulness of Multiple Means of Engagement UDL Strategies

An independent-samples t-test indicated no statistically significant difference between students with ADHD and those without ADHD in perceived helpfulness scores across all UDL engagement checkpoints (see Table 3). Mean differences between the groups were small, and all comparisons were nonsignificant at the $\alpha = .05$ level. Agreement to the helpfulness of UDL checkpoints surveyed were rated between somewhat agree and strongly agree by students with ADHD ($M = 3.57$, $SD = .74$). Students without ADHD rated agreement to the helpfulness of UDL checkpoints surveyed similarly between somewhat agree and strongly agree ($M = 3.31$, $SD = .91$). Figure 1 displays mean Perceived Helpfulness scores across UDL engagement checkpoints by disability status. The t-test results are illustrated in Figure 2.

Comparative Relationship Between UDL Engagement Occurrence and Perceived Helpfulness by ADHD Status

Independent-samples t-tests were conducted to examine differences between students who self-identified with ADHD and those without ADHD in their responses to the Frequency of Occurrence and Perceived Helpfulness of UDL engagement checkpoints. Results indicated no statistically significant differences between the two groups across either measure (see Figure 2). Mean differences between students with ADHD and students without ADHD were small, and all comparisons were nonsignificant at the $\alpha = .05$ level. Overall, students with and without ADHD reported similar perceptions regarding both the frequency with which UDL engagement checkpoints occurred and the extent to which strategies supported their academic success. The t-test results are illustrated in Figure 2.

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Table 3

Descriptive Statistics for Frequency and Helpfulness of UDL Checkpoints

UDL Checkpoints/ Construct	Students with ADHD (n = 9) M (SD)	Students without ADHD (n = 48) M (SD)	Total (N = 57) M (SD)	p
7.1 Optimize individual choice and autonomy				
Frequency of occurrence	1.88 (1.26)	1.88 (1.19)	1.88 (1.19)	.98
Perceived helpfulness	3.78 (0.44)	3.31 (0.87)	3.40 (0.82)	.12
7.2 Optimize relevance, value, and authenticity				
Frequency of occurrence	2.89 (0.60)	2.58 (0.89)	2.62 (0.85)	.33
Perceived helpfulness	3.78 (0.44)	3.52 (0.98)	3.55 (0.92)	.12
7.3 Minimize threats and distractions				
Frequency of occurrence	2.67 (1.11)	2.89 (0.86)	2.84 (0.89)	.51
Perceived helpfulness	3.67 (0.50)	3.48 (0.79)	3.50 (0.75)	.49
8.1 Heighten salience of goals and objectives				
Frequency of occurrence	3.22 (1.30)	2.90 (0.88)	2.95 (0.95)	.36
Perceived helpfulness	3.22 (0.97)	2.94 (0.99)	2.98 (0.99)	.43
8.2 Vary demands and resources to optimize challenges				
Frequency of occurrence	2.11 (1.36)	1.94 (1.40)	1.93 (1.40)	.74
Perceived helpfulness	3.78 (0.44)	3.60 (0.67)	3.62 (0.61)	.44
8.3 Foster collaboration and community				
Frequency of occurrence	2.67 (1.11)	2.06 (1.13)	2.12 (1.14)	.14
Perceived helpfulness	3.44 (1.01)	2.79 (1.25)	2.90 (1.20)	.14
8.4 Increase mastery-oriented feedback				
Frequency of occurrence	2.89 (0.92)	2.54 (1.07)	2.57 (1.01)	.36
Perceived helpfulness	3.89 (0.33)	3.58 (0.57)	3.64 (0.55)	.12
9.1 Promote expectations and beliefs that optimize motivation				
Frequency of occurrence	2.22 (1.39)	2.73 (1.06)	2.62 (1.12)	.22
Perceived helpfulness	3.67 (0.70)	3.52 (0.65)	3.53 (0.65)	.53
9.2 Facilitate personal coping skills and strategies				
Frequency of occurrence	2.33 (0.86)	2.48 (1.07)	2.43 (1.03)	.69
Perceived helpfulness	2.89 (1.26)	2.98 (1.02)	2.97 (1.04)	.81
9.3 Develop self-assessment and reflection				

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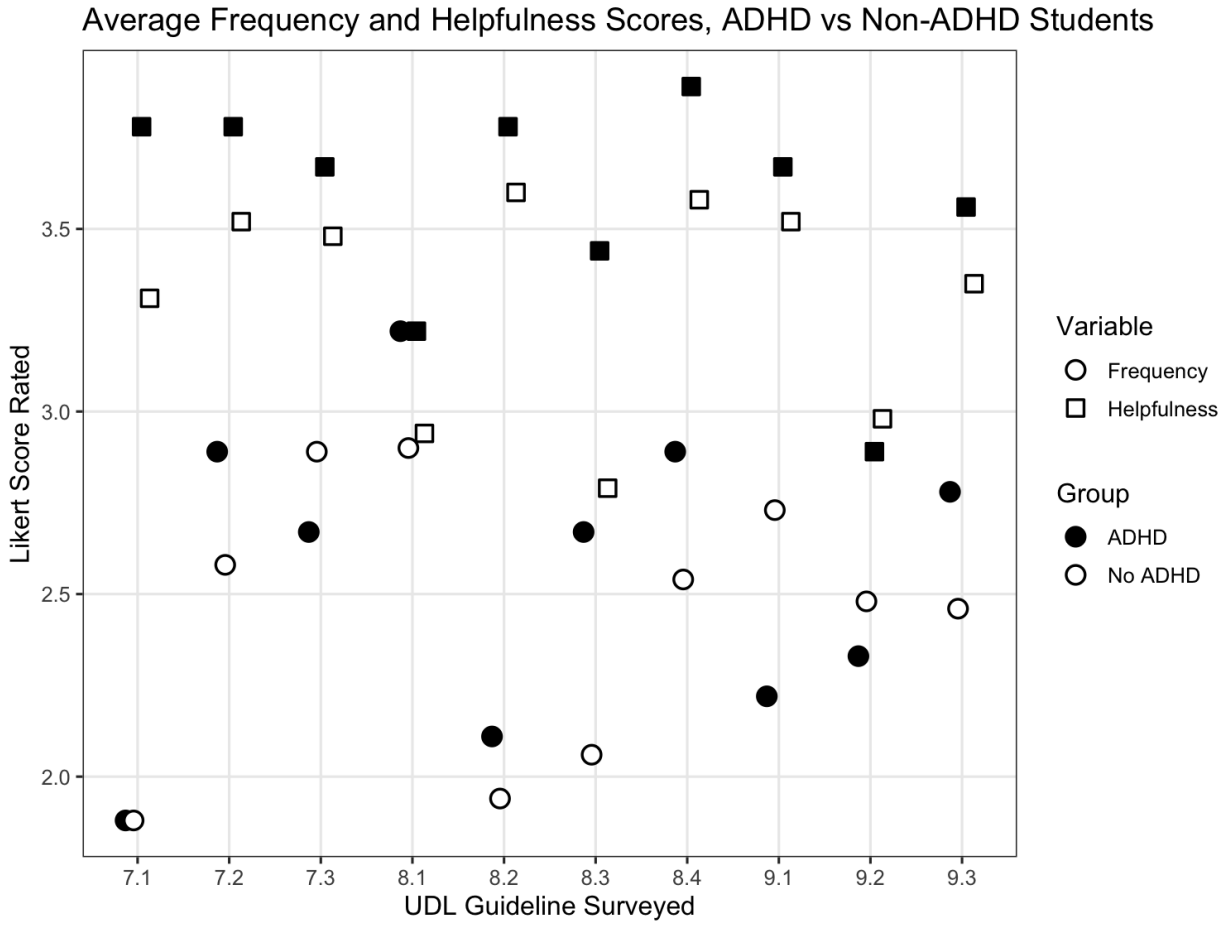
Frequency of occurrence	2.78 (0.83)	2.46 (1.01)	2.50 (0.96)	.37
Perceived helpfulness	3.56 (0.72)	3.35 (0.69)	3.38 (0.69)	.40

Note. p value = .05; *p* value reported for comparison between students with and without ADHD.

Figure 1

Scatterplot showing average frequency of occurrence and helpful scores for each UDL checkpoint reported by both students with ADHD and students without ADHD. Average frequency of occurrence and perceived helpfulness ratings across Universal Design for Learning (UDL) checkpoints for students with ADHD and students without ADHD. Circles represent frequency ratings and squares represent helpfulness ratings; filled symbols indicate students with ADHD and hollow symbols indicate students without ADHD. Scores reflect mean Likert-scale ratings for each UDL checkpoint.



Note. 4=always; strongly agree, 3=often; somewhat agree, 2=sometimes; neither agree nor disagree, 1=rarely; somewhat disagree, 0= never, strongly disagree (pertaining to frequency, helpfulness respectively)

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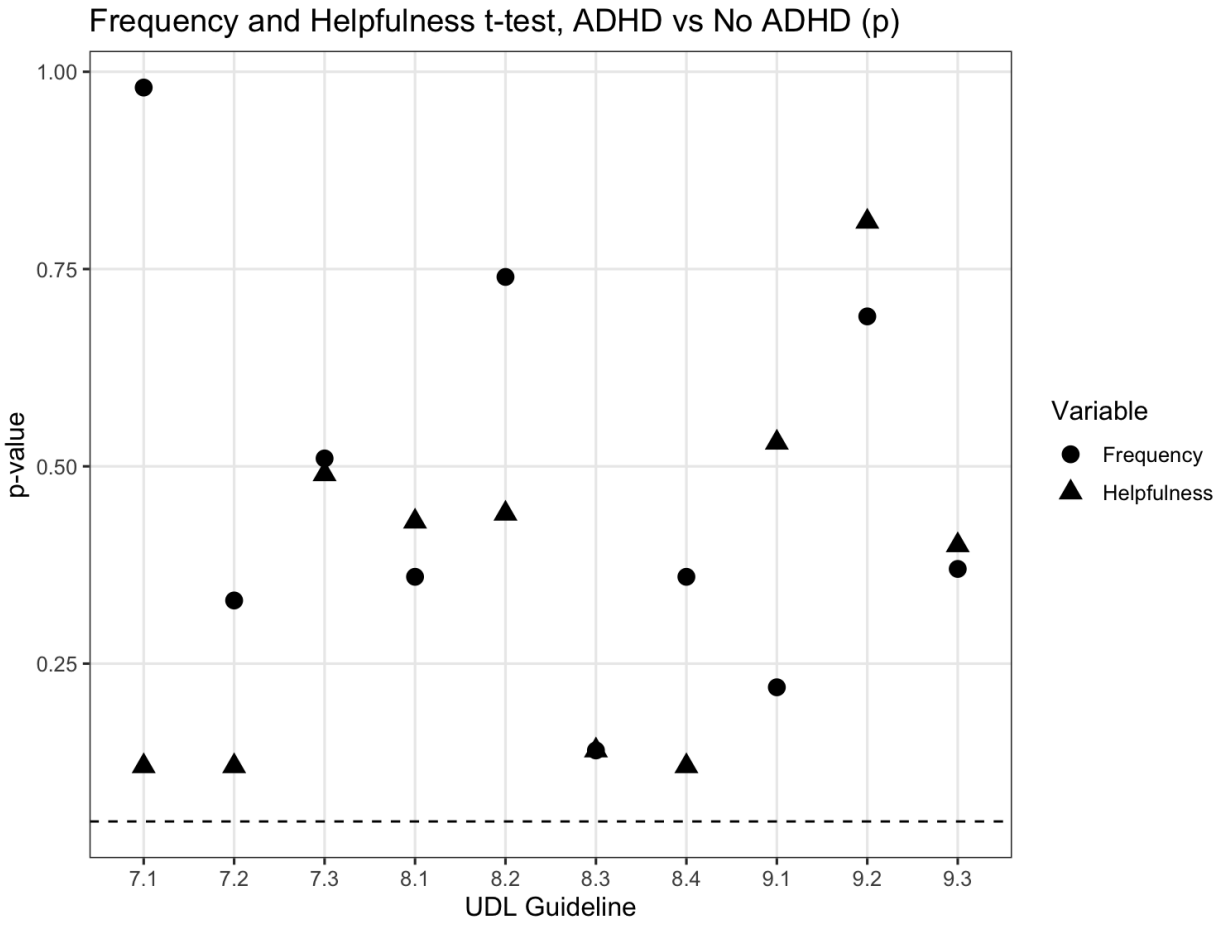
Figure 2

T-test results of the survey, comparing the answers of students with ADHD and students without ADHD. Frequency scores are represented with a circle, and helpfulness scores are represented with a triangle.



Note. P-value for guideline 8.3 (p = .14) was equivalent for both frequency and helpfulness scores. Dashed line indicates the conventional α = .05 significance threshold.

Discussion

The purpose of this study was to explore how students experienced the engagement principle of UDL in their university courses at one large institution of higher education in the Southwestern U.S. On average, students reported that instructional strategies that aligned with UDL's engagement principle happened in a range between sometimes and often. Students on average reported the lowest occurrence for checkpoint 7.1, which addresses choice in the ways that students engage with the course material (e.g., reading a

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chapter, listening to a lecture on the chapter), and the highest occurrence for checkpoint 8.1, which addresses goals and objectives within the classroom.

Students expressed agreement in their perceived helpfulness for engagement-aligned UDL strategies, generally assigning a somewhat agree to strongly agree rating to the checkpoints surveyed. Students reported that most helpful to their academic success was checkpoint 8.4, the offering of improvement-oriented feedback by faculty. On the contrary, the least helpful was checkpoint 8.3, which addresses collaboration and fostering an engaging learning environment through community (F. C. Durgungoz & Durgungoz, 2025). Students reported the most benefit from checkpoints, which encourage feedback and improvement (e.g., 8.2, 8.4), and less benefit from community and well-being resources (e.g., 8.3, 9.2, respectively).

There were no significant differences between responses for students with ADHD compared to students without ADHD. This suggests that there may be a more universal benefit for students generally from implementing instructional strategies aligned to UDL's principle of engagement in a university class (F. C. Durgungoz & Durgungoz, 2025). This finding is in alignment with the purpose of UDL for minimizing any potential barriers to educational success by proactively planning for accessibility by all learners (Rose et al., 2006) and may be of benefit for those under identified (Aquino & Bittinger, 2023).

This study contributes to our understanding of university students' course experiences. By identifying broader patterns in what students see as helpful, faculty members may begin to identify ways in which they can improve their teaching methods, proactively creating accessible educational experiences and opportunities for all students. In building a classroom experience utilizing UDL-aligned instructional strategies, faculty members may expect to see students develop enhanced expert learner skills, becoming (a) purposeful and motivated, (b) resourceful and knowledgeable, and (c) strategic and goal-oriented (CAST, 2017). These strategies may benefit students, particularly those with ADHD (Rose et al., 2006) who may be challenged by tasks surrounding motivation and self-sufficiency (Canu et al., 2021).

This research also expands upon previous research, as it is inherently focused on student-reported perceptions: student voices are a necessary part of understanding best educational practices (Cook-Sather, 2002; F. C. Durgungoz & Durgungoz, 2025). Especially pertaining to the diverse nature of learners at the university level, surveying student voices within the university may improve the experience of students within the classroom (Bracken et al., 2025). This is especially true for students with ADHD when these findings are considered with the larger body of research and with thoughtfully applying UDL

strategies in the classroom (F. C. Durgungoz & Durgungoz, 2025). Our findings contribute to previous research about UDL strategies, demonstrating student perspectives affirming what researchers have previously hypothesized surrounding the benefit of UDL's implementation.

Limitations

As an exploratory study, this research offers insights into how students experience UDL engagement strategies within one higher education context. We also acknowledge several limitations. First, while we sought to explore possible similarities and differences within the convenience sample at one large public university in the southwestern U.S., our ability to do so was constrained by completion rates. The total sample of students who identified as having ADHD (n = 9), as well as students who did not identify as having ADHD (n = 48) were small relative to the broader student population. Small sample sizes may reduce statistical power and limit the stability and generalizability of the findings, because observed differences may reflect sample-specific variability, rather than true population effects (Tipton et al., 2017). Replication of this study with larger samples across multiple contexts is needed, suggesting that our understanding will only grow with more research. Although standard deviations describe the variability of responses within each group, the limited number of participants constrained confidence in detecting meaningful group differences. This pattern of findings is not unexpected given the well-documented challenges in survey-based research. Accordingly, conclusions should be interpreted in light of this limitation.

Additionally, the small sample size limited the extent to which the study could capture variation across all areas of study at the university, particularly when examining the reported occurrence of instructional practices. While we sought to reach students across multiple academic programs, our recruitment methods may have constrained the sample with many programs not represented. Teaching strategies may vary between the different areas of study across the university for many reasons, including differences in subject matter and instructional traditions, as well as both the age of the faculty member and of learner (Jennings & Cashman, 2008). Both the areas of study sampled and the academic level of study, between undergraduate and graduate programs, may be valuable factors to consider in pursuing future research related to the research questions, as occurrences of UDL within educational institutions may also change based on these differing factors.

When identifying students by disability, it is important that we recognize that there are limitations to the accuracy of self-reported measures, with students underreporting and changes in reporting over time (Aquino & Bittinger, 2023). The study utilized self-reporting for participant diagnosis status, but it is important to consider that many students with

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ADHD remain undiagnosed until later into adolescence or adulthood, and as a result, this self-reported total may not paint a complete picture of participants with ADHD (Garnier-Dykstra, 2010). Students may still experience the traits of ADHD, whether they are aware of these traits or not, with or without a diagnosis.

This is a limit of self-identified categories, but also helps to reinforce a core focus of this study: UDL, and in particular, the checkpoints and recommendations of the engagement principle, can be used to build a structured classroom that supports students regardless of diagnosis or ability.

Despite these limitations, the study offers many strengths. By focusing on student-reported perceptions of UDL engagement strategies, the research foregrounds student voice and provides insight into how instructional practices are experienced within real classroom contexts. The study also operationalizes UDL engagement checkpoints into measurable survey items, offering a structured and replicable approach that can inform future research on inclusive pedagogical design. The small survey design may be the key to focusing on including nuanced experiences that may be overlooked in larger datasets, prioritizing broad generalizability. In researching best practices for education, the voice of students from all backgrounds is important and necessary.

Implications for Practice

Faculty members may see benefits from utilizing the results of the exploratory study within their own contexts. By reviewing the results of this pilot study, faculty members may find ways to improve their support of students in a more implicit manner. The study results may act as a "playbook," offering some initial guidance to faculty members in building a more accessible classroom, and also in the design of future surveys and studies. Faculty members can hand-tailor a survey, similar to the one featured in this research, finding which strategies would give the most support to a given class of students.

By reviewing the results of the study, faculty members may see benefit from implementing more direct methods of improvement-oriented feedback in the classroom. By finding ways to inform students about the ways they can improve their work, faculty members may see intentional and goal-oriented work submitted from their students which they may not see if feedback is not given. This may also benefit students by motivating them to see graded score improvements when incorporating specific feedback on future assignments, especially for students with ADHD that may struggle with task motivation and executive function (APA, 2022).

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The findings suggest when faculty members are building a learning experience, intention is everything: by building a classroom with an intention to allow students to show their mastery of a subject and giving them opportunities to reach these goals through challenge and improvement, faculty may see improvement in the value of the education they give students.

Especially when considering the implications of practices aligned to UDL, educators may consider that the most helpfully ranked guidelines may also align with opportunities to support challenges in function for students with ADHD. For instance, the overall report of checkpoint 8.4 (increasing mastery-oriented feedback) being most helpfully rated may speak volumes for the smaller handful of students with ADHD. Emerging literature, including APA (2022) and Bedrossian (2021), have noted that executive function, rejection sensitive dysphoria (defined as heightened sensitivity to perceived criticism or failure), self-esteem, inattention and self-motivation are often more difficult to regulate for students with ADHD. The use of punitive grading or failure without opportunity for revision may discourage continued engagement in learning. In contrast, improvement-oriented feedback may support persistence and self-regulation by framing academic progress as iterative rather than punitive. Within this context, feedback structures that emphasize growth, revision, and improvement may help mitigate discouragement, boost emotional regulation skills, and support solution-oriented engagement with coursework. Faculty members may see benefit in letting students resubmit assignments, which allows feedback to help students reach their full potential. By allowing a resubmission to show improvement, students may be more inclined to learn and take in more information, rather than view an assignment as busywork.

Students with ADHD experiencing rejection-sensitive dysphoria may also experience feelings of embarrassment or shame when actively seeking assistance, and this feeling may discourage students from accessing available academic or mental health resources (Kim et al., 2025). Thus, strategies that require students to actively request support may be perceived as less helpful, even when the resources provide meaningful assistance. Students with ADHD may therefore benefit from seeking to “embed” structural support rather than merely encouraging external support and feedback; however, further research is needed to explore this relationship more directly.

Implications for Research

By further investigating both multiple means of (a) action and expression and (b) representation, researchers may find that they can further improve student outcomes. Future research could use a survey measuring Frequency of Occurrence and Perceived Helpfulness of representation or expression checkpoints. Researchers could also

investigate practices by school, area of study, or program, as educational methods may change across fields of study. Each area of study within the university investigated in this survey is remarkably different in many ways, from content taught, to level of education (e.g., undergraduate, graduate, professional), and the faculty members' beliefs and practices.

By investigating these factors further, faculty members may find ways to "fine-tune" the educational experiences they design for their students, creating more learners who develop expert learner traits (Rose et al., 2006).

Additionally, future research may benefit from adapting the methods and procedures in this study to accommodate the newer changes to UDL's engagement principles accompanying UDL 3.0. This study was completed in the spring of 2024, before CAST unveiled UDL 3.0 guidelines in July 2024 at UDL-Con International, Sacramento, California, USA. After the release of UDL 3.0, multiple engagement guidelines and considerations (formerly checkpoints) changed, with changes including renaming of considerations, guidelines, and principles, to seeing additions in each guideline section. Guideline 7 received an additional principle, "Address biases, threats, and distractions," Guideline 8 received an additional consideration, "Offer action-oriented feedback," and Guideline 9 received an additional consideration, "Cultivate empathy and restorative practices." Overall, the guidelines and their associated considerations were restructured to share and balance elements into the revised principle headers, as each saw title changes and restructuring throughout 7, 8, and 9. Because the guidelines have been recently changed, replicating this study with modifications to the questions asked, as the research team subsequently piloted with a smaller focus group in Spring 2025, will be beneficial to further grasping the magnitude of benefit that UDL's engagement principle gives students of varying backgrounds and disability status.

Conclusion

This exploratory study examined university students' perceptions of faculty members' implementation of UDL engagement strategies and the perceived helpfulness of these strategies, with particular attention to students with and without ADHD. Findings indicated that students generally reported moderate-to-frequent exposure to UDL-aligned engagement strategies, and perceived these practices as helpful to their academic success, regardless of ADHD self-reported status. Because no statistically significant differences emerged between the groups based on self-reported ADHD status, the results underscore the broad value of engagement-focused instructional practices across higher education contexts.

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By utilizing these results, faculty members may create a classroom experience for higher-education students that supports institutional commitments to education access, inclusion, and student success. When instruction is informed by UDL principles, classrooms can move beyond reactive accommodations towards flexible, engaging and equitable learning experiences that support the variability of higher education students.

Collectively, these findings highlight the value of continued pedagogical development using UDL frameworks and provide a foundation for future research that can expand the scope and scale of this exploratory work.

Acknowledgements

The authors thank the students who participated in this study and shared their experiences. Appreciation is also extended to reviewers, mentors, family, partners, and friends who provided feedback and support to the authors during the development of this research. Finally, this author thanks Arizona State University and Mary Lou Fulton College for Teaching and Learning Innovation for fostering inclusive research opportunities. No external funding was received for this research.

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IJUDUDL
International Journal for Universal Design and Universal Design for Learning

International Journal for Universal Design and Universal Design for Learning (IJUDUDL) Vol. 1, No. 2, April 2026 ISSN: 3119-6055

ChatGPT as Universal Design for Neurodivergent English Learners? Perceptions from Moroccan Higher Education

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DOI: https://doi.org/10.34874/PRSM.ijududl-vol1iss2.6940

ABSTRACT

Higher education institutions have yet to accommodate neurodivergent populations for whom cognitive processing, attentional regulation, and learning variances deviate from conventional expectations. Generative AI tools like ChatGPT align theoretically with Universal Design for Learning principles, yet limited research examines whether they meet neurodivergent learner needs or risk compounding inequities, especially in Global South contexts. This quantitative study assessed ChatGPT use and perceptions among English major students (N=122; 70 neurodivergent, 52 neurotypical) in Hassan II University of Casablanca in Morocco using a UDL framework comparing group differences across Engagement, Representation, and Action and Expression. Neurodivergent students rated ChatGPT significantly more favorably than neurotypical students for Engagement and Action and Expression, with particular value for reading comprehension support and idea generation. No group differences emerged for Representation or perceived Barriers, as both groups acknowledged concerns about academic dishonesty and over-reliance. Usage frequency strongly correlated with perceived helpfulness. These findings represent the first systematic assessment of ChatGPT as a compensatory tool for neurodivergent learners in multilingual, under-resourced settings. Results suggest that neurodivergent students perceive AI-mediated scaffolding as helpful for addressing executive functioning challenges and literacy accessibility gaps when institutional accommodations remain insufficient, though ethical concerns require attention from educators and policymakers.

Keywords

ChatGPT, neurodiversity, Universal Design for Learning, English language learning, Morocco; higher education

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Introduction

The more universities confront cognitive diversity, the clearer it becomes that traditional teaching methods assume everyone processes information, maintains attention, encodes knowledge, and engages with material the same way, an assumption that neurodivergent students experience as systematically excluding rather than occasionally challenging. Neurodiversity, a term coined to recognize neurological differences as natural variations of human cognition rather than deficits to be corrected (Walker, 2021), encompasses conditions including Attention-Deficit/Hyperactivity Disorder (ADHD), autism spectrum conditions, dyslexia, dyscalculia, and dyspraxia. Students with these conditions face significant challenges in higher education, where traditional teaching and assessment methods tend to penalize neurodivergent learners and focus on deficits rather than strengths (Clouder et al., 2020). These learners comprise an expanding percentage of higher education populations, UK data recently documented 14.2% self-reporting as autistic and having ADHD, or both. Yet institutional accommodation frameworks remain insufficient relative to need (as cited in McDowall & Kiseleva, 2024). What faculty interpret as lack of focus may reflect fundamental differences in how neurodivergent students process and engage with instruction, as educators often default to neuro-normative interpretations of student behavior (Hamilton & Petty, 2023). The question shifts from whether institutions should accommodate cognitive difference to whether they can restructure learning environments treating diversity as foundational expectation rather than peripheral consideration requiring special provisions.

Universal Design for Learning (UDL) addresses this challenge by embedding multiple learning pathways from initial design rather than retrofitting accommodations. The 2024 UDL Guidelines 3.0 reoriented toward developing learner agency through varied engagement, representation, and expression methods (CAST, 2024). Research shows neurodivergent students demonstrate greater emotional engagement with UDL-enhanced strategies, particularly through anonymous technology-mediated interactions (Durgungoz & Durgungoz, 2025), findings corroborated by studies showing anonymous digital tools reduce anxiety and enhance emotional engagement (Cole et al., 2024; Vincent et al., 2025; Adams et al., 2019; Ritzman & Subramanian, 2024).

ChatGPT, released by OpenAI in late 2022, arrived with capabilities that map remarkably well onto UDL principles. Drawing on Vygotsky's Zone of Proximal Development, ChatGPT can function as a 'More Knowledgeable Other,' potentially providing adaptive scaffolding between what learners accomplish independently and what they achieve with support (Al-Hamdani & Yousif, 2025).

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Available constantly, ChatGPT offers immediate feedback, adapts explanations to proficiency levels, switches between languages, and engages in role-play scenarios that let students practice language in low-stakes environments (Sreen & Majid, 2024). Research suggests that for neurodivergent learners specifically, generative AI tools may enhance accessibility, personalization, and executive functioning support through constant availability and judgment-free practice spaces, while breaking down complex tasks into manageable steps (Mittler, 2025). But with such promise nonetheless, a vast geographic disaggregation complicates the state of research. Most studies emerge from North America, East Asia, Western Europe, and Australia, Anglophone, established technological centers. North Africa is yet to be accounted for and more specifically, the Moroccan population emerges as relatively invisible.

Understanding the Moroccan educational context requires an intersectional lens that considers how multiple axes of difference converge to shape student experiences (Crenshaw, 1991; OECD, 2023). In Morocco, students must navigate a complex multilingual environment where Arabic serves as the primary medium in primary education, French dominates higher education, and English occupies a tenuous position as a foreign language receiving inordinate underrepresentation despite its growing importance (Jebrane & Sahbi, 2022). For English major students, this creates a unique challenge: they cultivate advanced skills in a language with minimal social reinforcement, especially since social discourse remains in Arabic or Amazigh. This linguistic complexity intersects with systemic barriers in inclusive education. Although Morocco ratified the UN Convention on the Rights of Persons with Disabilities in 2009 and instituted a National Inclusive Education Programme in 2019, policies on paper falter compared to tangible realities, with limited support services, minimal relevant teacher training, and variable institutional acknowledgment of neurodivergent learning needs (Aabi & Bracken, 2023; UNESCO, 2023). Teacher-centered approaches persist, classroom sizes exceed 40 students, and Francophone linguistic dominance reflects postcolonial remnants that complicate English learning (Boualili & El Bakkali, 2025; Ben Haman, 2021; Boutieri, 2016). Furthermore, gendered and geographic disparities compound these challenges, as female students and those from rural areas face additional technological access barriers (Boualili & El Bakkali, 2025). Research indicates that neurodivergent students experience compounded disadvantage when such systemic barriers converge, with multiplicative effects where each obstacle amplifies others (Gillespie-Lynch et al., 2025). In this context, ChatGPT could help bridge gaps, requiring little more than linguistic and lexical processing without prerequisite faculty-specific training or school-based financial restraints. Whether such promise becomes reality for neurodivergent Moroccan learners is yet to be seen.

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Neurodivergent student voices are systemically excluded from the scholarly discourse surrounding AI-based teaching alternatives. For all learners operating in academic environments constructed with neurotypical sensibilities, stakes are higher than merely theoretical discussions; access, equity, and agency are all currently at risk. Recent research has discovered that neurodivergent students prefer technologically mediated connection over in-person group interaction which may trigger cognitive overload (Durgungoz & Durgungoz, 2025). Such a finding champions UDL 3.0's agency principles (CAST, 2024). Whether or not ChatGPT exists as a UDL facilitator that minimizes barriers to learning or simply replicates the inequitable access rendered in face-to-face classrooms cannot be determined without attention to the subjective experiences of neurodivergent students.

This quantitative, cross-sectional survey study examined three research questions focused on neurodivergent Moroccan university students' experiences with ChatGPT, with neurotypical students providing comparative context: RQ1: For what learning tasks do neurodivergent students report using ChatGPT, and how does this compare to neurotypical students? RQ2: Do neurodivergent and neurotypical students differ in their perceptions of ChatGPT's usefulness for supports aligned with Universal Design for Learning principles? RQ3: What barriers to ChatGPT use do students perceive, and do these differ by neurodivergent status? Ultimately, this study will broaden the scope of UDL applicability across a non-Western, under-resourced, linguistically diverse learning environment and create a first study for both investigators where perceptions of AI as a language-based learning tool for neurodivergent learners in the Global South is assessed through the UDL framework at the intersection of neurodiversity, multilingualism and emerging learning technologies.

Methods

This quantitative, cross-sectional survey assessed ChatGPT use and perceptions among English major students at Hassan II University of Casablanca. The design addressed three objectives: documenting ChatGPT usage patterns, evaluating neurodivergent perceptions through Universal Design for Learning principles, and identifying potential barriers. Neurotypical students provided comparative context. This one-time assessment captured perceptions during a period of emerging AI adoption in Moroccan higher education.

The population for this study included English Major students enrolled at Hassan II University of Casablanca, a large public institution in Morocco characterized by high student-to-faculty ratios and multilingual instruction.

They were recruited through convenience and snowball sampling via a purposeful request for survey dissemination sent out to university email lists, social media posts from students and course announcements where the researcher vetted the appeal.

The survey link was live from December 10 through December 16, 2025, with n = 125 responses collected. However, as three survey respondents stated that they had not engaged with ChatGPT, they were excluded from any analysis of perception of ChatGPT; therefore, for final assessments and analyses, n = 122 was used (70 neurodivergent, 52 neurotypical).

Inclusion criteria: currently enrolled English major students, regardless of ChatGPT experience. Given limited access to formal diagnosis in Morocco (Aabi & Bracken, 2023), the survey included behavioral descriptions of six neurodevelopmental categories. These descriptions were adapted from DSM-5 diagnostic criteria and rephrased into accessible behavioral statements (e.g., for ADHD: difficulty sustaining attention on tasks, frequently losing items, difficulty organizing tasks). This approach aligns with neurodiversity literature recognizing self-identification as legitimate (Chapman, 2021; Newton et al., 2025). Participants also reported formal diagnosis status, enabling sensitivity analysis comparing formally diagnosed and self-identified groups.

This study adhered to the ethical requirements of the British Educational Research Association (BERA, 2024) ethical framework. Participation was entirely voluntary. Prior to accessing the questionnaire, respondents viewed the study's purpose, anonymity protections, and the right to withdraw at any time without penalty. Proceeding to the survey constituted informed consent. The survey was configured for anonymous participation via Microsoft Forms, collecting no identifying information (no names, student IDs, email addresses, or IP addresses). Power dynamics were explicitly considered: participants were not recruited from courses taught by the researchers, and no researcher had an evaluative relationship with participants. Recruitment through general university channels ensured participation had no academic consequences.

The survey instrument consisted of 22 questions in three sections. Demographics consisted of age, gender, neurodivergence, formal diagnosis, ChatGPT use (Yes/No), version used (free or paid or both) and frequency of use via a 5-point Likert scale (Never to Always (Daily)) and a frequency matrix of 8 constructs: essay writing, grammar check, vocabulary understanding, translation, reading assistance, brainstorming, planning/organization and writing better.

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The main portion of the instrument consisted of 21 Likert-type items ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) in relation to ChatGPT as perceived through the UDL 3.0 framework (CAST, 2024). Three items pertained to Engagement (items one and two in relation to motivation/lower interest; item three in relation to the complex affective domain; items four through six in relation to stress and frustration, or both while using ChatGPT).

Seven items pertained to Representation, addressing UDL's principle of presenting information in multiple formats: translation across Arabic, French, and English supports linguistic accessibility; multiple methods of explanation provide varied pathways to comprehension; vocabulary level adjustment ensures appropriate linguistic complexity; contextualized examples anchor abstract concepts; and reading comprehension support (summarization and main idea identification) aids processing of extended texts.

Eight items pertained to Action and Expression, addressing UDL's principle of supporting multiple ways to demonstrate learning: pre-writing organization and brainstorming support executive function during planning; task breakdown scaffolds complex assignments into manageable steps; revision and error correction support the editing process; and clarity enhancement helps students to express ideas effectively.

Additional ratings assessed perceived helpfulness of six barriers to ChatGPT use: accuracy concerns, dependence concerns, academic integrity concerns, access difficulty (internet problems, cost), prompt writing difficulty, and privacy concerns. The survey also assessed likelihood of future use and interest in ChatGPT training through the university, each measured on multi-point scales. An optional open-ended final question invited additional comments or feedback.

The survey was designed to take approximately six to ten minutes to minimize participant burden and support completion rates. Items were developed through alignment with UDL Guidelines 3.0 (CAST, 2024) and were written in accessible language appropriate for Moroccan English majors. To support self-identification of neurodevelopmental profiles in a context where formal diagnosis may be limited, behavioral descriptions were adapted from DSM-5 condition descriptions (American Psychiatric Association, 2013) and rephrased into lay terms; these descriptions were used to guide participants' self-report and were not intended to function as a diagnostic instrument. Barrier items were informed by recent work on academic AI literacy concerns (Chiu, 2024) and barriers observed in assistive technology use for neurodivergent learners (Le Cunff et al., 2024). Internal

consistency was assessed for the UDL scales and Barriers scale using Cronbach's alpha, with item level diagnostics used to identify poorly functioning items.

Descriptive statistics (means, standard deviations, medians, ranges) summarized demographics, usage patterns, and perception ratings. Cronbach's alpha tested reliability for UDL (three scales) and Barriers scales. Independent samples t-tests (normally distributed data) and Mann-Whitney U tests (non-normally distributed data) compared neurodivergent and neurotypical groups, with secondary comparisons between formally diagnosed (ND_Official) and self-identified (ND_Self) neurodivergent students. Mann-Whitney U tests assessed frequency of use across eight purposes.

Spearman's rho correlations assessed relationships between frequency of use, UDL perception scores, barriers scores, and helpfulness ratings. In addition, sixteen students provided optional written comments, which were organized into themes that reinforced quantitative findings. All statistical analyses used SPSS with significance set at $p < 0.05$ (2-tailed).

Findings

Participant Characteristics

A total of 125 students initially responded to the survey (see Figure 1). Three participants who indicated they did not use ChatGPT for English learning were excluded, resulting in a final sample of N=122 active ChatGPT users. 70 neurodivergent (57.4%) and 52 neurotypical (42.6%) students, ages 17-48 (M=22.36, SD=5.62), majority female (n=84, 68.9%). Half the neurodivergent participants (n=35) had formal diagnoses. ADHD was most common (n=53, 75.7%), followed by processing disorders (n=26, 37.1%), autism (n=19, 27.1%), dyslexia (n=14, 20.0%), dyspraxia (n=10, 14.3%), and dyscalculia (n=5, 7.1%).

The neurodivergent proportion in this sample (57.4%) should not be interpreted as a prevalence estimate for the wider university population. This study used convenience and snowball sampling, and recruitment materials explicitly foregrounded both ChatGPT and neurodiversity.

Those design features can attract participants with stronger topic salience and greater willingness to disclose neurodivergent traits in an anonymous survey. In addition, the analytic sample included only active ChatGPT users. Consequently, the findings reflect

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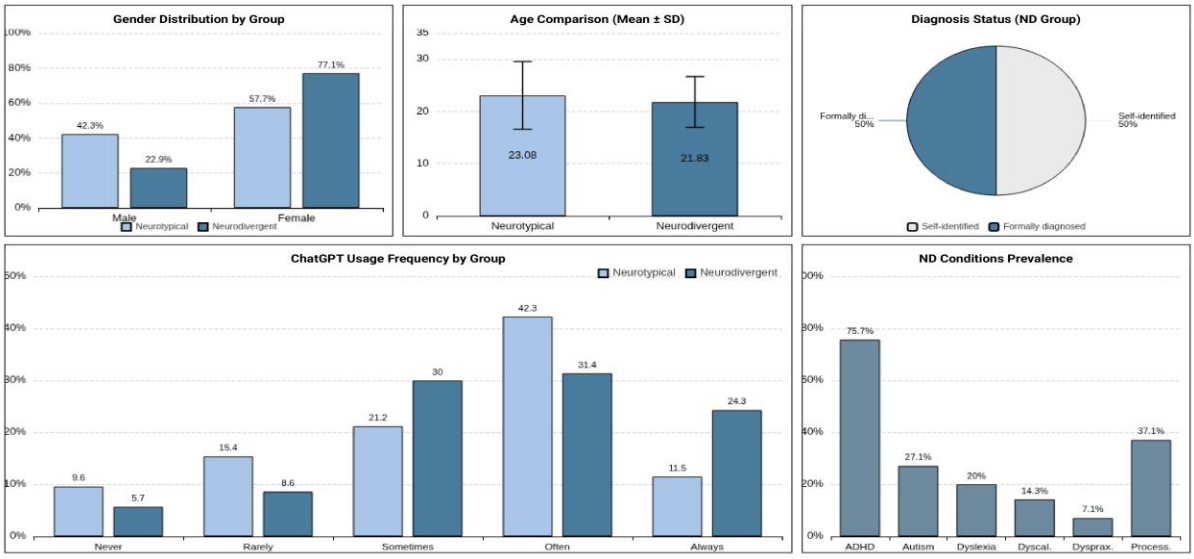
perceptions of English-major ChatGPT users who self-identified as neurodivergent, rather than prevalence patterns in the broader student population.

Regarding ChatGPT access, nearly all participants (n=109, 89.3%) used the free version, with a minority using the paid version (n=3, 2.5%) or both versions (n=10, 8.2%). Frequency of use varied considerably across the sample. Notably, neurodivergent students reported using ChatGPT daily at more than twice the rate of their neurotypical peers (n=17 (24.3%) vs. n=6 (11.5%)). Overall, 55.7% of neurodivergent students and 53.8% of neurotypical students used ChatGPT at least twice weekly (see Figure 1).

Figure 1

Demographic Characteristics and ChatGPT Usage Patterns of Neurotypical and Neurodivergent Participants



Preliminary Analyses

Before examining group differences, scale reliability and data characteristics were assessed. The three UDL scales demonstrated strong internal consistency: Engagement (6 items, $\alpha = 0.929$), Representation (7 items, $\alpha = 0.886$), and Action and Expression (8 items, $\alpha = 0.926$). The Barriers scale showed acceptable reliability (6 items, $\alpha = 0.685$).

This lower consistency likely reflects the heterogeneous nature of barriers students encounter, technical challenges (access, prompt writing), trust concerns (accuracy,

privacy), and social factors (academic integrity, over-reliance) represent conceptually distinct obstacles that may not uniformly co-occur for individual students.

Table 1

Scale Reliability

Scale	Items (n)	Cronbach's α
Engagement	6	0.929
Representation	7	0.886
Action & Expression	8	0.926
Barriers	6	0.685

Shapiro-Wilk tests revealed significant departures from normality for all four scales in at least one group (all $p < .05$), confirming the appropriateness of Mann-Whitney U tests. Effect sizes were calculated using $r = Z/\sqrt{N}$, with values of 0.10, 0.30, and 0.50 interpreted as small, medium, and large effects respectively (Field, 2013). As shown in Table 2, neurodivergent students rated ChatGPT significantly higher than neurotypical students on Engagement ($p = .031$, $r = .19$) and Action and Expression ($p = .006$, $r = .25$), with the latter showing a medium effect size. No significant differences emerged for Representation ($p = .171$) or Barriers ($p = .905$).

Table 1

Group Comparisons

Scale	NT Mdn (IQR)	ND Mdn (IQR)	U	p	r
Engagement	3.33 (3.00-4.00)	3.83 (3.17-4.33)	1405	0.031	0.19
Representation	3.86 (3.43-4.43)	4.00 (3.57-4.57)	1556.5	0.171	0.12
Action & Expression	3.69 (3.19-4.19)	3.94 (3.44-4.50)	1291.5	0.006	0.25
Barriers	3.33 (2.67-4.17)	3.33 (2.50-4.17)	1797	0.905	0.01

Note: NT = Neurotypical; ND = Neurodivergent; U = Mann-Whitney U statistic; r = effect size ($Z/\sqrt{N}$)

ChatGPT Usage Patterns

Neurodivergent students reported daily use at more than twice the rate of neurotypical students (24.3% vs. 11.5%). Across eight learning contexts (Table 3), neurodivergent students rated ChatGPT significantly more helpful for understanding reading materials and generating ideas. No differences emerged for the remaining six purposes.

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Table 2

ChatGPT Usage Purposes by Neurodivergent Status

Purpose	Neurotypical (n = 52)M (SD)	Neurodivergent (n = 70)M (SD)	U	p	r
Writing essays	3.10 (1.24)	3.27 (1.18)	1660	0.322	0.09
Grammar checking	3.62 (1.09)	3.77 (1.09)	1665.5	0.34	0.09
Vocabulary understanding	3.37 (1.14)	3.64 (1.15)	1541.5	0.115	0.14
Translation	3.02 (1.35)	3.36 (1.28)	1545	0.122	0.14
Reading help	3.08 (1.17)	3.80 (1.06)	1241.5	**0.001**	0.29
Getting ideas	3.42 (1.18)	3.93 (1.01)	1365.5	**0.009**	0.24
Planning & organizing	2.42 (1.23)	2.83 (1.33)	1530	0.105	0.15
Improving writing	3.46 (1.12)	3.61 (1.14)	1667	0.345	0.09

Note. Significant differences are indicated in bold ($p < .05$).

The UDL Principles

Engagement. For Engagement, the top item for the neurodivergent cohort was safe practice opportunities (M = 3.89, SD = 1.15), ChatGPT doesn't judge them and allows them to practice their English without fear of bad grades. Neurodivergent learners also tend to enjoy persistence support (M = 3.91, SD = 1.00) and emotional regulation when frustrated (M = 3.71, SD = 1.13), which suggests that neurodivergent participants perceive the ChatBot as helpful for navigating the emotional challenges of language acquisition.

The lowest item for Engagement was encouragement for homework (M = 3.43, SD = 1.07), meaning that it's good for continued efforts, but not as effective in getting the learner off the ground.

The only difference that was significant between learners was the Overall Engagement Scale between neurodivergent (Mdn = 3.83) and neurotypical (Mdn = 3.33) (U = 1405.0, p = .031, r = .19), small-to-medium effect size. However, it's clear that neurotypical students scored significantly lower on all assessed entries across the board for Engagement, especially encouragement for homework (M = 2.98, SD = 1.08), persistence (M = 3.50, SD = 1.16) and emotional regulation (M = 3.23, SD = 1.23). Therefore, these ratings suggest neurodivergent students experienced stronger engagement-related value in ChatGPT than neurotypical peers, particularly for persistence and emotional regulation during practice. for those learners who require it more in the realm of effort maintenance and emotional challenges when frustration kicks in.

Representation. Multiple explanations ranked highest for Neurodivergent (n = 70) as the highest item of all 21 UDL items posed in the survey (M = 4.26, SD = 0.81) which indicates that the most favorable attributes are ChatGPT's ability to explain something in various ways until it gets through. Examples (M = 4.23, SD = 0.90) and reading help (M = 4.09, SD = 0.83) are next in line through summary and main ideas as well, while simple explanations of difficult grammatical rules (M = 3.84, SD = 1.19) and adjustment of vocabulary based on their level (M = 3.93, SD = 1.05) was a nice feature, too. The lowest valued Representation construct was the ability to blend languages (M = 3.51, SD = 1.27), however, this is above the scale midpoint which suggests it's something nice to have but not entirely necessary. Thus, for these particular students, receiving clear, varied explanations and tangible examples is prioritized over blending languages during the learning process. The fact that the lowest valued item is still deemed useful but not as useful as the rest suggests it's comparable, though not top tier.

No significant difference however was observed between Neurodivergent (n = 70) and Neurotypical (n = 52) students on the total Representation scale (Mdn = 4.00 vs. 3.86, U = 1556.5, p = .171, r = .12). Neurotypicals supported this trend item by item as well, multiple explanations ranked highest for them as well (M = 3.88, SD = 1.00), followed by examples (M = 3.87, SD = 1.14), and then reading assistance (M = 3.73, SD = 1.14). The general receptiveness across both populations suggests that ChatGPT assistance relative to presentation and discussion of information and explanation works across the board for this multilingual classroom where Moroccan students must balance learning in Arabic, French and English regardless of their neurodivergence status.

Action and Expression. For neurodivergent participants, the most favorable Action and Expression items were correcting mistakes including grammar and vocabulary (M = 4.13, SD = 0.92), expressing ideas (i.e., clearly) in the English language (M = 4.06, SD = 0.95) and reviewing what they wrote (i.e., improving what's written) (M = 3.99, SD = 0.93). They also appreciated generating ideas when they were stuck (M = 3.91, SD = 0.96), planning the structure (M = 3.90, SD = 1.01) and outlining their ideas (M = 3.67, SD = 0.99) as processes ChatGPT helps with. Furthermore, they rated breaking down large writing tasks into smaller steps as somewhat helpful (neutral; M = 3.69, SD = 1.11). The least helpful item within Action and Expression was the ability to write faster (M = 3.40, SD = 1.04), indicating that writing speed may not be as critical as clarity and organization or quality of ideas when using ChatGPT for English Writing from the neurodivergent student's perspective.

The Action and Expression principle demonstrated the largest group difference wherein neurodivergent students rated ChatGPT higher than their neurotypical peers (Mdn = 3.94 vs. 3.69, U = 1291.5, p = .006, r = .25; medium effect size). Like the neurodivergent students, the neurotypical students found value in which features were most helpful, correcting mistakes (M = 3.63, SD = 0.99), expressing ideas clearly (M = 3.48, SD = 1.06) and reviewing what they wrote (M = 3.54, SD = 1.08), but again, consistently lower overall ratings for each feature. The significant difference between groups is consistent with the interpretation that ChatGPT serves as a perceived accommodation for executive function challenges typically encountered by neurodivergent students, particularly in relation to planning structure, outlining ideas and breaking larger tasks into smaller, more manageable pieces.

Table 3

Item-Level UDL Perceptions by Principle and Neurodivergent Status

UDL Principle & Item	Neurotypical (n = 52) M (SD)	Neurodivergent (n = 70) M (SD)
ENGAGEMENT		
Motivation for homework	2.98 (1.08)	3.43 (1.07)
Makes learning interesting	3.37 (1.17)	3.66 (1.02)
Helps when I want to give up	3.50 (1.16)	3.91 (1.00)
Safe practice without judgment	3.48 (1.25)	3.89 (1.15)
Reduces stress	3.25 (1.26)	3.50 (1.16)
Helps manage frustration	3.23 (1.23)	3.71 (1.13)
REPRESENTATION		
Translates words and sentences	3.77 (1.25)	4.01 (1.12)
Explains grammar simply	3.62 (1.30)	3.84 (1.19)
Offers multiple explanations	3.88 (1.00)	4.26 (0.81)
Lets me mix languages	3.46 (1.35)	3.51 (1.27)
Adjusts vocabulary level	3.54 (1.25)	3.93 (1.05)
Provides examples	3.87 (1.14)	4.23 (0.90)
Helps understand readings	3.73 (1.14)	4.09 (0.83)
ACTION & EXPRESSION		
Organize thoughts before writing	3.31 (1.12)	3.67 (0.99)
Generate ideas when stuck	3.56 (1.07)	3.91 (0.96)
Plan essay structure	3.54 (1.06)	3.90 (1.01)
Break tasks into steps	3.35 (1.15)	3.69 (1.11)
Review and improve writing	3.54 (1.08)	3.99 (0.93)
Fix grammar and vocabulary errors	3.63 (0.99)	4.13 (0.92)
Express ideas clearly	3.48 (1.06)	4.06 (0.95)

Write faster	3.29 (1.19)	3.40 (1.04)

Note. Scale: 1 = Strongly Disagree, 5 = Strongly Agree. Statistical comparisons were conducted at the scale level (Table 1 and 2)

Barriers to ChatGPT Use

No significant difference emerged between groups on perceived barriers to ChatGPT use (Mdn = 3.33 for both groups, U = 1797.0, p = .905, r = .01). Both neurodivergent and neurotypical students reported similar concern levels across six barrier items. The most prominent barrier for both groups was academic integrity concerns (NT: M = 3.88, SD = 1.28; ND: M = 4.00, SD = 1.27), followed by worries about over-reliance (NT: M = 3.90, SD = 1.16; ND: M = 3.83, SD = 1.39) and accuracy concerns (NT: M = 3.33, SD = 1.20; ND: M = 3.27, SD = 1.26). The least concerning barriers were access issues (NT: M = 2.17, SD = 1.18; ND: M = 2.23, SD = 1.04) and prompt writing difficulty (NT: M = 2.50, SD = 1.11; ND: M = 2.73, SD = 1.06). The absence of group differences suggests these challenges are universal rather than specific to neurodivergent learners, with both groups navigating similar concerns about appropriate ChatGPT use in academic contexts.

Table 4

Barriers to ChatGPT Use by Neurodivergent Status

Barrier	Neurotypical (n = 52) M (SD)	Neurodivergent (n = 70) M (SD)	U	p	r
Accuracy concerns	3.33 (1.20)	3.27 (1.26)	1777.5	0.795	0.02
Over-reliance worries	3.90 (1.16)	3.83 (1.39)	1766.5	0.743	0.03
Academic integrity concerns	3.88 (1.28)	4.00 (1.27)	1728	0.599	0.05
Access difficulties	2.17 (1.18)	2.23 (1.04)	1783	0.833	0.02
Prompt writing difficulty	2.50 (1.11)	2.73 (1.06)	1649.5	0.29	0.1
Privacy concerns	3.19 (1.28)	3.13 (1.35)	1786.5	0.851	0.02

In addition, Spearman's rho correlations revealed significant positive associations between ChatGPT usage frequency and perceived helpfulness (r=.529, p<.001). When examined by group, this relationship was stronger among neurodivergent students (r=.593, p<.001) compared to neurotypical students (r=.424, p<.01), indicating that more frequent use was associated with greater appreciation of ChatGPT's benefits, particularly for neurodivergent learners.

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In contrast, perceived barriers to ChatGPT use were not significantly correlated with helpfulness ratings (r=-.010, p=.913), suggesting that students' concerns about potential drawbacks (academic integrity, over-reliance, accuracy) did not diminish their recognition of ChatGPT's usefulness.

Student Voices

Sixteen students provided additional comments, revealing three themes reinforcing quantitative findings.

- ChatGPT as Cognitive Scaffold: Neurodivergent students connected ChatGPT to managing executive function challenges. One ADHD student explained: "chat gbt helps me to think calmly by giving me ideas that could suit my needs" when overwhelmed by racing thoughts. These comments align with neurodivergent students rating ChatGPT higher on Action and Expression (p=.006).
- Tension Between Tool and Crutch: Both groups recognized ChatGPT's dual nature. Students described it as having "two sides" and warned against overuse. One stated: "I use chatgpt daily, but not to cheat...a smart student will use chatgpt to get better not to be lazy." Critical voices emerged: "Chatgpt destroys your intelligence" (NT) and ChatGPT should be avoided "for activities that stimulate our brains" (ND). These views align with over-reliance emerging as the second-highest barrier (M=3.86).
- Academic Integrity Concerns: Students distinguished learning support from cheating: "do not use it in the exams because it's cheating," consistent with academic integrity as the top barrier (M=3.95) for both groups."

Discussion

This study examined neurodivergent Moroccan university students' perceptions of ChatGPT as a language learning tool through a Universal Design for Learning framework. Findings revealed neurodivergent students rated ChatGPT significantly higher for Engagement and Action and Expression, particularly for reading comprehension and idea generation (see Tables 1-4).

Both groups shared similar concerns about academic integrity and over-reliance, representing the first systematic investigation of AI-facilitated language learning among neurodivergent learners in the Global South. Because this study used a cross-sectional survey design capturing perceptions at a single time point, findings reflect reported usefulness and usage patterns rather than causal effects on learning outcomes.

The medium effect for Action and Expression (r = .25) reflects ChatGPT's compensatory role for executive functioning challenges. With 75% of the neurodivergent sample having ADHD, ChatGPT's features for organization, outlining, and task breakdown appear to align with the needs associated with core ADHD-related writing difficulties. Neurotypical students rated these features lower, suggesting executive function supports are most salient for those who need them. As one ADHD student noted, ChatGPT "helped me think calmly by giving me ideas that could suit my needs.".

The highest effect for Reading Comprehension (r = .29) reflects the multilingual demands Moroccan students navigate, complicated further by processing disorders (37.1%) and dyslexia (20.0%) in the neurodivergent sample. ChatGPT's ability to summarize complex texts and identify main ideas provides crucial support for students processing material across multiple languages. The significant rating gap suggests these scaffolds are perceived as addressing neurodivergent-specific needs rather than universal concerns.

ChatGPT's support for idea generation (p = .009, r = .24) addresses task initiation challenges common among neurodivergent learners. By reducing activation energy and suggesting starting points, participants described using ChatGPT in ways that they experienced as scaffolding during the writing process. Neurodivergent students valued organizational support over speed, prioritizing depth and quality over productivity, challenging deficit narratives that frame accommodations solely as compensating for limitations rather than enabling desired outcomes.

No significant difference emerged between groups for Representation (p=.171), yet both groups rated 'Multiple explanations' highest among all 21 UDL items (M=4.10). Students' high ratings for multiple explanations suggest that they experienced ChatGPT as filling a practical explanation gap in under-resourced Moroccan English classrooms. When universities face large classes (over 50 students), teacher-centered approaches, and limited participation (MESRSFC, 2024), participants perceived ChatGPT as providing paced, individualized explanations that in-person instruction in large classes cannot consistently offer.

This basic support benefits all students but is especially critical for neurodivergent learners who require varied explanatory approaches. ChatGPT can present such pedagogical stressors in pacing and explanation that in-person teachers cannot. Thus, what's commonly challenged is the idea that these AI tools benefit students with diagnosed disabilities; where the average successful-support based fundamentals do not exist in institutional

classrooms, access resources work for larger demographics but even more so for students with documented disabilities with urgent need.

The lowest engagement mean relevance (r=.19) implies that neurodivergent students found comfort in psychological safety. Safe spaces in practice are important for those who struggle behind the scenes in content accomplishments or social learning. For example, research indicates how tech-based interactions highly benefit neurodivergent classrooms as social anxieties surrounding group interactions can exacerbate cognitive overload (Durgungoz & Durgungoz, 2025).

ChatGPT allows individuals to practice making mistakes and asking questions without the socially-cognitively charged impetus of real-time participation. It's unsurprising, then, that this population did not feel as safely supported with the commencement of homework because as a symptom of ADHD learners, simply getting started is a barrier unique to homework presentation, an issue that all learners face uniformly.

The two populations report similar access challenges (p=.905) to helpfulness and importantly, access challenges are not significantly associated with helpfulness ratings (r=-.010, p=.913). Thus, students had a uniquely comprehensive perspective to differentiate helpfulness from access challenges merely by their reflection upon using ChatGPT. Students also qualitatively supported such complexity by indicating that ChatGPT was "two sided" and that ChatGPT should be "used smart" not "as a fool". This nuanced position casts a shadow against the idea that students participate in unethical behavior compared to the information available to them via AI tools. The lowest mean response for concern was access to ChatGPT (M=2.20) and the access to input prompting correctly (M=2.63) which implies that college-educated students possess the digital literacy equity necessary to succeed, what's otherwise successful with limited-access versions. This differs from Global South populations still facing access challenges, but not Morocco, whose growth has skyrocketed in terms of digital access offerings but not yet across all African nations where internet is an expensive commodity.

Ultimately, Usage frequency strongly predicted perceived helpfulness (r=.529, p<.001), with stronger correlations among neurodivergent students (r=.593) than neurotypical students (r=.424). Familiarity appears to increase appreciation, supporting frequent use for maximizing AI tool benefits.

An exploratory analysis comparing formally diagnosed (n=35) and self-identified (n=35) neurodivergent participants revealed no statistically significant differences across UDL scales or usage patterns (all p>.05). However, this comparison was underpowered; non-

significance in small samples may reflect insufficient statistical power rather than true equivalence between groups.

Despite this limitation, the finding is consistent with neurodiversity-affirming frameworks recognizing self-identification as legitimate (Newton et al., 2025) and is methodologically relevant for contexts like Morocco, where limited diagnostic resources, stigma, and training gaps prevent many neurodivergent individuals from obtaining formal diagnoses (Aabi & Bracken, 2023; Es-Sahib et al., 2025). Future research with larger samples is needed to rigorously assess whether self-identified and diagnosed groups report similar experiences.

This study contributes to the literature by finding lessons learned from neurodivergent students in a multilingual, under-resourced, Global South setting where such findings are rarely found. Most literature hails from North America, Western Europe and East Asia, countries and regions with more stable technological infrastructures and monolingual or bilingual settings. Morocco is different. English is a third language for many; neurodivergent students exist on the multilingual spectrum without active accommodations to help support them; ChatGPT functions simultaneously as multilingual scaffolding, the individualized attention a large classroom cannot give, and executive function support that a lack of established accommodation access cannot provide. It operates as a substitution for what currently, on a systemic level, is nonexistent, not an addition to what is usually provided when extensive systems exist.

Several limitations warrant acknowledgment. The cross-sectional design prevents causal claims. Convenience and snowball sampling limit generalizability. The survey's dual focus on ChatGPT and neurodiversity likely produced self-selection bias: the 57.4% neurodivergent proportion substantially exceeds typical university prevalence rates (approximately 14.2% in UK contexts; McDowall & Kiseleva, 2024), suggesting neurodivergent students with interest in AI tools were disproportionately motivated to participate. Findings thus reflect neurodivergent ChatGPT users rather than the full spectrum of neurodivergent student experiences. Additionally, the study captured only active ChatGPT users, preventing examination of barriers to initial adoption.

Conclusion

Students used ChatGPT for increased positive enjoyment (p=.031) and writing process support (p=.006) by and for neurodivergent students compared to neurotypical students for difficult assignment comprehension and ideation purposes for both.

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Yet despite these distinctions, attitudinal fears of academic misconduct and overreliance suggest perceived awareness of limitations for both groups as they gravitated to the same problems. The differences where the extent to which they used ChatGPT and perceived usefulness were more pronounced for neurodivergent (r=.593) students compared to neurotypical (r=.424) meaning that usefulness was higher for the neurodivergent in comparison to their typical classes suggesting both enjoyed ChatGPT but the neurodivergent found targeted usefulness in structured provision and explanatory framing.

The more students engaged with ChatGPT, the more useful it was; especially neurodivergent students in especially favorable terms compared to their typical classes as it compensated for structured organization, systematic explanation and cognitive assistance that generally only compensated for personalized settings conducive to individualized considerations.

Student responses suggest that ChatGPT offers immediate accessibility in contexts where classrooms are large and professors may lack specific training in neurodivergence. For these participants, AI-based scaffolding appeared to support executive function deficits and English as a Second Language (ESL) comprehension development. Such immediate applicability was highly valued by the respondents. However, these findings also point to a systemic gap: ChatGPT currently compensates for what the educational system fails to provide, yet it does not mitigate the underlying institutional lack of support. Inclusive learning fundamentally relies on purposeful teacher training, syllabus development, and institutional acknowledgment of cognitive diversity, which AI tools alone cannot replace.

An important interpretive caveat concerns sample composition. Among neurodivergent participants, 75.7% self-identified with ADHD, substantially higher than other neurodevelopmental categories. Consequently, findings attributed to 'neurodivergent learners' may primarily reflect ADHD-specific patterns, particularly regarding executive function supports (planning, task breakdown, idea generation) where group differences were most pronounced. Whether similar patterns extend to autism-predominant, dyslexia-predominant, or other neurodivergent profiles requires targeted investigation.

Ultimately, it's uncertain whether AI scaffolding fosters independence or sets students up for failure through dependence or whether generalized international findings apply to similarly under-resourced situations in Morocco, where students use ChatGPT already with or without policies of access; the question remains how to best scaffold such accommodations with others instead of letting each work independently effectively.

Acknowledgments

The authors would like to acknowledge the support of the Ministry of Higher Education, Scientific Research, and Innovation, as well as the National Center for Scientific and Technical Research (CNRST), for funding their research through the PhD-Associate Scholarship (PASS).

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IJUDUDL
International Journal for Universal Design and Universal Design for Learning

International Journal for Universal Design and Universal Design for Learning (IJUDUDL) Vol. 1, No. 2, April 2026 ISSN: 3119-6055

Evaluating the Implementation of Universal Design for Learning (UDL) in an Infant Mathematics Lesson: A Case Study in the Irish Primary Context

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DOI: https://doi.org/10.34874/PRSM.ijududl-vol1iss2.6712

ABSTRACT

Universal Design for Learning (UDL) is an educational framework that frontloads lessons, making them accessible and removing barriers to learning. The National Council for Special Education (NCSE) recommended a full inclusion model, in line with the UN Convention on the Rights of Persons with Disabilities, and suggested UDL. Despite this, there is limited literature on the use of UDL within the Irish primary context. This qualitative case study evaluates the implementation of UDL in a senior infant classroom. The research addressed two questions: (1) Can UDL increase all pupils' engagement in the subject of mathematics? and (2) How does implementing UDL affect teacher planning? Using observations to measure engagement and a reflective journal to assess teacher planning over a six-week period, the study focused primarily on Checkpoint 7.1: optimising individual choice and autonomy. Findings from observations revealed that almost all students engaged. The majority of students demonstrated increased productivity, challenged their learning, and became reflective. Findings from the reflective journal indicated that considerable time was required for planning and preparation. The findings suggest that UDL aligns well with the Irish curriculum. However, appropriate continuing professional development (CPD), support, and resources are essential to equip teachers for successful implementation.

Keywords

universal design for learning, primary education, infant mathematics, teacher planning

Introduction and Background

Universal Design for Learning (UDL) is an educational framework widely used in the United States and endorsed in the Every Student Succeeds Act (2015). Derived from the architectural concept of universal design (UD), UDL proactively designs teaching to be accessible for all students, regardless of ability, acknowledging diversity and moving away from a "one size fits all" approach (Norwich, 2014). UDL is based on neuroscience research and utilises three networks—affective ("why" of learning), recognition ("what" of learning), and strategic ("how" of learning)—to offer multiple means of engagement, representation, and action and expression (CAST, 2018).

Ireland ratified the UN Convention on the Rights of Persons with Disabilities in 2018, leading to a push towards a more equitable education system. The NCSE recommends using UDL to support a full inclusion model, similar to that adopted in New Brunswick, Canada (NCSE, 2019). This study addresses the lack of research regarding UDL implementation in mainstream Irish primary school settings. This case study sought to examine the research gap by evaluating the implications of implementing UDL in a mainstream class of 28 senior infant students (aged 5–6 years) with a variety of educational needs. The research objectives were twofold, examining the implications for both the teacher and the students. The research questions were:

Research Question 1: Can UDL increase all pupils' engagement in the subject of mathematics?

Research Question 2: How does implementing UDL affect teacher planning?

Using observations to measure engagement and a reflective journal to assess teacher planning over a six-week period, the study focused primarily on Checkpoint 7.1: optimising individual choice and autonomy.

Literature Review

UDL and the Curriculum as the Barrier

UDL is a proactive, constructivist, and flexible planning tool. A core tenet of UDL is the belief that barriers to learning reside in inflexible educational goals, materials, methods, and assessments, not in the capabilities of the learners (Rose & Meyer, 2002). UDL differs from differentiation, which is reactive and addresses only identified needs while UDL "front loads" lessons to prevent barriers for all (CAST, 2015). UDL is a proactive educational framework that can improve outcomes for all learners (Pisha & Coyne, 2001). UDL improves pupil engagement by offering multiple means of engagement in the design stage. The case study used meaningful choice to improve student engagement.

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The Irish Primary School Curriculum (Department of Education and Science [DES], 1999) does not explicitly mention barriers to learning and often implies a child-deficit model with no guidance on inclusive practices and the use of fixed learning objectives by class level. However, its principles regarding pluralism, equality, and accommodating different pathways to learning suggest UDL would fit well.

UDL and Engagement

The purpose of this study was to examine the extent to which a UDL informed approach can increase all pupils' engagement in mathematics. Engagement is commonly defined as a combination of attention, interest, and motivation, and is essential for purposeful learning (Meo, 2008). Within the UDL framework, engagement is addressed primarily through the affective network ("the why" of learning), which focuses on recruiting interest, sustaining effort and persistence, and supporting self-regulation (CAST, 2018). By deliberately designing multiple means of engagement at the planning stage, UDL seeks to remove motivational and emotional barriers that might otherwise prevent learners from participating fully in a lesson.

Research indicates that UDL can improve outcomes and engagement for a broad range of learners, not only those with identified additional needs. Al-Azawei and Lundqvist (2016) found that UDL informed course design was associated with higher student satisfaction and more positive attitudes to learning, while King-Sears et al. (2019) reported that UDL based planning templates enhanced engagement and performance for students with and without learning disabilities in mathematics. Basham et al. (2018) similarly showed that higher fidelity to UDL principles correlated with increases in on-task behaviour and learner persistence across diverse ability levels. Collectively, these studies suggest that when UDL is implemented systematically, it can substantially increase behavioural and cognitive engagement for many learners, though effects will vary by context and implementation quality.

UDL's multiple means of engagement directly address barriers that arise from a "one size fits all" approach by providing different routes into the same learning objective. Rather than assuming a single way of presenting content or a single acceptable response, teachers can offer meaningful choice in tasks, materials, and modes of participation, enabling pupils to connect with learning in ways that align with their interests, strengths, and needs (CAST, 2018). This is particularly important in early mathematics, where anxiety, low confidence, or fine-motor difficulties can quickly become barriers to participation. By offering options such as movement, manipulatives, visuals, and technology, UDL reduces these access barriers and allows children to demonstrate understanding without being limited by non-essential demands (e.g. handwriting speed).

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In this way, UDL shifts the focus from "fixing" individual learners to redesigning the learning environment so that more pupils can engage productively.

This case study builds on that literature by exploring how a targeted focus on UDL Checkpoint 7.1 (optimising individual choice and autonomy) influences engagement in senior infant mathematics lessons. The study examines not only whether engagement appears to increase, but also how pupils engage differently when barriers are addressed at the design stage through varied options and autonomy. This directly responds to the research question: to what extent, and in what ways, can UDL increase all pupils' engagement in mathematics in an Irish infant classroom?

UDL and Choice

The use of choice is a key component of UDL and was selected as the anchor checkpoint (7.1) for this study to identify if UDL increased student engagement in research question 1. Within the UDL guidelines providing multiple means of engagement by offering choice has the goal to encourage purposeful and motivated students. (CAST, 2018) Offering choice is widely used in special education and early years settings to promote positive behaviour, independence, and cognitive skills (Jolivette et al., 2004; Edyburn, 2010, 2020). Choice offers students autonomy over their learning and reflects the idea that "control leads to compliance; autonomy leads to engagement" (Pink, 2009, p. 108). This autonomy-choice link is well-established in early years research, where structured choice increases task completion and reduces disruptive behaviour (Jolivette et al., 2004; Strain & Hemmeter, 1997). UDL aligns conceptually with the Irish Aistear framework for early childhood education, which emphasises holistic learning, active learning, and hands-on, flexible methodologies (National Council for Curriculum and Assessment [NCCA], 2009).

Structured choice requires explicit teaching for young learners, including response time and scaffolds like dice-rolling for decision-making (Green, Mays, & Jolivette, 2011). Importantly, choice maintains curriculum objectives while offering variability across task selection, resources, and presentation formats

As with any teaching method, choice should be "purposefully planned and implemented across the learning experience. (Green, Mays, Jolivette, 2011). A menu of choice can be offered such as what work station the child sits at, the activity, the resources and many more. For young children explicit teaching of how to choose must first be offered. Students can learn to be autonomous, small interventions such as roll the dice to help choose can be used early on for the children who struggle with decision making. A response time must also be offered when offering choice. Green, Mays and Jolivette, 2011 offered a step by step process to implement choice and avoid negative behaviours (Green, Mays and Jolivette, 2011).

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It is important to note that choice can be given across many means during a lesson but the learning objective remains the same, promoting the variability of UDL while focusing on clear learning outcomes. Choice can be used not just during the activity but throughout the lesson. Children could also contribute by suggesting choices or offering feedback.

Checkpoint 7.1 ("optimising individual choice and autonomy") was selected as the anchor principle for this study to address Research Question 1: to what extent can UDL increase all pupils' engagement in senior infant mathematics? Within UDL guidelines, offering structured choice recruits learner interest and sustains motivation by allowing pupils to select personally meaningful pathways to the same learning objective (CAST, 2018). This proactive approach aligns with the construct that "control leads to compliance; autonomy leads to engagement" (Pink, 2009, p. 108).

In early years and SEN contexts, choice-making is well established as promoting on task behaviour, independence, and cognitive engagement (Jolivette et al., 2004; Strain & Hemmeter, 1997). For senior infants (5-6 years), UDL choice is implemented through:

- Task selection: Pupils choose between manipulatives, drawing, technology (SeeSaw), or movement activities to demonstrate the same addition objective
- Pacing: Fast-finishers select extension challenges; others access scaffolds like number lines or peer support
- Seating and resources: Choice of work station, materials (counters, chalk, playdough), or response format (oral vs. written)

For pupils with SEN, these options are critical: children with fine motor difficulties select drawing or playdough over writing; those with attention challenges choose movement stations; EAL pupils access video instruction via SeeSaw. Structured choice requires explicit teaching of decision-making skills, including visual menus, response time (e.g., "10 seconds to choose"), and scaffolds like dice-rolling for hesitant learners (Green, Mays, & Jolivette, 2011).

UDL choice aligns with the Irish Aistear framework for early years which has an emphasis on active, child-led learning while maintaining Primary Maths Curriculum objectives (NCCA, 2009; DES, 1999). Importantly, choice maintains curriculum rigour, all pupils demonstrate the same mathematical competency, but through personally accessible means.

This study examines whether these targeted choice options measurably increase engagement indicators (attention, interest, persistence) across a mainstream senior infant class containing pupils with diverse needs, addressing the identified research gap in Irish primary UDL implementation.

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UDL in the Irish Primary Context

While the NCSE promotes UDL in the context of full inclusion, there is little research regarding its implementation in Irish primary classes (NCSE, 2019). The Irish context is particularly relevant due to the government ratification of the UN Convention on the Rights of Persons with Disabilities in 2018 and the introduction of more equitable support models.

Teacher Perspective

For UDL implementation to be successful, the teacher's perspective must be considered. Some literature argues that UDL can be time efficient in the long run by providing lessons that meet diverse needs better than only differentiating for specific students. Shaw 2011 stated that implementing UDL was more time efficient for teachers by providing a lesson that met diverse needs than differentiating for specific students (Shaw, 2011). This study reflects on how UDL's implementation affected teacher planning.

However, teachers often report that UDL guidelines are "difficult to negotiate" or "unwieldy" (Nelson, 2014; Reynor, 2018, 2020). Novak 2016 stated that implementing UDL did "take time and practice to effectively plan and teach using the framework" (Novak, 2016). It is important that issues such as this are addressed through policy and support to help teachers deliver UDL without stress. Nicol reported 90% of teachers felt time, planning and preparation were considered "obstacles in implementing UDL" (Nicol, 2014). Recent Irish research echoes these implementation challenges, with teachers citing lack of UDL-specific training and curriculum-aligned resources as key barriers (Reynor, 2020).

Studies emphasise the need for appropriate policy, training, support, and resources to ensure UDL does not become an "educational fad" (Edyburn, 2010, 2020).

Methodology

Research Design and Context

This study adopted a qualitative single-site case study design to provide a nuanced, context-rich account of UDL implementation in one senior infant mathematics classroom in an Irish primary school (Yin, 2014). The 'case' is bounded by one class group (20 participating children aged 5–6 years), one teacher researcher, and a six-week period of UDL informed mathematics teaching (April–May 2021), allowing for in-depth exploration of processes and outcomes in a naturalistic setting.

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This design is well suited to capturing the complexity of classroom practice and learner engagement in the specific Irish context, rather than seeking statistical generalisation (Stake, 1995).

Reflexive thematic analysis was selected as the analytical approach because it explicitly accommodates researcher subjectivity and "insider" perspectives, enabling the teacher-researcher to systematically interpret complex classroom data while maintaining methodological rigour (Braun & Clarke, 2006). This case study design enabled in-depth examination of the two research questions regarding research question 1: pupil engagement and research question 2: teacher planning.

Research Context

The research took place in a mainstream co-educational senior infant classroom (ages 5–6 years) in a suburban Dublin school during COVID-19 restrictions.

Ethics

The research received ethical approval from Trinity College Ethics committee in March 2021. As participants are under the age of 19 parental consent was given. 20 children participated out of 28 enrolled with parental consent. Parents were reminded that participation was voluntary and they could opt out at any time. The researcher also served as the class teacher/participant observer, necessitating the use of a reflexive diary. Convenience sampling reflected COVID-19 restrictions.

Role of Researcher

The researcher served as both class teacher and participant observer, having taught this senior infant class for two years prior to the study. This "insider" position provided deep contextual understanding and rapport with participants, enabling rich, naturalistic data collection typical of qualitative case study work (Creswell, 2013). To minimise bias and power dynamics inherent in this dual role, structured tools were used including the TOAD observational checklist for objective behavioural coding, clear operationalisation of "engagement" as attention/interest/motivation, and systematic reflexive journaling using Basham & Marino's (2013) four-prompt framework. While this researcher positionality represents a limitation in terms of potential subjectivity, it also constitutes a strength by facilitating access to authentic classroom processes that external observers might miss.

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UDL Implementation Focus

The study focused on Checkpoint 7.1: providing "multiple options for recruiting interest by optimising individual choice and autonomy" (CAST, 2018). Mathematics lessons involved pre-teaching vocabulary, activating prior knowledge, offering content in different visual, audio, and technological modalities, and embedding music, movement, and art to engage students using multiple means of representation and action and expression. (CAST 2018)

Data Collection Instruments

Classroom observations were used to determine whether UDL increased pupil engagement. Observations ranged from unstructured anecdotal notes to semi-structured observations (date, time, topic, activity) and structured observations using a checklist and the TOAD observational tool, which measures talking out of turn, out of seat, attention problems, and disruption (Department of Education and Science [DES], 2007). Engagement was operationalised as attention, interest, and motivation.

A reflective journal was used daily to evaluate how implementing UDL affected teacher planning. The journal entries were guided by four prompt questions (Basham & Marino, 2013), focusing on meeting objectives, UDL contributions, successes and failures, and changes for maximised outcomes.

The reflective journal will use the following four prompt questions based on (Basham & Marino, 2013):

1. Did all children meet the learning objective of the mathematics lesson?
2. How did the use of UDL contribute to meeting the learning objectives?
3. What worked / not worked well?
4. What could be changed in the design to maximise student outcomes?

This case study design enabled in-depth examination of the two research questions regarding research question 1: pupil engagement and research question 2: impact on teacher planning.

Data Analysis

Thematic analysis, using the six steps outlined by Braun and Clarke (2006), was used to identify emerging themes from the qualitative data corpus of observations and the reflective journal. Using the dual perspectives of teacher and student provided a broad insight into the feasibility of UDL implementation.

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Findings

Research Question 1: Student Engagement in Mathematics

Observations indicated that the majority of the class were highly engaged with the UDL lessons. Several key themes emerged:

- Challenged learning: Fourteen students demonstrated a strong eagerness for more challenging work, completing tasks quickly and requesting to move on to the next stage or more complex addition. Students who could calculate mentally often preferred not to use manipulatives, suggesting the previous teaching style was demotivating them. When the topic of missing add ends was introduced which normally is very challenging for senior infants, half the class found it difficult but did not give up and continued to figure it out using multiple strategies and manipulatives. One child progressed to subtraction even though it was not on the infant curriculum.
- Gaps in learning became evident: When children had choice and tasks were less predictable than workbook activities, gaps in learning were more visible, allowing earlier scaffolding. Students were more inclined to seek help promptly when unsure. One interesting point is as children worked on their activity of choice it reduced the amount of children who would normally copy.
- Video, movement, art, and dance: Students were more engaged when videos were used for instruction rather than direct teaching. Videos stored on SeeSaw (educational app) could be replayed by students for reference, increasing independence and focus. Movement, music, and art activities, such as using chalk to draw number lines outside, were highly engaging for most students. When given alternatives to written work (e.g., using playdough or drawing), students with poor fine motor skills showed increased productivity.
- Reflective and active learners: Students became more reflective about their learning and took agency, often referring back to the learning objective to stay on task. They began to plan and prepare for tasks autonomously. Children displayed agency suggestions the use of games-based learning similar to literacy lessons End of lesson reflection prompts, seen below, were adapted from Novak's UDL Now! helped children discuss difficulties, normalise problems, and incorporate self-identified needs into the next lesson (Novak, 2016).

1. Did the lesson help you meet the objective? If not, what was confusing?
2. What could you have done better today
3. What could I , as your teacher have done better?
4. Did you enjoy today's lesson? Why or why not?

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- Increased productivity: The majority of children finished activities quickly and often moved on to a second choice or additional challenging content. This active engagement coincided with very few behaviour issues during the mathematics lessons. One child who previously complained of a sore hand during written maths activities was able to present work in other ways during a UDL lesson. This child went on to work on challenging activities as her stress relating to motor skills reduced, her productivity increased.

Research Question 2: Impact on Teacher Planning

The implementation of UDL had a notable effect on teacher planning and preparation. Key themes included:

- Time requirement. Considerably more time was needed to plan and prepare UDL lessons. Additional activities and resources had to be created to accommodate student choice and increased productivity. Planning involved aligning methods, assessments, and resources with curriculum objectives through the lens of UDL to systematically remove barriers.
- Classroom management. As students worked on different activities at different paces, classroom management became more complex, requiring the teacher to relinquish some control and provide individualised support. Although student behaviour improved due to engagement, additional management was needed to ensure all children remained on task and focused on the lesson objective.
- Technology support. Technology, particularly the educational app SeeSaw, supported planning by enabling the creation and distribution of videos, audio instructions, and visual content, making lessons more accessible and supporting student independence.
- Perceived difficulties and overwhelm. The non-prescriptive nature of UDL caused stress due to the lack of clear guidance for Irish infant classes. The large number of checkpoints and the need to consistently reflect on and remove subtle barriers led to feelings of overwhelm.
- Informed assessment for learning. Closer observation and time spent working alongside individual students led to a better understanding of their learning needs and motivations. This assessment for learning informed subsequent planning and contributed to a heightened sense of pride and effectiveness in teaching.

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Discussion

UDL and Learner Variability

The findings support the importance of addressing learner variability and align with literature advocating a move away from "teaching to the middle" (Meo, 2008). The fact that 14 students immediately sought more challenging work when offered choice suggests that flexibility and autonomy are powerful motivators for purposeful learning and reinforces the need for UDL principles such as optimising individual choice and autonomy and varying demands and resources to optimise challenge (CAST, 2018).

The UDL framework appeared effective in reducing barriers by promoting engagement. Students with poor fine motor skills, for example, were able to demonstrate mathematical understanding using alternative modalities, reducing stress and increasing productivity. The early identification of learning gaps also supports UDL as a proactive framework that enables timely scaffolds and intervention, consistent with research emphasising the importance of scaffolding and early intervention within UDL informed designed lessons.

The case study underscores the critical role of learner variability in designing effective mathematics instruction. Consistent with current research, the findings demonstrate that teaching to the middle is insufficient; when afforded autonomy and choice through UDL, students are motivated to challenge themselves beyond preset expectations (Norwich, 2014).

Moreover, the identification of earlier learning gaps among students highlights UDL's potential for facilitating formative assessment and scaffolding. Unlike traditional workbook-based activities, the flexible task structure encouraged students to recognise their own learning barriers and seek timely support. This empowerment aligns with Novak's (2016) assertion that choice promotes self-confidence even among young learners. The decreased reliance on copying and increased ownership over learning processes further reinforce the value of varying demands and resources to optimise challenge, benefiting all students regardless of ability.

The case study also revealed that offering a variety of sensory modalities—such as videos, movement, and art not only caters to diverse preferences but is essential in maintaining engagement. The findings suggest that engagement is maximised not by a single modality, but by providing students with multiple options aligned with their strengths and interests. The use of technology, particularly the SeeSaw app, enhanced student independence and focus by allowing learners to revisit instructional content at their own pace.

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Collectively, these findings affirm UDL as an inclusive, proactive framework that overcomes the limitations of one-size-fits-all instruction and fosters expert learners from an early age.

Teacher Planning Challenges and Policy Implications

While the implementation of UDL resulted in positive student outcomes, the increased time required for planning and preparation presents a significant challenge. This finding is consistent with studies that report time and planning as obstacles to UDL implementation (Novak, 2016). Increased student productivity, although desirable, necessitated the creation of additional, challenging content, further increasing teacher workload.

Despite UDL's time demands echoing Reynor (2020) and New Brunswick's 90% of teachers reported "considerable planning" (NCSE, 2019). The use of reflective journaling transformed preparation into proactive, student-centered assessment for learning. Closer observations fostered deeper relationships and understanding, aligning with Kumar and Wideman (2014) on heightened teacher engagement. Increased productivity necessitated extra challenges, yet technology (SeeSaw) streamlined delivery, reducing long-term workload. This duality of initial overwhelm yielding pride and efficacy (Novak, 2016), suggests UDL boosts job satisfaction when supported by CPD, resources, and phased rollout akin to Primary Language Curriculum, ensuring sustainable inclusion without burnout.

Despite the “dilemmas of difference” faced by teachers, this study indicated an increased sense of pride and effectiveness during UDL lessons (Norwich, 2013). The process of implementing UDL, especially when coupled with reflective journaling, led to deep assessment for learning (AfL), transforming planning to be truly student-centred. For UDL to be realistically implemented for full inclusion in Ireland, this burden on teachers must be addressed through systemic support (Meo, 2008). Policy recommendations include clear guidance, adequate training and CPD, and collaboration with publishers to provide UDL-aligned resources.

Limitations

The case study is a single case study and so it is narrow in nature. The case study did not look to generalise or justify it as a definitive answer but looked to evaluate if UDL is possible in the Irish context.

The research took place in one classroom. The class had adequate access to technology and good manipulative resources. This may not be in the case for all Irish mainstream classrooms.

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Conclusion and Recommendations

The overall aim of evaluating UDL implementation in an Irish primary school was achieved. The results indicate that implementing UDL, with a focus on choice and autonomy, had a predominantly positive impact on student engagement in mathematics, benefiting almost all participants. This supports the argument that UDL benefits the entire student population, not only those with identified special educational needs.

However, the case study confirmed that implementing UDL requires considerable time and preparation, contributing to feelings of overwhelm for the teacher, despite the eventual positive sense of accomplishment and increased effectiveness of lessons. This small-scale case study offers a promising introduction to UDL in the Irish primary context. To ensure UDL's successful and sustainable rollout in alignment with the goal of full inclusion, further research should be conducted in Irish classrooms with adequate UDL training and support documentation. A systematic rollout, potentially mirroring the introduction of the Primary Language Curriculum, could support teacher buy-in and address planning demands. Policy support should ensure adequate time, resources, and CPD. The emergence of reflective and active learning skills in young students indicates that offering flexibility and focusing on the "why" of learning can help even young children become purposeful and motivated expert learners, suggesting that a flexible, proactive UDL approach enhances learning outcomes for diverse populations.

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IJUDUDL
International Journal for Universal Design and Universal Design for Learning

International Journal for Universal Design and Universal Design for Learning (IJUDUDL) Vol. 1, No. 2, April 2026 ISSN: 3119-6055

Exploring Neurodiverse-Supportive Environments through Universal Design for Learning in an English Multi-Academy Trust

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DOI: https://doi.org/10.34874/PRSM.ijududl-vol1iss2.6967

Abstract

This small-scale study explores how English primary and secondary schools within a single Multi-Academy Trust (MAT) in the West Midlands interpret and apply the principles of Universal Design for Learning (UDL). Adopting a qualitative, interpretivist approach, data were gathered through semi-structured interviews with two education professionals, a Director of the MAT and a Special Educational Needs Coordinator (SENCO), alongside document analysis from seven schools in the Trust. Using Reflexive Thematic Analysis, six themes emerged: sensory-friendly environments, inclusive teaching practices, professional training, leadership and whole-school ethos, emotional inclusion, and enactment challenges. Findings reveal increasing awareness of neurodiversity and UDL-aligned adaptations such as flexible learning tools, structured routines, sensory supports, and peer mentoring. However, persistent inconsistencies in leadership, training, and funding continue to impede systemic inclusion (Carrington et al., 2024; Donath et al., 2023; Liasidou, 2012). The study concludes that embedding UDL principles requires sustained professional development, collaborative leadership, and proactive design strategies to translate inclusive policy into everyday practice and create equitable, accessible learning environments for all learners.

Keywords

Neurodiversity, Universal Design for Learning (UDL), Inclusive Education, SEND, Reflexive Thematic Analysis, Neurodiverse-Supportive Environments.

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Context and Rationale

Over the past few years, neurodiversity, an approach that recognises neurological differences such as autism, ADHD, and dyslexia as natural variations of the human brain rather than deficits, has become an increasingly important part of human diversity discussed in the context of inclusion in education (Doyle, 2020). In the English education system, the Equality Act (2010) and the SEND Code of Practice (2014) have encouraged schools to create learning environments that are fair and accessible to every student (Department for Education [DfE], 2015). However, a persistent gap between policy and classroom practice signals the need for practical, research-informed frameworks that facilitate enactment (Conn & Davis, 2024). Universal Design for Learning (UDL) offers such a framework, emphasising anticipatory curriculum design that considers learner diversity rather than reacting to individual needs (Meo, 2008). Grounded in neuroscience and cognitive psychology, UDL promotes multiple means of engagement, representation, and expression to ensure that all learners can participate meaningfully (Chick et al., 2025; Novak & Bracken, 2019). Bendou et al. (2025) found that schools enacting UDL reported greater levels of learner autonomy and more substantial teacher confidence in managing diversity.

UDL is especially relevant to English primary and secondary schools, where diagnoses of autism, ADHD, and dyslexia are increasing, and where an estimated one in seven children are neurodivergent (Frolli et al., 2023; DfE, 2025). Although schools are committed to inclusion, gaps in staff training, leadership accountability, and resource allocation continue to hinder sustainable progress (Carrington et al., 2024; Donath et al., 2023; Liasidou, 2012). Embedding UDL principles within school cultures can shift inclusion from an accommodation-based model to an anticipatory, design-driven approach that benefits all learners (Lopes-Murphy, 2012).

This study provides new empirical insights into UDL and neurodiversity in the English education context. While prior research has often examined individual classroom adaptations or early education, this study uniquely explores how UDL principles are interpreted and applied at a whole-school level within a Multi-Academy Trust (MAT). A MAT is a group of academies that come together to form a single trust with a board of directors answerable to the Trust's members (Male, 2022). By integrating staff perspectives with documentary evidence, it reveals how inclusive practice is shaped by leadership culture, emotional inclusion frameworks, and systemic constraints such as funding and accountability pressures (Carrington et al., 2024). The findings extend current scholarship by linking UDL's theoretical dimensions, engagement, representation, and expression to institutional leadership and policy enactment, offering a holistic understanding of what enables or limits neurodiverse-supportive environments. Within

this educational and policy context, the study explores how neurodiverse-supportive environments within an English MAT reflect UDL principles in practice, providing empirical evidence that bridges theoretical understanding with educators' lived realities and institutional policies.

Problem Statement and Research Gap

Despite progressive legislation such as the SEND Code of Practice (2014) and the Equality Act (2010), a gap remains between policy aspirations and classroom realities in England (Mairi et al., 2020). Many schools espouse inclusivity principles but struggle to enact them due to limited professional development, inadequate resources, and weak leadership accountability (Genovesi et al., 2022; Deroncele-Acosta & Ellis, 2024). Although UDL offers a proactive and research-informed framework for designing accessible curricula, its enactment in English schools remains fragmented, inconsistently interpreted, and largely unsupported by coherent leadership or policy structures, suggesting that existing statutory guidance has not translated into practical uptake (Rusconi & Squillaci, 2023).

Current research on neurodiverse-supportive environments often takes a narrow, diagnosis-specific focus, such as autism or ADHD interventions, rather than analysing how whole-school culture and physical environment contribute to inclusion (Petersson-Bloom & Holmqvist, 2022). Empirical research on UDL enactment within English MATs remains scarce. This represents a significant research gap in understanding how UDL can drive systemic, sustainable inclusion across diverse school settings. Addressing this gap, the current study explores how neurodiverse-supportive environments are practiced and enacted within an English MAT, using UDL as the analytical framework to bridge theory and practice in inclusive education.

Research Aim, Question, and Objectives

This study aims to explore how neurodiverse-supportive environments are understood and practised within a West Midlands Multi-Academy Trust, and how these environments reflect the principles of Universal Design for Learning (UDL). Rather than treating such environments as abstract or uniformly defined, the study examines how they are expressed through staff beliefs, leadership priorities, and policy language, and how they are enacted in practice across different dimensions of school life.

To provide greater practice clarity, the study distinguishes between how neurodiverse-supportive environments are understood and how they are practiced. Understanding is reflected in leadership vision, inclusive values, and institutional policy discourse, while practice is examined through leadership practices, pedagogical practices, technological practices, and environmental practices. Leadership practices include strategic priorities, monitoring, and the promotion of a whole-school ethos of inclusion. Pedagogical practices

refer to adaptive teaching, differentiation, and flexible approaches to learning. Technological practices include the use of assistive technologies and digital learning tools, while environmental practices relate to sensory adaptations, classroom design, and the use of physical spaces to support regulation and participation.

The study is guided by two research questions. The primary question asks how neurodiverse-supportive environments are understood and practised within an English Multi-Academy Trust. The secondary question asks in what ways these practices reflect the principles of Universal Design for Learning. In addressing these questions, the study does not seek to measure the extent of UDL enactment in a quantitative sense. Instead, consistent with its interpretivist design, it reflects on how features of the UDL framework are realised in practice, drawing on participant perspectives and documentary evidence to explore how inclusive principles are interpreted, negotiated, and enacted within the Trust context.

The study therefore investigates how staff interpret and apply inclusive practices across schools, identifies the strategies and features that characterise neurodiverse-supportive environments, and examines the structural and organisational factors that shape their enactment. Particular attention is given to how leadership, pedagogy, technology, and the physical environment interact to support or constrain inclusive design.

It is important to acknowledge from the outset that the study is based on a small sample of two participants, complemented by document analysis across seven schools. While this allows for rich and in-depth insight into leadership and SENCO perspectives, it limits the breadth of representation across the Trust. As such, the study offers an interpretive, context-specific understanding of practice rather than a comprehensive or generalisable account.

Literature Review

The literature review critically analyses available research on inclusive education and neurodiversity to examine how the Un2013iversal Design for Learning (UDL) can serve as a model for creating neurodiversity-equalising learning environments in schools. It explores the theoretical foundations, empirical evidence, and ongoing challenges related to enacting UDL principles in English Primary and Secondary educational settings. The literature reviewed in this study was sourced from reputable international academic databases, including Scopus, ERIC, ScienceDirect, and Google Scholar, ensuring access to peer-reviewed, high-quality research relevant to inclusive education and Universal Design for Learning (UDL).

Neurodiversity and Inclusive Education in England

The concept of neurodiversity has increasingly been incorporated into the inclusionary paradigm, reframing conditions such as autism, ADHD, dyslexia, and dyspraxia as natural variations in human cognition rather than deficits (Armstrong, 2012; Sewell, 2022). This shift reflects a move away from deficit-oriented models towards a strengths-based understanding of learning diversity. In England, legislative frameworks such as the Equality Act (2010) and the SEND Code of Practice (2014) provide a foundation for inclusive education by requiring schools to ensure equitable access through reasonable adjustments and inclusive pedagogy (DfE, 2015). However, despite this policy infrastructure, a persistent gap remains between legislative intent and everyday classroom practice (Ainscow, 2020; Liasidou, 2012).

Empirical evidence indicates that schools within Multi-Academy Trusts (MATs) vary significantly in their capacity to support neurodiverse learners, with differences linked to leadership priorities, staff expertise, and resource allocation (Chowdhury et al., 2024; Humphrey & Symes, 2013). While some schools incorporate sensory-friendly design, differentiated instruction, and assistive technologies, these approaches are often inconsistently embedded and reliant on individual teacher initiative rather than coordinated, whole-school strategies (Iliska & Gudoniene, 2025). As a result, inclusion frequently operates as a reactive process, highlighting the need for more systematic and anticipatory frameworks such as Universal Design for Learning (UDL).

Within this context, neurodiverse-supportive environments can be understood as multi-dimensional systems that extend beyond discrete interventions to encompass whole-school culture, leadership direction, pedagogical practice, and physical design (Ainscow, 2020; Carrington et al., 2024). Such environments are not defined solely by the presence of support strategies, but by the extent to which inclusive principles are embedded across institutional structures and everyday practices (Liasidou, 2012; Conn & Davis, 2024). Research suggests that effective environments integrate flexible pedagogy, sensory-aware spaces, assistive technologies, and relational approaches that prioritise belonging and emotional safety (Humphrey & Symes, 2013; Petersson-Bloom & Holmqvist, 2022; Allen et al., 2022). However, how these elements are enacted differ across contexts, reflecting variations in organisational capacity, leadership commitment, and strategic focus (Chowdhury et al., 2024; Donath et al., 2023). Consequently, understanding neurodiverse-supportive environments requires examining how inclusive practices are expressed in both policy discourse and lived educational experiences, recognising that inclusion operates simultaneously at structural, pedagogical, and relational levels (Ahlers et al., 2023; Martin-Denham, 2022).

Universal Design for Learning (UDL): Theoretical and Practical Foundations

Universal Design for Learning (UDL), developed by an interdisciplinary team at the Harvard Graduate School of Education, offers a proactive framework for creating flexible learning environments that anticipate learner variability rather than reacting to it (Meyer et al., 2014). The framework is structured around three core principles, multiple means of engagement, representation, and action and expression, which guide educators to design learning experiences that accommodate diverse interests, cognitive profiles, and modes of communication (Bracken, 2024).

UDL is an approach to learning, teaching, and assessment design that is proactive in addressing the varied identities, competencies, learning strengths, and needs of every learner in our learning environment (Flood & Banks, 2021, pp. 2). By identifying this variability, UDL redirects inclusion from a remedial adjustment to an embedded design principle benefiting diverse learners. Recent primary studies in different contexts further demonstrate UDL's potential to increase access and participation: Tīģere et al. (2025) used a mixed-methods case study in a Latvian inclusive preschool and showed that UDL-aligned strategies, such as visual schedules and multi-sensory activities, improved communication, engagement, and social interaction for children with autism; Gilleran Stephens et al. (2025) redesigned an Irish primary-school environmental science festival using UDL and reported higher pupil engagement and more inclusive teaching practices; and Schuck and Fung (2024) evaluated a UDL- and design-thinking-informed virtual summer camp for U.S. high-school students, finding significant gains in autism/ADHD knowledge and more positive attitudes towards neurodiversity. Rao et al. (2014) and Bracken and Novak (2019) show that classrooms designed according to UDL principles are associated with greater engagement and academic performance among neurodivergent and neurotypical students.

While Universal Design for Learning (UDL) is widely valued as an inclusive pedagogical framework, recent scholarship has raised important theoretical and empirical concerns. Anastasiou et al. (2025) argue that UDL is more appropriately understood as a practice framework than a scientific theory, and that its learning network model remains insufficiently validated. They further suggest that claims of universality, multiplicity, and digital flexibility require more systematic scrutiny, particularly where they conflict with cognitive load theory or overlook the continued need for specially designed instruction. Similarly, Boysen (2024) questions the strength of the empirical evidence supporting CAST's guidelines. Together, these critiques do not invalidate UDL, but they do indicate that its practice claims and practical application should be approached with greater critical caution.

However, barriers persist in operationalising UDL. Scholars note that inadequate teacher preparation, rigid curricula, and limited institutional support often result in superficial adoption rather than transformative change (Jardinez & Natividad, 2024). For UDL to be

effective, schools must integrate its principles into broader professional development systems, leadership accountability, and inclusive policy frameworks (Priyadharsini & Mary, 2024).

Empirical Evidence and Research Gaps

Recent empirical work in England and other high-income settings, however, indicates positive findings about how schools may enact UDL-influenced approaches. For example, Barrett et al. (2013) identify that features of classroom design, including natural light, reduced noise and visual order, are integral to neurodivergent learners' participation and attainment. Dockrell et al. (2015) also provide a valuable case study of how a classroom environment and sensory modifications can promote inclusion for students with speech, language and communication needs. Lastly, Tsou et al. (2024) report that peer mentoring and sensory modification are particularly helpful strategies for facilitating the social inclusion of autistic students.

Despite these promising findings, many gaps remain. First, most research focuses on early education, leaving secondary-level enactment under-researched. In addition, few studies are informed by a systematic investigation of how the UDL principles interplay with institutional policies, leadership cultures, and staff development practices within the MATs. This gap also extends to the reflexive, practitioner-informed studies that capture educators' lived experiences in embedding neurodiverse-supportive strategies (Ahlers et al., 2023; Martin-Denham, 2022).

Methodology

Participants and Sampling

This study involved a Multi-Academy Trust in the English West Midlands, comprising seven schools: four primaries and three secondaries. Participants included two key professionals: a Director of the MAT and a Special Educational Needs Coordinator from one of its schools. While the small sample size of two participants limits the breadth of perspectives, it allowed for depth of insight into leadership and practice within a single school trust context. In qualitative research, rich contextual data rather than numerical representation establishes rigour (Tracy, 2020). The participants were selected through purposive sampling; hence, their suitability became evident, as they had extensive experience in enacting and managing inclusive neurodiverse support practices (Campbell et al., 2020).

Besides semi-structured interviews, the study also encompassed the document analysis of school- and trust-level documents, such as SEND policies, accessibility statements, inclusion frameworks, and improvement plans (Bowen, 2009). This gave a multi-layered interpretation of institutional policies and practices regarding neurodiversity. These data

sources enabled triangulation, thereby increasing the credibility and richness of the data (Carter et al., 2023).

To ensure trustworthiness and rigour, the study drew on Lincoln and Guba's (1985) criteria. Transferability was enhanced by providing a thick description of the MAT context and triangulating insights from staff interviews with documentary evidence, enabling readers to judge the applicability of the findings beyond the immediate setting. The transferability of these findings depends on the presence of comparable contextual conditions, including supportive leadership, staff capacity for inclusive practice, access to appropriate digital and sensory resources, and organisational structures that enable collaboration between SEND and classroom staff. In settings where these conditions are absent, enacting UDL-aligned practices may be more limited or take different forms. Dependability was supported through transparent documentation of procedures for data collection, coding, and theme development, ensuring that the analytic process remained consistent and traceable (Lim, 2025). Confirmability was strengthened through reflexive journaling, triangulation of data sources, and the maintenance of audit trails, which helped to demonstrate that interpretations were grounded in participant accounts rather than researcher bias.

The inclusion of only two participants constitutes an important limitation of the study. Although the interviews provided rich insight into leadership and SENCO perspectives, they do not capture the views of classroom teachers, students, parents, or other staff across the Trust. As such, the study captures leadership and SENCO perspectives on inclusion rather than a fully representative account across all seven schools within the Trust. It therefore offers analytical and contextual insight rather than statistical generalisability, and its relevance to other settings depends on the extent to which similar structural and organisational conditions are present. The study is thus best understood as an exploration of leadership and SENCO perspectives on neurodiverse-supportive environments within the MAT, rather than a comprehensive account of practice across all seven schools.

Data Collection Methods

Two semi-structured interviews were conducted via Microsoft Teams, each lasting approximately 40 minutes. This format allowed participants to elaborate flexibly on issues relating to teaching practices, leadership commitment, and environmental adaptations, consistent with Kallio et al. (2016). The interviews were audio-recorded with consent, transcribed verbatim, and anonymised.

In parallel, document analysis was conducted using school- and trust-level documents available through public websites (see Table 1). Following Bowen's (2009) approach, documents were selected based on their relevance to neurodiversity, inclusion,

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accessibility, and SEND policy. The dataset comprised documents drawn from seven schools, including SEND policies, accessibility plans, inclusion frameworks, behaviour policies, and school improvement plans. These documents were examined for references to UDL-aligned values such as flexibility, accessibility, learner engagement, and multi-sensory support (Orndorf et al., 2022). Manual coding in Microsoft Word and Excel was employed to facilitate engagement and transparency (Ose, 2016). Documentary evidence was therefore used to contextualise interview findings and provide institutional insight into how neurodiverse-supportive environments were formally articulated across the MAT.

Table 1

Overview of Documents Reviewed in the MAT

School/Setting	Main document types reviewed	Main focus of review
School 1	SEND policy, accessibility statement, behaviour policy	Inclusion structures, pupil support, and leadership expectations
School 2	SEND policy, equality/objectives, accessibility information	Reasonable adjustments, access, inclusive provision
School 3	SEND policy, behaviour policy, inclusion information	Pastoral support, inclusive language, and behavioural expectations
School 4	SEND policy, improvement planning, and inclusion information	Leadership coordination, monitoring, and curriculum support
School 5	SEND policy, accessibility plan, behaviour/inclusion documents	Emotional regulation, retreat spaces, whole-school inclusion
School 6	SEND policy, transition/support information, behaviour/inclusion documents	Peer support, transitions, relational inclusion

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School 7	SEND policy, accessibility plan/statement, inclusion framework	Calm base provision, environmental adaptation, staff support

Document analysis and interviews were conducted in parallel rather than sequentially, meaning that school-specific policy documents did not directly inform interview questions. While this supported an independent exploration of policy and practice, it may have limited the depth of alignment between documentary evidence and participant responses. Future research could address this design limitation, as well as the small sample size, by including a broader range of participants across school roles and adopting a sequential design in which document analysis precedes interviews.

To enhance transparency and credibility, the study provides an overview of all data sources used in the analysis, including the two interview participants and the documentary evidence drawn from seven schools within the Multi-Academy Trust. Table 2 clarifies the role of each source and how it contributed to addressing the research objectives.

Table 2

Summary of Participants and Data Sources

Data Source	**Type**	**Description / Role**	**Relevance to Study Objectives**
Participant 1	Director of the Multi-Academy Trust (MAT)	Oversees inclusion, SEND coordination, and professional development across seven schools (four primary and three secondary). Provides strategic oversight on inclusive leadership, funding priorities, and policy enactment.	Offered a Trust-wide leadership perspective, highlighting systemic enablers and constraints in enacting Universal Design for Learning (UDL) principles across schools.

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Participant 2	Special Educational Needs Coordinator (SENCO)	Leads the design and delivery of SEND and neurodiversity-related initiatives within a secondary school. Coordinates teacher training, classroom adaptations, and pupil support strategies.	Contributed school-level insights on inclusive pedagogy, daily teaching challenges, and practical interpretation of MAT inclusion frameworks.
Document Analysis (7 Schools within the MAT)	School and Trust-Level Policies and Reports	Publicly available documents include SEND policies, accessibility statements, behaviour policies, inclusion frameworks, equality objectives, and improvement plans across the seven schools.	Provided triangulated evidence of how inclusion and neurodiversity are practiced and enacted institutionally. Enabled comparison between policy rhetoric and classroom practice, supporting the thematic analysis.

Data Analysis and Reflexive Thematic Approach

Data were analysed using Reflexive Thematic Analysis (RTA), following Braun and Clarke's (2021, 2024) six-stage model: familiarisation, coding, theme development, review, definition, and reporting. The overall analysis was primarily inductive, with minimal imposition of pre-existing categories, allowing themes to emerge from the data. However, the UDL lens informed the interpretation, such that the findings were considered in relation to the principles of engagement, representation, and action and expression, as discussed by Orndorf et al. (2022).

Initial coding was undertaken manually using Microsoft Word and Excel to identify meaningful statements and recurring ideas (Ose, 2016). Codes were then grouped into broader patterns, including sensory-friendly environments, inclusive teaching practices, professional development, and leadership commitment. These patterns were subsequently refined into six overarching themes: sensory-friendly environments, inclusive teaching and learning, professional training, leadership commitment, emotional inclusion, and enactment challenges. Reflexive journaling was incorporated throughout the analytic process to track interpretive decisions and enhance transparency, consistent with guidance emphasising researcher self-awareness in meaning-making (Olmos-Vega et al., 2023).

Rather than formal triangulation in a strict comparative sense, the study drew on multiple data sources to enhance contextual richness and interpretive depth. Interview data and documentary evidence were analysed in parallel and then brought together during theme development to identify areas of convergence and divergence. For example, themes such as leadership commitment and inclusive teaching practices were supported by both participant accounts and policy documentation, while inconsistencies in training and resource allocation were illuminated through contrasts between reported practice and institutional statements. This approach enabled a layered understanding of inclusion, though the study did not employ a fully systematic triangulation matrix, an area for future methodological development.

Reflexivity and Researcher Positionality

As shared by Musgrave (2025: 183)," engaging with reflexivity is not only a vital ingredient of educational research but also has implications for improving practice, as well as being a tool for personal development". The concepts of reflexivity and author positioning, especially in values-laden, inclusion-oriented research, ought to be key considerations; thus, reflexivity is central to the credibility and transparency of this study. The lead author is a young, emerging Nigerian female researcher who currently works as a teaching assistant at an English secondary school. The diverse cultural experiences she takes to the research and practitioner spaces are consistently negotiated and, reflecting Yip's (2024) experiences, position her simultaneously as both an insider and an outsider. Nonetheless, it is important to recognise that despite the potential 'othering' of that outsider status, it also has agentive qualities. The lead author sees herself as learning from, but also acting in and upon, the researched and teaching spaces. In this context, she adopts the singular personal pronoun throughout the research, and accordingly, her positioning and reflections are further explored below.

I am an insider because my professional background as a former student of psychology, education, guidance and counselling enables me to gain insights into school practices, pedagogical language, and staff perspectives. Simultaneously, I remain an outsider due to my cultural background and educational experiences outside the UK, which provide analytical distance and curiosity when examining English inclusion practices. My academic journey, from an initial degree that inspired further study to a Master of Arts in SEND, has strengthened my commitment to Universal Design for Learning (UDL) and inclusive educational practice. It has also shaped my long-term goal of establishing an inclusive school in Nigeria that fully supports SEND learners.

The co-author enriched the research experience by bringing to bear a contrasting positionality grounded in over three decades of transcultural teaching, leadership, and research in inclusive education. As an experienced practitioner and researcher, and

following strategies espoused by Wyatt and Chapman de Sousa (2017), he acted as a coach and cultural broker for the lead author. Whilst this role was facilitative at all stages of the research process, it is necessarily elided in the research to give voice and prominence to the primary researcher.

Importantly, this positionality directly influenced data interpretation. There was a tendency to privilege relational and inclusive understandings of neurodiverse-supportive environments, with particular emphasis placed on themes of belonging, emotional inclusion, and adaptive pedagogy. These interpretive tendencies reflect the researcher's prior experiences and commitments to inclusive practice. To address this, reflexive journaling and ongoing dialogue between the authors were used throughout the analysis (Braun & Clarke, 2024), ensuring that themes remained grounded in participants' accounts and documentary evidence rather than being shaped solely by prior assumptions.

Ethical Considerations

The research was carried out in accordance with the University of Worcester's and BERA's (2024) ethical guidelines. Ethical approval for the study was granted by the University of Worcester Research Ethics Panel under reference number 2538091781 prior to data collection. An information sheet and consent form regarding the candidate, explaining the purposes of the study, the procedures, and a person's right to withdraw at any time during or after the research process. Guaranteed anonymity and confidentiality were preserved by using pseudonyms for participants and schools, as explained by Saunders et al. (2015). All digital data was securely stored on password-protected devices and deleted after transcription.

The research also followed the UK General Data Protection Regulation GDPR, 2018, to ensure that all data was processed lawfully and fairly. Since it involved only professional participants and the data collection posed no harm, the study was classified as low risk. Ethical reflexivity, through memo writing and transparent reporting, was maintained throughout to uphold participant dignity and research credibility.

Findings and Discussion

This integrated Findings and Discussion section combines the presentation and interpretation of results due to word count constraints, allowing for a more concise and cohesive analysis of how neurodiverse-supportive environments are enacted across the Multi-Academy Trust. Using UDL as the analytical lens, six interconnected themes emerged, illustrating both progress and systemic challenges in embedding inclusive practice. The six themes draw on both interview and documentary evidence, although the contribution of each source varies across themes. Themes relating to leadership, emotional inclusion, and enactment challenges were supported by both participant accounts and policy

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documentation, while themes such as inclusive teaching practices and professional training were more strongly illuminated through interview data, with documents providing contextual support. This integrated structure is retained to show how lived perspectives and institutional discourse interact in shaping neurodiverse-supportive environments across the MAT.

It is important, however, to distinguish between the depth of insight achieved in enactment and the more limited exploration of practice. While enacting is examined extensively through the six emergent themes, practice is primarily inferred from leadership perspectives and institutional documents rather than systematically compared across all schools. Participant 1 framed neurodiverse-supportive environments as a values-driven, relational approach grounded in inclusion as a whole-school ethos, while Participant 2's contributions reflected a more practice-oriented understanding centred on classroom adaptations and support structures. Document analysis further suggested that practices were embedded within policy language, though these were not always explicitly defined or consistently articulated across schools. As such, the findings reflect how inclusion is understood within leadership and SENCO perspectives rather than providing a fully comprehensive trust-wide practice account. To demonstrate how the study's findings relate to the Universal Design for Learning framework, Table 3 maps the three UDL principles onto the emergent themes and supporting evidence from the analysis.

Table 3

Mapping of Universal Design for Learning (UDL) Principles to Emergent Themes

UDL Principle	Description	Corresponding Study Themes	Illustrative Evidence (from Findings)
Multiple Means of Engagement	Motivating learners through relevance, autonomy, and belonging.	• Emotional Inclusion and Peer Relationships • Whole-School Commitment and Leadership	*"It is about feeling like they belong and being part of something."* *Peer mentoring and inclusion circles fostered a sense of belonging.*

Multiple Means of Representation	Presenting information in various formats to accommodate diverse learning needs.	• Inclusive Teaching and Learning Practices • Professional Training and Staff Capacity	*The use of Google Slides, planning sheets, and adaptive materials enabled flexible access to content.*
Multiple Means of Action & Expression	Providing alternative ways for students to demonstrate understanding and participate.	• Sensory-Friendly School Environments • Enactment Challenges and Policy Gaps	*Chromebooks, sensory rooms, and adaptive seating supported learner autonomy despite resource constraints.*

Sensory-Friendly School Environments

Across the MAT, most schools enact sensory-supportive features such as quiet rooms, calm bases, sensory circuits, adjustable lighting, overlays, and noise-reducing headphones. Participant 2 described how: *"Students with ADHD... might have supervised walking breaks... Use of a Chromebook for more autistic students, if they have difficulties with fine and gross motor skills, they can type in a more ordinary way of working things."*

Documentary evidence further showed that school policies and accessibility documents referenced calm spaces and flexible seating for emotional regulation.

Taken together, these findings align with Barrett et al. (2013), who emphasise the importance of environmental design, lighting, noise control, and physical layout in supporting learner participation. Within a UDL framework, such adaptations represent "multiple means of engagement," anticipating sensory variability rather than reacting to distress. However, enacting across the MAT remained inconsistent, reflecting what McKenzie et al. (2023) describe as inclusion that depends heavily on local leadership and resources. This unevenness suggests that sensory-friendly design must be systemically embedded rather than school-dependent.

Inclusive Teaching and Learning Practices

Interview data indicated that flexible pedagogy was understood not simply as differentiation, but as responsive redesign in relation to learner variability. Teachers across schools demonstrated growing use of flexible instructional methods. Participant 1

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emphasised: "*It is really important to me if I am really honest with you. I think everybody learns differently, and I think it does not matter whether you are neurodiverse or neurotypical… It is not about worksheets; it is about being able to say: Oh, so we cannot access it like that. What can I do instead?*" Teachers used tools such as planning sheets, Google Slides for self-paced learning, and adaptive seating arrangements. These practices reflect UDL's principle of multiple means of representation, enabling varied pathways to content. This suggests that inclusive teaching within the MAT was increasingly framed as adaptive and anticipatory rather than reactive.

Inclusive strategies appeared strongest in schools with established digital infrastructures, echoing Fernández-Batanero et al. (2022), who argue that digital accessibility broadens participation irrespective of diagnosis. However, the findings also highlight variance in teacher confidence and digital fluency. As Lieberman et al. (2024) argue, UDL becomes transformative only when understood as a pedagogical philosophy rather than a checklist of accommodations. Across the MAT, this philosophical shift was emerging but not yet fully institutionalised.

Professional Training and Staff Capacity

A significant barrier identified was uneven staff training. Participant 1 reported receiving mainly "*Over my period of time as a teacher, I have had quite a sort of standardised basic training… in-depth, high-quality training is something that I feel the profession is missing."*

Lacking specialist depth, whereas Participant 2 detailed greater support in their Trust: *"We attend network meetings… and received valuable training from recognised organisations in areas such as ADHD, neurodiversity, and inclusive practice."* Documentary evidence also reflected this inconsistency, revealing variation in staff development structures across schools. This contrast between participant accounts suggests that staff capacity depended heavily on localised access to specialist professional learning.

Literature strongly supports the need for sustained, specialist-focused professional learning. Ainscow (2020) and Arnaiz-Sánchez et al. (2023) argue that surface-level training perpetuates compliance cultures rather than reflective, adaptive practice. The MAT's inconsistencies reflect broader national patterns in which teacher preparedness for inclusion depends on institutional commitment rather than national frameworks (Donath et al., 2023; Sims et al., 2025). Collaboration models, such as School 7's joint planning between SENCOs and teachers, demonstrate best practice consistent with Wenger's (2000) "communities of practice." However, staffing shortages and workload pressures limited teachers' ability to engage deeply in ongoing continuous professional development (CPD).

Whole-School Commitment and Leadership

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Both interview and documentary evidence suggested that leadership shaped whether inclusion was embedded culturally or treated as a procedural requirement. Leadership emerged as the strongest determinant of inclusive culture. Documents emphasised shared responsibility for inclusion, while Participant 1 stressed that *"Inclusion should not be a policy; it should be who we are as a school."* Schools with leaders who embedded SEND into monitoring systems, curriculum planning, and performance expectations showed more coherent UDL application. For instance, School 4 reported structured communication between SEN and subject leads, and School 1 held termly inclusion meetings.

This finding aligns with Harrison and Mosen (2025), who argue that inclusive schools normalise diversity through leadership-driven cultural transformation. However, not all schools demonstrated such coherence. As Abson et al. (2024) note, inclusion becomes aspirational rather than actionable when leadership is fragmented or reactive. The findings show that, even within a single MAT, leadership-driven variability significantly shaped UDL enactment.

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Emotional Inclusion and Peer Relationships

Emotional inclusion was widely prioritised. Participant 1 explained that inclusion begins with relationships, stating, *"It is about meeting pastoral needs… having positive relationships with people, and at a curriculum level, adaptive practice."* Schools enacted well-being rooms, peer mentoring, inclusion circles, and pastoral care rooted in respectful communication. School 5 created retreat spaces for emotional regulation; School 6 used structured buddy systems; School 3 provided whole-school training on inclusive language. Documentary evidence, therefore, complemented the interview data by showing that belonging was supported not only relationally but also through formal pastoral structures.

Taken together, these practices reflect UDL's affective dimension of engagement, recognising belonging as foundational to learning (Allen et al., 2022). Research supports this emphasis: Humphrey and Symes (2013) found that peer support and belonging improve well-being and reduce behavioural difficulties among autistic students. However, emotional inclusion initiatives were not always formalised or sustainably resourced, reflecting disparities in leadership support and staffing capacity.

Enactment Challenges and Policy Gaps

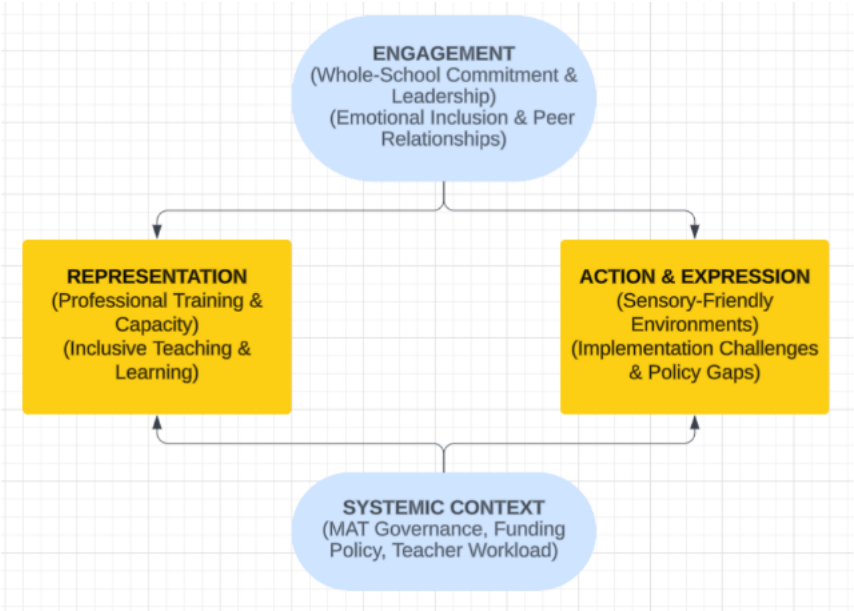
Despite a shared ethos of inclusion, systemic barriers, particularly funding shortages, MAT governance pressures, and workload intensification, undermined sustainability. Participant 1 noted, *"We have not got the money… it impacts timetable, support, and many more sorts,"* while Participant 2 referenced a 'national crisis' in SEND funding.

This pattern supports Liasidou's (2012) critique that austerity-driven policies fragment inclusive provision and widen inequalities. Ahlers et al. (2023) argue that England's accountability pressures reinforce an enactment gap between policy rhetoric and practice. By contrast with the inclusive aspirations described earlier, these constraints revealed how structural conditions continued to limit consistent enactment across the Trust. Within the MAT, devolved governance led to resource disparities between schools, making inclusion dependent on local capacity rather than on systemic provision.

Figure 1 provides a visual synthesis of how the three UDL principles, engagement, representation, and action and expression, interact across the six themes identified in this study. The model highlights that these dimensions do not operate in isolation, but are shaped by systemic influences such as governance, funding, and teacher workload. In this sense, the figure reinforces the study's central argument that neurodiverse-supportive practice depends not only on classroom adaptation, but also on the broader organisational conditions that enable or constrain inclusive design.

Figure 1

Interactions of Engagement, Representation, and Action & Expression Under Systemic Influences



To further illustrate how the six emergent themes align with the core principles of Universal Design for Learning (UDL), Table 4 presents a synthesis of each theme, its corresponding UDL principle, and supporting evidence from interviews and school documents.

Table 4

Mapping of Study Themes to UDL Principles with Supporting Evidence

Theme	**UDL Principle**	**Supporting Evidence (Participant Quotes & Documents)**
Sensory-Friendly School Environments	Action & Expression	*"Students with ADHD... might have supervised walking breaks... use of a Chromebook for more autistic students."* (Participant 2) *"Calm base… low-stimulation, safe retreat for pupils requiring emotional regulation."* (School 7)
Inclusive Teaching and Learning	Representation	*"Everybody learns differently… it is not about worksheets; it is about being able to say: 'What can I do*

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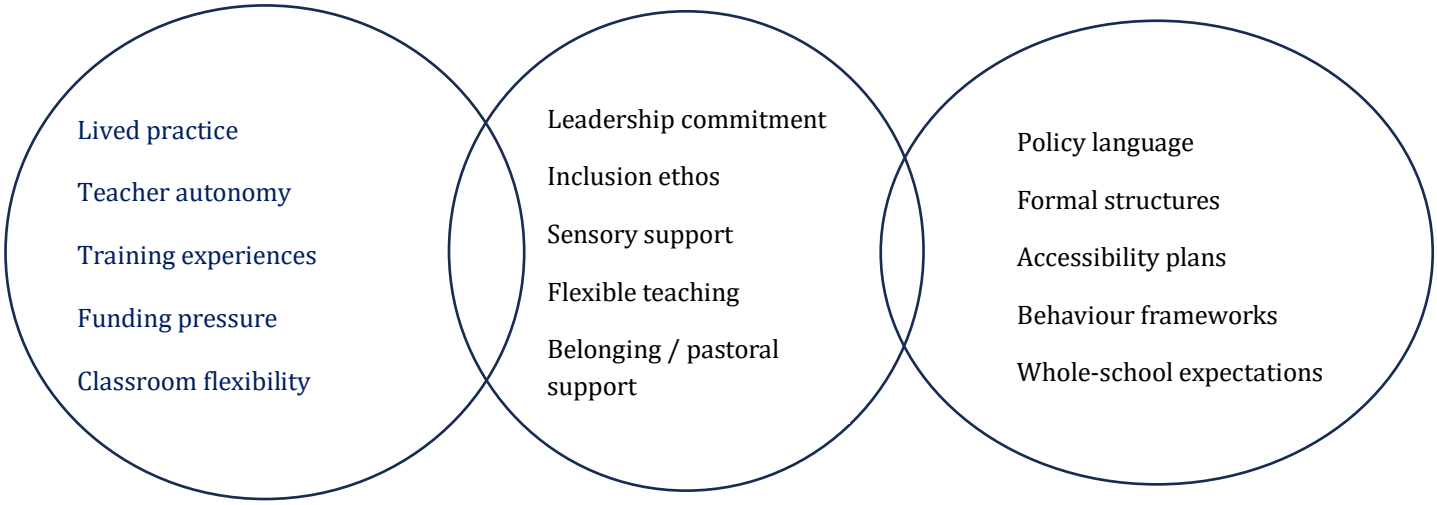
Practices		*instead?'"* (Participant 1) *"Google Slides can be shared directly with a student so they can go at their own pace."* (Participant 2)
Professional Training and Staff Capacity	Representation / Engagement	*"Over my period of time as a teacher, I have had quite a sort of standardised basic training… high-quality training is something that I feel the profession is missing."* (Participant 1) *"We attend network meetings… and received valuable training from recognised organisations in ADHD and inclusive practice."* (Participant 2)
Whole-School Commitment and Leadership	Engagement	*"It is about feeling like they belong and engaging with it and being part of something."* (Participant 1) *"SEND was built into the whole-school monitoring… not just the role of the SENCO, but actually everybody is a part of it."* (Participant 2) (School 5: "Whole-school approaches promote and support all learners.")
Emotional Inclusion and Peer Relationships	Engagement / Action & Expression	*"It is about having positive relationships with people… and adaptive practice."* (Participant 1) *"Trained staff provide Autism and ADHD one-to-one mentoring sessions."* (Participant 2) (School 6: "Paired peer support during transitions.")
enactment Challenges and Policy Gaps	Systemic Enabler (Cross-cutting)	*"It all comes down to training and the enabling features that make training happen… we have not got the money."* (Participant 1) *"Funding for all students nationally does need to improve… there is a bit of a crisis nationally."* (Participant 2) (School 5: "Provision dependent on available funding and staff capacity.")

Figure 2 below presents a simple comparative overview of the interview and documentary evidence used in this study. It highlights areas that were emphasised primarily in participant accounts, areas articulated mainly through school documents, and areas of overlap across both sources. This visual comparison strengthens the integrated analysis by showing that neurodiverse-supportive practice within the MAT was shaped both by lived professional experience and by formal institutional documentation.

Figure 2

Areas of Convergence and Divergence Between Interview and Document Evidence



Conclusion

This paper explored how neurodiverse-supportive environments in English primary and secondary schools within one Multi-Academy Trust were practiced and enacted, and the extent to which they reflected principles underpinning Universal Design for Learning. Revisited in direct relation to the research question, the findings indicate that neurodiverse-supportive environments were practiced primarily through leadership and SENCO perspectives as inclusive, relational, and values-driven spaces centered on belonging, adaptability, and whole-school responsibility. In terms of enactment, the study identified evidence of sensory-friendly classrooms, flexible teaching practices, peer mentoring, and emotionally supportive structures, although these were unevenly

embedded across the Trust. With respect to UDL alignment, the findings demonstrate partial but meaningful correspondence with the principles of engagement, representation, and action and expression, while also showing that systemic barriers, including insufficient funding, staffing pressures, and fragmented leadership, constrained their consistent enactment.

Taken together, the study suggests that inclusion must move beyond compliance and become embedded within the culture, structures, and everyday practices of school life. This requires strong leadership, sustained professional development, and cross-departmental collaboration so that neurodiverse-supportive practice is not dependent on isolated initiative. Neurodiverse inclusion, therefore, entails a shift from reactive support to proactive design, in which UDL principles inform pedagogy, policy, and school ethos. The study contributes valuable insights for policymakers, educators, and school leaders seeking to strengthen equitable, compassionate, and accessible learning environments.

This study is subject to important limitations, particularly the small sample size of two participants. While the findings provide valuable insight into leadership and SENCO perspectives, they reflect the views of two professional participants, supported by documentary evidence, and therefore do not represent the full range of perspectives across all seven schools in the Trust. The absence of perspectives from classroom teachers, students, and parents further constrains the breadth of interpretation. As such, the conclusions should be understood as a context-specific exploration rather than a comprehensive trust-wide representation. Their transferability depends on comparable conditions, including leadership commitment to inclusion, staff expertise, access to digital and sensory resources, and collaborative organisational structures.

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IJUDUDL
International Journal for Universal Design and Universal Design for Learning

International Journal for Universal Design and Universal Design for Learning (IJUDUDL) Vol. 1, No. 2, April 2026 ISSN: 3119-6055

From Intent to Practice: Reflecting on Inclusive Curriculum Audit Design

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DOI: https://doi.org/10.34874/PRSM.ijududl-vol1iss2.6120

Abstract

The *National Universities Accord Final Report* (2024) highlights persistent challenges faced by students from underrepresented backgrounds in Australian higher education, while offering limited guidance on how inclusive teaching practices might be enacted. In response, Edith Cowan University's UniPrep team identified three barriers commonly experienced by academics seeking to engage in inclusive practice: limited time, uneven knowledge, and uncertainty about where to begin. This practice report reflects on the design and development of three strengths-based reflective audits (Universal Design for Learning, Aboriginal and Torres Strait Islander Representation, and Diverse Representation) created to support academic reflection prior to curriculum change within Enabling programs. Framed by Gibbs' (1988) reflective cycle, the paper foregrounds the process of audit creation, including the importance of cultural consultation, reflexivity, and time in translating inclusion from intent to practice. It outlines how explicit questions and illustrative examples were used to guide academics in reflecting on curriculum design, teaching approaches, assessment practices, and representation. This paper emphasises team learning and ethical considerations, positioning reflective audit design as a practical and transferable precursor to inclusive curriculum development in higher education.

Keywords

Inclusive Practice, Universal Design for Learning, Enabling Education, Diversity, Equity, Pedagogy, Curriculum

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Introduction

The Enabling (also referred to as bridging or pathway) education sector exists at a significant point in the long arc of higher education in Australia. As highlighted in the National Universities Accord Final Report (Department of Education, 2024), students from underrepresented backgrounds continue to face challenges in accessing and completing tertiary study. While the Accord and broader university strategic policies emphasise equity initiatives, programs, and inclusive and diverse curricula, there remains limited literature outlining practical, process-oriented approaches to implementing inclusion strategies in higher education teaching. "Inclusive practice" itself is a contested and multifaceted concept (Kefallinou et al., 2020; Stentiford & Koutsouris, 2020). What is understood as foundational or non-negotiable teaching and learning praxis within social justice education spaces may be positioned elsewhere in universities as an optional curriculum enhancement or, at worst, a compliance-driven exercise. This tension is likely influenced by ambiguity between policy and legal requirements, ideological and philosophical positions, and pedagogical interpretations of inclusion. Scoping reviews consistently note that while the literature raises awareness of diversity and inclusion in higher education, it often stops short of offering a clear "how-to" for developing academic practice (Kefallinou et al., 2020; Stentiford & Koutsouris, 2020).

The aim of this project was therefore to support Enabling academics to build understanding of inclusive practice through reflective engagement, develop shared language and confidence, and identify achievable actions prior to curriculum change. Although educational strategies and policies are well intentioned, they frequently provide limited guidance for how academics might enact inclusion in practice. Academics are often time poor, bring varied disciplinary backgrounds, and hold uneven understandings of inclusion, practice, and pedagogy. Despite holding "good" intentions, they may be uncertain where or how to begin. As Boyle and Anderson (2020) note, there are inherent complexities in defining "good education," and positioning inclusive practice within inclusive environments risks oversimplifying an inherently relational and contextual process (p. 204). Reflecting on the positionality of Enabling academics, the design team, comprising a Course Coordinator and two Unit Coordinators, deliberately sought to step academics backwards into reflection before moving forwards into curriculum change. The guiding research question for this project was therefore: How can educators develop an understanding of inclusive practice in their curriculum prior to implementing curriculum change?

In response, the team designed a set of rigorous yet accessible reflective audits to support academics in developing a nuanced understanding of inclusive practice and critically self-assessing Enabling curricula. Using a strengths-based lens, the audits enable academics to identify existing strengths, surface challenges, articulate inclusive

practice goals, and plan incremental, sustainable change. This practice report focuses on the process of audit design and the importance of cultural consultation, detailing the development and application of three audits: Universal Design for Learning, Aboriginal and Torres Strait Islander Representation, and Diverse Representation, across seven Enabling units at Edith Cowan University (ECU) in Western Australia. Drawing on Gibbs' (1988) reflective cycle, the paper foregrounds the learning of the design team throughout this process and the importance of time, consultation, and reflexivity in translating inclusion from intent to practice. A focused review of Enabling education and inclusive practice literature provides the conceptual context for this work.

Literature

Over 15 years ago, Kift developed a first-year experience transition pedagogy that included diversity as a key principle, acknowledging that the first-year curriculum should ensure accessibility and inclusion, as diversity can intensify transitional challenges (2009, p. 41). In Enabling cohorts, diversity can be a compounding disadvantage, with approximately half of students belonging to at least one equity group (Lisciandro, 2022; Syme et al., 2021). Enabling students often begin their educational journey with mental health challenges such as anxiety and depression (Crawford & Johns, 2018). Students also bring varied aspirations, educational histories, diverse "life worlds" (Hattam et al., 2024), and "emotional" individualities, adding to their heterogeneity and complexity (Jones et al., 2016). For these reasons, Jones et al. modified Kift's model into an Enabling Transition Pedagogy (ETP) in 2016, revised in 2022. This adaptation retained curriculum principles but applied an Enabling lens and added "wellbeing" as a principle, recognising its role in student transition. Pedagogies of "care" in curriculum design and praxis have regularly featured contemporary Enabling literature, centring student wellbeing (Crawford et al., 2018; Hattam et al., 2024; Motta & Bennett, 2018). While strategies for inclusion are recognised throughout Enabling literature, terminology in higher education remains slippery. The elusiveness of practical applications is potentially due to diverse understandings and interchangeable use of terms: inclusion, inclusive education, inclusive design, inclusive pedagogies, and inclusive practice (Kefallinou et al., 2020).

Historically, Australian literature on inclusion has been particularly focused on students with disability or behavioural challenges in primary and secondary schooling (Kefallinou et al., 2020; Shyman, 2015; Stentiford & Koutsouris, 2020). Inclusion in this context is defined by Topping (2012) as supporting the achievement of diverse students, regardless of educational challenges, equity status, ethnicity, cultural or religious beliefs, gender or sexuality. In a higher education context, literature is predominantly focused on the socio-cultural context to include/provide access to university to students from underrepresented backgrounds and defined equity groups. (Collins et al., 2018; Department of Education, 2024; Gale & Parker, 2013; Jones et al.,

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2019; Lisciandro et al., 2023). In their systematic review of inclusive education research spanning 2015-2020, Kefallinou et al. (2020) highlight different interpretations of inclusive education as an ideology, widening participation agenda or moral/legal imperative. Findings note that, although there is ample research on inclusive education, stakeholders lack a shared understanding of its values, benefits, implementation methods, and necessary systemic changes (Kefallinou et al., 2020). Stentiford and Koutsouris (2020) position it as an ideology that leads educational practice, ensuring all learners have access to "quality education" (p. 126; see also Allan, 2014). They note that as a philosophy, inclusive education values diversity, equity and increasing participation (see also Booth, 2009). Shyman's (2015) definition of inclusion encapsulates historical, ideological and widening participation understandings of inclusion, as well as an inclusive education, stating that all students deserve inclusive, accessible and supportive education in a "regular classroom" (p. 351). This approach considers both providing access for diverse learners and addressing the individual needs of students, which is another area of the "inclusion" debate (Stentiford & Koutsouris, 2020).

Alternatively, inclusive design can be defined as a methodology for designing engaging educational environments, so that *all* students experience a "sense of belonging" (Lomellini et al., 2025, p. 2). Inclusive design is celebrated in the Universal Design for Learning (UDL) framework, which encourages learning design that is accessible, inclusive and equitable (Al-Azawei et al., 2016; Quirke et al., 2023). CAST states that UDL reduces barriers in the environment so "learners can engage in rigorous, meaningful learning," which shifts rhetoric of learner deficit (2024, para. 4). Moving beyond environment design, Quirke et al. (2023) believe that UDL should be applied broadly to foster student participation and belonging, which as Jones et al. (2016) suggests, includes understanding learner cohorts to ensure diverse representation is designed for. However, the UDL framework versions 2 to 3 are not exhaustive wells for designing for diverse representation; thus, additional elements of inclusive design need to be considered.

One needed area of design focus is the centring of Indigenous perspectives, knowledges and representation within higher education (Accord Final Report, 2024; Indigenous Education Strategy 2022-2025; Universities Australia, 2022). Universities must acknowledge the lasting impacts of colonisation and ensure curricula reflect the realities of diverse student cohorts and the cultures, values, perspectives, and knowledge of its Aboriginal Torres Strait Islander communities (Universities Australia, 2022, p. 10). Like UDL, strengths-based approaches to inclusion are necessary to "correct or counterbalance existing negative stereotypes" and move away from deficit discourse (Fogarty et al., 2018, p. vii). Fogarty et al. (2018) note that "'deficit discourse' refers to all types of communication that represents people or groups in terms of deficiency – absence, lack or failure" (p. vi). Decolonising the curriculum through a

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strengths-based approach to inclusion is a step toward redressing deficit discourse and reductionist understandings of a multifaceted culture. Such approaches do not ignore disadvantage but rebalance "narratives of failure and inferiority" (Fogarty et al., 2018, p. vi). In curricula, these approaches offer Aboriginal and Torres Strait Islander students' visibility and voice and enable them to see "themselves and cultural backgrounds as recognised and respected" (Fogarty et al., 2018, p. vi). Additionally, they show non-Indigenous students not only the impacts of colonisation, but also "First Nations Australians' cultures, histories, rights," knowledge systems and perspectives to gain a holistic education in their disciplinary fields (Ah Chee (Bundjalung) et al., 2024, p. 8). Cross-cultural collaboration (Ah Chee et al., 2024) and a co-constructed curriculum are important parts of the decolonisation process that affords non-Indigenous educators "an opportunity to navigate complex spaces at the nexus between colonisation and Indigenous sovereignty," with the goal of moving educators away from fear or tokenistic inclusions (Hughes & Fricker (Dja Dja Wurrung), 2024, p. 1919).

Strengths-based approaches to educational design that counterbalance deficit narratives can also support inclusion for marginalised groups such as LGBTIQA+, people with disability and those who are culturally and linguistically diverse (CALD). Butcher and Lane wrote, "Between 2014 and 2019, the enrolment rate of students with disability in undergraduate tertiary studies at Australian universities increased at a faster rate than for students without disability" and this does not consider those students with disability who do not identify as such (2024, para. 2). Historically, Western curriculums, physical teaching locations and technological systems such as learning management systems have not been designed with inclusion at the fore, creating additional accessibility barriers for students with disability or neurodivergence (Butcher & Lane, 2024). University learning or education support plans enable reasonable adjustments to support equitable access and facilitation of learning but are upon "student request" (Edwards et al., 2022, p. 781). However, such supports operate like a "plugin," as they sit outside of the curriculum and programs, fulfilling the university's legal obligation to support learning. Applying a UDL lens during curriculum design instead can proactively support students (Edwards et al., 2022), avoiding retrofit inclusion later.

Additionally, inclusive design should include non-ableist language and gender affirming names/titles to counterbalance Eurocentric heteronormative curriculum design that privileges abled cohorts. Of LGBTIQA+ students, Waling & Roffee assert that "students report feeling excluded when their experiences are not represented" (2023p. 668). Inclusion of visible markers such as gender-neutral language, use of pronouns by teaching staff, pride flags/colours, and representation in teaching materials can support students in feeling seen and respected (Waling & Roffee, 2023; Melendez & Crowley, 2022). Curriculum resources and pedagogies have not historically modelled or fostered

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inclusion for LGBTIQA+ and CALD communities, and representation has remained partial and contingent at an intersection of disciplinary knowledge and identity. LGBTIQA+ communities are often marginalised within such representations, for example described as "optional" in Nursing curricula (Priddle et al., 2025) or shallow in Education courses (McKenzie et al., 2024). Noddin argues that campus inclusivity has direct pedagogical implications, negatively affecting the engagement and retention of LGBTIQA+ students (2022, p. 21). This is supported by Sharp et al.'s mapping of Australian LGBTQIA+ higher education research, which links negative student experiences to campus climate–dominated discourses (2022, p. 2396). Similarly, scholarship on CALD and CALMMR (Culturally and Linguistically Marginalised Migrant and/or Refugee) students highlights how racialised representations outside of the higher education classroom are linked to "derogatory *epistemic misrepresentation*," which when reproduced through pedagogical practices and curricular representation, further others students (Burke et al., 2024, p. 175). In the Australian context, Dobinson (2023) demonstrates how curricula and assessment practices often privilege monolingual Australian English and lack diverse representation, rendering other legitimate varieties of English and cultural knowledges invisible. Deficit representation or limited stereotypes that are influenced by the wider culture outside of the classroom, are compounded by an absence of pedagogical approaches that lack consideration within it. Thus, strengths-based approaches to representation and pedagogies that consciously consider diversity are needed to create cultural safety and foster engagement.

Pedagogies are also an important strategy to foster inclusive practice. Stentiford and Koutsouris' (2020) systematic review of five databases on inclusive pedagogies found that literature consisted predominantly on "awareness raising" or strategies for promoting diversity, rather than examining pedagogies, noting that "'inclusive pedagogies remains something of a black box; a term used to refer to a potentially disparate array of practices, and with inclusion itself remaining a hazy and under-examined concept" (p. 2246). While ill-defined pedagogical examples are detailed in general higher education literature, there is a growing body of work within the Enabling space for strengths-based inclusive pedagogies to support diverse cohorts, such as the engagement zone to create "cognitive pegs" (Jones et al., 2016), intersectional pedagogies for teaching identity (Bennett & Burke, 2024), critical literacy for destabilising social constructions of power (Hattam & Stokes, 2019), and drawing on students' "funds of knowledge" to co-construct curriculum connected to their realities (Hattam et al., 2024, p. 293). These inclusion philosophies and strategies coalesce into a definition of inclusive practice, defined here as: "the enaction of ideology, design and pedagogy supporting all students' access to, engagement with, and success in an educational environment."

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Reflective Audit Approach

The Enabling Context

The UniPrep Enabling program equips students with essential academic and study skills for university and life, as well as a pathway into most undergraduate courses at Edith Cowan University. The fee-free program has approximately 1200 students annually, and, in line with Enabling program literature, 68% of students are from a government-defined equity group (Jones & Navin, 2023). These figures do not account for other equity groups, such as first-in-family, and marginalised groups, such as LGBTIQA+ students, also present in Enabling cohorts nationally. Furthermore, noted and excluded from the government-defined equity groups is the intersectionality evident in Enabling students, with 33% of UniPrep students belonging to two or more equity groups and non-government-defined groups (Jones & Navin, 2023). UniPrep is offered in multiple modes (on-campus, offline, full and part-time) across three campuses in Whadjuck Noongar Boodjar and Wardandi Country. Students must achieve a minimum of 50% in three core units: Mathematics, Learning Skills and Academic Writing, and one disciplinary elective. Each unit is designed to equip students with the academic knowledge and skills to successfully participate in undergraduate studies through the development of their academic communication, integrity, digital literacy, collaboration, cultural awareness and critical thinking.

Inclusive Practice Audit Process of Design

The design of the audits took place in 2024, with the first goal of creating a usable tool for auditing Enabling units. Adopting a reflective process, the design and implementation of the original Inclusive Practice Audits was cyclical and aligned with the UDL 2.2 framework, drawing on the UDL Guidelines for practical implementation support. The UDL framework provides the overarching principles of Engagement, Representation, and Action and Expression, and from there, the Guidelines offer practical, inclusive strategies aligned to the principles (CAST, 2024). The process involved the following key stages: development of the UDL audit framework; design of three audits; cultural and diversity consultation; application of feedback, revisions and transition to Microsoft Forms; beta testing; and review of findings.

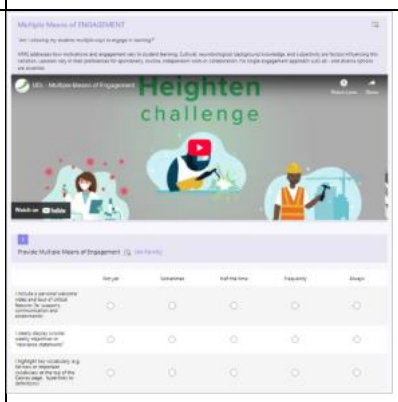
The goal of the audits was twofold – firstly for Enabling educators to gain a nuanced approach to inclusive practice and generate a snapshot of strengths and secondly to identify areas for unit and personal development. UDL offered an entry point for audit design. The UDL 2.2 framework is designed to “elevate strengths and eliminate barriers” (CAST, 2024, para. 1) and formed the foundation for designing the Inclusive Practise Audits. The initial stage used the three UDL Guidelines (CAST, 2025.) to design one survey in Microsoft Excel that incorporated Aboriginal and Torres Strait Islander Representation into the UDL framework. However, the UDL 2.2 framework did not

capture the nuances of Aboriginal and Torres Strait Islander and diverse student representation. Therefore, to ensure one area of inclusion was not prioritised over another, the audit was split into three separate audits: UDL, Aboriginal and Torres Strait Islander Representation and Diverse Representation.

UDL was used to inform the design of all audits and align with the UDL goal to "support learner agency" (CAST, 2024). The learners in this context were Enabling academics. Thus, the audits also modelled inclusive practice, deploying strengths-based and growth mindset language throughout (see Table 1 for a sample of the layout) in a shift away from deficit discourse, empowering and educating participants. Additionally, whilst the framework provided the principles for building the audits in the initial stages of design, the team faced the challenge of distilling the depth of information and examples in the UDL guidelines into digestible chunks. Understanding that many Enabling and university academics have a discipline, rather than education backgrounds, the inaccessible "edu-speak" needed to be distilled and translated into understandable and applicable language. This was an important and lengthy step in the process, and the same approach to language was taken in the Aboriginal and Torres Strait Islander and Diverse Representation audits.

Table 1

Sample of UDL Audit layout

Overview	Questions	Reflections & Pledges
		

To fulfil the second goal of identifying areas for development, the design team added the "Plus One Pledge" as the final question. The "Plus One Pledge" asks participants to think about "one change" they would make. Behling and Tobin (2018) frame "Plus One" thinking as breaking down and chunking insurmountable tasks into smaller, actionable, achievable and sustainable tasks. This aligns with the goal of UDL to give educators agency over design choices and to ensure that the audits were "strategic and action-oriented" (CAST, 2024). As Quirke et al. (2023)

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note, “Without some personal and professional reflection, the danger is that any UDL approach will become a checklist or template approach to what we do. The inherent risk here is that such an approach will unconsciously result in exclusionary practice once again” (p. 48).

Table 2

Sample of Audit Questions

Audit	**Question Overview/Focus**	**Example OR Explanatory Blurb**
Universal Design for Learning	Multiple means of engagement: The “why” of learning - Am I allowing my students multiple ways to engage in learning? Can you share an example of how you provided multiple means of engagement last semester?	*I provide students with a variety of materials (e.g., websites, journals, eBooks, recordings, YouTube).* *I provide students with choice in assessment (e.g., choice of question or format).*
	Multiple means of representation: The what of learning - Am I presenting the information in a variety of ways? Can you share an example of how you provided multiple means of representation last semester?	*I represent content in a variety of ways (e.g., diagrams, animations, videos, podcasts).* *I provide physical objects and spatial models to show perspective or interaction.*
	Multiple means for action and expression: Am I allowing my students multiple ways to demonstrate their understanding and knowledge? How well do you feel you provided multiple means for action and expression?	*I encourage and model how to solve problems using a variety of strategies.* *I provide opportunities for students to receive and give feedback in a variety of formats (e.g., checklists, rubrics, exemplars, peer review).*
Aboriginal and Torres Strait Islander	Can you give an example of how you include Aboriginal and Torres Strait Islander visibility and voices in your curriculum?	*Inclusion of Aboriginal and Torres Strait Islander peoples - academics, authors, students in unit-specific content. Resources, such as readings, lectures and activities that are created by Aboriginal and Torres Strait Islander Peoples (rather than only about) – balancing voices in teaching materials.*
	Aboriginal and Torres Strait Islander language, greetings and place names are included in my unit.	*The greetings and places names are included in teaching materials and the Canvas site to prioritise local language, place names etc. (where known), and explain when/why different names/words have been used.*
	Can you give an example of how you include Aboriginal and Torres Strait Islander pedagogies in your unit?	*In consultation with Aboriginal and Torres Strait Islander peoples, engage Aboriginal Torres Strait Islander pedagogies in teaching such as yarning, the spiral, Aboriginal 8 Ways of Knowing*
Diverse Representation	Visibility of LGBTIQA+ peoples is present in my curriculum.	*I provide visibility of LGBTIQA+ people - academics, students and unit-specific content. LGBTIQA+ people*

		or related topics in communications, presentations, lectures, research, events and other discussions are included.
	Can you give an example of how you include a diverse range of perspectives in your curriculum and teaching?	*Readings, lectures, etc. include those written by, or from the perspective of, LGBTIQA+ people, culturally and linguistically diverse peoples, people with disabilities - including differently abled scholars/students, etc.*
		I include inclusive language, such as pronouns, swap gendered words for gender-neutral ones, and include an inclusivity statement and examples. Always assume that there is a member of the LGBTIQA+ community within my team, student group, and/or participating in an activity I am running for the University.
	Can you give an example of how you include LGBTIQA+, non-ableist and culturally and/or linguistically inclusive language in your curriculum and teaching?	*I have reflected on word choice and changed to non-ableist language.*

Universal Design for Learning Audit

The UDL Audit was intentionally designed to model UDL in action. Furthermore, enhancing its accessibility acknowledged that, despite the participants' university education, they also have diverse needs. Designed as a guide to address learner diversity and variability, the Audit was structured using the three UDL principles. The Audit provided a structured framework for participants to systematically assess their teaching strategies, course materials, and assessment methods through a UDL lens and to identify tangible goals for their "Plus One Pledges."

Upon commencement, the UDL Audit articulated alignment with ECU's policy and explicitly stated the purpose "to reflect on current practice and help identify areas in your unit which utilise and embrace UDL and provide you with an opportunity to focus your further inclusion of UDL." Recognising that not all participants had prior knowledge of UDL, each section began with a reflective 'tuning-in' question, such as, "Am I allowing my students multiple ways to engage in learning?" then provided additional education on the section via a written summary, video and diagram of the principle.

Following the overview, the participants then moved to the questions, which were designed using the UDL Guideline checkpoints to create examples relevant to tertiary curriculum design/delivery, teaching and ECU. Furthermore, the questions used a strengths-based approach to create a sense of ownership, connection and self-reflection. "I" statements (see Table 2) with practice examples such as, "I include a welcome video

and tour of critical features" were included as a metacognitive approach requiring participants to self-assess against a growth mindset scale of "not yet to always" and modelled an inclusive strategy to support understanding and assist with the end of Audit "Plus One Pledge." This approach aimed not only to document current levels of inclusion but also guide participants in identifying actionable steps, either by drawing on the modelled examples provided in the survey or by reflecting on their own understanding to develop tailored strategies for enhancing accessibility and engagement within their teaching contexts. To achieve this, the design ensured that respondents could critically evaluate their units by engaging with key UDL principles, prompting self-reflection on existing practices and areas for improvement.

Aboriginal and Torres Strait Islander Representation Audit

The Aboriginal and Torres Strait Islander Representation Audit (see Figure 1) was also designed using a strengths-based structure and language to move educators away from both deficit discourse and tokenistic inclusions. Tokenism can be defined as superficially "placating a demand for a particular course of action" (Grant, 2017) and is a recognised issue within university curriculum when "tokenistic" inclusions are "added" to the curriculum to achieve cultural competency measures (Hollinsworth et al., 2017). Examples of retrofitted inclusions include a single reading about Aboriginal and Torres Strait Islander people and culture or decontextualised examples that offer limited perspectives. Decolonising curriculum is a long journey, which starts with first developing an understanding of decolonisation and deficit discourse. Hence, educators were provided with definitions of these concepts, as well as "why" strengths-based approaches are key to inclusive practice. The Australian Institute of Aboriginal and Torres Strait Islander Studies pyramid of "Against Mob" through to "By Mob" was used to further frame the importance of considering the subject, perspectives and authorship of resources (AIATSIS, 2022, p. 15).

After consultation and feedback from a representative from the university's Centre for Indigenous Education and Research - Kurongkurl Katijin - the Audit focused on Indigenous representation, including voice and visibility, in learning outcomes, curriculum, assessment and pedagogy. Questions invited educators to thoughtfully reflect not just on whether Indigenous content was present in their unit but also on the *kinds* of resources included and *who* authored them. The audit was designed to move educator thinking away from tokenistic resources and inclusions that presented a limited or deficit-based understanding of Aboriginal and Torres Strait Islander peoples. The final questions asked educators to provide an overall reflection of Aboriginal and Torres Strait Islander representation in the unit prior to outlining their "Plus One Pledge".

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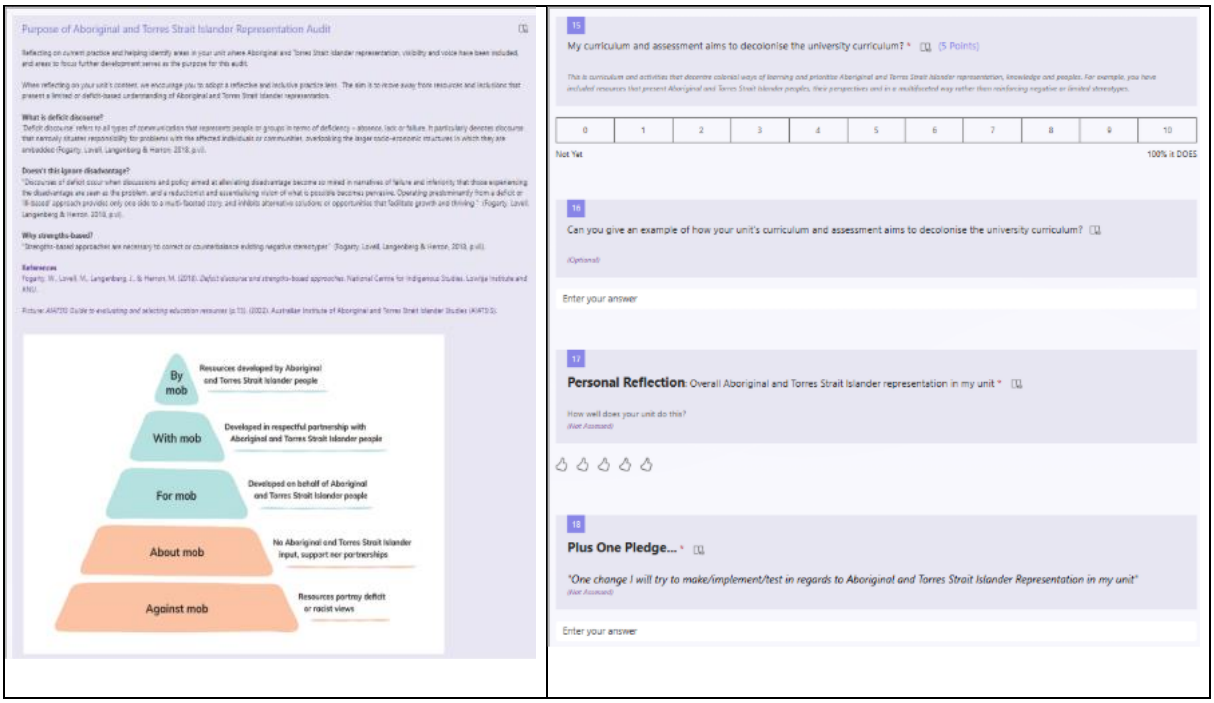
Figure 1

Sample of Aboriginal and Torres Strait Islander Representation Audit Layout



The first iteration of the Aboriginal and Torres Strait Islander Representation Audit used a combination of strengths-based "my" statements, ranked from 0 to 10, with 0 aligned to growth-mindset phrasing of "not yet" and 10 as "every time." A clarification question of *how* these were included followed. These ranked statements were supported with an explanatory blurb (see Table 2) to support ranking. General explanations were opted for in the first iteration as questions, as opposed to the "I" statements in UDL, which had more categories and detail due to the UDL guidelines and strategies. In this audit, a broader reflective approach to inclusive practice was taken to first develop understanding of decolonisation and strengths-based approaches, developing an inclusive lens to identify and rank their inclusive practice, and identify areas for development before learning the *how-to*. The only deviation was in relation to imagery and culturally appropriate language. Specific questions relating to language and imagery were included, but in reference to approved icons designed by Kurongkurl Katijin for digital use, as well as the use of Noongar and Wardandi greetings, and place names, as encouraged by ECU (see Table 2 above). Further consultation with a cultural reference group was needed before questions relating to language and imagery could be included.

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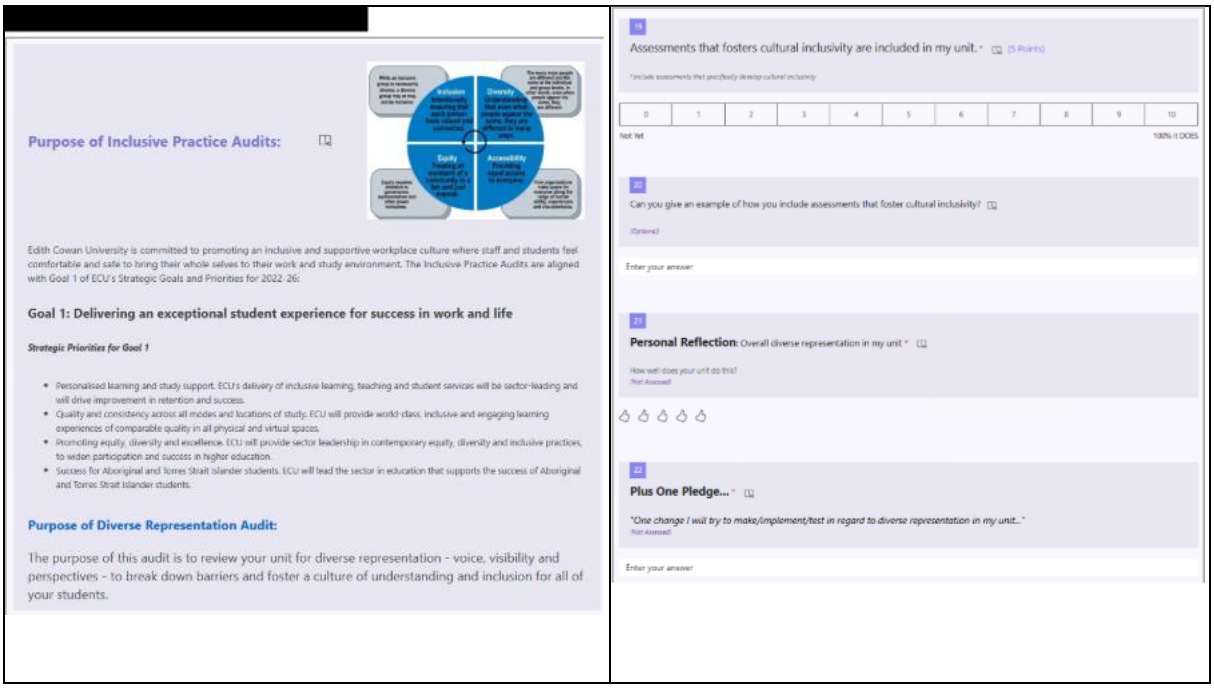
Diverse Representation Audit

Like the UDL and Aboriginal and Torres Strait Islander Representation Audits (see Figure 2), the purpose was explained, showing alignment with ECU's strategic goals and commitment to creating "an inclusive and supportive workplace culture where staff and students feel comfortable and safe to bring their whole selves to their work and study environment" (ECU, 2024). The audit oriented the participants at commencement with a diversity diagram, defined terms, and unpacked quadrants of inclusion, diversity, equity, and accessibility in lay terms to foster an understanding of the nuances of diversity. The educators' goal was to review their unit for the voice, visibility, and perspectives of diverse groups, to break down barriers and foster a culture of understanding and inclusion for all students. Questions focused on creating cultural inclusivity by reflecting on LGBTIQA+, people with disability, and CALD inclusions. Like the Aboriginal and Torres Strait Islander Representation Audit, questions focused on curriculum that represented, or was created by, scholars and students from these groups. The approach to audit question design straddled the previous audits. Questions included a combination of strengths-based statements with "I" statement clarification, as well as 0 to 10 ranking, with 0 aligned to growth mindset phrasing of "not yet" to 10 meaning "every time". This nuanced approach was taken because there were some tangible and explicit inclusions around language that could be shared without the need for cultural consultation.

Figure 2

Sample of Diverse Representation Audit layout



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Questions on both language and imagery in this context were included to highlight the importance of visibility when creating safe teaching and learning spaces for students. Such approaches to inclusive language and strengths-based representation are important in rebalancing deficit discourses for people, staff, and students with disability. Waling and Roffee (2023) note that not including Queer visibility can negatively impact students social and emotional wellbeing. Non-ableist language and strengths-based representation in the curriculum are two starting points. Similarly, it is important for educators to review inclusions, as well as non-inclusions that ignore or leave out any cohort and privilege the dominant culture, for example, in language and culture, which can force cohorts such as CALD students to remain hidden or "blend in" (Dobinson, 2023, p. 173). Thus, explicitly posing contextual questions on language and imagery can shift inclusions away from limited stereotypes.

Consultation and Revision Process

To ensure cultural and equitable inclusivity, consultations were undertaken for both Representation Audits. Cultural consultation was undertaken with Kurongkurl Katijin. This was a reflexive process and encouraged the designers to recognise that the best intentions of allies are not necessarily underpinned by a firm understanding of cultural knowledge (what can be shared and what cannot be taught). This process required humility, and for designers to sit outside their comfort zone to unlearn pre-conceived ideas. One designer coined the phrase "having a colonial moment" to signal where their own Western lens influenced content questions that required collaborative consultation with Aboriginal and Torres Strait Islander community members. This content was removed from the surveys and "parked" for further consultation. Additionally, the ECU Equity Projects and Access and Inclusion team – consisting of officers from LGBTIQA+ community, disability officer, assistive technology representatives, and student advisors - also provided feedback. They shared recommendations and resources for inclusive language, as well as advice on audit structure for accessibility. These recommendations were applied, and the audits were recreated in Microsoft Forms, for ease of use, accessibility and tracking.

Beta testing was conducted across seven Enabling units. High-level findings showed that the audits were a quick tool to use as participants took an average of 13.6 minutes to complete each of the two Representation audits, while the UDL audit averaged 9.1 minutes. The longer completion times for the Representation audits may indicate varying levels of understanding regarding terminology and contextual relevance. Ethics approval is being sought for future assessments to better evaluate the audits' effectiveness and usability in promoting inclusive practices in unit design.

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Discussion

In line with the Accord Report, the 2026 increase of government funding for Higher Education Disability Support and the introduction of "Demand Driven Funding" to support students from underrepresented backgrounds demonstrate a drive toward supporting students from equity groups. The funding is provided to "deliver equity interventions and support activities that are proven to deliver positive outcomes" (Department of Education, 2024, para. 4). The use of funding to assist with the training and delivery of inclusive practices is cited in example activities. Reflecting on inclusive practice audits as a precursor for "training" is a crucial step in ascertaining their efficacy. Gibb's reflective cycle offers a six-point model - description, feelings, evaluation, analysis, conclusion, and action plan - for reflecting on learning experiences (1988). Gibb's cycle can "help focus participants' reflections and turn challenging situations into valuable learning experiences" Markkanen et al., 2020, p. 59).

When *describing* the audit design process, it is noted that it took the three designers time - six months - and thoughtfulness to create tools that foster inclusion in meaningful and non-tokenistic ways. The process was necessarily elongated by the need to create, consult, and clarify what to include, how to structure the audits, and how to model inclusive practice, as well as to ensure the use of strengths-based language and UDL design. The design process *felt* cognitively and technically challenging at times but rewarding when the three audits were ready for testing. When *evaluating and analysing* the findings from project, it was noted that the audits fostered thoughtful reflection and plus one actions. Designers noted three areas for further consideration: the need for time, training and more definitions, and examples and resources that demonstrate the "how-to," which is a goal for the next iteration of the audit. The completion of the audits showed that the time and thought that went into the design process achieved the goal of creating accessible, easy-to-use audits that took minimal time to complete. *Concluding* thoughts are that while these audits were usable, they needed to be developed with further consultation, resourced with more examples and 'how-to' exemplars, and tested with a wider pool of participants from different disciplines and universities.

The *action plan* involves applying participant and external feedback, including insights from the senior learning designer for an Indigenising Curriculum project at the Centre for Learning and Teaching (CLT). An Aboriginal and Torres Strait Islander consultation group will be established to review parked items and inform resource choices. Early audit designs failed to reflect the diversity of student cohorts, prompting a revision to align with the culturally responsive UDL Guidelines 3.0, which include enhanced terminology and examples. Designers will ensure audits are not used merely as checklists. Initial consultations with CLT have begun for a university-wide rollout linked to professional development, such as microcredentials; however, further consultation with the consultation group, students, and other stakeholders is needed. The audit

design process received positive feedback at national conferences in 2024, and a beta testing project with universities nationwide is set to launch in 2026. These audits offer educators a way to step backwards before moving forward with making curriculum changes.

The reflective audits contribute to the field by offering a practical, strengths-based mechanism for translating inclusive education policy and theory into everyday academic practice, addressing a long-recognised "how-to" gap in higher education inclusion work. By combining UDL with explicit audits of Aboriginal and Torres Strait Islander and diverse representation, the approach extends existing frameworks to more holistically address culture, identity, and power in curriculum design. In practice, the audits are transferable and scalable, from unit to course level auditing, to allow for tailoring and expansion to meet the needs of different educational environments, as well as industry. This scalability was built in so other institutions could embed them into professional learning or curriculum review processes as a non-tokenistic precursor to meaningful, sustainable inclusive curriculum redesign.

Conclusion

This practice report positions inclusive practice audits as an innovative mechanism for translating institutional policy into pedagogical action. It has outlined the nuances of the design process, demonstrating relevance and applicability to the wider university context, beyond Enabling programs. The audit design process required ongoing collaboration and critical reflection, challenging designers to surface assumptions and negotiate culturally responsive, accessible, and action-oriented approaches to inclusion. This process highlighted the importance of cultural consultation in this design process to ensure that the audits were designed and could be engaged with in authentic ways. Early findings indicate that the audits function as an effective preparatory tool, strengthening Enabling academics' understanding of inclusive practice prior to enacting change. Ongoing refinement will involve wider cultural consultation with community elders and students, as well as iterative testing. This is in order to embed the audits as a practical resource that not only identifies areas for improvement but also supports academics to actively rethink and redesign curricula in ways that meaningfully include all learners.

Acknowledgements

The authors acknowledge that this research meets ethics standards, and no artificial intelligence was used in its completion. Access to the audits available on request.

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IJUDUDL
International Journal for Universal Design and Universal Design for Learning

International Journal for Universal Design and Universal Design for Learning (IJUDUDL) Vol. 1, No. 2, April 2026 ISSN: 3119-

Breaking the Code– Using the (In)CLUDE Framework to Support the Implementation of Universal Design for Learning 3.0 in the Classroom through the Use of Drama in Education

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DOI: https://doi.org/10.34874/PRSM.ijududl-vol1iss2.6798

ABSTRACT

Major global developments have contributed to increasing diversity in our classrooms. Education systems are being challenged to respond to diverse student populations. With teachers at the front line of enacting inclusive education, many education systems have begun to explore ways in which innovative pedagogies can promote more inclusive educational practice. Research highlights increasing evidence about the effectiveness of UDL in creating more inclusive classrooms across education sectors. However, UDL's implementation has been challenging as educators struggle to translate UDL theory into classroom practice. This paper presents Drama in Education (DiE), a student-centred teaching methodology, as a medium which can be used to support the implementation of UDL 3.0 in the classroom. The paper maps the UDL 3.0 guidelines and its associated thirty-six considerations on to key DiE principles and specific DiE strategies in order to support the practical implementation of UDL in the classroom. The paper introduces the (In)CLUDE framework to support the implementation of UDL in any classroom through the use of DiE. As a non-subject, non-sector specific pedagogy, DiE is a teaching methodology available to all educators. As such, this paper has implications for teachers working at all levels of the education system, teacher educators and policy makers.

Keywords

Universal Design for Learning, Drama in Education, inclusion, inclusive pedagogies

Introduction

Major global developments such as demographic shifts, migration and refugee crises, rising inequalities, and climate change have contributed to increasing diversity in our countries, communities and classrooms (OECD, 2023). Consequently, international education policy increasingly emphasises the need for national education systems to provide inclusive and equitable education for every student (Heinz et al., 2025). Education systems the world over are being challenged to respond to diverse student populations, with governments and education policy makers increasingly focusing on the impact that diversity has on education systems and the potential role education systems can play in building more sustainable, cohesive and inclusive societies (OECD, 2023). Responding to student diversity therefore, has become a key policy priority in education systems around the world (Flood & Banks, 2021).

With teachers at the front line of enacting inclusive education, many education systems have begun to explore ways in which innovative pedagogies can promote more inclusive educational practice (Takacs & Zhang, 2020). A growing interest in UDL across education systems worldwide highlights increasing evidence about its effectiveness in creating more inclusive classrooms across education sectors (Capp, 2020). However, research on UDL also reveals challenges in terms of its implementation, with literature highlighting that educators struggle to translate UDL theory into practice; with educators feeling that once they understand what the principles look like, they are left to figure out how to apply UDL for themselves (Edyburn, 2020).

This paper places UDL 3.0 (CAST, 2024) in conversation with Drama in Education (DiE), an asset-based pedagogy which centres, values, and sustains students' cultural practices. Synergies between UDL 3.0 and DiE have been established in the literature (Heeran Flynn, 2026). This paper advances on the synergies between UDL and DiE by mapping the UDL 3.0 guidelines and its associated thirty-six considerations on to key DiE principles and specific DiE strategies in order to support the practical implementation of UDL in the classroom. The paper also introduces the (In)CLUDE framework for using DiE to support the implementation of UDL in any classroom. As a non-subject, non-sector specific pedagogy, DiE is a teaching methodology available to all educators. As such, this paper has implications for teachers working at all levels of the education system, teacher educators and policy makers.

Drama in Education (DiE)

If we think of any material stored in books as an unpalatable beef bouillon cube, to use Heathcote's metaphor, then some means must be found for releasing this dense mass into a savoury broth of human experience.

In educational circles this process has been called code cracking – breaking the code so the message can be read (Wagner, 1976, p.187).

According to Dorothy Heathcote, one of the pioneers of DiE, DiE is the means which facilitates this process, positioning DiE as a learning medium which helps students to access the curriculum and "crack the code to curriculum areas" (Wagner, 1976, p. 222).

Positioned in this manner, DiE is considered a teaching and learning methodology that uses performative elements in a classroom setting, where the focus is not on the final product but rather on the learning process (Göksel, 2021). In DiE, the aim is not to prepare students to perform a play (product); instead, it takes students through a series of dramatic episodes, linked together by a narrative thread (process), to afford learning opportunities (Piazzoli, 2018). The emphasis is on drama as an intentional teaching strategy to enhance learning in a particular curricular area (Wagner, 1976). Therefore, as opposed to learning about drama, in DiE, students learn through drama. As a student-centred pedagogy, teachers and students work collaboratively to create a fictional world in which they assume roles to explore issues that are of concern to them. Working through drama, students get to know themselves and others, with DiE affording students the unique opportunity to walk in other people's shoes (Aitken, 2021). DiE is not taught by drama experts, rather, drama is used as a teaching and learning medium to learn about any subject. DiE therefore, is a non-subject, non-sector specific teaching methodology which is available to every teacher within their classroom.

DiE is considered a highly effective and well-recognised pedagogy in many educational systems (Göksel, 2021), with a vast body of literature attesting to both its versatility for teaching across the curriculum (see Edmiston & Towler-Evans, 2022) and highlighting how DiE significantly enhances students' skills and abilities (see Göksel, 2021) across a variety of domains including critical thinking, communication, collaboration, cultural competence and creativity (see Neelands, 2009).

DiE is also considered a powerful tool for furthering inclusive practices (Karaolis, 2023). With learner variability as its premise (Kilinc et al., 2025), DiE's inherent multimodality increases access to the curriculum for diverse learners (Beaumont, 2020). Considered as an embodied practice which uses the physical body, its movements, and expressions (Piazzoli, 2018), in DiE students can access learning through kinaesthetic (body), cognitive (mind), and affective (heart) channels (Göksel, 2021). Drama thus functions as a multimodal pedagogy, allowing students to demonstrate their learning in ways that integrate multiple semiotic modes, broadening the ways curriculum can be both represented and assessed and providing students who do not always succeed in traditional measures of competence with alternative means to participate (Bernstein et al., 2024).

As a language-rich pedagogy therefore, drama is well-established as an effective tool in supporting communication (see Bryer, 2024) and language and literacy development (Cleeve Gerkens, 2024), with drama considered a space where language is applied and practised (Baldwin & Fleming, 2003) in multi-modal forms (Wells & Sandretto, 2017).

Language is, however, profoundly more than a medium of expression. It is a tool for thinking, playing a central role in cognitive development and learning (see Vygotsky, 1962), shaping how we understand reality (see Wittgenstein, 1921) and helping to define our identity (see Gee, 2015; Tannen, 1994; Anderson, 2006). As humans, we vary in almost every dimension imaginable, and language is no exception (Kidd & Donnelly, 2020). Not all students come to school with the same experiences of using language. For some, the socialisation contexts in which they have participated have prepared them well for the use of language they encounter in school.

For many others, this is not necessarily the case. Research is unequivocal that the language of schooling (see Schleppegrell, 2004) and academic language (see Cummins, 2000) differs significantly from the interactional language that students use for social purposes outside of school and provides specific linguistic challenges.

This has considerable implications for students where language growth is closely connected to literacy and academic success in school (Nippold, 1998) and a student's level of success or otherwise in the education system is largely dependent upon their ability to tap into the formal linguistic mode of instruction in operation in schools (Heeran Flynn, 2013).

Language, therefore, emerges as an individual developmental variable (Kidd & Donnelly, 2020) which can present as a barrier hidden in plain sight (CAST, 2024). While on the surface, it may be considered that students speak the language of schooling, they may have different language experiences, which can affect how they interact with the curriculum. Rooted in children's play with its cognitive, social and emotional development benefits, DiE facilitates knowledge construction and reorganises cognitive patterns, enhancing students' skills and abilities across a range of developmental domains (Arda Tuncdemir, 2025).

Language growth is prolonged, continuing to develop long after childhood, through the school-age years, adolescence and well into adulthood (Nippold, 1998). Placed within this context, DiE provides a pedagogy for use across education sectors, where language and learning are co-constructed through social interaction in dramatic experiences expanding students' repertoire of language experiences, thereby helping to level the linguistic playing pitch and providing access to its concomitant affordances (Heeran Flynn, 2013).

The benefits of DiE as a teaching method can therefore, be seen as multiple. DiE can reach students who are not reached through traditional methods, it engages students who are not engaged through traditional methods, it connects students to themselves and others, it transforms the traditional learning environment, and challenges students who are already considered successful under traditional paradigms (de Water, 2021). Drama develops unique, powerful, and multiple ways of perceiving, interpreting, knowing, representing, and communicating understandings about self and the world. It

is for these reasons that DiE has become increasingly valued in the context of inclusion (Beaumont, 2020) and it is in this respect that synergies between DiE and UDL become apparent (see Heeran Flynn, 2026).

UDL 3.0 and DiE - Synergies & Strategies

To support the practical implementation of UDL 3.0 in the classroom, Table 1 maps UDL 3.0's principles and considerations onto key DiE principles and specific strategies. The strategies are not prescriptive and can be used interchangeably across UDL considerations. As a non-subject, non-sector specific pedagogy, DiE strategies mentioned below can be modified accordingly based on requirements at local and sectoral level.

Teachers are advised to use a variety of DiE strategies to ensure that students attain comparable development and are assessed across a range of required domains. As with planning for any teaching and learning experience, considered choice and combination of DiE strategies will provide teachers with real-time feedback on students' learning across a range of domains, help teachers to identify any discrepancies which may occur across domains and ensure that strengths in any one domain do not potentially mask difficulties in another. (For example, incorporating 'why' and other 'wh-questions' into DiE strategies challenges students to justify their responses and provides the teacher with feedback on the development of students' conceptual understanding as well as their linguistic comprehension).

Table 1

UDL 3.0 and DiE - Synergies & Strategies for Implementation

Multiple Means of Engagement		
Welcoming Interests & Identities (Guideline 7)		
UDL 3.0 Consideration	**DiE mapping**	**DiE Strategy**
Optimise choice and autonomy (7.1)	**Drama creates learning experiences where agency is a designed outcome.** Drama's choice-rich structures positions students as co-creators, affording students meaningful choice and autonomy in the learning process, supporting the expansion of students' active agency (see Lehtonen, 2015).	**Mantle of the Expert (MoE)** - students are repositioned as *experts* in an imaginary *enterprise* (a company or a team). Within this fictional context, the students work together to carry out an important job, a *commission,* for a high-status fictional *client.* Along the way, they encounter problems or *tensions,* (either naturally occurring or planned and introduced by the teacher) and explore other perspectives (see Farmer, 2012).
Optimise relevance, value and authenticity (7.2)	**In drama, students work on problems and roles that matter to them and their communities.** Drama embeds curricular tasks in realistic, co-constructed scenarios, providing authentic, interest-driven	**Forum Theatre** - students are given the opportunity to step into a scene, intervene and change the action/outcome. A scenario is presented by several students to the class at least twice. During the second run-through, any member of

	learning opportunities in which students act in roles that connect to their personal interests, goals and community concerns (see Neelands, 2009).	the class is allowed to shout 'Stop!' when they think a different course of action would produce a more successful outcome (see Neelands & Goode, 2015).
Nurture and Play (7.3)	**Drama nurtures play for students.** Rooted in children's play, drama contributes to a general pedagogy of play in the classroom where the form of drama used to teach in the classroom is considered as dramatic playing. Drama approaches can be designed to nurture and extend play for learning across education settings from early childhood up to and including third level and workplace settings (see Arda Tuncdemir, 2025).	**Role play** - Role play simulates real-life situations by having students take on specific roles, stepping into another character's shoes (see Farmer, 2012).
Address biases, threats and distractions (7.4)	**Drama intentionally creates and sustains learning spaces where students are encouraged to take risks.** Drama can be used to surface and address controversial issues, bias and social threats. Protected by dramatic distance, the fictional world creates learning spaces where students are encouraged to take intellectual and social risks, producing accepting contexts that support dialogic risk-taking (Wells & Sandretto, 2017).	**Classroom Agreement** - co-create a Classroom Agreement with students outlining the type of behaviour that is expected during drama. **Hot Seating** - involves questioning a character about their background, behaviour and motivations. **Iceberg game** - the teacher draws an iceberg on the board and students add words to describe the feelings and emotions of the character - both those above and below the surface (see Farmer, 2012).
Sustaining Effort and Persistence (Guideline 8)		
UDL 3.0 Consideration	**DiE mapping**	**DiE Strategy**
Clarify the meaning and purpose of the goals (8.1)	**Drama makes learning goals transparent and meaningful**. In drama, curriculum tasks are presented as professional tasks in real-world contexts. By embedding objectives within authentic tasks, students can see *why* a task matters (purpose), what successful performance looks like (success criteria), and which choices will help them meet those aims, outcomes that increase purposeful engagement and student ownership in classrooms (see Danckwardt-Lilliestrom et al., 2024).	**Writing in Role** - writing from a character's perspective (see Farmer, 2012).
Optimise challenge and support (8.2)	**Drama can optimise both challenge and support, raising expectations and supplying the scaffolds students need to succeed.** Drama affords teachers the opportunity to design tasks that present cognitive	**Teacher in Role (TiR)** - the teacher takes on a role related to a story or theme and sets up a dramatic situation for students to participate. The teacher scaffolds and challenges from within TiR (see Farmer, 2012).

	and social challenge while at the same time, using discreet scaffolds such as in-role scaffolding, briefings, role constraints and modelling from within Teacher in Role (TiR). This creates a low-threat challenge, yet highly supportive learning space in which students can take risks, extend skills and meet explicit learning goals (see Heathcote, 1999).	
Foster collaboration, interdependence and collective learning (8.3)	**In drama, students work through interaction, negotiation, and collaboration to broaden their understanding of their own experiences as well as those of others.** Engaging in drama activities offers students a way to interact with each other, expanding their knowledge of themselves and others (Arda Tuncdemir, 2025).	**Hot Air Balloon Game** - students representing various characters (or abstract concepts) are in a sinking hot air balloon. In character, the students must argue their case to stay on board. **Reportage -** a drama technique that presents events through the medium of podcast or news report. Students act as hosts and audience members. Use **hotseating** to interview specific characters on the panel. Acting as the collective audience, students ask the panel questions.
Foster belonging and community (8.4)	**Drama can be used as a pedagogical tool to build community.** Drama creates shared imaginative experiences that put students in collaborative roles, require perspective-taking, and give everyone an authentic contribution to group tasks. This supports social skills, increases empathy, strengthens peer relationships through co-constructed meaning, and produces visible classroom norms of trust and responsibility, all of which raise students' sense of belonging (see Lobman, 2005).	**Rolling Role** - involves a team of teachers working together to develop a common context for a programme of work. The teaching team creates a common context, and agrees to the key features of the community. The students are then involved in building the community, often creating artefacts and texts which are published and shared with other classes. Working across a number of classes within a school, the programme of work 'rolls' from teacher to teacher; work produced by one class can be used as a resource by another class (see Heathcote, 1999).
Offer action-oriented feedback (8.5)	**Drama functions as a pedagogical space for iterative, action-oriented feedback.** Drama allows teachers to assess understanding in real-time and provide formative feedback during activities. Feedback is embedded in drama tasks and used immediately to shape students' next actions. Drama provides feedback to students on both the process *and* the product (see Winston, 2013).	**Teacher in Role (TiR) -** the teacher provides feedback in real-time about the process and the product.
Emotional Capacity (Guideline 9)		
UDL 3.0 Consideration	**DiE mapping**	**DiE Strategy**
Recognise	**Drama fosters confidence,**	**Mantle of the Expert**

expectations, beliefs and motivations (9.1)	**enthusiasm, and deeper learning.** Drama provides discreet opportunities for teacher scaffolding from within the drama, ensuring all students experience success. Drama is also seen to enhance self-confidence across various domains and enhance self-esteem and mental well-being (Karatay et al., 2023).	
Develop awareness of self and others (9.2)	**Drama creates learning experiences where students learn about themselves and others.** **How?** Drama is a means of personal and social development. Literature highlights how drama improves social relationships, reduces bullying behaviours and enhances students' self-awareness and empathy (Cleeve Gerkens, 2024).	**Freeze Frame combined with Thought Tracking** - students create a silent **Freeze Frame** (students 'freeze' their bodies to create a scene, like pausing a film) of a particular scene/scenario. Develop this further by using **Thought Tracking** i.e. asking each student to verbalise the thoughts and feelings of the characters in the Freeze Frame (see Farmer, 2012).
Promote individual and collective reflection (9.3)	**Through drama, students engage in self-reflection and collaborative discussions.** Drama pedagogy is characterised by cycles of individual reflection (the student's own internal responses to role/scene) and collective reflection (whole-class discussion/debrief and negotiated understanding), leading to enhanced understanding of civic issues, improved social relationships, and increased self-awareness (see Cleeve Gerkens, 2024).	**Individual and collective reflective debrief** - provide opportunities for structured individual reflection activities for example, using drama journals as well as guided collective debrief discussions during and post drama work.
Cultivate empathy and restorative practices (9.4)	**Drama helps students to develop empathy, show concern for others, and be more able to change their perspective.** Dramatic role-taking provides students with the unique opportunity to walk in the shoes of others, thereby, fostering empathy, perspective-taking (and perspective-changing), listening skills and conflict-management capacities that are essential for repairing relationships (see Aitken, 2021).	**Cross Cutting (or Split Screen**) - two or more scenes are performed at the same time. The technique is used to contrast a particular theme or aspect of the story and how different people can have different experiences of the same event (see Farmer, 2012).
Multiple Means of Representation		
Perception (Guideline 1)		
UDL 3.0 Consideration	**DiE mapping**	**DiE Strategy**
Support opportunities to customise the display of information (1.1)	**Drama functions not only as a way to *learn* curriculum content but also as a powerful mode for *displaying* and *communicating* the curriculum in multimodal forms.** Drama gives teachers multimodal means to display curriculum content,	**Still Image** - is a silent, human sculpture that is created by a group of students using their bodies, to represent an interpretation of an event, action, location or scene. Scaffold students' 'reading' of the still image by analysing facial expressions, use of hands, body

	thereby affording students a variety of ways to access the curriculum (Edmiston & Towler-Evans, 2022).	posture, and proxemics (space and distance between the participants within the still life). **Soundscapes** – students create a sound picture or soundscape using voices and body sounds. **Proxemics** - students physically position themselves in relation to a character or central point in the scene or topic, then justify their placement to explain their perspective or understanding of the situation (see Farmer, 2012).
Support multiple ways to perceive information (1.2)	**Drama functions as a multimodal perceptual pedagogy for students.** Drama's embodied and multimodal work changes how students attend to and interpret curriculum content, making abstract concepts concrete, enabling alternate semiotic modes (visual, bodily, verbal, digital) to carry meaning, and supporting students to *perceive* curricular knowledge in richer, more accessible ways. The literature therefore positions drama not only as a method for displaying curriculum but as a way of *perceiving and coming to know* the curriculum through coordinated multimodal resources (Edmiston & Towler-Evans, 2022).	**Whoosh storytelling** - the story is brought to life and students play characters, objects, places or events (see Farmer, 2012). **Talking Objects** - enables objects to speak in role. The objects can talk to themselves and to each other, and students can talk with the objects and question them (see Neelands & Goode, 2015).
Represent a diversity of perspectives and identities in authentic ways (1.3)	**Drama provides structured, embodied ways for students to take, compare and reflect on multiple perspectives**. Drama offers both the *experiential* (role enactment, embodied point-of-view) and the *dialogic* (facilitated debriefs, audience-in-role interventions) mechanisms that help students learn through multiple and varying perspectives. Studies report cognitive gains (theory-of-mind, perspective-taking) and measurable increases in empathy when drama experiences are paired with facilitation, and classroom formats that afford students opportunities to try alternatives and hear peer responses, all of which scaffold learning from varied viewpoints (see Briones et al., 2022).	**3D Living Pictures** - images can be brought to life to create a 3D Living Picture, using **freeze frames** and **thought tracking**. **Identity Texts** - students construct artefacts by using resources of their choice to express a meaningful message related to their identity and culture.
Language and Symbols (Guideline 2)		
UDL 3.0 Consideration	**DiE mapping**	**DiE Strategy**
Clarify vocabulary, symbols and language structures (2.1)	**Drama acts as a multimodal meaning-making engine**.	**Ten Second Objects -** students make the shape of an object using their bodies, in only ten seconds

	Drama helps students to externalise abstract words, symbols and numeric relations as visible, physical and narrative forms they can inspect, test and re-symbolise (see Danckwardt-Lilliestrom et al., 2024).	(see Farmer, 2012). **Sculpting** - involves the physical manipulation of bodies in pairs or groups, to embody the characteristics and form of a character or object, (see Farmer, 2012). **Spectrum of Difference** - students express their views by choosing where to stand on a line representing a continuum of opinion (see Neelands & Goode, 2015).
Support decoding of text, mathematical notation and symbols (2.2)	**Drama gives students actionable, multimodal affordances for decoding the curriculum.** **How?** Drama converts curricular representations (abstract symbols, technical language, dense text), into embodied visual and dialogic forms that students can inspect, manipulate and discuss, helping to reveal meaning (see Dorion, 2009).	**Role on the Wall -** is a collaborative activity for developing thoughts and ideas about a character or concept. The outline of a gingerbread man is created. Words or phrases describing the character are written directly onto the drawing (see Farmer, 2012). **Powerline** - is a physical representation of a spectrum of power or influence. In class, the teacher can place a line (either real or imaginary) across the floor, with one end labelled as 'most powerful' and the other 'least powerful'. Students position themselves and justify their positions, along the line to represent a character or group in relation to the issue being discussed (see Neelands & Goode, 2015). **Walking Debate -** the teacher divides the space into three i.e. Agree, Disagree, Unsure. The teacher makes various statements in relation to the curriculum content, and students position themselves in one of the three areas, justifying their positions. This also allows for opportunity to discuss situations where students are unsure of their position.
Cultivate understanding and respect across languages and dialects (2.3)	**Drama can be used to both develop language learning and model respect for linguistic diversity.** Drama not only advances linguistic skills but also cultivates mutual understanding and respect across languages and dialects. In translanguaging drama, students embody multiple languages and	**Living Newspaper** - students explore an issue by bringing it to life using various drama techniques such as for example, narration (a newsreader or chorus narrates the scene, still images or role play) (Neelands & Goode, 2015). Include translanguaging in **3D Living Pictures** and multimodal

	expressive modes in role, affirming all as valid communicative forms, enabling diverse communicative resources to be legitimised (Campbell & Tigan, 2022).	**Identity Texts.**
Address biases in the use of language and symbols (2.4)	**Drama produces classroom cultures in which multiple language forms are visible, usable and respected.** Research on drama highlights an increased willingness to use diverse repertoires, improved attitudes toward peers' speech, and pedagogical routines that explicitly position varied language forms as legitimate resources for learning (Campbell & Tigan, 2022).	**Incorporating translanguaging into narration** - characters may narrate, or a student who is not involved in the action can carry out the role of 'narrator' (Farmer, 2012).
Illustrate through multiple media (2.5)	**Drama enables students to illustrate curriculum content through multiple media.** As a multimodal pedagogy, drama allows students to demonstrate their learning in ways that integrate multiple semiotic modes, broadening the ways curriculum can be both represented and assessed (see Bryer, 2024).	**Still Images** **Proxemics** **Digital Tools** **Talking Objects** **Props**
Building Knowledge (Guideline 3)		
UDL 3.0 Consideration	**DiE mapping**	**DiE Strategy**
Connect prior knowledge to new learning (3.1)	**Drama supports students in linking prior knowledge to new learning across multiple domains.** Drama functions as a meaning-making and knowledge-integration tool, enabling students to scaffold new learning on familiar concepts while engaging in embodied, collaborative, and reflective learning processes (Danckwardt-Lilliestrom et al., 2024). By situating new knowledge within familiar contexts and experiences, drama strengthens both comprehension and retention (Beaumont, 2020).	**Flashback and Flashforward** - these techniques can be used to expand on a Freeze Frame to envision the before and after. Using flashback and flashforward creates a context, helping students to access prerequisite and prior knowledge. It shows what led up to a particular moment, how it might be resolved or how it may lead onto additional challenges (see Farmer, 2012).
Highlight and explore patterns, critical features, big ideas and relationships (3.2)	**Drama supports students in exploring and highlighting patterns and relationships in academic content.** Drama provides a multimodal collaborative way to observe and analyse patterns, fostering deeper comprehension, critical thinking, and problem-solving skills. By making abstract relationships visible, students can recognise and articulate connections that might otherwise remain implicit in traditional teaching (Winston, 2013).	**Decision Alley** - a student in character (or abstract concept) walks down an alley (two lines formed by their fellow students in character). As the character walks down the alley, each character along the alley, gives the individual character advice to help make a decision. When the character reaches the end of the alley, they make their decision, based on the advice given (see Farmer, 2012).
Cultivate multiple ways	**Drama is a pedagogy that cultivates**	**Marking the Moment** - is a

of knowing and making meaning (3.3)	**new ways of knowing and meaning-making**. Drama encourages active exploration, collaborative inquiry, and embodied learning. These experiences allow students to negotiate perspectives, experiment with ideas, and generate understanding that extends beyond traditional classroom approaches (Winston, 2013).	dramatic technique used to highlight a key moment in a scene or stage in a process. This can be done in a number of multi-modal ways, for example through slow-motion, a freeze frame, still image, narration, thought tracking or music (Neelands & Goode, 2015).
Maximise transfer and generalisation (3.4)	**Drama facilitates the generalisation and maximisation of learning by allowing students to abstract, transfer, and apply knowledge across contexts.** Drama functions as a pedagogical tool for deep, transferable learning. Using drama can lead to the development of broader understanding through generalising and making connections via the personal involvement that initially engages and motivates students in their learning (Winston, 2013).	**Narrative progression via Still Images -** in groups students create three still images to encapsulate the beginning, middle and end of the narrative/process under discussion.
Multiple Means of Action and Expression		
Interaction (Guideline 4)		
UDL 3.0 Consideration	**DiE mapping**	**DiE Strategy**
Vary and honour methods for response, navigation and movement (4.1)	**Drama is a multimodal pedagogy, supporting students in interacting with tools and environments that make learning accessible.** As a multimodal pedagogy, in drama students can access and express meaning through multiple semiotic channels supporting interpretation and enabling wider participation from students with diverse learning profiles. Distributing meaning across modes leads to increased student engagement and comprehension (Bryer, 2024).	**Still Images** **Writing in Role** **Role Play** **Art work** **Digital Technologies**
Optimise access to accessible materials and assistive technologies (4.2)	**Drama is a tool-rich multimodal pedagogy, which allows students to access tools and materials in ways that enhance their learning.** Drama's multimodal affordances pair naturally with assistive digital tools to scaffold access, participation and learning to provide equitable access to content, supporting varied learning preferences and abilities (Zakopoulos, 2023).	**Communication boards, mobile speech-output apps, captioning, tactile/visual props** **Tablet devices (and apps)** - can be integrated into group activities to scaffold communication, prompt turn-taking, and increase social participation **Dramatic storytelling activities** - use image-text graphics, e-read communication pens, speech-output apps.
Expression and Communication (Guideline 5)		

UDL 3.0 Consideration	DiE mapping	DiE Strategy
Use multimedia for communication (5.1)	**Drama enables students to demonstrate their learning using multimedia as part of communication.** Drama offers multiple semiotic pathways that broaden who can participate and how they can demonstrate knowledge. These varied semiotic resources allow students to demonstrate understanding in ways that are more inclusive than solely traditional written formats (Bryer, 2024).	**Video and/or audio recordings** **Digital storyboards** **Digital media** **Visual artefacts** **Physical enactments** with speech (**Action Clip**) or without (**Still Image or Freeze Frame**) **Writing in Role**
Use multiple tools for construction, composition and creativity (5.2)	**Drama gives students multiple tools for construction, composition, and creative production.** Drama's inherent multimodality not only validates diverse ways of expressing knowledge but also encourages students to compose and demonstrate learning creatively beyond print-based tasks. These opportunities expand the creative agency of students, allowing them not only to absorb content but to invent, shape and present it in original ways. This multimodality fosters inclusion, creativity, and deeper engagement by giving students multiple channels to construct and communicate ideas (Wells & Sandretto, 2017).	**Learning stations** - create stations with various multimodal tools e.g. digital technology (such as spell checkers, grammar checkers, word-prediction software or speech-to-text software), props, images, or text prompts. Students rotate through stations working on the subject related scenarios using their preferred tool(s).
Build fluencies with graduated support for practice and performance (5.3)	**Drama provides structured opportunities for students to build fluencies with graduated supports and gradual release.** Drama functions as a scaffolded pedagogy that nurtures fluency across multiple dimensions of learning while accommodating individual needs and diverse abilities. Drama functions as an adaptive scaffold with staged release that can be tightened or relaxed so students progressively take on agency in dramatic inquiry (Edmiston & Towler-Evans, 2022).	Beginning with **Freeze Frame,** progressing to **Thought Tracking** and ultimately developing the scene into an **Action Clip** (the teacher says 'Action!' and students bring the scene alive for a few moments with speech and movement).
Address biases related to modes of expression and communication (5.4)	**Drama can affirm all forms of communication as valid.** Drama creates inclusive learning environments where multiple voices, languages, and communicative practices are recognised as legitimate, fostering equity, confidence, and critical reflection on social and linguistic biases. Through drama,	**Multimodal storytelling -** students retell a story using spoken English, snippets of their heritage languages, gestures and images. Use drama conventions and allow students to combine modalities. **Still Image translanguaging adaptation -** alongside the still image, students label the still image

	students are able to communicate in ways that validate diverse expressive forms, challenging hierarchies that privilege standard speech or written text (Campbell & Tigan, 2022).	with words in different languages, or add short oral narrations in their chosen language(s), validating multiple forms of expression. **Hotseating translanguaging adaptation** - allow students to answer questions in their home language, English, or a mix, with peers encouraged to respond using gesture, translation, or bilingual prompts.
Strategic Development (Guideline 6)		
UDL 3.0 Consideration	**DiE mapping**	**DiE Strategy**
Set meaningful goals (6.1)	**Drama empowers students to co-create meaningful and authentic learning goals**. Drama functions as a goal-oriented pedagogy. Drama worlds provide scaffolds for students to define and pursue authentic learning goals, using imaginative and collaborative processes to shape outcomes (O'Neill, 1995).	**Mantle of the Expert**
Anticipate and plan for challenges (6.2)	**Drama supports students in anticipating and planning for challenges**. Drama fosters anticipatory thinking and planning skills. Drama allows students to simulate scenarios in a safe space and foresee possible difficulties, supporting reflective planning and strategic decision-making (Winston, 2013).	**Rewind, Fast Forward** **Forum Theatre**
Organise information and resources (6.3)	**Drama supports students in organising their learning information and resources**. Drama encourages students to systematically arrange information, tools and ideas for collaborative projects to support narrative coherence and learning outcomes (O'Neill, 1995).	**Role Play** **Mantle of the Expert**
Enhance capacity for monitoring progress (6.4)	**Drama enhances students' capacity to monitor their own learning progress**. Drama worlds provide spaces for iterative enactment and feedback in real-time, allowing students to monitor their comprehension, strategies and learning outcomes (O'Neill, 1995). Drama also facilitates reflective practices that enable students to track learning goals and self-assess progress (Winston, 2013).	**Teacher in Role**

Challenge exclusionary practices (6.5)	**Drama serves as a powerful tool for challenging exclusionary practices in education**. Drama functions as both a critical and liberatory pedagogy that empowers students to actively engage with and challenge exclusionary practices, promoting social justice and equity in educational settings (Streeter, 2020).	**Forum Theatre**

The (In)CLUDE Framework

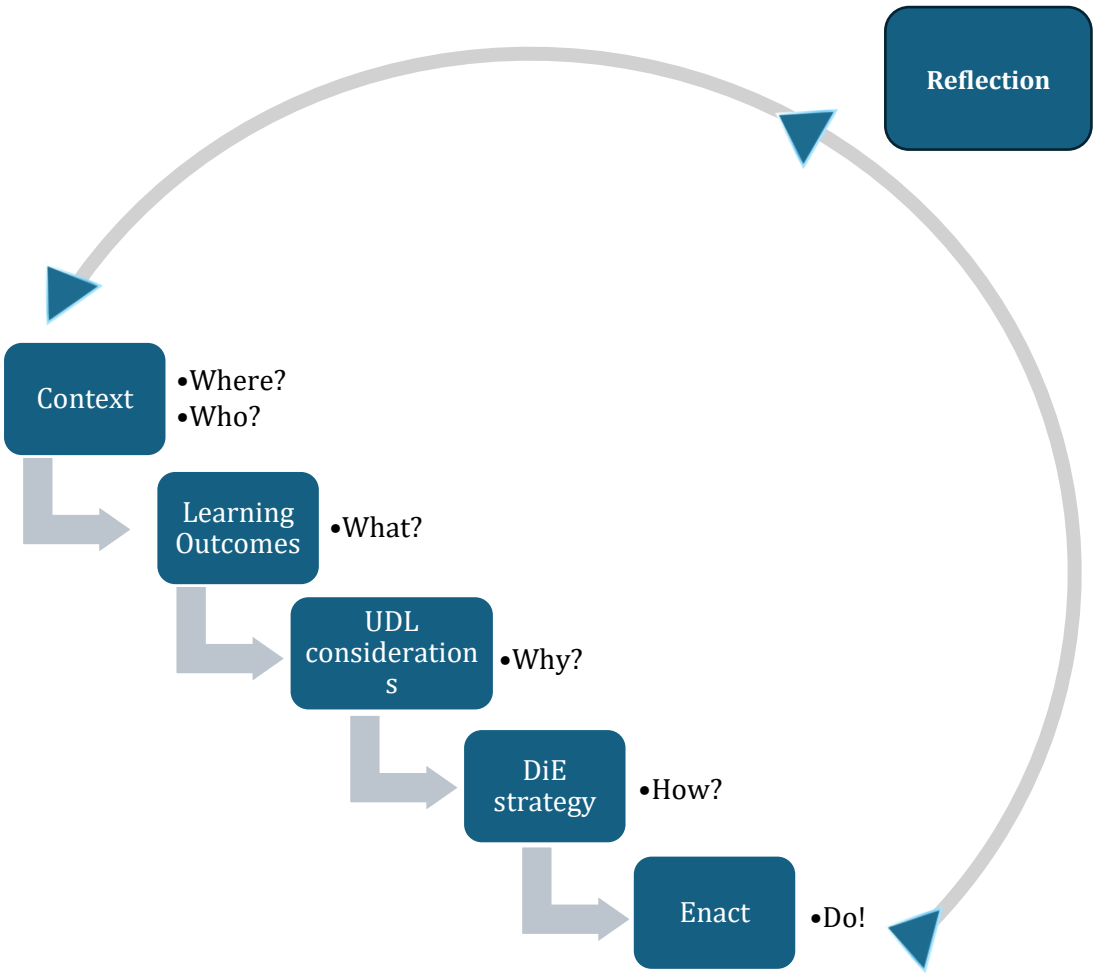
The (In)CLUDE planning framework has been developed to support the implementation of UDL 3.0 in the classroom using DiE. The framework puts UDL 3.0 front and centre of the teaching and learning planning and design processes, where effective use of DiE within a UDL framework presupposes an informed understanding of students' learning profiles, including their linguistic profiles.

Therefore, to get started implementing UDL 3.0 in the classroom, teachers are encouraged to consider the specific context (Where?) (i.e. education stage, school, level, subject and space); (Who?) (i.e. the class's learning profile including the class's linguistic profile and language experiences), in relation to potential opportunities and potential barriers.

Once teachers have identified the specific opportunities and potential barriers of their specific context, teachers can identify learning outcomes (What?) that they wish to work towards with students. Paying due attention to the potential opportunities and barriers identified within the context, teachers should identify the specific UDL 3.0 consideration(s) (Why?) that they wish to focus on. Finally, teachers map the specific UDL 3.0 considerations to suitable DiE strategies (How?) which will allow students to attain the required learning outcomes before enacting (Do!) the learning experience. The cycle should be followed by reflection to inform the next cycle of planning.

Figure 1

(In)CLUDE Framework – Implementing UDL 3.0 using DiE (Heeran Flynn, 2025)



While the framework has been developed to support the implementation of UDL 3.0 using DiE, the framework can be used to implement UDL 3.0 using other teaching methodologies, or indeed, in planning for any inclusive teaching and learning experience. Teachers can swap out the DiE strategy and replace it with other inclusive teaching and learning methods.

Concluding Remarks

Though educators believe that the UDL framework is essential to promote the development of inclusive education (Han & Lei, 2024), the implementation of UDL has been stymied by difficulties translating theory into practice. Literature highlights that teachers struggle to tie UDL to day-to-day teaching practices with teachers indicating that the lack of action plans to implement the UDL framework in schools is a considerable challenge (Capp, 2020). This paper presents DiE as a practical and meaningful way to implement UDL 3.0 in the classroom. Both student-centred in their approaches, UDL 3.0 and DiE combine to provide a formidable pedagogy for teachers

seeking to implement UDL 3.0 in the classroom and an empowering learning pedagogy for students.

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IJUDUDL
International Journal for Universal Design and Universal Design for Learning

International Journal for Universal Design and Universal Design for Learning (IJUDUDL) Vol. 1, No. 2, April 2026 ISSN: 3119-6055

Maker Education: Access to Creative Learning and Creative Work

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ABSTRACT

This article examines several recent demonstrations of the effectiveness of makerspace education approaches informed by the principles of Universal Design for Learning (UDL) to broaden access to participation in creative learning and creative work. With hands-on, project-based learning intrinsic to makerspace education, learners develop creative problem-solving skills through self-paced, self-directed growth. In contrast to the often negative associations with conventional classroom experiences, these programs embrace the methods of UDL to build on the rich life experiences of learners, remove the most common barriers to entry, and present a wealth of opportunities for personal growth and advancement. In each case, opportunities were developed to serve a broad cross section of communities historically underserved by more conventional educational settings and approaches. Bringing together the principles of Universal Design for Learning these examples demonstrate the promise of improved life chances when all learners are offered opportunities that are physically, emotionally, and cognitively welcoming.

Keywords

Maker education, creativity, low-income communities, disability inclusion

International Journal for Universal Design and Universal Design for Learning (IJUDUDL) Vol. 1, No. 2, April 2026 ISSN: 3119-6055

Introduction

Creativity is the capacity to generate novel and valuable ideas or solutions, bringing together imagination and practical execution to produce something new or find new solutions. It is essential for obtaining employment in STEM-related fields (Science, Technology, Engineering, and Math) and solving significant problems in the 21st century. Creative thinking, the mental processes leading to inventions such as new machines, social ideas, scientific theories, and artistic works, can be fostered through maker education given the hands-on, project-based learning approaches used and the capacity of maker education to bring together imagination and production. Makerspaces provide access to tools and technologies for design and fabrication, combining crafts with digital technologies. Maker education has proven to be a dependable pathway to the kind of creative problem-solving skills essential to promising careers in the "creative economy," widely considered one of the 21st century's key engines of growth and opportunity. However, to reach the communities where such opportunities would make the most meaningful difference, maker education must be made accessible geographically, physically, socially, emotionally, and cognitively. The central thesis of this work is that maker education approaches informed by the methods of Universal Design for Learning (UDL) can bridge gaps in access to creative economy skills for a broader diversity of low-income and historically marginalized communities.

To properly frame the example projects, this article introduces us to the key characteristics of maker education and makerspaces with particular attention to the kinds of engagement afforded by maker-centered learning experiences, tools, and opportunities. Next, we examine the alignments found between the specific kinds of problem-solving skills most stimulated by time spent in makerspaces and the experiences most closely associated with the emerging job opportunities of the 21st century "creative economy." Students who have ruled out certain careers based on their struggles in a traditional classroom, particularly in Science, Technology, Engineering, and Maths (STEM) related fields, have been surprised by the excitement triggered by their experiences in a makerspace. The hands-on project-based learning inherent in maker education centers joy and play, and reduces barriers frequently associated with conventional classroom learning, such as a lack of relevance and authenticity. However, to ensure the engagement that develops through the methods of maker education are fully realized, maker education programs benefit from attending to all three of the principles of Universal Design for Learning by proactively designing for learner variability. This is essential to ensuring that the greatest benefits accrue to all.

The authors of this paper are each working to address equitable access to creative learning and creative work. The projects described include: a multigenerational STEM makerspace

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situated in affordable housing and co-designed with residents; an accessible makerspace for youth and young adults with autism that involves collaboration between those with lived experience of disability and therapists and educators; Community Shop Class and the Tiny Home Academy which teaches carpentry and other skills while addressing community needs; Tikkun Olam Makers (TOM), a global movement creating solutions in Make-A-Thons that empower individuals with disabilities to co-design solutions to their challenges; and Remix The School and DTecla focused on maker-centered school and after-school programs addressing social-emotional well-being and creativity and equipping local communities to be participants in emerging innovation economies taking root in their regions.

Maker Education

Maker education focuses on globally recognized concepts of learning by doing and experiential education. Maker education is defined as a project-based pedagogical approach where learning is achieved through the active creation of tangible or digital artifacts (Blikstein, 2018; Halverson & Sheridan, 2014), blending traditional craft with digital fabrication technologies like 3D printing and coding (Ioannou & Gravel, 2024). Instruction and learning are guided by constructionist principles (Kretchmar, 2021; Papert, 1991; Piaget, 1952), in which prior knowledge, active inquiry, and social interaction are key components. Students construct knowledge and meaning through experiences of doing and making rather than by passively absorbing information.

In traditional teacher-led education, teachers typically impart their knowledge to students, and students' learning is demonstrated or proven through test results. In maker education, curricula are focused on individual and collaborative problem-solving and applied learning. Students are provided the tools and taught design methods (e.g., identify problem, brainstorm solutions, plan, build, test, improve, share) to try things out and apply what they learn (learning by doing). Instead of depending on teachers to impart knowledge or to validate student learning, the physical act of making itself compels makers to build on their existing knowledge (Piagetian constructivism) to construct new understandings, or in Papert's words, "learning without being taught" (constructionism; Valente & Blikstein, 2019). Making offers continuous feedback on learner success reinforced socially within the community of makers. The instructor plays an important role, but in an inversion of traditional pedagogy. Students' knowledge is demonstrated and shared through iterative milestones documented along the way and in final projects, inventive solutions, and learning portfolios. Teachers play the role of facilitators supporting and encouraging an iterative series of trials and failures essential to fostering a maker mindset—characterized by curiosity, persistence in the face of failure, and the ability to solve unexpected problems—and creative problem-solving skills.

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Because of these proven results, educators are turning to maker education and maker-centered learning practices to bring about more meaningful, relevant, and impactful education. Learners experience increased engagement, agency, and resiliency, and develop lifelong skills in creative problem-solving and innovative thinking (Clapp, Ryan, & Tishman, 2016).

Creativity and the Potential of Maker Education to Foster It

Creativity is a set of abilities, dispositions, and mental processes that generate original work such as products (e.g., artistic work, machine), thoughts (e.g., theories), or techniques (e.g., scientific experiment or process). Creativity requires imagination, the capacity to express oneself, take calculated risks, and advance original thought (American Psychological Association, n.d.). Inventing, designing, and iterating naturally foster creative thinking, and individuals who are able to successfully identify, frame, and creatively solve problems have an advantage in the workforce. What is more, distributing creative capacity across an organization, rather than just in top leadership, is key to an organization's long-term success (Amabile & Khaire, 2008). This is understandable given that "much human problem solving, activity, and creativity is social, arising from activities that take place in contexts in which interactions with other people and the artifacts that embody collective knowledge are essential components to address the problems of the 21st century" (Fischer, 2013, p.5).

Creativity, whether at an individual level or as a collective investment for organizations or societies, is increasingly essential in this ever-changing learning, working, and living environment (World Economic Forum, 2024). Creativity is the defining characteristic of developed 21st-century economies (Sung, 2015), just as manufacturing was the defining characteristic of the 19th and early 20th-century economies. Creative problem-solving is an acquired skill, yet it is often absent from traditional education curricula. Unlike traditional stand-and-deliver-based teaching approaches, maker-centered learning is a natural conduit for building creativity. The making process empowers students to become self-directed to figure out what to do based on their ideas rather than to perform a predefined task (Dougherty, 2013). They craft, tinker, learn, troubleshoot, and invent, inevitably honing their ability to identify, frame, and creatively solve problems, an important differentiator to success in school, work, and beyond (Fischer, 2013). Prioritizing maker-centered learning is a radical proposition for more traditional forms of education.

Martin (2015) defines making as "a class of activities focused on designing, building, modifying, and/or repurposing material objects, for playful or useful ends, oriented toward making a 'product' that can be used, interacted with, or demonstrated." (p. 31). Making

combines traditional craft and hobby techniques such as sewing and woodworking with digital technologies for design and fabrication using equipment such as laser cutters, CNC machines, and 3D printers.

In formal and informal education, makerspaces are physical spaces that provide shared access to tools, technology, equipment, and materials for design and fabrication (Blikstein et al., 2021; Digital Promise, 2021). Research shows that the makerspace approach can change attitudes towards Science, Technology, Engineering, and Math (STEM) by naturally engaging learners in project-based learning through personally relevant, hands-on, creative investigations of the world around them (Blikstein et al., 2021).

A meta-analysis of makerspaces and the creativity tools and technologies available there finds that they lend themselves to individuals building creative competence and learning to co-create with others (Soomro et al., 2023). The physical artifacts and social relationships available in makerspaces allow for interdisciplinary work and actual making or creating products from ideas (e.g., 3D printing, laser cutting, alongside traditional shop tools). Learners can combine their imaginations with tools, technologies, and fellow makers to create innovations. Makerspaces also teach design processes and allow learners to generate products that foster critical thinking, experimentation, and problem-solving or solution-finding. In the context of these spaces, maker education democratizes access to creative tools, empowers learners to be self-directed (to create, not just consume), fosters resilient mindsets (to see failure as part of the creative process), and unlocks opportunities.

Maker education holds great promise, but not everyone has access (Digital Promise, 2021). Careful attention to programming, curriculum, and space design is critical and dependent upon the principles of Universal Design—accessibly designed spaces and tools—and Universal Design for Learning—a cognitive and pedagogical framework that ensures inclusively designed learning experiences for all. Proactively designing experiences and programs that anticipate potential barriers and offer flexible means to learning ensures inclusion, access, and engagement for a range of contexts, communities, and learners (Meyer et al., 2013; CAST, 2024). In this paper, the authors describe applications of UDL that are broad in reach and, in many cases, the first of their kind and explain why and how these efforts matter. Although beyond the scope of this article, Universal Design of the physical space is also critical, complementary to UDL, and merits research.

The Challenge

Creative thinking skills are not necessarily innate but learned through education and work. Disparities in access to learning environments that foster creativity start young and persist

through education and employment. For example, lower-income preschool students in the U.S. have far less access to creative play-based education programs (including maker education) than higher-income peers, even though there is abundant evidence around later life benefits of play-based early education, from pursuing university or post-secondary education to choosing to vote (Long, 2024).

Human capital development—skills, knowledge, and competencies that directly generate economic value—is rapidly and constantly changing because of globalization, work automation (e.g., robotics and AI replacing human work), labor shortage, and surplus cycles (e.g., waves of retirements or entries into the workforce). Individuals must constantly redefine themselves, build new competencies, and shift between learning and working (Jacobs & Hawley, 2009). At a time when AI will continue to transform the nature of work and jobs across sectors, creativity is one durable skill that will remain critical across career pathways and be least affected by AI, as indicated by Indeed Hiring Lab's GenAI Skill Transformation Index, a U.S.-based labor market analysis (World Economic Forum, 2025).

Makerspaces often provide alternative means of learning Science, Technology, Engineering, and Math (STEM) in a hands-on manner. STEM in school can provide ample opportunities for creative thinking and engagement in creating and working with new ideas, theories, tools, and approaches. However, instruction is often not accessibly designed to address learner variability. Additionally, too often, students at risk of poverty and other marginalized populations have less access to effective STEM education at every level of education (Education Commission of the States, 2019; US Department of Education, 2018; Pew Research Center, 2021). In the United States, students from lower-income racially and ethnically marginalized communities, in particular, experience classrooms as not belonging to them because of inequitable structures and disregard for their identities, cultures, and the assets they bring to the classroom (Nasir & Vakil, 2017; Tedesco & Bagelman, 2017; Calabrese Barton & Tan, 2020; Rozek et al., 2019). Often, how young people are asked to engage in STEM learning in their classrooms, such as rote memorization and testing, leads to disengagement from STEM. It does not engage them in real-world problems that matter to learners, bring in their assets and identities, or impact their lives. However, young people from low-income, racially and ethnically marginalized communities who were given a chance to use STEM skills to solve authentic problems that negatively impact their daily experience were deeply engaged in STEM learning and saw themselves as having possible STEM futures (Calabrese Barton & Tan, 2019). "Whether or not youth have access to experiences with the sciences beyond school, the nature of those experiences, and if, or how actively, they participate in these science-related activities (and with whom and for what purpose) across settings are all important because they reflect the kinds of social

encounters that can affect identity work" (Kang et al., 2019, p.423). For this reason, supportive environments need to be built inside and outside of school to help learners build STEM identities and engage in STEM learning that is relevant.

Other populations, such as people with disabilities, are marginalized within STEM education environments because instruction and materials are rarely accessible. This is problematic because STEM skills are needed to create products and solutions that are essential for people with disabilities (e.g., accessible technologies, vaccines, gene therapies).

While people with disabilities are directly impacted by education and workforce decisions in STEM disciplines, and the products these decisions yield, they are too rarely decision makers in these fields. This leads to challenges such as a lack of prioritization or misunderstanding of the needs of people with disabilities when designing products (National Academies of Sciences, Engineering, and Medicine, 2024). There is no shortage of creative capacity in the disability community when members are given a chance to build STEM skills - many inventions that are widely used today, were created by people with lived experience of disability (e.g., text-to-speech, speech-to-text, captioning) (Weitzman, 2022).

Makerspaces also help address critical gaps in career guidance, which is essential for creating equitable access to careers in STEM disciplines. Social Cognitive Career Theory (SCCT; Lent, Brown, & Hackett, 1994), which explains educational and career interests (Dika, 2016), and performance of underrepresented students in STEM (Dutta, et al., 2015; Byars-Winston, 2017), explains that academic and career interests are derived from self-efficacy beliefs and outcome expectations, with performance accomplishments having a much stronger association with self-efficacy beliefs than did vicarious learning, social persuasion, or affective arousal (Bandura, 1997). The Manufacturing Institute report (2020), Attracting the Next Generation of Talent, similarly found that direct experience and students' interests were the greatest influence on career pathways. In short, makerspaces allow young people to try out careers by engaging with workplace skills, tools, and technologies, and thinking processes actually used in the workplace.

How Maker Education Paired with UDL Addresses the Challenges

Maker-centered learning, or maker education, empowers students to explore and improve their world. It enables students to create by building, prototyping, coding, digitally fabricating, and experimenting, and is interdisciplinary, fusing arts and design with science, technology, engineering, and math. Maker education puts the student at the center of the

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learning experience, and empowers them with the skills and experiences to be creative and collaborative problem solvers and entrepreneurs in their communities. It has the potential to play a central role in supporting the development of a diverse and inclusive workforce.

Maker education doesn't automatically solve all problems encountered in conventional education, however, continuing the phenomenon of exclusion. UDL is not inherent to maker education, and without UDL, maker education runs the risk of stopping short of reaching the learners who can benefit from it most and have historically been left behind by conventional education. Maker education can ensure unique opportunities by integrating and implementing all three principles of Universal Design for Learning in various learning environments, including within makerspaces. Makerspaces, when they apply UDL and deliberately foster inclusion and diversity, can provide a safe and welcoming space for individuals to learn new skills, cross-pollinate ideas, and work together on projects.

Maker Education and Makerspace Examples

The example projects that follow are broad in reach and, in many cases, the first of their kind. You will see all three UDL principles and associated considerations of the UDL Guidelines (CAST, 2024) at work. Some projects support engagement by optimizing relevance, value, and authenticity, nurturing joy and play, honoring diverse interests and identities, promoting reflection, and cultivating empathy. You will see examples of multiple means of representation provided via a diversity of perspectives and identities represented in authentic ways, in the building from prior knowledge to new learning, and in many instances of honoring multiple ways of knowing and making meaning. Finally, the Action & Expression principle can be seen at work in projects that optimize access to accessible materials and technologies, and tools, and that honor existing methods for response.

The programs and models described foster social mobility and support community-driven innovation, supporting and harnessing local talent and ingenuity. They also address numerous UN Sustainable Development Goals, including quality education and inclusive and sustainable industrialization and innovation (Genders, 2023). The projects seek to broaden access to and participation in the creative economy. The authors note that maker education is a global approach. Highlighted here are projects from the U.S., Spain, and Israel.

Boosting School and Career Prospects for Multigenerational Makers in Affordable Housing

The first example involves individuals and families experiencing income insecurity and who are significantly underrepresented in higher-paying jobs within the creative economy.

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Multigen STEM Makerspaces in Affordable Housing: Co-Designing a Model with the Community is a U.S. National Science Foundation-supported project seeking to create opportunities for residents to define their place within the makerspace movement on their terms, and to change the narrative on what is valuable, who makes, and what it means to make. In 2020, in collaboration with NHPF, a National Affordable Housing provider, and residents of a 200-unit mixed-income apartment complex in Stamford, Connecticut, CAST partnered in the proposed project. The resident community is diverse and multi-generational. There are approximately 590 residents with average annual incomes well below the mean incomes for the area. Of residents reporting their data, approximately 17% are sixty-five or older, 26% are under eighteen, and 57% are between 19 and 55. Approximately 30% are immigrants, and languages spoken include Spanish, Polish, Haitian Creole, Hindi, and Arabic.

Co-locating a makerspace and an extensive program of activities within the community center and outdoor spaces of the apartment complex (essentially in their own homes) provided multiple "stumbled upon" STEM learning experiences to all who passed by on their way to and from work and school. Universal Design for Learning was used throughout this project. For example, flyers were routinely presented in six languages, and activity instructions were made available in easily translatable digital platforms to ensure multiple means of representation. Inspirational posters displayed in the makerspace represented leaders from underrepresented populations and successful in their respective fields. There were photos on the walls of makers from the residence themselves in action (we even taught a photovoice workshop (Wang & Burris, 1997) so residents could develop and define their own narratives of making).

The program design increased exposure and fostered a sense of belonging by holding maker activities in well-trafficked spaces and by pairing them with existing community events like annual barbecues and emphasizing joy and play. Workshops, events, and open makerspace hours for events held in the community center helped build and strengthen the community, and were directly influenced by residents' interests and values. All programming was co-designed with the residents, and purchasing decisions about materials and resources to support programming were made by staff on site (hired from the community) and with resident input throughout. Combining learning and fun was important to residents (e.g., workshop on upcycling clothes and paint nights with light-up circuit options), and ensuring these components went together boosted attendance in opportunities that honed creative problem-solving skills applicable to work and life. Meaningful workshop topics emerged from the community's interests and needs, and the project utilized an existing text messaging system where residents could learn about and

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respond to their interest in events. Activities had low floors to entry (i.e., easy entry points) to encourage those with no making experience to participate and high ceilings (e.g., opportunities for advanced exploration) for those with or wanting to build more STEM skills.

This aligns with the UDL action and expression principle, providing graduated supports and scaffolds that could be reduced as makers became more confident and skilled in their making. The purpose of these low floors/high ceilings was to allow all learners to have a sense of agency. Maker showcases supported individual and collective reflection, even for those not (yet) directly involved in the making. Emerging community leaders and interns from within the community tapped into a wealth of resident wisdom and expertise, building community pride and helping to ensure the program's sustainability. Finally, fostering connections with local industry and leadership from within the community ensured sustainability for the program, which continues to this day. Readers can visit the Multigen Makers Playbook (2023) to learn more.

Numerous positive outcomes resulted from this project. Individuals and the community became vessels for enacting and navigating change, unlocking opportunities, and expanding career pathways. Two such examples: The first Lead Facilitator for the program is now a Manufacturing Engineer for GE Appliances' CoCreate makerspace—a micro-manufacturing facility and public-facing collaborative space in Stamford, CT; the program's first resident intern, with no former interest in STEM, went on to become a top-performing student of Computer Science in university. Broadening participation in informal STEM in these ways can foster the next generation of STEM leaders to engage in the essential work of the 21st Century.

Creating Accessible Technology-Rich Makerspaces and Learning Activities for Youth and Young Adults with Autism

Several other ongoing projects focus on leveraging maker-centered learning and makerspaces to create inclusive learning experiences for individuals who are neurodiverse and individuals with disabilities. In Baltimore, MD, Space for All: Creating Accessible Technology-Rich Makerspaces and Learning Activities for Youth and Young Adults with Autism, is a project supported by the U.S. National Science Foundation focused on investigating how to design accessible and safe makerspaces and technology-rich maker activities for youth and young adults with disabilities, with input from therapists, special education teachers, psychologists, assistive technology experts, and learners themselves. Baltimore is a city known for its rich history of arts, culture, and innovation, from technological breakthroughs in transportation to the first public library system in the U.S.

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(Visit Baltimore, 2024). It is also a city faced with significant social and economic disparities. Approximately 2 in 10 Baltimore City residents live below the poverty line (20.1%), significantly higher than the national average of 11.1% (U.S. Census Bureau, 2023). The unemployment rate for workers of color is three times higher than the unemployment rate for White workers (Cities for Financial Empowerment Fund, 2017).

Average makerspaces are often not designed inclusively for individuals with autism. Due to the nature of the tools, equipment and activities taking place in these spaces, makerspaces can be loud, bright and overly stimulating. This project uses Universal Design for Learning as a theoretical framework to inform and structure co-design activities that center the perspectives of multiple stakeholders, including youth and young adults with autism. In centering the voices of autistic youth, this project engages them in multiple ways to express their ideas, from writing and drawing to discussions and prototyping.

This approach aligns with UDL guidelines focused on designing multiple means of engagement and action & expression. It builds on findings from two previous projects that explored how to design self-directed technology-rich learning experiences in new contexts, such as hospitals or recreation centers, by incorporating the perspectives and interests of young learners. A collaboration between the non-profit organization Digital Harbor Foundation, University of Maryland Baltimore County, and Kennedy Krieger Institute, this initiative will create three accessible community makerspaces in Baltimore for learners with autism, develop accessible technology-rich STEM learning activities for these learners, and include an educator training program to prepare informal and extracurricular educators to deliver them (U.S. National Science Foundation, 2024).

Fostering Skills Development and a Sense of Community at Community Shop Class

In 2021, more than 570,000 teens and young adults (ages 16-24) in California were disconnected from school and/or employment (Malka & Sainz, 2023). In Sacramento, California, Community Shop Class is a workshop-based neighborhood learning center and makerspace focused on programs and projects to expand access to trades work and job development for neurodivergent, youth, women, and gender-expansive people. One example is Tiny Home Academy, a 6-week workforce development experience for 16 to 24-year-olds experiencing food, housing, or opportunity insecurity. Students learn the basics of carpentry while exploring technology, urban agriculture, community service, and climate resilience. Through addressing real learner needs, the Tiny Home Academy addresses relevance, value, and authenticity while building linkages to the workforce and income. Building meaningful projects helps students find purpose while learning (Lam, 2019). This

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program offers graduates opportunities for expanded learning, pathways to entrepreneurship and collective innovation, apprenticeships, employment, and educational opportunities. Tiny Home Academy students receive the first CORE module of the NCCER (National Center for Construction Education and Research—a nationally recognized U.S. construction training credential). Basic Construction Skills training course at no cost to the learner. This allows the individual to accrue academic and hands-on hours toward their construction career goals. In terms of UDL, the program designs options for sustaining effort & persistence and emotional capacity.

Tiny Home Academy puts a strong focus on supporting participants in developing their sense of selves and the confidence to learn technical and durable skills. This includes opportunities to explore how their ideas, skills, and character are valued and appreciated in a work environment and in the broader community. This includes creating a safe space where participants can work in a team and take on leadership roles, providing participants with approaches and strategies they can use to address challenges and issues as they arise (Community Shop Class, 2026).

The program uses an inspirational environment, emotional components, and experiential learning to drive retention and understanding. Tiny Home Academy is locally supported by Sacramento Municipal Utility District, a community-owned electric utility, through its Sustainable Communities program. The tiny homes project ensures relevance by focusing on community needs and developing making skills.

Empowering Need Knowers to Co-Design Solutions to their Challenges through Tikkun Olam Makers

Tikkun Olam Makers (TOM) was started in 2014 in Israel and is now a global movement of communities that creates and disseminates affordable solutions to neglected challenges faced by people living with disabilities and those in low-resource communities (Tikkun Olam Makers, 2024). TOM's model centers on the "Need Knowers"- the individuals living with a disability or who have an intimate understanding of their unmet needs. The structure of TOM Make-A-Thons repositions individuals with disabilities, who are too often not included in the process of designing assistive technologies and other solutions to meet their needs as an expert with critical and unique insights that only they have based on lived experience. TOM partners with local need centers such as hospitals, rehabilitation centers, and other healthcare facilities.

During a TOM Make-A-Thon, need knowers and makers with a wide range of skill sets and backgrounds are brought together in teams to design and prototype solutions to these

challenges. To date, participants in 24 countries and 70 communities have contributed to these projects, with more than 215,000 products being delivered to need knowers (Tikkun Olam Makers, 2026).

The Wondr'y, Vanderbilt University's Innovation Center and makerspace, hosts a TOM Make-A-Thon annually, and in 2023, over 150 individuals, including 120 students, participated in designing and building a wide range of solutions, including an accessible music and water station for a 5-year-old and a foot brace for gait training (Vanderbilt University, 2023). Make-A-Thons have also taken place at Singapore University of Technology and Design and in France, in collaboration with CNCPH - Conseil National Consultatif des Personnes atteintes de Handicapées (National Advisory Council of People with Disabilities) (Tikkun Olam Makers, 2026).

Through Make-a-Thons, individuals with lived experience have the opportunity to generate solutions to their challenges, addressing their needs with their ideas. TOM Make-A-Thons center lived experience in the creative problem-solving process, aligning with the UDL Principle of Representation, specifically cultivating multiple ways of knowing and making meaning.

Nurturing Students' Social and Emotional Well Being through Culturally Relevant Making with Remix the School and DTecla

Barcelona, Spain, presents dramatic social and educational inequalities. Approximately 32% of children live at risk of poverty or social exclusion (Government of Catalonia, 2024). This is well above the EU (25%, Eurostat, n.d.) and the U.S. rates (15%, U.S. Census Bureau, 2023). About one third of Barcelona's public schools are classified as "high complexity," serving communities disproportionately affected by poverty, unemployment, migration, and special educational needs. These schools experience marked learning gaps: while 48% of students in low-complexity schools reach high academic performance, only 18% do so in high-complexity contexts (Assessment Notebook No. 59, 2023).

In 2020, Fab Lab Barcelona developed Remix the School to develop a maker-centered after-school curriculum guided by UDL principles (Fundació Diverse and Fab Lab Barcelona, n.d., Fab Lab Barcelona, n.d.). It chose a "high complexity" school in the former industrial neighborhood of Poblenou. Starting small, Remix the School's 30 participants have demonstrated the effectiveness of a maker-centered approach sensitive to the social-emotional well-being of learners at each step. This was supported by a methodology that emphasized emotional reflection throughout the creative process—such as asking students to express how they experienced each activity, and encouraging self-evaluation of soft skills

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like empathy and collaboration.

In reducing anxiety levels, participants used digital fabrication to help raise awareness about sustainability (Fab Lab Bcn, 2024; Burdiles Araneda et al., 2022). Barcelona is recognized as an epicenter for Southern Europe's digital and creative economy, with major investments in artificial intelligence, data centers, and research infrastructure (Government of Catalonia, 2022). Poblenou is special not just as "the Catalan Manchester" for its concentration of historically underserved communities, but also as the site of Barcelona's Innovation District initiative that, since 2000, has brought several thousand new companies to the neighborhood of about half of which are new startups (Ali, 2021). From the start, the challenge and promise of 22@Barcelona is to bring job opportunities without displacing its communities, specifically: how to prepare the lower-income children of the neighborhood to benefit from the new creative economy growing around them?

In 2022, the Fundació Diverse recognized that maker education is not only a vehicle for creativity but a strategy for equity. Their mission is to expand primary school students' access to meaningful learning and creative futures, especially for those historically excluded from innovation ecosystems. They supported a significant expansion of Fab Lab Barcelona's promising work to promote self-efficacy, inclusion, and social justice in education.

Their program, DTecla, aims to transform pedagogical models to promote active learning, creativity, and knowledge construction through experience and the responsible and critical use of materials, technologies, tools, and digital fabrication processes. In line with UDL's call to design for community and interest by welcoming learners' identities and values as entry points, this approach allows us to contextualize STEAM (Science, Technology, Engineering, Arts, and Mathematics) areas in authentic and meaningful situations for students, connecting them with their culture and interests. DTecla has had ripple effects beyond the eighty-five teachers directly participating in its programs. It has strengthened teacher training and validated a pedagogical framework that promotes scientific and technological vocations. DTecla has also increased the self-efficacy and self-perception of primary education students in STEAM. Although it is too early to quantify the number of graduates working in Poblenou's creative economy, since launching in five high-complexity schools with vulnerable populations, DTecla has reached more than six hundred students.

The results of the Remix the School and DTecla projects demonstrate their positive impact on students and their potential as models for maker-centered educational innovation. Both projects exemplify the effectiveness of the maker philosophy and co-creation as strategies for inclusion and educational empowerment, offering an inspiring vision for transforming

education and preparing students for future challenges.

Conclusion

There continues to be significant gaps in access to inclusive maker education in communities globally. These gaps will widen without support from key stakeholders, including government, philanthropy, and other funding models, and university or post-secondary education institutions. In the U.S., the recent rollback of funding, resources, and support across federal agencies such as the National Science Foundation (Mervis, 2025), Department of Education (Totenberg & Gatti, 2025), the Institute of Museum and Library Services (ALA, 2025), and AmeriCorps, a federal agency for national service and volunteerism (Kavi, 2025) is reducing the capacity for communities to provide inclusive and equitable education programs and initiatives, including maker education.

However, maker spaces and their community partners are working to explore and identify new ways to ensure these learning experiences are sustainable, such as leveraging support at the local and state levels. In contrast, through the NextGenerationEU recovery fund, the European Union has launched an unprecedented investment in transforming education systems, strongly emphasizing digitalization, hands-on, and maker-centered learning. Spain, as one of the main beneficiaries, has directed significant funding toward the development of maker-centered education across all levels of schooling.

This includes the creation of over 1,000 technology-rich classrooms in vocational education, the nationwide roll-out of the Código Escuela 4.0 program introducing robotics and programming from early childhood, and regional projects like Catalonia's FAIG initiative, which equips 150 schools with makerspace inventory for creative prototyping (Ministerio de Educación y Formación Profesional, 2025; Departament d'Educació de la Generalitat de Catalunya, n.d.). These efforts are equipping schools with digital fabrication technologies and embedding maker pedagogy into curricula and teacher training programs, demonstrating a large-scale public commitment to fostering innovation, creativity, and digital equity through maker education.

While support for maker education and makerspaces at the national, regional, and local levels may vary across countries over time, leveraging the UDL framework and key UDL elements in the design and implementation of maker education and programming in makerspaces will ensure that more individuals have access to creative learning and creative work. The project examples in this article demonstrate how UDL methods support historically underrepresented and marginalized groups as they build skills of creativity and innovation. Universally designed maker education promises access to creative learning and

the multitude of advantages inherent in creative work.

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Experience-Based Co-design of Universal Design for Practice Learning Guidelines to Enhance Nursing Practice Placements

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DOI: https://doi.org/10.34874/PRSM.ijududl-vol1iss2.6622

ABSTRACT

Background: Inclusive practice learning environments are essential to supporting nursing students' engagement, wellbeing, and professional development. Universal Design for Learning (UDL) offers a framework for enhancing accessibility and flexibility, yet its use in clinical practice education remains limited.

Aim: To co-design UDL-informed guidelines that enhance the inclusivity and accessibility of nursing practice learning environments.

Methods: An Experience-Based Co-design (EBCD) approach was used. Nine nursing students from General Nursing, Mental Health Nursing, and Integrated Children's and General Nursing programmes were recruited via expressions of interest and screening interviews. Participants completed UDL training and took part in co-design workshops centred on emotionally significant practice learning experiences, structured around the three UDL principles. Draft guideline components were refined with UDL experts and reviewed during an implementation workshop with practice placement educators.

Results: The co-design process generated a set of practice-oriented UDL guidelines addressing engagement, representation, and action and expression. Students' lived experiences shaped recommendations that were feasible across diverse practice settings and responsive to learner diversity, including disability-related needs.

Conclusion: Co-designing UDL guidelines with students and educators offers a practical route to strengthening inclusivity, clarity, and consistency within nursing practice learning environments.

Keywords

Universal Design for Learning; Clinical Practice Learning; Nursing; Nurse Education

Introduction

Creating inclusive practice learning environments is central to supporting nursing students' engagement, wellbeing, and professional development. Nursing programmes require students to consolidate theoretical, classroom-based learning with experiential learning in clinical environments where knowledge is applied, refined, and translated into professional competence. Workplace learning is a core component of all entry-to-practice health professional programmes, and in nursing it plays a critical role in preparing students to expand their scope of practice and acquire the competencies required for professional registration. In the European context, this is reinforced by EU Directive 2005/36/EC Article 31, which stipulates that clinical instruction must comprise at least half of nurse education. A comparable balance between theoretical instruction and clinical practice is evident in international nursing curricula, which similarly emphasise a significant requirement for practice-based learning (Ryder et al., 2025). This regulatory requirement highlights the fundamental importance of clinical learning within nursing programmes.

Clinical placements offer unique educational value. Supportive practice environments enable students to link theory to practice (Luders et al., 2021), develop confidence (McKenna et al., 2019), and acquire skills such as problem-solving, decision-making and critical thinking (Hobenu et al., 2025). Placements also support students to explore future professional roles (van der Riet et al., 2018), including non-conventional placements (Hall et al., 2021) and to experience a sense of belonging within the healthcare team (Diane et al., 2023). However, clinical learning is also subject to wide variation due to differing models of care, supervisory practices, and workplace cultures. Growing demand for placements and increasing resource pressures on health services and education providers further intensify this variability, making it timely to consider how clinical placements can be designed to optimise learning for diverse student cohorts.

Higher education is witnessing increasing diversity among students (Cumming & Rose, 2021; Ramjan et al., 2025), and this trend is mirrored within nursing programmes. Contemporary nursing cohorts reflect a wide range of socio-economic backgrounds, cultural and linguistic heritages, gender identities, disabilities, and neurodiversity profiles (Kotcherlakota et al., 2024). This diversity highlights the responsibility of educational institutions to embed inclusive pedagogical practices across all aspects of programme delivery (Halligan et al., 2019; Ramjan et al., 2025). Inclusive curriculum approaches have been shown to reduce barriers to participation and support equitable progression for diverse learners (Kotcherlakota et al., 2024).

Universal Design for Learning (UDL), developed by the Centre for Applied Special Technology (CAST), was initially designed to support learners with disabilities. It is now recognised as a framework that acknowledges variability among all learners (Coffman & Draper, 2022; CAST, 2024). While emerging studies indicate growing interest in applying

UDL within nursing education (Gilmore & Browne, 2025a; Brereton et al., 2025; Ciolfi & Howard, 2024; Kyle & Reilly, 2024), this work has focused primarily on classroom-based instruction.

This is notable given that, under EU Directive requirements, students spend approximately 50 percent of their education in clinical placements, where learning is shaped by real-world environments and diverse patient populations. Despite the centrality of practice learning to student development, there is very little evidence on how inclusive frameworks such as UDL are applied in clinical settings.

At present, support for diverse learners in practice environments is largely delivered through reasonable accommodations or adjustments. Although these are legally required, they rely on individual disclosure in each placement, a process many students experience as anxiety provoking and exposing (AHEAD, 2022; Cumming and Rose, 2021). As a result, accommodations function as a reactive and individualised strategy rather than a proactive, systemic approach to inclusion. Traditional teaching approaches or clinical practice placements that assume one way of learning cannot meet the needs of contemporary learner populations (Coffman & Draper, 2021).

Given the centrality of clinical placements to professional formation, and the reported vulnerability of students with disabilities and other minority identities in these settings, there is a clear need to develop more inclusive practice learning environments that support all students, not only those who disclose a need. UDL has been shown to positively influence learning and may support student success and programme completion (Levey, 2021). Applying UDL within practice learning therefore offers considerable potential to create more equitable, supportive, and effective learning experiences for diverse nursing cohorts.

This study aimed to co-design Universal Design for Learning–informed guidelines to enhance the inclusivity and accessibility of nursing practice placements. Using an Experience-Based Co-design approach with nursing students, the goal was to translate UDL principles into practical strategies that address barriers in clinical learning and support more equitable engagement and participation across diverse practice settings.

Methodology

This study employed an experience-based co-design (EBCD) approach, adapted for use within nursing education to collaboratively develop Universal Design for Learning (UDL) guidelines for practice learning environments. Nursing students were recruited from three professional programmes: General Nursing, Mental Health Nursing, and Integrated Children's and General Nursing. Recruitment took place through an open call for expressions of interest circulated via programme mailing lists and virtual learning environments. Interested students were invited to take part in a brief screening interview to ensure a balanced group in terms of programme representation, stage of training, and previous experience of practice placement.

A total of nine students were selected to participate the group included three men, five women, and one non-binary student. The sample included students from five different student cohorts. Consistent with the project's focus on inclusion, four students disclosed registered disabilities and four were mature students (at least 23 years old on entry to higher education programme through a specified route), providing important insight into the accessibility of practice learning environments and the variable experiences of learners.

All participants received an information sheet outlining the aims, expectations, and structure of the workshops. Written informed consent was obtained prior to participation, and students were reminded of their right to withdraw at any stage without consequence. Ethical approval for the study was granted by the University Human Research Ethics Committee (Ref: LS-C-24-136-REDACTED for peer review).

What is Co-Design?

Co-design refers to collaborative design approaches in which end-users, stakeholders, and designers work together as equal partners to generate new or improved products and services. Historically, design activity in industry focused on creating products for people or based on assumptions about their needs (Ward et al., 2018). In contrast, co-design emphasises active participation, shared problem-solving, and collective ownership of solutions. It extends beyond consultation or observation, instead facilitating joint working among researchers, designers, practitioners, and end-users during a structured design process (Lee, 2008).

Although co-design has traditionally been applied within service improvement, it is increasingly used in nursing and health professions education to support the development of learning interventions, curricula, and educational resources. In these contexts, co-design enables students, educators, and practice partners to work collaboratively to shape educational innovations that are grounded in lived experience and responsive to the realities of contemporary learning environments.

One increasingly used approach to co-design in healthcare is Experience-Based Co-Design (EBCD), originally known as Experience-Based Design (Bate & Robert, 2023). EBCD focuses on understanding the experiences and emotions of those who use and deliver services, identifying 'touchpoints', critical moments in a journey that shape overall experience. Since its introduction, EBCD has been applied across numerous contexts internationally (Donetto et al., 2014) including palliative care, neonatal services, orthopaedics, cancer care, mental health, and diabetes. More recently we have seen the design applied in nurse education with students, educators and clinicians (Hardie et al., 2022; Pollitt et al., 2023)

In this project, EBCD provided a structured group-based method for engaging students, practice supervisors, and academic staff to examine experiences of clinical placement learning. Rather than relying on interviews or individual forms of data collection,

participants worked collaboratively in facilitated co-design workshops to identify and reflect on key touchpoints that shaped inclusion, accessibility, and learning; such as orientation processes, interactions with supervisors, opportunities for feedback. These touchpoints included orientation processes, interactions with supervisors, opportunities for feedback, assessment expectations, and the physical and organisational contexts of practice settings.

The identified touchpoints formed the basis for structured co-design activities, during which participants collectively prioritised areas for improvement and translated UDL principles into practical, context-sensitive recommendations for practice learning environments.

Following standard EBCD phases, the study included:

- Initial UDL training for student collaborators, providing a shared understanding of UDL principles and establishing a foundation for meaningful partnership in the co-design process.
- Experience gathering through UDL-focused workshops, where students reflected on emotionally significant moments from their practice placements and applied each UDL principle to identify barriers, enablers, and opportunities for more inclusive practice learning.
- Identification of shared priorities, synthesising students' experiences to highlight common touchpoints and areas where UDL-informed improvements could support accessibility and engagement.
- Co-design workshops, during which students and academic staff collaboratively developed draft guideline components based on the identified priorities and their application of UDL principles.
- Expert refinement, where UDL specialists reviewed and enhanced the draft components to ensure pedagogical coherence, alignment with UDL's core principles, and applicability across diverse practice learning environments.
- Implementation workshop with practice placement educators, enabling supervisors and clinical partners to review the emerging guidelines, assess feasibility, and support preparation for implementation across varied practice contexts.

These methods enabled the development of UDL practice learning guidelines grounded directly in lived experience and created collaboratively by those who use, navigate, and support clinical learning environments.

Findings

The co-design process resulted in a structured set of Universal Design for Practice

Learning Guidelines, published in September 2025 (reference redacted for peer review), that translate the CAST UDL principles (CAST, 2018) into practical actions for clinical education.

The guidelines are organised around the three core UDL principles of Engagement, Representation, and Action and Expression, with each principle broken into a series of checkpoints. These checkpoints are not exhaustive instructions but serve as concrete examples of ways in which practice educators and placement sites can embed small, meaningful changes to enhance inclusion. Each checkpoint includes a short explanation followed by a set of recommendations that offer practical ways to enact the UDL principle in a practice learning setting. This structure allows educators to identify entry points that fit their context and to adopt a "Plus One" approach by implementing one manageable change at a time.

Multiple Means of Engagement

Checkpoint 1.1 (Optimise individual choice and autonomy) includes recommendations such as enabling students to shape aspects of their learning, for example by contributing to the selection of learning objectives or requesting a preceptor whose teaching style aligns with their needs. For example, one recommendation encourages offering students the option to demonstrate learning through different formats, such as case studies or presentations, thereby respecting individual strengths and communication preferences.

Checkpoint 1.3 (Minimise threats and distractions) includes recommendations such as providing clear information before placement, including routines, expectations, and points of contact. For example, a short introductory email before the placement begins can reduce anxiety by clarifying shift patterns, dress code, and where to report on the first day.

Checkpoint 2.1 (Heighten the salience of goals and objectives) includes recommendations such as discussing placement expectations early and returning to them regularly. For example, educators may co-develop weekly goals with students and revisit them during informal check-ins to reinforce learning priorities.

These checkpoints show how engagement is strengthened when students feel psychologically safe, informed, and able to shape elements of their learning experience. Student collaborators described the early moments of placement as defining their confidence and sense of belonging. Simple practices such as offering limited but meaningful choices, reinforcing relevance, clarifying expectations, and providing predictable information can significantly reduce anxiety and create supportive conditions for active engagement.

Multiple Means of Representation

Checkpoint 4.2 (Offer alternatives for auditory information) includes recommendations such as offering written or visual summaries of verbal instructions. For example,

providing a brief written outline of handover content or medication rounds helps students who struggle to retain rapid verbal information.

Checkpoint 4.3 (Offer alternatives for visual information) includes recommendations such as supporting students who find visual information difficult by offering verbal explanations or hands-on demonstration. For example, where documentation pathways are visually complex, an educator might talk through each step while the student listens and asks questions.

Checkpoint 5.1 (Clarify vocabulary and symbols) includes recommendations such as providing short glossaries or pausing to explain abbreviations and commonly used terms. For example, students appreciated when educators checked their understanding of key terminology during handover or clinical discussions.

These checkpoints reflect the diversity in how students process and interpret information. During co-design, students described challenges related to unfamiliar terminology, fast-paced verbal communication, and unfamiliar documentation systems. Providing multimodal information and offering clarification where needed supported students to orient themselves more quickly and reduced cognitive overload. This cluster emphasises the importance of accessibility, predictability, and clarity in enabling students to understand and navigate new practice settings.

Multiple Means of Action and Expression

Checkpoint 7.1 (Vary the methods for response and navigation) includes recommendations such as allowing students to demonstrate learning through different approaches depending on their strengths. For example, a student may prepare a written explanation of a procedure before performing it in practice, supporting both confidence and accuracy.

Checkpoint 9.1 (Guide appropriate goal-setting) includes recommendations such as supporting students to set small, achievable goals early in placement and linking these to programme learning outcomes. For example, providing a simple goal-setting template can help students structure their learning in busy clinical settings.

Checkpoint 9.4 (Enhance capacity for monitoring progress) includes recommendations such as scheduling regular review conversations or providing written prompts for reflection. For example, short mid-shift check-ins help students identify what is going well and where additional support may be needed.

These checkpoints recognise that students differ in how they plan, organise, and express their learning. Co-design discussions highlighted that rigid expectations for demonstrating competence and limited opportunities for structured reflection contributed to stress and reduced confidence. Offering varied methods of expression, supporting planning, and helping students monitor their progress enabled them to demonstrate learning more authentically and manage the demands of placement more

effectively.

Discussion

The guidelines reflect the lived experiences of the nursing student collaborators, many of whom described challenges related to orientation, communication, emotional safety, and demonstrating competence in high-pressure environments. The co-design workshops enabled students to align these experiences with supporting UDL principles, creating recommendations that are directly relevant to the realities of practice learning.

UDL offers a means of recognising and responding to this diversity by shifting responsibility away from individual students seeking adjustments or accommodations, and towards educational systems that anticipate and reduce barriers for all learners (Gilmore & Browne, 2025a). This shift is particularly relevant given the increasing diversity of nursing cohorts in terms of disability, culture, language, gender identity, and socio-economic background (Cumming and Rose, 2021; Ramjan et al., 2025; Kotcherlakota et al., 2024). Reliance on disclosure-driven accommodations has been shown to cause anxiety and vulnerability for students in practice settings (AHEAD, 2022; Cumming & Rose, 2021), underscoring the need for systemic rather than individual solutions. Inclusive and flexible approaches to curriculum design, such as UDL, may further play a role in enhancing student retention and supporting progression, a critical consideration in light of ongoing workforce shortages and the need to prepare nurses for increasingly complex and diverse care environments (Gilmore & Browne, 2025b).

The success of this co-design initiative was supported by several contextual factors that may not be universally present in practice learning environments. These included institutional commitment to inclusive education, established partnerships between academic staff and practice placement educators, and the provision of structured, facilitated time for students to engage meaningfully in co-design activities. In overworked and under-resourced healthcare settings, such conditions may be challenging to replicate (Gilmore & Browne, 2025a). However, the guidelines were intentionally designed to be flexible and scalable, encouraging educators and placement sites to adopt a ‘plus one’ approach by implementing small, achievable changes aligned with local capacity and priorities. Future research should explore the implementation of these guidelines across diverse clinical contexts and examine their impact on student experience, learning outcomes, and perceptions of inclusion in practice learning environments.

The principles underpinning UDL also reflect broader critiques of traditional “one-size-fits-all” pedagogy, which has been identified as inadequate for contemporary learner populations (Coffman & Draper, 2021). While emerging scholarship has begun to explore UDL within academic instruction (Gilmore & Browne, 2025a; Brereton et al., 2025; Ciolfi & Howard, 2024; Kyle & Reilly, 2024), this study extends the field by applying UDL within clinical learning, where half of nurse education typically occurs. Given evidence that UDL may support student success and programme completion

(Levey, 2021), its application in clinical settings offers considerable potential to improve equity, engagement, and progression.

This shift has clear social-justice implications: by widening participation and enabling more consistent access to meaningful learning experiences, UDL contributes to diversifying the nursing workforce itself. Such diversity is essential in a profession that must meet the needs of heterogeneous patient populations and address longstanding inequities in healthcare experience and outcomes. Applying UDL within clinical as well as classroom settings ensures that students encounter inclusive, flexible, and equitable learning conditions throughout their education, supporting their development as practitioners capable of providing culturally responsive, person-centred care in an increasingly complex health landscape (Gilmore et al. 2022).

Limitations

This study involved a small co-design group of nine student collaborators from a single university, which may limit the transferability of recommendations to other programmes or national contexts. Participants self-selected into the study, meaning those with particular interest or confidence in discussing practice learning may be overrepresented. Although the co-design process generated practical and contextually grounded guidelines, their feasibility and impact were not evaluated in real-world implementation, and further research is required to assess their effectiveness across diverse clinical settings.

Conclusion

This project demonstrates the value of co-designing Universal Design for Learning guidelines with nursing students to enhance the inclusivity and accessibility of practice learning environments. By adapting Experience-Based Co-design for use in nursing education, the project foregrounded students' lived experiences and centred their insights in shaping practical, feasible recommendations for clinical settings. The resulting guidelines translate UDL principles into concrete actions that support engagement, understanding, and varied expressions of learning, addressing longstanding challenges in placement consistency and accessibility. Importantly, the

process created a collaborative space where students, UDL experts, and practice educators could collectively identify priorities and refine meaningful improvements.

As nursing education continues to evolve, the integration of UDL principles into practice learning offers a promising approach to strengthening learner support, advancing equity, and promoting high-quality clinical education. Future research should explore the implementation and impact of these guidelines across different practice contexts, evaluating their effectiveness in improving student experiences, confidence, and learning outcomes.

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IJUDUDL
International Journal for Universal Design and Universal Design for Learning

International Journal for Universal Design and Universal Design for Learning (IJUDUDL) Vol. 1, No. 2, April 2026 ISSN: 3119-6055

UDL, AI, and Special Educational Needs: Considerations in the Context of Physical and Motor Disabilities

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DOI: https://doi.org/10.34874/PRSM.ijududl-vol1iss2.7031

ABSTRACT

The article aims to raise awareness of various aspects when AI tools are used to implement aspects of Universal Design for Learning in primary school classrooms, in this case in the form of adaptations of learning material for students. What happens when teachers outsource these tasks to AI, such as generative AI tools like Chat-GPT as a large language model, which are not explicitly developed for school contexts but are often used here, e.g., in the context of lesson planning? Challenges that arise, such as sensitivity to students´ specific individual needs, to the importance of social interactions and to AI divide, are illustrated using a case study of a student in 4th grade with physical and motor disabilities. Based on this, possible guiding questions for teachers are formulated when AI is used to implement UDL.

Keywords

Artificial Intelligence, special educational needs, physical and motor disability, Universal Design for Learning

Introduction

The education system faces various challenges. These include, on the one hand, the implementation of inclusive education, which provides a supportive learning environment for all learners regardless of their abilities, age, or special educational needs (SEN) (UNESCO, 2020, p. 20). Universal Design for Learning (UDL) is an educational framework that promotes flexible approaches to learning to accommodate diverse learners. It has established itself as a framework for teaching and learning and for inclusive and barrier-free lesson planning (Boothe et al., 2018; Pannullo et al., 2025). On the other hand, there is a need for digital education as a condition for digital participation in the digitalised society (OECD, 2023, p. 21). To deal with these challenges, the potential of Artificial Intelligence (AI) is described as increasingly significant (Song et al., 2024; Long & Magerko, 2020), especially when it comes to more interactive, adaptable, and inventive classroom experiences (Pratiwi & Waluyo, 2023).

It therefore is only logical to combine these two topics. The goal is accessible teaching and learning that breaks down barriers through the meaningful combination of traditional (in the sense of non-digital) teaching material and methods, digital media, and, above all, the possibilities offered by AI. This implies creating diverse approaches to learning, offering learning support, and thus enabling all learners to participate and get involved. The article argues that the use of AI does not automatically make UDL-based teaching more inclusive but can instead reinforce existing norms in the classroom. In our case study, the limitations of AI-supported UDL implementations become particularly apparent with students with physical and motor disabilities, as contextual, physical, and social aspects of learning are insufficiently addressed.

UDL and AI as a Shared Framework

There are several concepts for combining UDL and AI, or for using AI to implement UDL in the classroom. CAST, the inventor of UDL, has published key points on how AI and UDL can work better together to make learning more accessible, inclusive, and personalised (CAST, 2025). The authors highlight that the focus on designing AI tools is not on their use in the classroom and teachers or students are rarely involved.

This is where some kind of theory-practice gap emerges: in theory, AI can contribute to teaching that focuses on the needs of all learners. In practice, the question arises as to how this can be implemented if, for example, students with SEN are not specifically considered, as AI tools are usually designed for the average student. Furthermore, there are initial drafts of a framework for inclusive AI learning design for diverse learners (Song et al., 2024). Based on a literature review, this framework makes a convincing attempt to combine the AI Five Big Ideas (perception, representation & reasoning, learning, natural interaction, societal impact) and the three UDL principles from the guidelines 3.0 (multiple means of engagement, representation, and action &

expression; CAST, 2024).

Each of the three principles is complemented by three corresponding praxes including examples: For example, engagement is about Authenticity & relevance, collaboration & community and self-regulation & autonomy, accompanied by problem-based learning, personally-relevant project design or self and peer evaluation (ibid, p. 7). The result is a detailed framework. To be used for lesson planning, it must be specifically adapted to the respective learning group. This is where teachers often use AI tools such as MagicSchool, SchoolAI or the chatbot LUDIA, which was trained with UDL guidelines. This comes with the promise that AI tools can help with lesson planning based on the ideas of UDL. AI tools are thus used to make teaching adaptive and, for example, to create different versions of a text, including a rap battle (Pack, 2024), to generate concise directions for tasks or multiple explanations for concepts, or to level text for different reading skills. Overall, the idea is often to support autonomous learning (Saborio-Taylor, 2024), since it is seen as an important component for pupils' motivation, creativity and their perceived level of stress in school (Nuñez & León, 2015).

There is nothing fundamentally wrong with using AI tools for lesson planning. Some of the AI ideas are really helpful in terms of UDL, for example, when students can use the representation of a text they want to read or when text-to-speech or vice versa enables a learner to complete different tasks related to a text. This broadens the range of learning approaches. In other examples, or when AI tools are used to simplify, summarise, or explain teaching materials and learning content, more caution is required. It is necessary to raise awareness of what happens when teachers outsource these tasks to AI. The principle of "garbage in, garbage out" (Rose & Fischer, 2011) applies especially to Large Language Models like ChatGPT: If you train your model on poor data, it produces bad results. There are different types of poor data. In context of school and teaching, this usually refers to data that is not representative because certain groups of students, for example those with disabilities, are missing or because data sets contain incorrect information. As a result, the AI's adjustments often do not correspond to the students' individual needs or their level of learning. Furthermore, Large Language Models have no ability to consider pedagogical, methodological, or individual contexts, but calculate their output according to the principle of highest frequency of occurrence.

About the Combined Use of UDL and AI

When using UDL, there is one thing everyone agrees on: for practical usage, it is important to contextualise UDL principles (Almeqdad et al., 2023). The same must also apply to the use of AI tools in the context of UDL. But how can this be implemented in the classroom?

To deal with this question, we will use a case we have created ourselves. The description of the student is based on our own teaching experience with students with physical and

motor disabilities and is based on typical formulations found in school files and SEN assessment reports. For ethical and data protection reasons, the name Tom has been chosen at random and does not correspond to any real person. The case serves to critically examine our thesis to what extent AI-supported adaptations are actually inclusive in the sense of UDL, or whether existing barriers can be reinforced and new barriers can emerge.

Tom attended an inclusive primary school, and it was my job as a special education teacher to design a learning environment based on UDL to adapt the lessons to his learning requirements. Tom is diagnosed with SEN in the field of physical and motor disabilities. Disability is here understood as a wide concept of limitations in daily activities resulting from an impairment, often worsened by societal barriers, making it a complex interaction between a person's body and their environment, not just a health issue. Central to physical and motor disabilities is the individual examination of physicality and a specific experience of spatial perception and social interaction, which are caused by an impairment or disorder (for example, spina bifida, asthma). In addition, comorbidities (for example, speech disorders) and secondary impairments (for example, difficulties with eating and drinking) often occur. Tom has spina bifida in conjunction with paralysis of the legs and hydrocephalus. He is in a wheelchair, and his motor skills are limited. According to the SEN assessment, his cognitive abilities are average, but he is experiencing increasing difficulties at school.

Lesson planning for students with physical and motor disabilities requires a high degree of differentiation due to the complex needs of the students which is based on an in-depth analysis of their learning situations. In some cases, individual and ability-oriented learning goals that differ from the learning goals of other students are also required, as well as learning content tailored to these goals. The current state of health and any associated (care) needs must also be considered depending on the specific situation. The following aspects are particularly important (Thiele & Thies, 2025, pp. 220-227):

1) Spatial and temporal structures, for example, by analysing existing barriers in the classroom or school and considering increased time requirements, for example, due to necessary care needs, when changing between classrooms, or due to shortened attention spans.

2) Selection of learning content based on individual learning factors and curricular requirements. In this context, it is important to examine the present and future significance of the learning content, for example, regarding life planning and organisation against the backdrop of the student´s physical disability.

3) Use of methods in the sense of problem-based or project-based learning with consideration of different levels of acquisition: (a) basal-perceptual: understanding the world through sensory perception (for example, hearing,

International Journal for Universal Design and Universal Design for Learning (IJUDUDL) Vol. 1, No. 2, April 2026 ISSN: 3119-6055

touching) and physical experiences, for example, through movement; (b) concrete-objective: learning by active engagement and exploratory interaction with people and subjects to develop practical skills; (c) vivid: learning by constructing inner images and ideas of the world, one´s own actions and contexts; (d) abstract-conceptual: learning by language, symbols and mental reflection in order to recognise connections and enable transfer.

In this context, it is important to consider individual abilities such as communication and interaction, for example, in group work or regarding support options, as well as accessible learning materials and the use of assistive technologies.

Now we have fed two different AI-Tools with information about Tom: Chat-GPT 5.2 without meta-prompts or information about UDL and the Your UDL Pal 5.2, a version of Chat-GPT trained with the UDL guidelines. We asked both AI-Tools how we should proceed in our lesson planning to promote Tom´s reading skills, as colleagues had identified a particular need for support in reading at that time. Therefore, we just used one prompt without adjusting: Tom is diagnosed with SEN, in particular in the field of physical and motor disabilities. Tom has spina bifida in conjunction with paralysis of the legs and hydrocephalus. He is in a wheelchair, and his motor skills are limited. According to the SEN assessment, his cognitive abilities are average, but he is experiencing increasing difficulties at school. The aim is to support Tom´s reading skills. Table 1 shows a selection of the different answers.

Table 1

Selection of the Different AI Tool Answers

Chat-GPT without Meta-Prompts	**Your UDL Pal 5.2**
Differentiated reading materials: Offer texts at different levels and degrees of difficulty on topics that are of personal interest to him.	Multiple ways of accessing the text, for example, provide the text digitally in advance or allow the option to listen to the text being read aloud (with headphones)
Use of technology: Use software with text-to-speech functionality and offer e-books.	Focus on comprehension, not reading speed, for example, use text-to-speech or read along simultaneously; adjust font size to suit his needs
Visualization: Incorporate visual aids and text structuring.	Adapt learning materials, for example, limited text per page, clear paragraph structure
Multisensory reading activities: Use audiobooks as a supplement in class.	Seating and Organisation, for example, height-adjustable desk; extra time allowed for transitions between activities in the classroom
Individual support: Provide reading support with a reading coach as part of individual tutoring and	Important: Same learning goals, different pathways, for example, record answers as audio messages, dictate key words or sentences using

regular feedback.	speech-to-text

A comparison of the responses clearly reveals the different approaches of the two AI tools. The left column suggests reducing the text's difficulty level, while the right column focuses on improving access to the text. Furthermore, the left tool recommends individualised student support, while the right emphasizes learning within the learning group. Both AI tools refer to the use of multimodal technology and text-to-speech, but their recommendations are highly teacher-centered and tend to neglect learner agency. The UDL-trained AI tool also makes a clear effort to consider Tom's specific learning needs in order to anticipate potential learning barriers.

Discussion

The teacher is responsible for the concrete implementation of the AI suggestions in both cases. Both AI tools point to an adaptation of the learning environment and the teaching methods. However, if a teacher relies on the suggestions in the left-hand column, there is a greater risk of designing lessons exclusively for Tom and, for example, separating him from the learning group for individual reading support.

This must be critically questioned, as inclusive education is defined by joint learning, preferably on a common subject, and therefore relies heavily on methods such as differentiation (Olsson & Hansson, 2025), and it is precisely the opportunity for shared experiences, interactions and cooperation that is seen as a key element of social inclusion in particular (Lindner et al., 2022). Or, to put it another way: frequently removing a student from the classroom for individual learning support can have a negative impact on their social integration.

The AI suggestions exemplify two different aspects in the context of inclusive education and AI: On the one hand, the high complexity of inclusive teaching becomes clear when it comes to the question of teaching students with SEN in class as often as possible while at the same time providing individual learning support. The latter can be more effective in individual or small group support. It is important to reflect on the risk of unintentionally reproducing and reinforcing the classification of students into two groups based on SEN, which runs counter to inclusive education: the more often students with SEN are taught individually, the more the image of two groups in the classroom becomes obvious. One group is labelled as disabled/incapable, and one group is labelled as not disabled/capable. Teachers usually place students with SEN in the first group (Krämer, 2025).

On the other hand, the importance of AI literacy among teachers is evident. It is unlikely that all teachers have an understanding of how AI/large language models work and are able to critically reflect on the origin of the output. This makes it even more necessary to

raise awareness that AI is not automatically effective for diverse learner needs – rather, it remains the primary task of teachers to contextualize AI results.

In total, this short article aims to raise awareness of three aspects when AI is used to implement UDL ideas in the classroom:

1) Sensitivity to the students´ specific individual needs: Due to the way they work, AI and, above all, Large Language Models cannot "know" the student, the class, the teacher, or the school, nor can they understand their interactions. Instead, the only results that can be produced are those that occur very frequently in the AI's data material. This can create new barriers that conflict with the three principles of UDL.

2) Sensitivity to the importance of social interactions: Especially in times of advanced digitalisation and AI, teaching must remain a place where interpersonal interactions remain central. Strongly focusing on individual solutions seems inappropriate here.

3) Sensitivity to the AI divide (Daepp & Counts, 2025): This includes the underrepresentation of certain, mostly marginalised, groups (for example, students with SEN) in Large Language Model/AI data, as AI tools are designed for the average student. Additionally, it must also be noted that students from these groups in particular may have difficulties using these tools and, for example, allow the learning process to be taken away from them too much, which can lead to deskilling (Ferdman, 2025).

Conclusion

The article dealt with various aspects when AI tools are used to implement aspects of UDL in primary school classrooms, in this case in the form of adaptations of learning material for students. To this end, a self-created case of a student with physical and motor disabilities was used to show what can happen when teachers delegate these tasks to AI. In conclusion, our aim is to raise awareness of sensitivity to the students´ specific individual needs, to the importance of social interactions, and to the AI divide.

To achieve this, we suggest three reflection questions:

1. Are the AI-generated adjustments really appropriate for the student's individual learning requirements? Of course, AI can, for example, create texts at different levels and degrees of difficulty for Tom that are interesting to him. However, due to the lack of context sensitivity, these text adaptations are likely to be very unspecific or not well tailored to his abilities, as, in this case, the construct of reading competence is complex, and many different subdomains must be considered. Tom has (in terms of the SEN assessment) age-appropriate decoding and fluency skills, but his reading comprehension is limited, especially regarding

domain-specific knowledge. Sensitivity to blanket categories of AI is therefore necessary, as the adaptations made by the AI are hardly comprehensible for teachers. Once again, the necessity of critical questioning of AI results becomes clear at this point.

2. Do the AI-generated adjustments support my teaching goals? If so, can other students benefit from these adaptations as well? Text-to-speech or vice versa can be helpful for Tom in terms of reducing his workload and supporting him reading long or difficult texts. However, it must be kept in mind that its use can also lead to a habituation effect and Tom losing motivation to improve his reading skills. It is also possible that Tom will reject the text-to-speech function so as not to reveal another difference in the classroom (in addition to his physical impairment symbolised by his wheelchair). It is therefore necessary to supplement this with other methods or approaches to prevent the adjustments from running counter to the learning objectives. By offering text-to-speech to all students as a learning opportunity, (a) acceptance of this assistive technology can be increased and (b) other students who need support in a specific learning situation can also benefit.

3. Do the AI-generated adaptations support social participation, cooperation, and interaction? Some AI tools (as seen in Table 1) tend to incorporate support through individual assistance or further levels of learning differentiation and individualization. But students with SEN are already at risk of being taught in parallel with the rest of the class or within isolated individual settings. However, students with physical and motor disabilities need a wide range of opportunities for social interaction, as their participation in many activities in school and in their free time is limited due to their impairments or barriers related to their impairments (Liu et al., 2025). It is therefore necessary to take a critical look at whether the AI-generated adaptations question the content-related connectivity with classmates and the idea of collaborative and social learning, as well as to address various follow-up questions: Where do adaptations lead to the completion of exercises without social interaction with classmates? How can learning content be individualised while at the same time implementing collaborative learning that goes beyond simply providing a shared learning space? What kind of adaptations are helpful and transferable for all students?

Addressing these three questions when planning lessons can help to design lesson plans with AI in accordance with UDL guidelines while also incorporating the principles of inclusive education

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IJUDUDL
International Journal for Universal Design and Universal Design for Learning

International Journal for Universal Design and Universal Design for Learning (IJUDUDL) Vol. 1, No. 2, April 2026 ISSN: 3119-6055

Universal Design for Learning in Project Management

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DOI: https://doi.org/10.34874/PRSM.ijududl-vol1iss2.6060

ABSTRACT

The formal project management (PM) framework, as expressed in the Project Management Body of Knowledge (PMBOK), does not explicitly advocate the use of inclusive design techniques to reduce access barriers for project participants and stakeholders. Because design, communication, budget, and quality are essential to any formal project, the Universal Design for Learning (UDL) framework dovetails well with formal project management processes to reduce waste, duplication, and rework throughout the project life cycle. In various phases and tasks within projects, project managers act in teaching and facilitating roles with stakeholders who need to learn information, understand processes, and contribute to project decisions. Barriers can arise in how project managers design engagements in which project personnel serve as stakeholders, take in information, and demonstrate their skills; UDL can proactively help lower such barriers to success. This article provides practical, evidence-based methods for implementing multivariate paths to improve task and project success, reducing rework, delays, and confusion.

Keywords

Universal Design for Learning (UDL), access, accessibility, barriers, design, project management

Introduction

Project management is equal parts planning, resource tracking, and asset management. Throughout project phases, project managers facilitate, train, and teach others about processes and information that help make stakeholder experiences smoother and more efficient. The Universal Design for Learning (UDL) framework is an evidence-based, systematic approach to developing and executing stakeholder learning engagements that lowers access and knowledge-gap barriers (Tobin & Behling, 2018), reducing unexpected negative risks and taking work off project managers' already full plates. Using a systems approach to change management, this article shares UDL techniques that have been

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Vol. 1, No. 2, April 2026 ISSN: 3119-6055

demonstrated to lower barriers and reduce project friction during the initiation, planning, and execution of projects. We propose aligning the UDL framework with process-based project management as effective practices that readers can apply and test, drawing on the authors' experiences and recent published research. The following sections preview our primary arguments.

Initiating Universally Designed Projects

In developing project charters and identifying stakeholders, applying the principles of UDL to the work helps project managers build in affordances and optimised options whenever stakeholders encounter new information, need to communicate, practice concepts, or collaborate with colleagues (Posey, 2018). During the charter and stakeholder-identification processes, both project managers and stakeholder groups are in learning roles, seeking information and predicting actions, timelines, and resource needs. A UDL lens at the start of projects helps everyone involved to speed up constitutive processes and reduce confusion and re-work, as we will demonstrate below.

Planning Universally Designed Projects

When defining, sequencing, and estimating project activities, a UDL perspective guides project managers to invest small amounts of time and effort up front, helping stakeholders become and stay engaged, absorb project information, and act based on it. The UDL framework helps project managers design stakeholder engagements to provide optimised options in all three areas—engagement, representation, and action/expression—lowering the risk of rework and reducing the likelihood of disengagement (Posey, 2018).

Executing and Monitoring Universally Designed Projects

During the execution and monitoring phases of projects, communication and team management are key elements of project success. In universally designed projects, quality assurance, change control, and risk management are aided by multiple pathways for stakeholders to participate in decision-making, receive information and communications, and communicate with one another, project sponsors, and project managers.

The Evidence for UDL's Effectiveness in Project Management

The neuroscientists at CAST developed the UDL framework in the late 1990s, and they have been evolving it through three major iterations since then (see CAST, 2024). Beginning in the early 2000s, part of CAST's organisational focus has been on workplace learning (CAST, 2025). Recently, several major studies of UDL's application and effectiveness in workplace learning and development have been published (e.g., Bartlett & Ehrlich, 2019; Gronseth & Hutchins, 2020; Lemanis, 2024; McKenna, 2023). Most of these publications share case

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studies of UDL principles in training scenarios carried out by formal learning-and-development units within organisations. Table 1 presents data from case reports from 12 organisations worldwide on the attributes and actions of project managers.

Table 1

International Attitudes and Actions of Project Managers

Source	Description
Canada: Chee & Weaver, 2024	Integration of UDL principles in the management of unit-level projects to adopt open educational resources (OERs) for a Canadian institution's library and information-technology operational data store (ODS).
Canada: Kearney, 2024	A report on the implementation of UDL principles across the entire organisation using project-management techniques. The "Universal Design for Learning for Technology-enabled Post-secondary Courses at Mohawk College" research project from 2018 is a forerunner to the ideas in this paper.
Ireland: O'Shaughnessy & McAvinue, 2025	A case report on implementing project management and UDL principles across entire organisations, not just those with formal disability-support and project-management roles. Demonstrates the distributed nature of UDL-supported project management at the University of Limerick.
Ireland: ALTIT**UD**E Project, 2024	A consortium of more than 50 further education and higher education institutions adopted UDL principles across their service operations, using formal project management processes. The organisations involved in the project asked one of this article's authors to consult on the development of the UDL/project-management schema developed for participating institutions, and outputs of this work directly inform this article.
Japan: Kravit, 2019	Establishment of a "Universal Design Action Project" to train Japanese civil servants and educators to craft action, advocacy, and work plans for lowering access barriers using formal project management principles.
Norway: Lund, 2016	Country-wide use of universal design principles in the design of physical spaces as well as digital resources used by the public, with evidence of savings in terms of time, re-work, and money across various project types.

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Spain: Saldaña, 2025	Merges UDL principles and an existing institutional project-management system to achieve efficiencies in a disability-support program.
United Kingdom: Moriarty, 2018	Adoption of UDL principles across DeMontfort University through a formal project-management approach in the "Learning and Organisational Development [office], the Centre for Enhancing Learning through Technology, the Department of Academic Quality, Information Technology and Media Services, Student and Academic Services, Library and Learning Services (LLS), and staff and students from the four academic faculties.
United States: LeGary & LaRocco, 2022	Narrative about how Goodwin University adopted UDL across all of its service touchpoints through a formal integration project.
United States: Bogdan, 2018	Establishment of Greensboro College as a "UDL institution," and sharing of their "Model of UDL in the Curriculum" report.
United States: Skaggs & McMullin, 2024	An edited collection of reports from large-scale academic libraries that have implemented formal projects to adopt UDL across their service and operational units.
Uruguay: Inspección Docente Departamento de Desarrollo y Diseño Curricular, 2025	An agile project management guide that advocates for incorporating several design frameworks into formal project management, including UDL.

Many of the formal processes in project management involve learning. From taking in information to analysing data to communicating effectively about progress and challenges, using the UDL framework increases efficiency and reduces rework across these processes. UDL is especially relevant to project management because of two patterns that we see in the evidence.

First, the slack and flexibility that need to be included in the design of well-run projects are often "take your best guess" factors: UDL provides a consistent and measurable way to think about flexibility in the design of project processes and tasks. For example, Pinto and Davis (2024) argue that "adding slack (extra time) to our activity duration estimates is a common behaviour and occurs for a variety of reasons, most commonly due to the desire to protect ourselves from aggressive or unreasonable project schedules" (p. 93). In other words, we create slack in schedules and budgets mostly to avoid setting expectations too

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tightly. By applying UDL principles to the design of our materials and schedules, project managers can more accurately predict where flexibility is needed.

Second, both project management and UDL "grew up" together and have been slowly merging since their inception. While both inclusive design and project management have existed for many decades, the publication of the first edition of the PMBOK (PMI, 1996) and the earliest version of the UDL principles (CAST, 2024) both occurred in 1996. As seen in the dozen resources outlined above, early UDL work took the form of implementation projects, in which a project management approach was used to introduce UDL across teams, units, and institutions. As project managers implemented UDL, they often found that UDL techniques assisted them in general project management (see Kravit, 2019; Lund, 2016; Moriarty, 2018). The most recent studies report on effective ways to adopt UDL in project management processes across entire organisations. Developing a "crosswalk" of practical ways to adopt UDL across the project management life cycle is one potential strategy.

Need for UDL in Project Management

The Project Management Institute (PMI) unveiled a major shift in focus between the sixth (2017) and the current seventh edition (2021) of the *Guide to the Project Management Body of Knowledge* (PMBOK). Where earlier editions of the PMBOK Guide were process-based, the newest iteration of the *Standard for Project Management* within the PMBOK Guide is principle-based. The authors explain that "while effective in supporting good practice, process-based standards are prescriptive by their very nature. . . [T]his edition shifts to a principles-based standard . . . to focus more on intended outcomes rather than deliverables" (PMI, 2021, p. x). The authors try to soften the impact of the shift from processes to principles, saying that "nothing in this [seventh] edition . . . negates alignment with the process-based approach of past editions" (PMI, 2021, p. xi). Especially now that PMI has shifted to an outcomes- and principles-based structure for project management, there remains a need to be able to "crosswalk" the formal rigidity and predictability of earlier PMBOK standards against the more fluid domain-based principles in PMBOK 7—stakeholders, teams, development/life-cycle, planning, work, delivery, measurement, and uncertainty. UDL can play such a bridging role. Project managers can combine specific earlier PMBOK standards with UDL considerations to achieve outcomes aligned with the latest PMBOK 7 principles. Indeed, the Project Management Institute itself has taken a "both paths" approach with the publication of *Process Groups: A Practice Guide* (PMI, 2022), which also aims to align the process-based approach from PMBOK 6 and the domain-based structure of PMBOK 7.

In James McKenna's book *Upskill, Reskill, Thrive*, he argues for the use of UDL across workplaces to "examine the environment for elements that would impede" learning

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connections, especially in situations where training and skill development are key business drivers: "the [UDL] guidelines help us establish, maintain, and enhance the learning triangle that is vital for any meaningful change" (p. 135). Throughout the project management life cycle, stakeholder groups encounter new information, knowledge gaps, learning needs, and communication challenges. One of the twelve principles of project management is *3.7: Tailor Based on Context*. While this principle does not explicitly speak to accessibility, inclusive design, or universal design in project materials and engagements, it prefigures a UDL approach, advocating for project teams to "examine the unique set of conditions for each project, so that they can determine the most appropriate methods of producing the desired outcomes." In other words, understanding stakeholders' specific needs, working methods, and preferences allows project managers to customise the elements of given projects to streamline work and provide communication and processes that align with how stakeholders expect to work together. The tailoring process occurs iteratively as project teams learn more about the resources, affordances, and constraints in specific projects. Because it is customised to the specific stakeholders in each project, this approach is time-consuming and resource-intensive (see Pinto & Davis, 2024).

Before we ever know the specific stakeholders, start tailoring for specific people, circumstances, and resources, and begin the first phase of projects, we can assume that the people involved in our work will bring varying characteristics to our engagements. By assuming variability among our colleagues—in terms of their levels of familiarity with our ideas, amount of background knowledge, skill levels, resource availability, preferences for communication, and many more vectors—we can plan the processes in the project life cycle using the UDL principles, guidelines, and considerations in order to lower access barriers and reduce overall project friction.

The Universal Design for Learning Framework

Universal design for learning, or UDL, has its origins in the neuroscience of how humans learn. When we learn anything, whether we are six years old or sixty, we activate three different chemical pathways in our brains. The neuroscientists at CAST mapped the neurochemistry of learning into three sequential and overlapping phases: engagement (affect), representation (recognition), and action/expression (strategy)—these are the three UDL principles. Using research from K-12, higher education, and workplace learning, the CAST team further breaks down the UDL framework into nine guidelines (three for each principle) and, in turn, into 36 action-oriented considerations, as shown in Figure 1. We will examine and share some of these UDL considerations below, as they apply to specific tools, inputs, outputs, and processes in formal project management.

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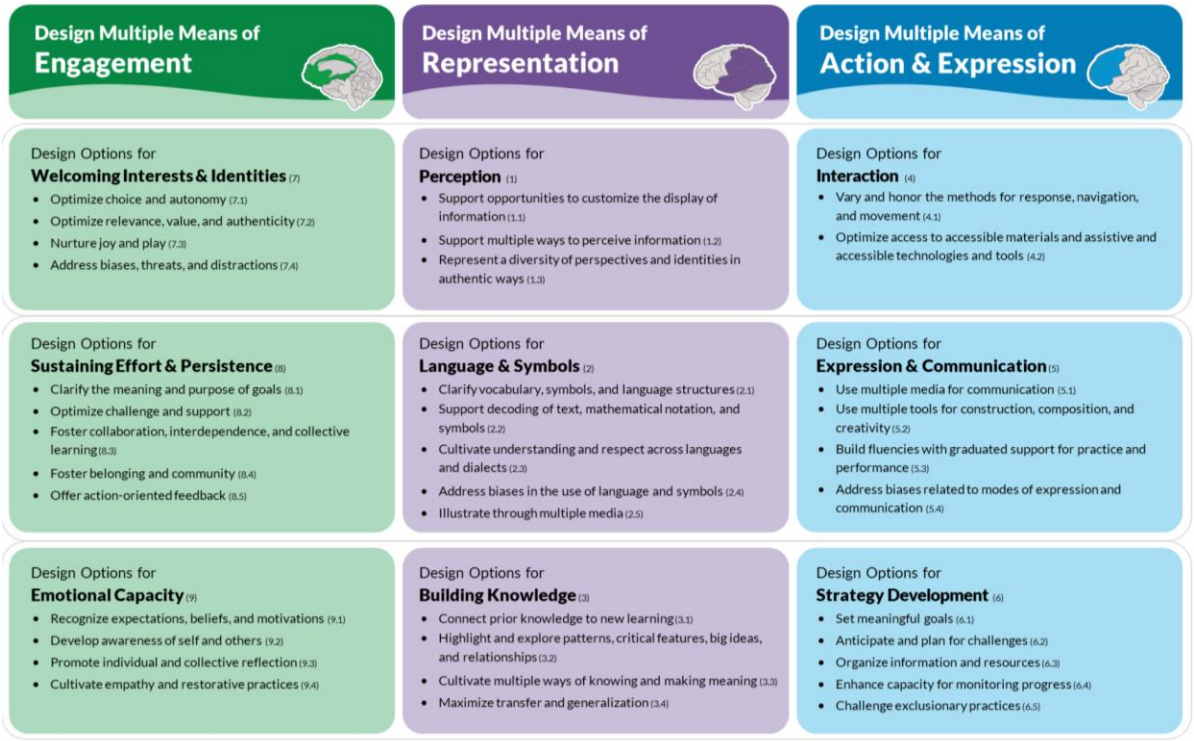
Figure 1

Universal Design for Learning Guidelines Version 3.0



https://udlguidelines.cast.org

UDL Origins & Overview

The discovery that led to the codification of the UDL principles and guidelines was that most learning engagements are designed for a target audience of intended learners, with typically only one way for learners to progress through the experiences. Think of lectures and readings in your experiences of formal schooling: if you were not yet good at, or did not conform to, the expectations for how such learning experiences were designed, that created barriers to your successful participation. Conversely, the researchers at CAST showed that learning "sticks" more effectively for more people when their learning experiences are designed to provide multiple means for learners to get engaged and stick with the learning when things get complex or confusing (Rose & Meyer, 2002). Multiple means of representation, such as alternative formats for video and audio materials, also increase recall and application. Finally, designing multiple means for learners to act and express their learning—whether in preparing, practising, or critiquing—also lowers barriers and allows learners to persist better and take agency in their learning (King-Sears et al., 2023).

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UDL in Workplace Professional Practice

When we say, "workplace learning," most of us think of direct training from learning and development teams: classroom- or online-based skill development or information sharing. We invite readers to broaden the idea of "workplace learning" to encompass a broader range of professional-practice tasks that fall under the umbrella of learning engagements. For instance, gathering information for a charter requires researching a project's resources, scope, and goals. Likewise, identifying stakeholders, scoping projects, developing activities/schedules, cost estimation, quality planning, and risk management all involve significant information-seeking on behalf of project managers and stakeholder groups. This addresses just the planning phase of a project.

In each major project phase, we can identify interactions in which one or more project roles need to discover, collect, and learn new information from data sources, each other, professional providers, support teams, or wider communities. As we will detail below, in planning for and designing the form for such interactions, applying the UDL framework allows project managers to reduce friction, speed time-to-solution, and lower barriers to task completion.

Conclusion

While all three UDL principles of engagement, representation, and action/expression apply to tasks in projects' initiation and planning phases, the principle of "design multiple means of engagement" comes to the fore in the executing and monitoring phases. During initiation and planning, there is greater focus on clarifying the project and its expectations to stakeholders (i.e., representation) and establishing how team members and stakeholders participate in the project (i.e., action/expression). This also supports the domain-based approach to projects, as outlined in the PMBOK 7 stakeholder-engagement cycle of "identify," "understand," "analyse," and "prioritise." Applying UDL to the executing, monitoring, and closing phases maximizes stakeholder engagement and team member interest through deliberate flexibility.

UDL focuses on the affective aspects of project management processes, subtly implying that successful project management—especially in complex environments—is less about driving progress through control, but benefits more from coordinating and engaging. The researchers at CAST emphasize that "UDL is a framework that addresses the primary barrier to fostering expert learners within instructional environments: inflexible, 'one-size-fits-all' curricula. It is inflexible curricula that raise unintentional barriers to learning" (CAST, 2025).

Applying UDL to project management goes beyond "checking boxes." UDL reduces complexity in projects through the intentional design of multiple pathways for engaging, taking in information, and demonstrating skill and communicating effectively. Intentional

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effort spent designing inclusive project-learning interactions saves many hours of work throughout the project life cycle. Project teams who feel their work is valued are more willing to contribute, increasing the quality of deliverables and reducing the risk of project failure.

As readers begin practicing with UDL in project management, we encourage you to start small and focus on pinch points. What project tasks repeatedly go differently than planned? Where do stakeholders ask clarifying questions about confusing language in documents? Where do project team members have to re-work tasks because of misunderstandings about requirements? Where do resources have to be re-allocated because of communication gaps? These are good places to consider applying one or two relevant UDL considerations.

In addition, build in time to assess "before" and "after" conditions: how much time, effort, and budget did UDL strategies save projects? Collect data and compare them to results from similar projects—use categories like stakeholder knowledge, participation, and satisfaction, with instruments like questionnaires, focus groups, and task-completion reports.

We encourage readers to share their UDL project-management experiences. Choose one task and one UDL strategy. Document the impact on deliverables, team morale, stakeholder satisfaction, and your own approach. Be an advocate within your organization and share your experience applying UDL. UDL is still an emerging topic in formal project-management circles, and we hope to establish UDL as a key driver that increases access and lowers barriers to project success.

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A Universal Design for Learning-Informed Approach to Peer Review

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DOI: https://doi.org/10.34874/PRSM.ijududl-vol1iss2.7035

ABSTRACT

Peer review is foundational to scholarly publishing, supporting research quality, editorial decision-making, and professional development of both authors and reviewers. As academic publishing evolves—particularly with the growing presence of artificial intelligence (AI) tools—longstanding concerns related to trust, equity, and accessibility have intensified. This Opinion article proposes that Universal Design for Learning (UDL) offers a valuable framework for strengthening its inclusivity, clarity, and developmental impact. Drawing on established literature and the review process of the *International Journal of Universal Design and Universal Design for Learning* (IJUDUDL), the article conceptualizes peer review as a reciprocal instructional practice rather than solely a gatekeeping mechanism. Through a UDL-informed lens, reviewer feedback is framed as a form of action and expression that supports the development of diverse authors, promotes engagement through respectful and constructive dialogue, and enhances representation through clear, accessible, and well-organized communication. The article highlights how structured, transparent, and ethically grounded feedback benefits not only authors but also reviewers and editors, contributing to a shared community of scholarly inquiry. Practical recommendations are offered for organizing and communicating feedback in ways that align with UDL principles, including the use of clear language, balanced commentary, and flexible formats.

Keywords

Universal Design for Learning (UDL), peer review, inclusive scholarly publishing, academic integrity

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Introduction

Peer review is a well-established scholarly practice that formally evaluates the quality, rigor, and merit of outputs such as conference papers, journal articles, books, and grant proposals. High-quality reviewing upholds the integrity of scholarly publishing and demonstrates core attributes of thoughtfulness, balance, and professionalism. Konstantinou (2025, para. 29) argues that "new knowledge and shared prosperity" remain impossible without the human reviewers who sustain scholarly continuity. He further contends that the reviewing procedure is a human-centred endeavour that promotes a shared community of inquiry, transcends hierarchical structure, and upholds the integrity of academic discourse. Through such a process, reviewers' assessments and feedback form a three-part anchor that refines the work, informs editorial and funding decisions, and supports professional growth (Ross-Hellauer, 2017; Spolarich & Wilder, 2015). Each of these parts will be discussed briefly.

Regarding work refinement, peer review can help to ensure that a study's methodology, analysis, and argumentation are sound and valid. By upholding trustworthiness, the process involves multiple perspectives to determine the extent to which manuscripts meet scholarly and ethical research standards (Spolarich & Wilder, 2015). As Tennant et al. (2017) noted, peer review is deeply embedded in academia, where professional recognition and advancement often depend on publication in refereed outlets. Therefore, reviewers contribute to the development and refinement of high-quality, professional publications aligned with research standards.

Second, peer review assists editors in decision-making by determining whether a manuscript is suitable for publication, presentation, or funding by evaluating aspects such as novelty, impact, and relevance to a journal's scope (Ross-Hellauer, 2017). In doing so, peer review acts as a filter, preventing weak and unsupported work from being disseminated, and guides authors through revision rounds to strengthen their manuscripts (Kelly et al., 2014). It also plays a protective role, safeguarding against errors, biases, or insufficiently supported claims that could undermine the credibility of research (Guston, 2000; Rennie, 2003). Providing unbiased, well-reasoned feedback requires clear structure and thoughtful organization to promote both effectiveness and objectivity, thereby maintaining the integrity and usefulness that define journal quality.

Thirdly, peer review contributes to scholars' professional development. Reviewers provide constructive, instructional feedback that improves and maintains research quality supported by logical reasoning and clear references to relevant sections of the manuscript (Emden, 1996; Lipworth et al., 2011).

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Through a Universal Design for Learning (UDL) lens (see Meyer et al., 2025), peer review can be viewed as a formative, collaborative process, which aligns naturally with UDL's emphasis on flexibility, engagement, and learner variability.

Giving and receiving reviews can be considered forms of action and expression that build community and shared responsibility for maintaining research standards. Through this process, scholars actively communicate their understanding, engage in critical thinking, and collaborate meaningfully, key elements of the UDL framework that promote agency and purposeful learning. Applying UDL principles to peer review encourages reviewers to consider the diverse needs of authors by providing accessible, clearly structured, and responsive feedback. Therefore, this paper underscores the importance of human-centred peer review and offers recommendations for navigating ethical and inclusive practices for journal article review.

IJUDUDL Review Process

The review process for the International Journal of Universal Design and Universal Design for Learning (IJUDUDL) reflects the core values of the International Collaboratory for Leadership in Universally Designed Education (INCLUDE, 2026) – valuing all people, promoting exceptional design and collaboration, advancing rigorous research, and driving positive global impact – and aims to provide supportive and developmental experiences for authors. The process begins with a technical review of submissions to ensure they meet the submission criteria (see Table 1).

Following this, a Deputy Editor provides a cursory manuscript review to determine its suitability for further consideration. If deemed appropriate, manuscripts are then assigned to a Section Editor (Research, Best Practice, or Opinion). The Section Editor assigns two Associate Editors or ad-hoc reviewers with relevant expertise in a double-blind review process. Once assigned, reviewers have around three weeks to complete the review. Reviewers complete a structured review form and provide qualitative comments on the manuscript's content, writing quality, and references.

For Research section manuscripts, reviewers are asked to comment on the clarity of the research questions, the appropriateness of the methods, institutional ethical approval, the presentation of results, and the conclusions. For Best Practice section papers, reviewers are asked to evaluate the practice's potential replicability, the extent to which inclusive approaches are demonstrated, the contribution's significance to the field, and cultural sensitivity. For Opinion section pieces, reviewers comment on the clarity of the focal argument, the use of evidence to support claims, the significance of the ideas or questions, and cultural sensitivity.

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Reviewers are asked to provide a final recommendation that guides editorial action, ranging from "Accept without changes" to "Minor changes requested," "Major changes required," or "Reject." Minor changes differ from major changes in that the former involves a fundamentally acceptable paper that has minor editorial adjustments needed, such as typographical corrections, grammatical refinements, or minor content clarifications; major changes indicate substantial needed revisions to a promising manuscript, such as removing or adding data, reformatting arguments, reorganizing sections, or clarifying key arguments, terminology, and methodologies to meet journal standards. A "Reject" recommendation indicates that, even with significant changes, a paper is unlikely to meet the journal's quality or scope requirements.

Regardless of the decision category, reviewers should accompany each recommendation with clear reasoning and actionable comments to help both editors and authors understand the basis of the decision. Submissions requiring minor to major revisions often undergo multiple rounds of review, revision, and resubmission. In this case, reviewers may be invited to evaluate revised manuscripts to determine if the authors have adequately addressed their concerns. Once the reviews are complete, Section Editors and Deputy Editors integrate the reviewer feedback and recommendations and determine the final decision.

Completing reviews within the agreed deadlines minimizes delays in the review process. While scholars often find peer review to be a rewarding service to the profession, reviewer fatigue is a common challenge (Tennant, 2018). Reviewers should accept assignments only if they can meet the deadlines (COPE, 2017).

Table 1

IJUDUDL Editorial Review Stages

Stage	Responsible Role	Purpose
Initial screening	Technical Editor	Check submission format, ethics compliance, and journal scope
Deputy Editor Review	Deputy Editor	Assess relevance and quality for further consideration
Reviewer Assignment	Section Editor	Identify reviewers with relevant expertise
External Review	Associate Editor or	Evaluate rigor, clarity, contribution, and

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	ad-hoc reviewer	alignment with UD/UDL scope
Editorial Synthesis	Section Editor and Deputy Editor	Integrate reviewer feedback and form a decision

Ethical Considerations

Conflicts of Interest

Reviewer feedback should aim to provide an objective assessment grounded in evidence rather than influenced by status or personal opinions (Konstantinou, 2025). Reviewers should declare potential conflicts of interest and decline assignments when objectivity could be compromised. Conflicts of interest arise when personal, financial, or professional relationships or influences, such as prestige, gender, nationality, or alignment with one's own perspectives, affect a reviewer's judgment of a paper (Lee et al., 2013).

Confidentiality

Breaches of confidentiality and unauthorized use of ideas, data, or methods also compromise the credibility of the review process and undermine the integrity of the scientific record. Manuscripts should be treated as confidential documents, and reviewers should not share manuscripts, discuss them with others, or use unpublished material for personal interests (Bos, 2020; COPE, 2017). Transparency initiatives, such as open or signed reviews, have been proposed to reduce subjectivity and increase equity in scholarly assessment (Köhler et al., 2020).

Use of AI

The integration of AI tools in peer review presents new challenges and opportunities. AI has rapidly become embedded in scholarly writing, editing, reviewing, and publishing, providing benefits such as improving language clarity in review reports, reducing time spent on grammar and spelling corrections, and supporting initial screening tasks. It has also raised questions about its ethical issues of transparency, accountability, and fairness (Colther & Doussoulin, 2024; COPE, 2023; Daoudi, 2025; Kooli, 2023; Mollaki, 2024; Stahl & Eke, 2024; Zielinski et al., 2023). Next are suggested guidelines for the use of AI in peer review to protect confidentiality, reduce bias and fabrication risks, and preserve the integrity of the peer review process.

First, the protection of manuscript data and the privacy of submitted materials must be prioritized. Reviewers should not upload manuscripts or excerpts to public generative AI

systems, as this risks breaching proprietary rights and data privacy (Elsevier, 2023; Mollaki, 2024).

Second, AI-written reviews should be prohibited; if any AI assistance is allowed, it must be limited to secure tools for minor language support and disclosed to the editor (Mollaki, 2024; Taylor & Francis, 2023). Third, reviewers should retain full responsibility for their judgments, independently verify any AI-assisted suggestions, and avoid relying on AI for methodological critique, originality assessment, or citation recommendations (Checco et al., 2021; Donker, 2023; Mollaki, 2024). Use of AI for screening or communication should be acknowledged in the review (Mollaki, 2024; Schulz et al., 2022).

Organizing and Communicating Feedback for Clarity and Impact

Effective peer reviews focus on the content, language, and tone of a manuscript, providing an objective and evidence-based perspective on the author's work and specific, actionable feedback with clear recommendations that the author can implement (Chong & Lin, 2024). The significance of articulating clear feedback lies in its inclusivity to support author growth at varied levels. Reviewers should keep the journal's guidelines and objectives in mind and connect their feedback to these expectations. For instance, within IJUDUDL, reviews should address relevance to Universal Design (UD) and Universal Design for Learning (UDL) and align with one of the journal's sections of Research, Best Practice, or Opinion (IJUDUDL, 2026). Additionally, reviewers should consider multiple reader perspectives as they examine each section of an article; this practice can yield more valuable information and help them view the manuscript objectively as critics (Brazeau et al., 2008). Reviewer comments should highlight both strengths and weaknesses, helping authors refine their work (Martin, 2008; Min, 2014).

It is not only about what reviewers say but also how they structure their comments. A professional, respectful tone enhances collaboration rather than conflict, and reviews that use such a tone tend to be more motivating for authors to improve their work (Chong & Lin, 2024; Spolarich & Wilder, 2015). A well-organized, systematic approach to review promotes consistency, transparency, and fairness by helping authors understand priorities and editors make publication decisions (Mohty & Melo, 2025). Reviewer feedback should integrate positive comments with critical recommendations for strengthening the scholarly work and be logically organized to enable authors and editors to prioritize revisions more effectively (Schultz, 2022; Spolarich & Wilder, 2015).

First, an overview statement can summarize a paper's overall contribution. Then, feedback should be organized by each paper section. Comments may include brief descriptions of the issues, explanations of their significance (e.g., whether they are major or minor changes), and recommendations for revision. It is helpful when specific page numbers and line items

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accompany suggested edits and feedback comments or when they are marked directly in the manuscript using Track Changes. If Track Changes are used, all markups and comments should be anonymized to maintain the integrity of the double-blind review process.

While there is typically no fixed number of comments required for a journal review, reviewers should exercise judgment to provide tactful, balanced, and actionable recommendations that address both major and minor concerns. When possible, reviewers are encouraged to conclude their comments with a summary paragraph that reinforces constructive intent, acknowledging strengths while guiding authors toward feasible revisions. Ending on a balanced, professional note strengthens collegial relationships and sustains a developmental spirit in the scholarly publishing process (Spolarich & Wilder, 2015).

Because reviewer comments often model academic writing, reviewers should attend to grammatical clarity and accuracy in their feedback. Well-written, precise comments not only improve understanding but also exemplify good scholarly communication (Spolarich & Wilder, 2015). Clear, objective, evidence-based feedback reflects the reviewer's mechanical skills, thoroughness, clarity, and efficiency and supports equitable evaluation (Chong & Lin, 2024). Table 2 summarizes the qualities of effective feedback.

Table 2

Qualities of Effective Feedback

Quality	Description
Balanced	Acknowledges strengths as well as needed improvements
Actionable	Offers specific recommendations that the author can implement
Respectful	Uses professional, collegial language that supports learning
Evidence-Based	Grounds observations in manuscript examples rather than opinion
Inclusive	Uses accessible language, clear structure, and sensitivity to diverse perspectives
Ethical	Maintains confidentiality, fairness, and transparency

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Multiple Means in Peer Review

UDL offers insights into ways that inclusivity and accessibility can be enhanced through strategic flexibility in the peer review process. Suggested recommendations are provided next for each of the three UDL principles.

Engagement

The review process can be approached as a collegial conversation, where reflection is encouraged, judgment is minimized, and constructive support is offered. Flexible schedules, tiered roles, and self-paced development pathways may foster motivation and sustained interest among reviewers. Offering such options can promote autonomy and accommodate diverse professional commitments, likely leading to more efficient and equitable feedback (Adler & Kletenik, 2025; CAST, 2024). A respectful and inclusive environment that values diverse perspectives can be cultivated, where dialogue and mentoring among reviewers support engagement and build community.

Feedback from review committees can serve as a mentoring role, helping reviewers recognize their strengths and areas for growth, thereby enhancing their sense of purpose and professional development. Equitable access to reviewer opportunities is also essential. Journals can recruit reviewers from underrepresented regions or institutions and offer onboarding support for early-career scholars or those with disabilities, ensuring inclusive participation in the review process.

Representation

To ensure clarity and accessibility in feedback, reviewers should avoid ambiguity and overly complex language. Various formats can convey meaning, such as visual elements, symbols, hyperlinks to relevant resources, and digital annotation tools like Track Changes, highlights, and comments. Review rubrics should be transparent and customized to specific manuscript types, incorporating criteria for clarity, accessibility, and inclusiveness. This supports alignment of reviewers and authors to the journal's expectations.

Reviewers should use clear, plain language that is respectful and bias-free. Unnecessary jargon should be avoided, and technical terms should be explained to support understanding across diverse audiences. Concrete examples can make feedback more actionable and relevant.

Action and Expression

Reviewer materials and platform interfaces should be accessible for individuals using assistive technologies. Reviewers should evaluate manuscripts with sensitivity to global

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contexts and encourage inclusive citations and examples. Multiple media for communication can be considered, such as written responses, annotated revisions, or audio/video explanations. This allows authors to express their ideas in culturally relevant ways and supports diverse scholarly voices.

Through a UDL-based approach, peer review can serve as a formative learning experience, enabling authors to benefit from scaffolded, actionable feedback that guides revision and growth. Likewise, reviewers can learn through reflection and dialogue, making the review process a reciprocal and developmental exchange. Providing opportunities for self-reflection and goal setting can help reviewers connect their work to broader scholarly impact. Table 3 synthesizes the preceding discussion into a practical reference guide for reviewers.

Table 3

UDL-Informed Peer Review Design Guide

Process Component	UDL-Informed Feature	Example in Practice	Intended Support
Feedback organization	Structured action and expression	Begin with a brief overview, then organize comments by section and label major versus minor issues.	Helps authors prioritize revisions and editors synthesize decisions.
Communication format	Multiple ways to communicate feedback	Use the review form, plus annotations, comments, or secure alternate formats when feasible and policy-aligned.	Makes feedback understandable and responsive.
Equity and inclusion checks	Bias-aware and culturally responsive reviewing	Use respectful language, explain jargon, consider global contexts, and notice whose voices and citations are centred.	Broadens participation and protects authors from avoidable bias.
Ethics and AI safeguards	Confidentiality, disclosure, and human accountability	Do not upload manuscripts to public AI tools; disclose any permitted assistance and keep final judgments reviewer-led.	Protects integrity, privacy, and trust in the review process.

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Conclusion

The role of a peer reviewer offers rewarding service experiences while contributing rigor and depth to academia. UDL not only supports the review process by offering valuable guidance for accessibility and equity, but peer review itself can also serve as a mechanism to enhance and uphold UDL principles.

UDL emphasizes inclusive language, cultural responsiveness, and equitable access to the review process, ultimately transforming peer review into a learning opportunity for both authors and reviewers. Reviewers should strive to provide clear, constructive feedback that enables diverse authors to engage meaningfully with the review process, improving their current work and benefiting them in future publications. Such a comprehensive and effective peer review embodies inclusive instructional feedback that supports authors as learners and contributes to the production of high-quality, accessible scholarship.

Realizing the potential of UDL-informed peer review requires intentional institutional and editorial commitment. Institutions can support reviewers by offering training that integrates accessibility practices, bias awareness, and guidance on delivering actionable, inclusive feedback. Journals and professional organizations can further embed UDL principles by revising reviewer rubrics, submission guidelines, and editorial policies to explicitly reflect UDL-informed standards. These structural changes signal a commitment to equitable reviewing practices and create the infrastructure needed to sustain a more inclusive review of culture. Collectively, such efforts transform peer review into a system that not only evaluates scholarship but also cultivates a publishing environment where diverse authors and knowledge forms are recognized, supported, and able to thrive. Figure 1 provides a visual summary for editorial teams of how UDL-informed practices can be embedded throughout the peer review workflow.

Several directions emerged for future research involving a UDL-connected peer review. First, future research could explore the appropriate language used in peer review. Reviewers adopting the specific language required in a review will help writers know what is needed and, in the long run, avoid the disappointments that follow the rejection of articles. Second, considering multimedia feedback would be more valuable than a single mode of feedback; therefore, future research can examine how multimodal peer review feedback—such as written, audio, or visual commentary—would benefit a writer. Another area could be evaluating the dialogue with a peer reviewer and how this can motivate the writer and promote inclusivity. Finally, future research could investigate professional development opportunities to improve feedback clarity and reduce bias among reviewers at all career stages. Such studies would examine the effectiveness of these programs and how they might advance equity and fairness in the peer review process.

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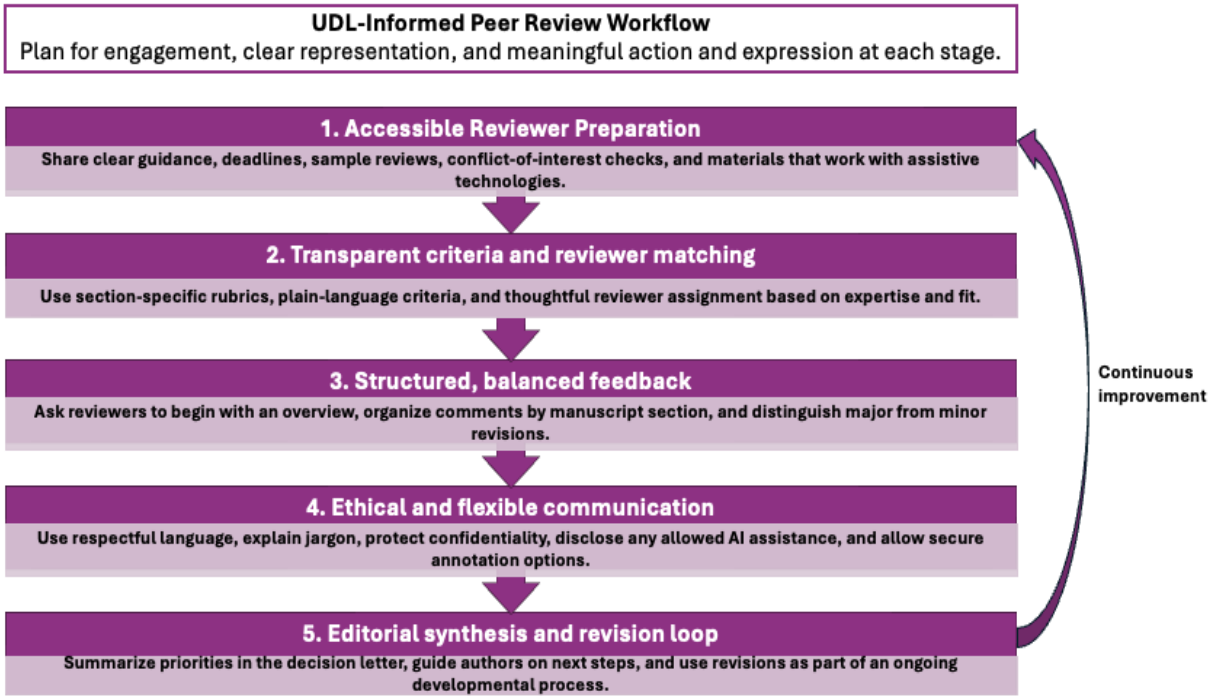
Figure 1

UDL-Informed Peer Review Workflow



The versatility of UDL creates meaningful opportunities to re-envision how review culture is approached and implemented. By shifting the focus away from narrow conventions of academic communication, UDL invites a more inclusive and flexible understanding of the diverse ways scholars produce and share knowledge. When reviewers apply UDL-informed methods such as emphasizing clarity, flexibility, and cultural responsiveness, they broaden participation in academic discourse and provide feedback that supports scholars from varied linguistic, methodological, and cultural backgrounds. In doing so, peer review evolves from a largely evaluative activity into a collaborative and pedagogical process that nurtures authors' growth and strengthens the accessibility and impact of scholarly work.

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