Perceptions of Social Presence among Public University Graduate Students Enrolled in Synchronous and Asynchronous Coursework

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Abstract

Students are accessing graduate study online in ever-increasing numbers with interactive experiences differing from those who traditionally enroll in corresponding face-to-face (F2F) classes. Soft skills such as collaboration/teamwork, communication and presentation are important to learning but difficult to practice outside the F2F environment. Robotic telepresence units (robots) might benefit distance learners by enriching their online experience, making it more similar to corresponding F2F classes. This study examines students' sense of social presence in courses that are accessed fully online, attended via robots or face-to-face. These experiences are compared through the lens of Social Presence Theory (Garrison, Anderson and Archer, 2000). Of the 227 enrollments in 30 educational leadership courses offered during the summer and fall semesters of 2016, a sample consisting of 66 students was selected to measure graduate students' perceptions of social presence. A one-way ANOVA yielded no significant differences between groups with regard to overall social presence and when social presence's effect was subsequently compared using eta-squared, only a small effect was found. When asked specifically, however, students using robots report an increased sense of class membership; a heightened appreciation for peers' humor, and a greater ability to form distinct impressions of fellow classmates. These preliminary results give reason to continue pursuit of this line of inquiry as subsequent findings could yield important implications for distance education programs.

Background

Graduate study via distance education has become fairly common. In 2014, one-third of graduate students participated in distance education (NCES, 2016). Private for-profit institutions dominate the market but public non-profit schools are serving a substantial portion of graduate students; many of the courses in both sectors are offered online rather than in a face-to-face (F2F) setting. In 2014, 28% of students enrolled in a public degree-granting institution took a distance education course while 17% of this group experienced graduate study exclusively through distance education (NCES, 2016). Moreover, it is estimated that between 2014 and 2025, overall graduate enrollment in distance education will increase by 21% (NCES, 2016).

Nationally, the growth potential for school leader positions is promising. Educational, leadership positions are expected to grow by 6% through 2025 (U.S. Department of Labor, 2015). A master's degree is typically required for entry into the field. Hence, it's reasonable to believe that many aspiring school leaders seeking credentialing will choose to avail themselves to any one of the hundreds of education leadership graduate programs available online. Such courses employ a variety of technologies to deliver instruction either synchronously or asynchronously.

Achieving the promise of equal educational opportunity in Montana includes closing the achievement gap for American Indian students (OPI, 2013). Educational leadership plays an important role in student achievement (Marks & Printy, 2003). Access to quality educational leadership via distance learning is particularly important in rural Montana, a state with a population density of only 6.86 people per square mile of land (MTGov, 2016).

Theoretical Framework

Much of learning to lead is essentially heuristic but many agree that a theoretical foundation and grounding in the major competencies of the field helps to ensure successful future performance (Doh, 2003). In comparing F2F instruction to distance learning the research seems to indicate equal learning outcomes (Arbaugh et al., 2013; Lyke & Frank, 2012; Weber & Lennon, 2007). Such studies mainly focus on "hard skills" such as budgeting, understanding of theory, law, etc. However, leadership is not merely mastery of hard content. It includes "soft skills" such as collaboration/teamwork, communication and presentation skills; skills that are difficult, if not impossible, to practice in isolation online (Crosbie, 2005). Rather leadership is an interactional experience. Classroom-based leadership instruction and simulations serve as a constitutive learning experience (Figueroa, 2014). Such experiences are very difficult to replicate in an asynchronous setting.

Robotic telepresence may have the potential to compliment online learning to improve the acquisition and development of soft leadership skills or, at the very least, make for a more robust distance learning experience for prospective school leaders. A telepresence robot is simply a computer-driven robot consisting of a video camera, screen and microphone. In this case it is an iPad on a device resembling a Segway (Figure 1).

Figure 1. Telepresence Robot. © 2016 Double Robotics, Inc.

The robot is connected to the internet using Wi-Fi making it possible for the user to control it remotely. The remote user (graduate student) can move around the classroom, turn to speak to classmates and the instructor, rise up and drop low. In short, it allows remote graduate students a means to access face-to-face classes more authentically thus enabling real-time synchronous experiences in leadership classes; in particular teaching presence. Synchronous instruction establishes a climate that promotes meaningful discourse among students (Szeto, 2014).

Review of Literature

Social Presence Theory (SPT) is helpful for framing the acquisition of "soft skills' in educational leadership courses because it offers a means to better understand graduate student experiences between the three instructional milieus; F2F, asynchronous online and the

synchronous experience provided by a telepresence robot. Social presence theory was originally defined as, "the degree of salience of the other person in the interacting and the consequent salience of the interpersonal relationships (Short, Williams and Christie, 1976). For purposes of this study we have selected Garrison and Anderson's (2003) definition, "the ability of participants in a community of inquiry to project themselves socially and emotionally, as real people through the medium of communication being used." Garrison & Arbaugh (2007) suggested that as students become familiar with each other as the course progresses, social presence becomes "transparent." This study examines the potential for telepresence robots to enable the transparency of social presence that Garrison et al. (2007) posited so that distance students can engage seamlessly with F2F students.

Hypothesis and Methods

Do graduate students accessing educational leadership coursework in a synchronous milieu using robotic telepresence report a greater sense of social presence compared to students who access coursework in an asynchronous setting? Do social presence perceptions differ between face-to-face students and students who access coursework in an asynchronous setting? Are social presence scores between students accessing educational leadership coursework in a synchronous milieu using robotic telepresence report and those attending class face-to-face different?

To test these questions, we used a one-way between groups analysis of variance (ANOVA) and hypothesized that the mean social presence score for at least one of the three groups (robotic telepresence, online and face-to-face) would not be statistically equal. Stated in the null, we hypothesize that mean social presence scores for graduate students accessing

educational leadership coursework would be equal for all three groups hence, H_0: $\mu_{\text{robotic telepresence}} = \mu_{\text{asynchronous online}} = \mu_{\text{face-to-face}}$ and we set *a priori* criteria for rejecting the null at $\alpha = .05$. Missing data were handled by pairwise deletion.

Significant findings were accompanied by post-hoc analyses to include estimates of effect size, specifically eta squared and omega squared. Eta squared the more common statistic is prone to overestimating explained variance – particularly with smaller samples (Peters & Van Voorhis, 1940; Olejnik & Algina, 2003). To provide a more complete picture we included omega squared because, compared to eta squared, it tends to be a less biased effect size estimator – especially when small samples are concerned (Carroll & Nordholm, 1975).

For the purpose of this study we measured social presence using a survey adapted from Lin's (2004) *Social Presence Questionnaire*. The survey (see Appendix A) consists of 15 questions that asked students to rate on a 7-point Likert Scale on how they perceived group membership, social comfort and social navigation. Using Qualtrics[1] survey software, a link for the survey was embedded in a learning management system webpage or emailed for 14 graduate-level courses in educational leadership held during the summer and fall of 2016. The "Prevent Ballot Box Stuffing" option in Qualtrics software was set to prevent respondents from taking the survey multiple times by placing a cookie on their web browsers.

Respondents were graduate students enrolled in educational leadership courses at a medium size public university in western United States. All survey item responses were recoded from lowest to highest to provide consistent logic; high scores represent greater social presence

[1] The data for this paper were generated using Qualtrics software, copyright © 2015 Qualtrics. Qualtrics and all other Qualtrics product or service names are registered trademarks or trademarks of Qualtrics, Provo, UT, USA. http://www.qualtrics.com

than lower scores. Responses were then averaged to obtain a mean social presence score for each respondent.

Results

Of the 227 enrollments in 30 educational leadership courses offered during the summer and fall semesters of 2016, 84 students responded to the survey. Eighteen were excluded from the sample (three refused to complete the survey, five were fall respondents who indicated that they may have completed the survey during the preceding summer session and ten were deleted due to extensive missing data) leaving a sample of 66 graduate students. An examination of all remaining missing data did not reveal any patterns.

Questions #4 through #18 are items that are derived from Lin's (2004) social presence questionnaire. These 7-point questions are scaled from 1= *strongly agree* to 7= *strongly* or *extremely disagree*. To make results logical these data were recoded so that high scale values a reflect positive opinion while low values correspond to a negative view. Descriptive statistics are contained in Table 1.

To assess internal consistency a Cronbach's alpha coefficient was computed ($\alpha = .93$) for questions #4 through #18. Based upon Bland and Altman's (1997) recommended guideline for interpretation of α, we conclude that these items cohere quite well and seem to consistently measure social presence.

Based upon Questions #2 and #3 each respondent was categorized as belonging to one of three groups: telepresence robot, online or F2F (see Table 2). A mean social presence score for each respondent was computed for questions #4 through #18. A one-way ANOVA compared the effect of instructional milieu on mean social presence scores for students in online, face-to-face, and robotic instructional c. There was no significant difference between the three conditions, $F(2, 63) = .88$, $p = .42$, $\eta^2 = .03$ (see Table 3).

Within the survey two individual questions, however, yielded significant differences. Again, a one-way ANOVA compared instructional milieu in Question #4, "I felt like I was a member of the class during the semester." There was a statistically significant difference between the three instructional settings, $F(2, 63) = 3.63$, $p = .03$, $\eta^2 = .10$, $\omega_p^2 = .07$ (see Table 4). Post-hoc analyses using Tukey's HSD indicated that feeling like a member of the class was lowest among online students and highest for face-to-race ($p = .03$) but face-to-face and robotic instruction did not differ significantly ($p = .28$). Based upon the general rule of thumb for interpreting effect size[2] using eta and omega squared (Cohen, 1988, Field, 2013), we find a medium effect between online and face-to-face milieus for a forming a sense of class membership.

Finally, a one-way ANOVA compared instructional milieu in Question #12, "I was able to for distinct individual impressions of other students during class activities." There was a significant difference between the three conditions, $F(2, 63) = 8.81$, $p = .002$, $\eta^2 = .18$, $\omega_p^2 = .15$ (see Table 5). Post-hoc analyses using Tukey's HSD indicated that forming distinct individual impressions of other students during class activities is lowest among online students and highest for face-to-race ($p = .01$). Additionally, online and robotic instruction differed significantly ($p = .01$) while face-to-face and robotic instruction did not ($p = .82$). The effect size here is large.

Discussion

Let us return to our initial research questions. First, do graduate students accessing educational leadership coursework in a synchronous milieu using robotic telepresence report a greater sense of social presence compared to students who access coursework in an asynchronous setting? Here we were unable to find a difference between synchronous (F2F and robots) and asynchronous (online) with respect to social presence.

[2] small = 0.01, medium = 0.06, large = 0.14

With respect to overall social presence perceptions differing between F2F students and students using a robotic telepresence, again we find no difference. Interestingly we did find a significant difference between online and F2F with regard to having a sense of class membership with no difference between F2F and robots on the same question. Hence, we infer that there is reason to believe that a feeling of belonging is more likely when graduate students attend class F2F or with robots but not so when they are solely online.

Finally, we inquired as to whether social presence scores among students accessing educational leadership coursework in a synchronous milieu using robotic telepresence report and those attending class F2F differ. Here we find no difference with respect to social presence. There was, however, a significant difference between instructional milieus on a question that measured a student's ability to form distinct individual impressions of classmates. In fact, the effect was large and no difference between F2F and robotic telepresence students. Again, we surmise that F2F and robots are superior to online instructional delivery when it comes to gaining familiarity with one's classmates.

The small sample size is undoubtedly a limitation to this study and despite non-significant findings on all three research questions; significant differences concerning developing a sense of belonging and increasing familiarity with classmates gives us reason to continue our pursuit of this line of research in the context of training school leaders.

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Tables

Table 1

Descriptive Statistics for Selected Survey Questions

#	*n*	*M*	*SD*
4	66	6.14	1.14
5	66	6.38	0.89
6	66	5.05	1.45
7	66	5.47	1.64
8	66	5.73	1.49
9	66	5.89	1.13
10	65	5.69	1.25
11	65	5.72	1.47
12	66	5.39	1.23
13	66	6.05	1.12
14	66	5.97	0.82
15	65	4.83	1.46
16	66	5.45	1.38
17	66	5.68	1.18
18	66	6.23	1.09
19	49	5.88	1.54

Table 2

Instructional Milieu and Social Presence Scores

Group	*n*	*M*	*SD*
Online	35	5.59	0.91
Face-to-face	14	5.9	0.68
Robot	17	5.83	0.82
Total	66	5.71	0.85

Table 3

One-Way Analysis of Variance of Mean Social Presence Score by Instructional Milieu

	df	SS	MS	F	*p*
Between Groups	2	1.27	0.63	0.88	0.42
Within Groups	63	45.35	0.72		
Total	65	46.61			

Table 4

One-Way Analysis of Variance of Question number four by Instructional Milieu

	df	SS	MS	F	*p*	η^2	ω_p^2
Between Groups	2	8.66	4.33	3.63	0.03	0.1	0.07
Within Groups	63	75.11	1.19				
Total	65	83.77					

Table 5

One-Way Analysis of Variance of Question #12 by Instructional Milieu

	df	SS	MS	F	*p*	η^2	ω_p^2
Between Groups	2	17.62	8.81	6.92	0.002	0.18	0.15
Within Groups	63	80.14	1.27				
Total	65	97.76					

Table 6

Mean and Standard Deviation for Survey Question #19

	n	*M*	*SD*
Robots enhance face-to-face courses	17	5.88	1.54

Note. Scores ranged from 1 (Strongly disagree) to 7 (Strongly agree).

Appendix

Perceptions of Social Presence Survey

Q1
- ❍ I have read the above information and agree to participate in this research. (1)
- ❍ I do not wish to participate in this research (2)

If I do not wish to participate in this research is Selected, Then Skip to End of Survey

Q2 In the past 12 months, have you used one of the ED Leadership Department's robot to participate in a face-to-face course?
- ❍ Yes (1)
- ❍ No (2)

If Yes Is Selected, Then Skip to Q4 I felt like I was a member of the class during the semester

Q3 In the past 12 months, have you taken more ED Leadership Department classes online using UM's Moodle learning management system or face-to-face classes on the campus of the UM in Missoula?
- ❍ I have taken more classes online using Moodle (1)
- ❍ I have taken more face-to-face classes on the UM campus in Missoula (2)

Q4 I felt like I was a member of the class during the semester.
- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q5 I felt comfortable participating in learning activities during the semester.
- ❍ Extremely comfortable (1)
- ❍ Moderately comfortable (2)
- ❍ Slightly comfortable (3)
- ❍ Neither comfortable nor uncomfortable (4)
- ❍ Slightly uncomfortable (5)
- ❍ Moderately uncomfortable (6)
- ❍ Extremely uncomfortable (7)

Q6 I felt that I came to know the other students in the class.
- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q7 The course activities helped me to complete assignments with higher quality than if I were working alone.
- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q8 The course activities helped me to learn more efficiently than if I were working alone.
- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q9 I felt comfortable addressing my feelings during the course.
- ❍ Extremely comfortable (1)
- ❍ Moderately comfortable (2)
- ❍ Slightly comfortable (3)
- ❍ Neither comfortable nor uncomfortable (4)
- ❍ Slightly uncomfortable (5)
- ❍ Moderately uncomfortable (6)
- ❍ Extremely uncomfortable (7)

Q10 I felt comfortable expressing my humor during the course.
- ❍ Extremely comfortable (1)
- ❍ Moderately comfortable (2)
- ❍ Slightly comfortable (3)
- ❍ Neither comfortable nor uncomfortable (4)
- ❍ Slightly uncomfortable (5)
- ❍ Moderately uncomfortable (6)
- ❍ Extremely uncomfortable (7)

Q11 I was able to appreciate the humor of other students in the course.
- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q12 I was able to form distinct individual impressions of other students during class activities.
- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q13 I was able to learn from the discussions.
- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q14 I learned to value other points of view during the semester.
- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q15 Actions by other students usually influence me to do additional work.
- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q16 Knowing that other students were aware of my work influences the frequency and/or quality of my work.
- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q17 Knowing what other students did helped me know what to do.
- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)

Q18 The courses were a useful learning experience.
- ❍ Extremely useful (1)
- ❍ Moderately useful (2)
- ❍ Slightly useful (3)
- ❍ Neither useful nor useless (4)
- ❍ Slightly useless (5)
- ❍ Moderately useless (6)
- ❍ Extremely useless (7)

Answer If Q2 Have you used a robot to participate in an EDLD course? Yes Is Selected

Q19 Robots enhance face-to-face courses.

- ❍ Strongly agree (1)
- ❍ Agree (2)
- ❍ Somewhat agree (3)
- ❍ Neither agree nor disagree (4)
- ❍ Somewhat disagree (5)
- ❍ Disagree (6)
- ❍ Strongly disagree (7)