

'It's almost like talking to a person': Student disclosure to pedagogical agents in sensitive settings

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Abstract

It would seem that emerging communication technologies are disrupting and changing societal norms and conventions. The literature suggests central to making sense of the unique qualities of cyberspace are understandings of such social networks, veracity and the differences between online and offline behaviour. We propose that as pedagogical agents are seen to help support and even improve the level of interactive learning on a programme or course, it is essential that these societal norms and behaviours are considered within pedagogical agent learning situations. Pedagogical agents are characters on the computer screen with embodied life-like behaviours such as speech, emotions, locomotion, gestures, and movements of the head, the eye, or other parts of the body. This paper presents findings of a pilot study that used pedagogical agents to examine disclosure in educational settings. The study used responsive evaluation to explore how the use of pedagogical agents might affect students' truthfulness and disclosure by asking them to respond to a lifestyle choices survey delivered by a web-based pedagogical agent. The findings of this study suggest that 3 key issues are important; firstly the pedagogical appearance of the agent, secondly, the issue of choice and finally that of disclosure. Data also suggested that body language is critical to the learning effectiveness of pedagogical agents. The appearance of the pedagogical agent and the images it invoked, determined partially by students' ability to choose their own pedagogical agent, were found to play a role in students' willingness to disclose information. Qualitative findings from users also suggested that they may feel comfortable disclosing more sensitive information to pedagogical agents than to the interviewer. Our findings support the growing body of literature which suggests that the social environment of cyberspace is characterised by more open, straightforward and candid interpersonal communication, and that a pedagogical agent can support this. Findings indicate that emotional connection with pedagogical agents were intrinsic to the user's sense of trust and therefore likely to affect levels of truthfulness and engagement. The implications of this study are that truthfulness, personalisation and emotional engagement are all vital components in using pedagogical agents to enhance online learning.

Keywords

Pedagogical agents, engagement, disclosure, personalisation, pedagogy, learning

INTRODUCTION

In many ways it would seem that emerging communication technologies are disrupting and changing societal norms and conventions (Turkle, 2011). Whitty & Joinson (2009) have suggested that central to making sense of the unique qualities of cyberspace are understandings of such social networks and veracity. Furthermore, issues of online and offline behaviour bear further exploration as indicated by Bailenson et. al. (2008). We propose that as pedagogical agents are seen to help support and even improve the level of interactive learning on a programme or course (Kim & Wei, 2011), it is essential that these societal norms and behaviours are considered within pedagogical agent learning situations. Pedagogical agents are characters on the computer screen with embodied life-like behaviours such as speech, emotions, locomotion, gestures and movements of many parts of the body (Dehn & van Mulken, 2000). These technologies have been increasingly adopted and tested in educational settings, yet little is known about the ways in which they can be used effectively, and indeed whether they can provide additional value to learning experiences. Further, the research that has been undertaken has not yet drawn clear distinctions between application across disciplines and in difficult and sensitive settings (Heidig & Clarebout, 2011). Themes across the literature indicate that their use is under researched and under discussed in terms of the possibilities in higher education. For example, conversational

agents might be used in libraries as virtual assistants, as mobile campus guides or as mentors for students in clinical settings as a mobile app. The central argument of the paper is that truthfulness, personalisation, emotional engagement and immersion are all vital components in using pedagogical agents to enhance online learning, and it argues in particular that:

- Students' perception of the pedagogical agent, influence the amount of information they disclose
- Being able to customise the avatar affects students' ability to form an emotional connection with the chatbot and subsequently affects the perceived trustworthiness of the pedagogical agent

Literature review

Early work in the area of use of pedagogical agents was undertaken by Santos & Osorio (2004) who used Virtual Agents to assist users and help them navigate in and interact with the virtual environment in both e-commerce and distance learning contexts. Chittaro & Ranon (2000) have further considered adaptation in the context of e-commerce. The literature to date in this area indicates key foci, namely personalisation, emotional engagement, truthfulness, and immersion. There are studies on truthfulness, but relatively little in relation to this and the use of pedagogical agents. In terms of personalisation a number of studies have developed a set of personalization rules that exploits a model of the customer to adapt the virtual store, such as the display of products, as well as the navigation and different layouts of the store. Such techniques have also been applied to e-learning by introducing Adaptive EVE, an e-learning platform tailored to the knowledge level of the learners and to their preferred learning style (Chittaro & Ranon, 2008). However, other studies have reported personalisation difficulties (e.g. Garau et al., 2003 reported split-attention effects in which students experienced high cognitive load due to competing demands for their attention). This occurred when students felt a pedagogical agent's voice and appearance did not match and were therefore distracted from the learning activity at hand. Even though there are authors who do not advocate the use of an human-like agent instead of a simple chat-window (e.g. Shneiderman & Plaisant, 2004), there is a large research community attempting to implement believable and life-like digital agents as user interfaces with capabilities like gaze or gestures (e.g. André and Rist, 1996). Such research focuses on the impact of personalisation factors such as appearance (Dunsworth & Atkinson, 2007), dialogue (Veletsianos, 2009), competency (Kim, 2007), and self-awareness (Ijaz et al., 2011). In relation to personalisation it would seem, that a lack of a perceived realism can affect students' willingness to engage with the pedagogical agent, thus it would seem that sound technical development is key to the effectiveness of these technologies in educational settings. Furthermore, through personalisation (e.g. changing the gender, ethnicity or voice of the pedagogical agent) the user is can tailor the experience their own requirements and consequently helping the user increase their emotional engagement with the pedagogical agent. The concepts of emotional engagement, trustworthiness and personalisation are highly related and impact on the responses given by individuals to pedagogical agents. Emotional engagement refers to the extent to which there exists a personal connection with the pedagogical agent, and whether such a connection (or lack of it) influences the quality and length of responses. Evidence has shown that many users are not only comfortable interacting with high-quality pedagogical agents, but that an emotional connection can be developed between users and pedagogical agents, resulting in a more positive engagement experience. These findings should be considered in relation to the work of Lessler & O-Reilly (1997), who, amongst others, have found that self-administered surveys can yield more truthful responses than interview methods and that this is particularly so when respondents are reporting on sensitive, personal or intricate information. Hasler et al. (2013) found, in a comparison of human interviewees with virtual world chatbots (pedagogical agents in non-learning situations), that chatbots and human interviewees were equally successful in collecting information about their participants' real live backgrounds. The perceived trustworthiness of the pedagogical agent could have an effect on the truthfulness of the responses given by users. Pedagogical agents, as neither human interviewees nor text-based surveys, therefore pose an interesting opportunity for the educator seeking to facilitate student discussion of sensitive topics. The disclosure of information, especially of sensitive information, requires the formation of a trust relationship (Wheless & Grotz, 1977). Corritore et al. (2003) propose that websites can be the objects of trust, in which trust is 'an attitude of confident expectation that one's vulnerabilities will not be exploited' (2003:70). For them, the concepts of risk, vulnerability, expectation, confidence and exploitation play a key role in information disclosure in an online environment and impact on potential learning applications. It would appear that such findings can also be applied to pedagogical agent situations. This emotional connection has been found to be one of the strongest determinants of a user's experience, triggering unconscious responses to a system, environment or interface (Éthier et al., 2008). Captivating a user's attention can induce a sense of immersion or presence (Robertson, Czerwinski & van Dantzich, 1997). This is a complex concept related to the physical senses and mental processes of the user, the required tasks within the environment and the types of interaction and technology involved (Pausch et al., 1997). This engagement of the student in the learning

experience is argued to focus and improve learning (Kang et al., 2008). Dede (1995) suggests that within learning environments, immersion can be created through the capacity to execute actions, through symbology and semantic associations, and through physical and sensory provision. Mental and emotional immersion has to be considered independent from visual or perceptual immersion (Robertson et al., 1997). The concept of immersion is closely related to that of social presence, in which users might feel 'present' in an interaction with a pedagogical agent. This experience is seen to be critical to the effectiveness of learning with a pedagogical agent, and occurs when a user is immersed in the interaction (Kim & Baylor, 2006). The central argument of the paper is that truthfulness, personalisation, emotional engagement and immersion are all vital components in using pedagogical agents to enhance online learning. This paper reports on the findings from a preliminary study of pedagogical agent use in educational settings, designed to consider student reactions to pedagogical agents in sensitive and research-focused settings. Students were asked to respond to a web-based lifestyle values and choices survey delivered by a pedagogical agent on topics of medium levels of sensitivity. These topics were: finances, plagiarism, alcohol, drugs and sexual health. The intent of the study was to evaluate the potential influence of a pedagogical agent in affecting a person's reactions and responses with regards to truthfulness, disclosure and personal engagement, and to use these findings to consider its application in and beyond educational contexts. We suggest that any findings are particularly relevant to disciplines of a sensitive nature, such as healthcare.

RESEARCH METHODOLOGY

In order to explore the influence of a pedagogical agent on students' responses, a mixed-methods approach was used. Quantitative data was gathered to assess differences in the amount of information provided to the pedagogical agent compared to a human interviewer, while qualitative data from interviews sought to explore how responses were influenced by perceptions of the pedagogical agent. This study adopted an evaluation approach. Evaluation has been used to study an organisation or curriculum in such a way as to contribute to a review of policy and/or decision making within the organisation. In this mixed-methods study, we adopt Stake's (1983) responsive evaluation methodology, a pragmatic approach in which attention is given to the information and issues that those involved in the evaluation want to know about and the questions to which they want answers. Therefore evaluation here is undertaken in relation to specific situations, contexts and questions.

Research Questions

The study sought to explore the following objectives:

- How do pedagogical agent appearances affect student perceptions?
- To what extent do students prefer and respond to different styles of pedagogical agent?
- How much information are users happy to disclose when engaging with the pedagogical agent?
- To what extent might pedagogical agents influence or affect a person's reactions and responses with regards to truthfulness, disclosure and personal engagement?

Data Collection and Analysis

Twelve students (m = 4; f = 8, both postgraduate and undergraduate) were recruited to participate in the research section of this project. Data were collected through the following methods:

- Online questionnaire with an interactive pedagogical agent; students were asked questions on sensitive issues including drugs and alcohol (coded data were subjected to non-parametric quantitative analysis).
- Face-to-face interview on the topic of the student's experience of using the interactive pedagogical agent (average 30 mins). The interview was audio recorded and transcribed for data analysis purposes. Analysis was through an interpretive approach (Denzin, 1989) which illustrated findings from the quantitative data and provided further insight into the themes of truthfulness, personalisation and emotional engagement.

The questionnaire also provided a testing phase and a means through which to facilitate student-pedagogical agent interaction, providing impetus for the interview process. Interviews explored students' experiences of engaging with the pedagogical agent and focused specifically upon the research objectives identified above.

RESULTS

Quantitative

The student responses obtained when they were interviewed by the pedagogical agent were coded to reveal how many idea units were included in their responses. Students' answers to the four substantive questions under each of the five topic areas (finances, plagiarism, sexual health, drugs and alcohol) were included in this analysis. For comparison purposes, the students' answers to three questions from the post-pedagogical agent interview were also coded for idea units.

1) *Were there gender differences in the quality of the students' disclosure to the pedagogical agent?*

The overall number of idea units given in answers appeared to be higher for male respondents (Mdn = 56) compared to female respondents (Mdn = 44). However, this pattern failed to reach statistical significance due to the limited sample used in this pilot study ($U = 7.5, p = 0.148, d = 0.918$). Although males appeared to give more detailed answers to the questions on drug use, finance and cheating (see Figure 1); the gender differences in the number of idea units across the categories was not statistically significant.

2) *Was there greater disclosure on some topics than others?*

There was evidence of significantly different levels of disclosure across the topics ($X^2 = 17.171, p = 0.002$), and this effect was attributable to significantly more detailed responses to the topic of cheating compared to that of sexual behaviour. As was observed in Figure 1, the responses to the questions on sexual behaviour were the most limited.

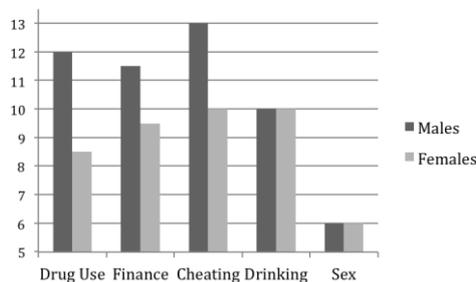


Figure 1: Median number of idea units disclosed in responses to the pedagogical agent, by question topic.

3) *Were there differences in disclosure levels between students who stated that they had been more truthful in their responses to the pedagogical agent than they would have been to an interviewer, and respondents who stated that their truthfulness would be unaffected by the format of questioning?*

When the two groups of participants were compared (more truthful vs same level of honesty) on the quantity of information produced in their responses to the two interview formats, an interesting pattern is revealed (see Figure. 2). As can be seen, there was no difference across interview formats in the number of idea units produced by the group who believed they were more truthful when they interacted with the pedagogical agent ($Z = -1.572, p = 0.116, d = 1.019$). However, the group who believed that their truthfulness was not influenced by the interviewer type produced significantly more detailed responses when they interacted with the interviewer than when they interacted with the pedagogical agent ($Z = -2.023, p = 0.043, d = 1.439$). It is important not to conflate detailed answers with truthful answers, but it would seem that for these respondents interacting with a human interviewer resulted in more detailed interaction. Conversely, it might be expected that the 'more truthful to the pedagogical agent' group to have given more detailed responses to the pedagogical agent than to the human interviewer. Of course, the interviewer was asking more general questions than the pedagogical agent was, and so this may be a contributory factor.

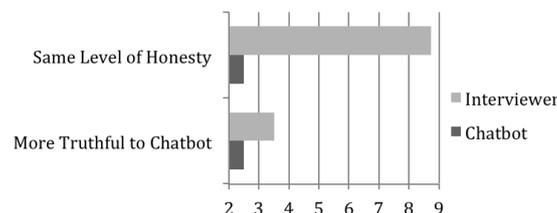


Figure 2: Students' levels of disclosure to questions, by 'truthfulness' groups.

Whilst quantitative findings in this study were not statistically significant levels due to the size of the sample, preliminary findings suggested that there may be a tendency for males to disclose more information in sensitive

settings than females. This is supported by prior work in this area (e.g. Kays et al., 2012). It also revealed, as suggested, that levels of disclosure differ across topics of conversation and are informed by the relative sensitivity of the topic, and that these translate into pedagogical agent platforms. Although cross-platform levels of disclosure are informed by the topic of discussion at hand, the pattern identified in Figure 2 warrants further investigation. It also suggested a need to perhaps include a 'socially desirable responding' measure to future studies in this area, to allow us to unpick 'truthfulness' and 'detailed responding' more precisely in relation to these data. The qualitative findings emergent from the interviews in this study allow us to further explore issues of truthfulness and how these are shaped by pedagogical agent personalization and personal engagement.

Qualitative

In total 3 themes were identified which were truthfulness, emotional engagement and personalisation.

1) Truthfulness

Students oriented their discussions of truth and truthfulness around the realism of the pedagogical agent. This referred specifically to how participants typically responded in correspondent face-to-face situations, and notions of judgement and acceptance. For some participants, their awareness that the pedagogical agent was not real encouraged a sense of disinhibition in which participants felt emboldened to share answers to sensitive questions without fear or awkwardness. For example, Rose commented:

If you do it with a real person then you might feel a bit scared and awkward. So it's more personal but not so personal that you feel a bit awkward. I think if you were talking to a person and they were asking those questions you would feel really embarrassed and you wouldn't want to, you wouldn't want to tell the truth. (Rose, undergraduate student)

Here, the pedagogical agent was positioned between two points of comparison – an online survey, and a face-to-face interview. The pedagogical agent was seen to provide an additional level of personalisation but was still separate from the embodied interaction between two individuals. The lack of realism of the pedagogical agent thus provided a safe space within which the student felt empowered to share truthful answers. Conversely, for others, the physical manifestation of the pedagogical agent, and its visual realness in comparison to an online survey, encouraged them to share the truth:

And I think one of the questions in it was whether it made me sort of more truthful? And I think that it does because you feel a bit guiltier, because it's almost like talking to a person. (Alice, undergraduate student)

Alice, above, saw the pedagogical agent as being almost like a person, and so the emotions she expects to feel are similar to those in face-to-face interactions. Thus truthfulness was seen to be essential, or at least preferred, when interacting with the pedagogical agent; in comparison to truthfulness and potential judgement being of little consequence. These findings closely related to the concepts of immersion and social presence, which are seen to be essential to learning using pedagogical agents (Kim & Baylor, 2006). This sense of presence can be social, cognitive, or emotional, and would seem to be vital in the development of realistic engagement with pedagogical agents, thereby enhancing and improving disclosure. This absorption and engagement is argued to focus and improve learning (Kang et al., 2008) and therefore would seem to be central to understanding the ways in which disclosure can be improved in the use of pedagogical agents. It is notable that those participants experiencing a greater sense of social presence with the pedagogical agent did not suggest experiencing feelings of judgement when disclosing sensitive information. Whilst for some students the interaction with a pedagogical agent invoked emotional responses, these did not parallel expected emotional responses when engaging in face-to-face interactions. The following theme explores this in more detail.

2) Emotional Engagement

Students spoke of emotional engagement through their sense of personal connection to the pedagogical agent. The findings from this theme suggest that the greater the emotional engagement, the more positive the experience was. Students argued that they felt a sense of being in a panoptical space: the feeling of someone 'listening' or 'being there'.

It felt, I don't know, maybe the fact that someone was there in a sense, you felt a bit more, oh okay someone's listening, sort of thing, than when it's a questionnaire it's like oh no one will really read this. (Sally, undergraduate student)

For Sally, the pedagogical agent was seen as a ‘someone’ who was able to take in and listen to information, and paid attention to her thoughts and opinions. For others, there was also a sense that there was a lack of emotional connection with the pedagogical agent, a belief that it was not ‘taking in’ their answers:

And it felt a little impersonal at times because you know you move from one topic to another topic, very separate topics, and it was almost like, you don’t care what I’m telling you do you?
(Claire, undergraduate student)

Here, the pedagogical agent was seen to be ‘listening’, and when its responses did not confirm to the expected norms, she was disappointed. The pedagogical agent’s inability to formulate responses based on Claire’s dialogue was interpreted as not caring about what she has to say. In this sense, typical conversational norms are anticipated and imposed upon the pedagogical agent. When it failed to fulfil them, the pedagogical agent was not seen as a technology but rather a conversational partner with a lack of investment in the engagement. Alternatively, for others these characteristics helped imbue the pedagogical agent with person-like qualities such as impatience. The theme of emotional engagement highlights the individuality of student responses to interaction with the pedagogical agent. It also emphasises that in situations where the student seemed to experience immersion and presence in the engagement, that the ability of the pedagogical agent to interact could both improve and detract from their emotional engagement in the interaction. This sense of emotional engagement could be improved through personalisation, which is explored in the following theme.

3) *Personalisation*

The use of personalisation here focused on using pedagogical agent technology to accommodate the differences between individuals and provoke and encourage choice. Here, there were a wide range of responses in terms of engaging with the pedagogical agent in relation to body language and voice. One student felt somewhat disarmed due to the body language of the pedagogical agent not matching up with the tone of the question, and offense at certain phrasing.

It made me slightly nervous. And I actually felt pressured to answer quicker. I thought well yes, I wanted to be truthful, but I actually wanted to think about the question, and wanted to answer it with a bit of a reflection. I thought these questions were really getting, you know, they were quite personal, and that is not something I would like to answer on a surface, so I had a feeling that they were in a way deep questions but the body language was like, yeah, come on, next question. (Pam, postgraduate student)

Pam’s engagement with the pedagogical agent as a conversational partner challenged her ability to respond to the questions in what she considered to be an adequate time period. Like Claire in the previous theme, she struggled with the technical characteristics of the pedagogical agent and specifically the sense that its body language invoked. By not displaying characteristics such as leaning forward or demonstrating investment, instead waiting for her response, the pedagogical agent suggested a sense of impatience which she found troublesome. Students also valued the opportunity to make choices about who they spoke to. For example, some students chose a particular face according to approachability or friendliness.

I find it easier talking to women, so I looked through the women, and the person, she looked like a newsreader, a correspondent. (Colin, undergraduate student)

Colin, whilst choosing a gender he would typically speak to, focused specifically on the impression the pedagogical assistant gave. A newsreader might invoke a sense of professionalism, authority and, potentially – referring to the first theme of this study – of trustworthiness. As seen in this theme, different learners have different characteristics, preferences, prior knowledge, skills and competences, motivation or needs, which may influence their learning process and experience and engagement with the pedagogical agent. Students’ emotional engagement in the interaction, and willingness to disclose truthful information, were thus informed by their ability to personalise their pedagogical agent.

Discussion

The findings of this study suggest that 3 key issues are important; firstly the pedagogical appearance of the agent, secondly, the issue of choice and finally that of disclosure. The appearance of the pedagogical agent and the images it invoked, determined partially by students’ ability to choose their own pedagogical agent, were

found to play a role in students' willingness to disclose information. As Clark & Mayer (2008) discussed, the realism of anthropomorphic pedagogical agents can play a key role in determining student perspectives of the pedagogical agent experience. Yet situations in which the realism of the pedagogical agent was felt to be compromised could result in entirely different reactions for the students. For some, it resulted in split-attention effect (Garau et al., 2003) in which the student struggled to focus on interaction. For others, the effect of body language was integrated into the experience. In this circumstance, the realism of the pedagogical agent was perceived to be strong enough to counter split-attention effect despite its body language. These findings support those of Woo (2009), which suggests that body language is critical to the learning effectiveness of pedagogical agents. Whilst it may not always result in split-attention effect, as in face to-face interactions, it is critical for assuring student openness and ability to engage comfortably in the interaction. These findings would also support those of Heidig & Clarebout (2011), who suggest that choice plays a key role in determining student reactions to pedagogical agents. This relates to the fact that student preference differs and, as of yet, has proven difficult to predict. It would seem that a variety of genders and ethnicities is particularly important for emotional engagement with the pedagogical agent. What seems to be particularly important is the context within which the pedagogical agent is placed. In this study students preferred friendly, approachable pedagogical agents. It is important to highlight that these roles are often specific to the context, discipline and indeed to individual modules, and thus adaptivity of the system is essential. Qualitative findings from users also suggested that they may feel comfortable disclosing more sensitive information to pedagogical agents than to the interviewer. Such findings support those of Barak & Gluck-Ofri (2007), who suggest that the social environment of cyberspace is characterised by more open, straightforward and candid interpersonal communication, and that a pedagogical agent can support this. This pattern of communication has been explained through disinhibition effects (Joinson, 1998) which are theorised to arise through deindividuation (Postmes, Spear & Lea, 2000) or the emergence of 'true self' (Bargh, McKenna & Fitzsimons, 2002). Quantitative findings in this study revealed that users disclosed more information in the interview than in the pedagogical agent interaction. However, whilst the pedagogical agent asked sensitive questions – as noted in the qualitative findings – the topic of discussion with the interviewer was more generic and thus students may have experienced less discomfort. Based upon the findings from this pilot study, six key implications have been identified:

- The adaptivity of the system and emotional connection to the pedagogical agent are intrinsic to the student's belief that they can trust and therefore be more truthful. By capitalising on an understanding of user emotions there is an opportunity to enhance the level of individual connection with the learning environment and the sense of immersion offered.
- The amount of information divulged was dependent on how well the participant engaged with the pedagogical agent. For example one student wanted to divulge more information but felt rushed by the pedagogical agent body language and movements. Another did not divulge as much information as he did in a paper questionnaire due to associating the pedagogical agent with having a real conversation and 'boring' it with talking too much.
- An emotional design philosophy will ensure the psychosocial features of the environments as well as physical and cognitive requirements. This emotional connection with the pedagogical agents would seem to heighten the sense of immersion and therefore it is argued, the disclosure potential.
- Learning and engagement using pedagogical agents provides opportunities for displaying, testing and responding to the emotions of self and others in a safe and non-threatening environment. This can be either subject specific emotional skills (for example empathy) or non-subject specific in the general sense of emotional intelligence.
- Despite the sense that when asked directly students did not feel pedagogical agents encouraged them to be more honest in reality, when questioned on particular aspects of interaction, they did in fact disclose more to pedagogical agents than they believed they had. This would seem to imply pedagogical agents encourage more disclosure than the student themselves believes they have disclosed.
- It is important not to conflate detailed answers with truthful answers. It might be expected that the 'more truthful to the pedagogical agent' group to have given more detailed answers to the agent than the interviewer. However, this pattern warrants further investigation.

Alongside the findings presented above, this study has also identified areas which deserve further consideration in future research; the authors are presently working on a large-scale research project designed to build upon these findings. As pedagogical agent technologies are increasingly integrated into commercial and educational arenas, it seems likely that they will transfer to mobile as well as blended learning settings. It is suggested, therefore, that such applications require both pedagogical nuance and further research into the ways in student perceptions of pedagogical agents are informed by the context within which they interact.

References

- André, E., & T. Rist. (1996). Coping with temporal constraints in multimedia presentation planning. In Clancey, B., & Weld, D. (Eds.) *Proceedings of the Thirteenth National Conference on Artificial Intelligence* (pp.142-147). Oregon: AAAI Press.
- Bailenson, J. N., Yee, N., Blascovich, J., & Guadagno, R. E. (2008). Transformed social interaction in mediated interpersonal communication. In E. Konjin, M., Tanis, S. Utz, & A. Linden (Eds), *Mediated Interpersonal Communication* (pp. 77-99). Mahwah, NJ: Lawrence Erlbaum Associates.
- Barak, A., & Gluck-Ofri, O. (2007) Degree and reciprocity of self-disclosure in online forms. *Cybersychology & Behavior*, 10 (3), 407-17.
- Bargh J.A., McKenna K.Y.A., & Fitzsimons G.M. (2002). Can you see the real me? Activation and expression of the 'true self' on the Internet. *Journal of Social Issues*, 58(1), 33-48.
- Chittaro, L. & Ranon, R. (2000). Adding Adaptive Features to Virtual Reality Interfaces for E-Commerce. In P. Brusilovsky, O. Stock, & C. Strapparava (Eds), *Proceedings of AH-2000: International Conference on Adaptive Hypermedia and Adaptive Web-based Systems* (pp. 86-97). Berlin: Springer-Verlag.
- Chittaro, L. & Ranon, R. (2008). An Adaptive 3D Virtual Environment for Learning the X3D Language. In S. Staab (Ed.), *Proceedings of the 13th International Conference on Intelligent User Interfaces* (pp. 419-420). New York: ACM Press.
- Clark, R. & Mayer, R. E. (2008). *E-learning and the science of instruction*. San Francisco: Jossey-Bass.
- Corritore, C., L., Kracher, B., & Wiedenbeck, S. (2003) On-line trust: concepts, evolving themes, a model. *International Journal of Human-Computer Studies*, 58, 737-758.
- Dede, C. (1995). The evolution of constructivist learning environments: Immersion in distributed, virtual worlds. *Educational Technology*, 35(5), 46-52.
- Dehn, D., M., & van Mulken, S. (2000) The impact of animated interface agents: A review of empirical research. *International Journal of Human-Computer Studies*, 51, 1-22.
- Denzin, N. (1989). *Interpretative biography*. London: Sage.
- Dunsworth, Q., & Atkinson, R., K. (2007) Fostering multimedia learning of science: Exploring the role of an animated agent's image. *Computers and Education*, 49, 677-690.
- Éthier, J., Hadaya, P., Talbot, J., & Cadioux, J. (2008). Interface design and emotions experienced on B2C Web sites: Empirical testing of a research model. *Computers in Human Behavior*, 24(6), 2771-2791.
- Garau, M., Slater, M., Vinayagamoorthy, V., Brogni, A., Steed, A., & Sasse, M. A. (2003). The impact of avatar realism and eye gaze control on perceived quality of communication in a shared immersive virtual environment. In G. Cockton & P.
- Hasler, B. S., Tuchman, P., & Friedman, D. (2013) Virtual research assistants: Replacing human interviewers by automated avatars in virtual worlds. *Computers in Human Behavior*, 29, 1608-1616.
- Heidig, S., & Clarebout, G. (2011) Do pedagogical agents make a difference to student motivation and learning? *Educational Research Review*, 6, 27-54.
- Ijaz, K., Bogdanovych, A., & Simoff, S. (2011). Enhancing the believability of embodied conversational agents through environment-, self- and interaction-awareness. In M. Reynold (Ed.) *Proceedings of the Thirty-Fourth Australian Computer Science Conference*.
- Joinson, A. N. (1998). Causes and implications of disinhibited behavior on the Net. In J. Gackenbach (Ed.). *Psychology of the Internet* (pp. 43-60). New York: Academic Press.
- Kang, M., Kim, J., & Park, M. (2008). Investigating Presence as a Predictor of Learning Outcomes in E-learning Environment. In J. Luca & E. Weippl (Eds) *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications* (pp. 4175-4180). Chesapeake, VA: AACE.
- Kays, K., Gathercoal, K., & Buhrow, W. (2012). Does survey format influence self-disclosure on sensitive question items? *Computers in Human Behavior*, 28(1), 251-256.
- Kim, Y. (2007) Desirable characteristics of learning companions. *International Journal of Artificial Intelligence in Education*, 17(4), 371-388.
- Kim, Y., & Baylor, A. (2006). A socio-cognitive framework for pedagogical agents as learning companions. *ETR&D* 54(6), 569-596.
- Kim, Y., & Wei, Q. (2011). The impact of learner attributes and learner choice in an agent-based environment. *Computers & Education*, 56, 505-514.
- Lessler, J.T., & O'Reilly, J.M. (1997). Mode of interview and reporting of sensitive issues: design and implementation of audio computer assisted self-interviewing. In L. Harrison, & A. Hughes (Eds) *The Validity of Self-Reported Drug Use: Improving the Accuracy of Survey Estimates* (pp. 366-82). Rockville, MD: National Institute of Drug Abuse.
- Pausch, R. Proffitt, D., & Williams, G. (1997) Quantifying Immersion in Virtual Reality. In G. S. Owen, T. Whitted & B. Mones-Hattal (Eds).