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Pet Avatars, Performance Visualization, and Social Presence

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Lack of social presence is one of the many challenges that online education is facing right now in spite of its numerous benefits and growing popularity. While different strategies, primarily behavioral- or cognitive-based, have been proposed and adopted to improve online social presence, affect-based intervention remains a novel approach to increasing learners' experience of connectedness. The Social Performance Optimization Tool (SPOT) is a university-funded, web-based interactive environment in which students interact with classmates through animated dog avatars that reflect their learning performance health and emotional states. This paper reports on an early, exploratory stage of research study wherein the SPOT users' experiences of social presence are explored through interviews. Tu and McIsaac's (2002) framework for social presence was used to analyze three dimensions of social presence: social context, online communication, and interactivity. Findings suggest that the SPOT personalizes the learning environment and helps learners feel more connected.

Keywords: online education, social presence, affect-based interventions, performance visualization, pet avatars

INTRODUCTION

Online learning is currently growing exponentially in many sectors, including K-12, higher education, and corporate training settings (Barbour, 2013; Berge, 2013; Clark, 2013; Moore & Kearsley, 2012; Seaman, Allen, & Seaman, 2018). In some cases, it is outpacing the growth of face-to-face instruction (Seaman, Allen, & Seaman, 2018). Online learning provides many advantages, including temporal and spatial flexibility—allowing learners to study at different times and from different places. Online learning can also offer greater demographic diversity, where those of different ages, backgrounds, and nationalities can learn in the same online space. For example, The Open University of the UK has an enrollment of more than 200,000 international students from all over the world, with

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20,000 students graduating every year (Moore & Kearsley, 2005). While some models of online learning are synchronous and require learners to be online at the same time, much of online learning is asynchronous (Legon & Garrett, 2018). In the asynchronous model, learners are able to access content (e.g., watch instructional videos and instructor's notes) and activities (e.g., submit assignments, participate in group discussions) at their convenience, affording them a more personalized learning experience (Ally, 2008).

ONLINE LEARNING AND SOCIAL PRESENCE

In addition to the documented growth and significant advantages of online learning, there are important challenges that need to be addressed. Due to the largely asynchronous nature, wherein online learners are often not interacting with other learners at the same time and location, one consistent problem is a sense of isolation and a lack of social presence (Lowenthal & Dennen, 2017). According to Shaw & Polovina (1999), social isolation among online learners is "well-documented" and a detrimental factor for the high dropout rates in online courses. Social presence was initially defined as a "degree of salience of the other person in the (mediated) interaction and the consequent salience of the interpersonal relationships" (Short, Williams, & Christie, 1976, p 65). In an online learning context, social presence has been discussed in terms of emotional expression, community development, and group cohesion (Garrison, Anderson, & Archer, 2000) as well as the degree to which learners perceive others as "real" people (Gunawardena & Zittle, 1997).

Social presence is a widely studied concept in the context of online learning, and a meta-analysis shows that it correlates positively with student satisfaction and perceived learning (Richardson, Maeda, Lv, & Caskurlu, 2017). Social presence has also been correlated with online retention (Liu, Gomez, & Yen, 2009). According to a study of persistence and retention data from over 28,000 online bachelor and associate degree-seeking students between the age of 18 and 62, indicators of social presence, such as affective expression and immediacy, significantly predict whether or not students re-enroll in online learning in the following semester (Boston et al., 2009).

Learning occurs in a socio-cultural constructed community. Online learning environments often fail to offer a plethora of opportunities for students to participate in learning communities (Cross, 1998; McClure, 2007). Therefore, it can be harder to establish social presence in online courses than in traditional ones because students are not provided enough opportunities to interact informally and establish meaningful connections (Stodel, Thompson, & MacDonald, 2006). For instance, Stodel, Thompson, and MacDonald (2006) found that for online students, "the bond with other learners was not as strong as it would have been in a face-to-face class, where learners are likely to meet after class to go for coffee or walk together to their cars or the bus stop and talk about life" (p. 13). In a study comparing learners' experience of social presence in a face-to-face course to an online course, the researchers found that face-to-face students experienced significantly greater social presence than their online counterparts (Zhan & Mei, 2013).

Researchers have also identified strategies to enhance social presence in online learning such as small group discussions (Akcaoglu & Lee, 2016) and the use of emoticons (Dunlap et al., 2016). Additionally, we know from the widespread adoption of social media across age groups that it is possible to have authentic and meaningful experiences of others as "real" people in spite of the asynchronous nature of much social media interaction. One investigation theorized that images offered greater ability to enhance social presence than text alone and found that the use of image-based social media (e.g. Snapchat, Instagram) had the potential to reduce loneliness and increase happiness in contrast to the use of text-based platforms (e.g., Twitter, Reddit) (Pittman & Reich, 2016).

PET AVATARS, AFFECTIVE CONNECTIONS, AND SOCIAL PRESENCE

Another important line of research considers how affective states impact learning (Kort et al., 2001; Craig et al., 2004) and has found that visualized, community learning spaces improve interactions (Grevet, Mankoff, & Anderson, 2010). Additionally, leveraging the emotional connection people feel for pets and their well-being has shown to be successful in building community. Mamykina et al. (2006) developed a mobile application to help obese people as a group to achieve their daily step goals through a growing "companion fish." The result of their research showed the effectiveness of adopting similar group-based performance visualization strategies in motivating people. In addition, Rodrigo et al. (2012) developed an intelligent tutor avatar to help K-12 students to improve learning outcomes and learning experiences.

Social presence has shown to be tied to emotional and affective connections. Some emerging research has indicated that the use of affective connections, such as animations and performance visualizations, predicts stronger learning communities. Grevet, Mankoff, & Anderson (2010) utilized visual representations to encourage sustainable behavior. They built a platform that displayed an image of a college dorm room that became cleaner as more energy was conserved. Forty-one participants were divided into two groups: an experimental and a control group. They found that participants tended to interact with others more through the visual representations and were more aware of energy consumption problems in comparison to the controlled group. In addition, Liao et al. (2011) explored how ownership of a "virtual pet" impacted learners' practice of math problems. They used a virtual pet dog as the learner's pet and outfitted the virtual dog with different attire to represent how well learners solved math problems. Their results demonstrated that the strategy increased the learners' engagement with the learning activities.

DEVELOPMENT OF THE SOCIAL PERFORMANCE OPTIMIZATION TOOL (SPOT)

To address the documented challenges with and importance of social presence in online learning, combined with emerging research showing the potential of affect-based performance representation for social presence and motivation, we designed and developed a tool called the Social Performance Optimization Tool (SPOT) to allow students to view their performance states, as well as those of their anonymized classmates, through the health and emotional states of their animated pet dog avatar. See Figure 1 for all emotional and health states of the dog avatar.

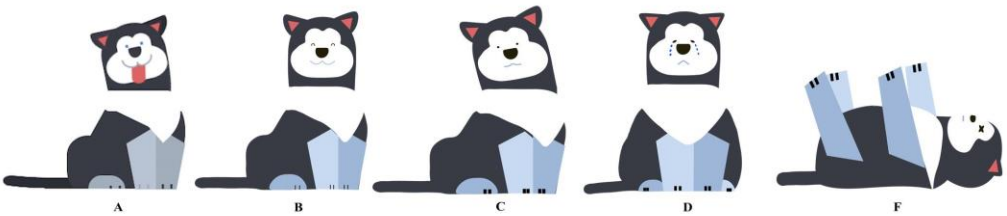

Figure 1. Emotional State of the pet dog Avatar (Each emotional/healthy state represents a grade from grade A to grade F)

Currently, SPOT is a standalone online tool that provides performance visualization, including a roster that lists the self-selected avatar names of participating students, a discussion forum where students can ask classmates questions, and instant messaging where learners can send private chat messages to each other. One area that has been

identified as a barrier to meaningful learning exchanges is the design of the discussion forum interface itself (Gao et al., 2013) and SPOT has been designed to be a more inviting community space. In addition, a learner can "raise her paw" (see Figure 2 for an overview of the SPOT functionality) to ask for help from others. In contrast to the standard learning management system performance dashboard that provides numeric or letter grades, SPOT represents each learner's performance in a visualized manner relying on affective states. SPOT was created, in part as a retention intervention to improve learners' experiences in their online courses by increasing both social presence and authentic engagement within a learning community as well as individual motivation through its gamified elements.

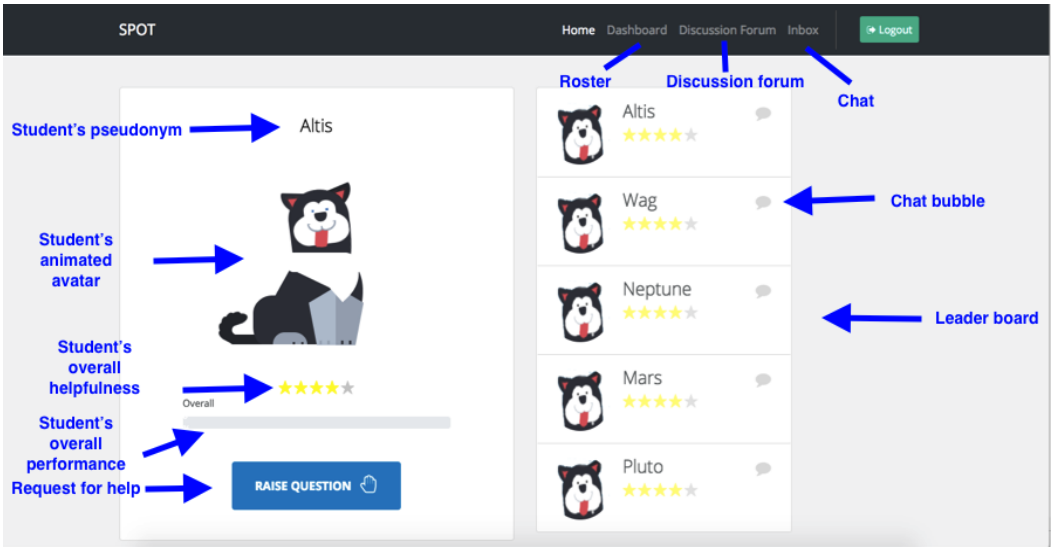

Figure 2. Annotation of the SPOT Homepage

Early research was conducted on the SPOT design and functionality to evaluate students' perceptions of the SPOT interface in terms of its visual displays of performance, motivation, and potential influence on peer-to-peer interaction (under review). Thematic analysis (Braun & Clarke, 2006) of the 57 participant responses suggests that our approach of representing learner achievement data in an attractive, informative, and dynamic manner, within the SPOT interface, has the potential to improve the online learning experience and increase social presence.

While SPOT was created to improve both motivation and social presence, this paper focuses specifically on the social presence aspect and reports a qualitative case study in which learners were interviewed to investigate their experiences of social presence in SPOT.

THEORETICAL FRAMEWORK

Since the 1970s, there has been a natural evolution of definitions and ways to operationalize and measure social presence (Richardson et al., 2017). For example, there are multiple quantitative survey instruments for measuring learners' experiences of social presence (Biocca, Harms, & Gregg, 2001; Kang et al., 2009; Wise et al., 2004).

As discussed in the introduction, multiple scholars have considered social presence through multiple dimensions, and many definitions have evolved from Short, Williams, and Christie's (1976) early articulation. A point of consensus across all of the definitions of social presence (e.g., Short et al., Gunawardena & Zittle, 1997; Garrison, Anderson, &

Archer, 1999; Shea, PIcket, & Pelz, 2003; Swan, Richardson, & Garrison, 2009) is that it entails the "ability to perceive others in an online environment" (Richardson, et al., 2017). Notably, as the concept of social presence has been explored both empirically and theoretically, later definitions address the learners' feelings of connections with others and the larger learning community. Earlier definitions focus more specifically on the experience of others as "real" (e.g., Gunawaradena & Zittle, 1997). In the more narrow definition, theoretically a learner could experience others in the learning community as "real," and hence experience social presence, without necessarily feeling any affective or emotional connection to those "real" others.

Tu & MsIsaac (2002) also identified three specific dimensions of social presence in online spaces: social context, online communication, and interactivity. Social context describes the specific social environment in which students are interacting including things like task topics, privacy, and social processes; online communication relates to the language and terminology used throughout the interactions; and, lastly, interactivity refers to how learners engage in the conversation and what communication styles each learner uses.

Given that SPOT was developed, in part, to enable a stronger learning community in which students feel affectively connected to each other (and as a result are comfortable both offering and receiving peer support), this study relies on Tu and McIsaac's (2002) conceptualization of social presence where the three dimensions of social context, online communication, and interactivity contribute to learners' social presence experiences.

While important studies on social presence have established validated instruments for measuring it, interview-based qualitative exploration and analysis were employed because of the exploratory nature of this study. The coding of the data was based on the existing research literature, including identifying areas that speak to particular survey items (Liao et al. 2011).

METHODS

RESEARCH FOCUS

Studies have also shown that using strategies to improve Tu and McIsaac's (2002) three dimensions of social presence will improve learner interaction in online learning environments. Therefore, based on Tu and McIsaac's framework, we designed this study to investigate the following:

> How does participating in SPOT impact learners' experience of social presence when considered through the three dimensions of social context, online communication, and interactivity?

STUDY DESIGN

This was an interview-based qualitative study with IRB approval (Creswell & Creswell, 2017; Seidman, 2013). In the Spring 2018 semester, SPOT was deployed in three fully online, asynchronous courses: a graduate course on distance education, a graduate course on research in adult education, and an undergraduate course with an information sciences curriculum. Each class had around 25 students enrolled. Participants were recruited during the first week of the semester. The instructors emailed recruitment material to the online classes with one of the researchers' contact information. Students were not required to participate in SPOT, and the participants could opt-out at any time during the study.

Seven participants were recruited for the interviews and each participant was incentivized with a $10 Amazon gift card. While one of the researchers was also an

instructor in the course, none of the course instructors knew who participated in the study as other researchers recruited students and pseudonyms were used throughout the study. For an overview of the participants, please see Table 1.

Table 1. *Participant Overview.*

Participant pseudonym	Country	Gender	Graduate/ Undergraduate
Ron	U.S	Male	Graduate
Dennis	U.S	Male	Undergraduate
Mike	U.S	Male	Graduate
Tammy	U.S	Female	Undergraduate
Tom	U.S	Male	Graduate
Ana	Brazil	Female	Graduate

DATA COLLECTION

The primary data were collected from semi-structured interviews, in part, on Seidman's (2013) suggested interview structure for in-depth investigation of a targeted phenomenon. The interviews were organized into two major components: (a) think-aloud observations wherein participants shared their screens and described their thoughts and feelings while working through common tasks in SPOT and (b) open-ended questions related to participants' perceptions of SPOT, and their experiences of using SPOT. All the interviews were conducted synchronously through Zoom, an online video conferencing tool. The interview length, on average, was an hour. Research memos were written throughout data collection and analysis and also served as supporting data for data analysis. (Saldaña, 2015).

DATA ANALYSIS

One researcher conducted and fully transcribed all of the video-recorded interviews. Due to technical difficulties resulting in poor audio quality, recordings from only six participants were used in the analysis. The data were considered within Tu and McIsaac's (2002) three dimensions of social presence: social context, online communication, and interactivity. Indicators for each of the dimensions were based, in part, on the variables Tu and McIsaac found in their study.

The interview recordings were first transcribed into text. One of the transcripts was then coded, line-by-line, by two authors to social context, online communication, and interactivity. The coders then compared codes and discussed inconsistencies. After calibration, one of them coded all remaining transcripts, and the other read through the codes. The results were the final codes agreed by the two coders. For an overview of the coding table with examples, please see Table 2.

Table 2. *Coding for social presence*

Social Context	Social Context Variables*	Examples
In the context of SPOT participation, references elements of learners' social context, including task orientation and attitudes towards peer support.	Familiarity with recipients Assertive/acquiescent Informal/formal relationship Trust relationships Social relationships (love and information) Psychological attitude toward technology Access and location User's characteristics	*I've learned I'm just as much if not more from my peers in all these classes that I have from the books themselves. Um, you know, I consider myself a pretty smart guy but some of these people are just over the top. (Tom)*
Online Communication	**Online Communication Variables***	**Examples**
In the context of SPOT participation, references elements of online communication, including expression of emotion and communication styles.	Keyboarding and accuracy skills Use of emoticons and paralanguage Characteristics of real-time discussion Language skills (reading, writing)	*So this looks like it gives me an overview of everyone that's here and a picture of how their dogs are doing. So if I wanted to reach out once, say to this person down here because one seems to be a little disgruntled. Or sad. (Dennis)* *It humanizes... I think when you have a dog in the middle of something that it's less formal, it usually helps. (Ana)*
Interactivity	**Interactivity Variables***	**Examples**
In the context of SPOT participation, references elements of interactivity, including elements of immediacy and group size.	Timely response Communication styles Length of messages Formal/informal Type of tasks (planning, creativity, social tasks) Size of groups Communication strategies	*Like how they would like to interact on spot, how many times they would log on per week and how many times they should respond to the message or respond to a chat or initiate a chat. Like anything. (Mike)*
Other	**Other Variables**	**Examples**
References elements outside of the three dimensions of social presence.	N/A	*I think it's OK as it is. I'm interested in it. So the health strength, the dog, does that come from one class or all the classes that I am enrolled in? (Ron)*

*Variables identified in Tu and McIsaac (2002)

FINDINGS

SPOT was developed as an online learning environment relying on people's affect and feelings of connectedness towards pets to encourage peer support. Interview data showed consistently that learners experienced the SPOT environment as it was designed: a clean and intuitive environment where the emotional state of their dog avatar (e.g., "happy," "sad") reflected their performance in the course and displayed the emotional states of their classmate's dog avatars reflected by their performance. Additionally, learners easily identified that there were multiple ways of interacting with their classmates in the SPOT environment. In demonstrating how they would communicate, participants demonstrated both the inbox as the one-to-one communications option and the discussion forum as the one-to-many option. Next, we report on the learners' experiences through each of the three dimensions of social presence.

SOCIAL CONTEXT

The social context within this framework (Tu & McIsaac, 2002) describes learners' characteristics, including key components such as their task orientation, social relationships, and attitudes toward online learning environments. Below we highlight some of the ways that participants engaged in SPOT from within their own social context.

Tammy was actively initiating conversations from the beginning. She posted on the discussion forum asking peers' advice on their approaches to succeed in an online class. She asked, "How everyone thought they were doing so well in the class?"

Ron represented more of the "lone wolf" [A1] in terms of distance education learner types (Brown, Hughes, Keppell, Hard, & Smith, 2015) and explained he was less likely to seek out peers for help. At the same time, he was actively searching for learners who themselves were struggling. He mentioned that he noticed that based on the state of the dog avatars, most people in the course were doing quite well and even recommended that "[m]aybe you need to make a fake dog that's doing poorly."

Tom regarded his learning cohort as a community, remarking that "I've learned just as much if not more from my peers in all these classes that I have from the books themselves." Within SPOT specifically, although he did not actively talk to people or seek out learners who needed help, he did expect others to reach out to him for help.

These participants presented very diverse approaches when comes to the social process of interactions. Overall, in terms of Tu and McIsaac's (2002) social presence dimension, from the participants' experiences, it seems that SPOT as a platform allows learners to build social connections within their own preferences.

ONLINE COMMUNICATION

Online communication within this framework (Tu & McIsaac, 2002) refers, in part, to the "attributes of the language used online and the applications of online language." SPOT is designed as a space for learners to have informal communication.

All the participants chose to use informal communication style as opposed to formal communication. Tammy used smiley faces when sending a private message, Ron and Tom started their private messages with greetings such as "hi, how's going?". All of these phrases are similar to the way students greet each other in the physical classroom that contributes to the experience of the social presence. Dennis used informal language to keep the conversation light, and Mike even initiated a non-academic question on the discussion forum. Another example of the online communication elements of the SPOT is in the informal names the participants chose for their pet avatars: Bear, Rexxar, Inigo Montoya, Charlie, Peanuts, and Diesel.

When Tammy saw a peer posted a non-academic question that has several movie references, she responded:

> That post? I open it says hello, my name is Montoya, which I know is from The Princess Bride. One of my favorite movies. The next one is I am your father, which is, I think that one is from Star Wars. I have also sent that person a chat, asking if he likes movies in general.

Dennis, who enrolled in the undergraduate course, showed sensitivity when reaching out to one of his peers who seems to be struggling with the course. He said, "I will just say hi, how's going, instead of asking if he needs any help. I don't want to come across as pretentious."

Mike, who enrolled in the undergraduate course, posted questions on the discussion forum and sent out chats to his classmate on the first day when SPOT was launched. He mentioned that he was interested to see how his classmates would respond to him. He said, "I want to see if SPOT is working and if there are just my classmates here."

INTERACTIVITY

Interactivity within the framework "includes the activities in which the computer-mediated communication environment users engage and the communication styles they use" (Tu & MsIsaac, 2002). Whereas the online communication dimension refers to the type of language used, including formality, interactivity has more to do with the technological ways in which students actually interact. For example, using instant messaging compared to asynchronous communication. As with the other elements, SPOT is flexible in terms of how students choose to interact.

SPOT has provided Tammy the opportunity for her to reach out to her peers and interact with them through the discussion forum as well as an inbox chat message. When she helped other people, she saw it as an opportunity to help her consolidate the knowledge. As she described it:

> It has the potential to be helpful because people do like it and that is struggling if you're doing well, I wouldn't mind helping somebody. I think that when you're helping you kind of learn more because you want to be educated when you're now in guidance. So that helps. Um, so that's my initial impression when everybody's doing so.

Ana reported that as an international student, SPOT was a great tool to have small talk with peers without having the potential to offend people who had a different culture. For her, SPOT "humanizes the course" and allows her to initiate funny everyday conversation as part of her culture. She said:

> "[H]aving the dog can help me start the conversation without worrying if I am offending other people. We Brazilians like to say jokes with others, but I am afraid of hurting people with a different culture"

Dennis chose to be polite and caring of others' feelings so that his peers would feel good. As for Tom, he would scan through the discussion forum to "pick other people's brain" and expect others to ask him for help.

Ron presented himself as a helper and SPOT had provided him an opportunity to help his peers who were left behind. Throughout the interview, Ron kept mentioning that he would not mind helping others when needed. In an online learning environment, this type of learner would be beneficial to instructors to increase interaction when there are a lot of students in one course.

DISCUSSION AND IMPLICATIONS

The SPOT environment spans Tu and McIsaac's three dimensions of social presence. In addition to being an online environment where students can connect with each other, SPOT also contributes to learners' experiences of social presence. When many of the key definitions of social presence were put forth (e.g., Garrison, Anderson, & Archer, 1999; Gunawardena & Zittle, 1997; Tu & McIsaac, 2002) the online learning environments themselves were largely text-based. In contrast, SPOT focuses on using pet avatars to communicate performance states. That form of visual communication creates an environment in which students naturally perceive and express affection. This is apparent in how they described the dogs in emotional terms (e.g., "happy", "sad", "distressed"), identified its visual states (e.g., "sticking its tongue out", "wagging its tail", "raise my little paw"), and named their own avatars (e.g., "Bear", "Peanuts"). Ana even suggested that further personalization of the avatars in terms of gender characteristics would lead to a greater sense of connection. This affective visualization-based online communication, in turn, impacted student motivation to interact with other students. For example, Dennis describes how he would select a struggling classmate to whom to offer help: "So if I wanted to reach out once, say to this person down here because one seems to be a little disgruntled. Or sad." This extends beyond the social presence opportunities available in contemporary text-based LMS discussion forums central to online learning (Legon & Garrett, 2018).

Another defining feature of SPOT is its reliance on student-selected avatar names. Because SPOT represents students' actual course performance, privacy, and ethical consideration necessitates that SPOT is an opt-in, anonymous environment. This prevents students from accessing protected information about other students. It is also intended to contribute to SPOT as a "safe space" away from instructors in which students can be vulnerable and ask for help in areas in which they are uncertain. For some, like Dennis, this was a positive factor: "I like visual representations and that it's anonymous." For others, though, there was a tension between the anonymity and social presence and feelings of connection. As Ron described, because he did not know who was the "real person" behind the avatar, he was less likely to invest as much emotionally:

> So they are anonymous, right? I don't know who Butter is. If Butter is having a hard time. I might shoot him a message and see what the deal is, but I don't really know who they are so I'm not going to invest a lot of time if they don't respond. However, if that's my friend that I know that I've talked to, you know, I might have a phone call or something like that (Ron).

This tension between protecting students' privacy, anonymity, and social presence warrants further exploration.

Interactivity, as the third dimension of Tu and McIsaac's framework, refers specifically to how learners interact with each other. This study suggests, though, that the interactivity of the system itself also plays a potential role in contributing to, or detracting from, social presence. One area remarked upon had to do with participants' desire for enhanced notification features as well as more seamless integration with their existing workflow. Currently, SPOT is a system outside the LMS and participants noted that that influenced their usage of it. For example, Tom explained that "...like I said, it's having the extra step to have to log into it and to go check, but if it was there and you could see probably use it a lot more frequently." Another area in which SPOT could itself be more interactive related to mobile notifications of new messages. Lastly, it was suggested that having the dog avatar on one's desktop would be another way to make the system itself more interactive, motivating learners' on their own performance as well as interacting to potentially help others.

LIMITATIONS

Because there were only six participants whose interview data could be analyzed, our observations represent only a small group of online learners. To gain deeper insights, more research, with a larger sample size and different research methods, needs to be conducted to further validate the findings. In addition, this study only presents one type of data—interview findings—that limit other aspects that could have been observed from learners' online behavior in a natural setting. We could not analyze participants' online discussion because the posts in the discussion forum collapsed due to technical issues. As a result, we could not triangulate our data through discussion forum post observations to cross reference how the participants interacted with each other throughout the course, and the dimensions of social presence each participant presented. Lastly, SPOT is still in development in terms of its functions and usability. Participants' reactions in the interview could be limited to what SPOT could provide, not how the visualization of pet avatar could influence their behavior and perceptions.

CONCLUSION AND FUTURE RESEARCH

Social presence is not a static construct. Affordances and constraints of the online learning environment, teaching and learning strategies, and characteristics of the learners can all contribute to the experience of social presence (Tu & McIsaac, 2002). After analyses, this study suggests that Tu and McIsaac's social presence framework will be useful as a lens through which to study learners' experience in future studies that use a newly designed environment such as SPOT. Through the framework, it supports the long-term potential of SPOT as an interface with the potential to enhance social presence as well as reveals important elements of SPOT that need improvement.

SPOT is part of an ongoing, multi-phased design-based research project, and this paper reports on one of the early studies intentionally designed to be exploratory and investigating how SPOT interacts with learners' self-reported experiences of social presence. A study currently in progress is investigating how, if at all, levels of participation in SPOT (a) mediate student measures of social presence using the Community of Inquiry social presence scale (Swan, Richardson, & Garrison, 2009) and (b) predict increases in social presence when measured before and after SPOT participation. Future research will triangulate content analysis (data from survey and interviews), learner experience, and behavioral analytics (clickstream data where learners' interactions can be tracked).

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