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Title:

"Is Anybody There? Exploring the Role of Social Presence in an Online Political Science Research Methods Class"

Introduction:

Social presence, or the "being there" and "being real" presence of others in an online learning environment, is widely considered to have a positive impact on student motivation and participation, actual and perceived learning, course and instructor satisfaction, and retention in online courses (Richardson et al. 2017; Oh et al. 2018).[1] Several aspects of social presence remain understudied however, such as how gender, class rank, and other demographical characteristics may influence perceptions of social presence and condition the relationship between perceptions of social presence and academic performance or course satisfaction. Furthermore, although studies of the impact of social presence abound, few studies examine the impact of perceptions of social presence on academic performance and course satisfaction across modalities – sections of online and face-to-face classes.

This study aims to address these gaps in the literature by analyzing perceptions of social presence in an undergraduate political science research methods course. Data were gathered from online and face-to-face sections offered concurrently over three consecutive semesters. Using a pre and posttest instrument, we control for several confounding factors and find that students' perceptions of social presence are positively correlated with higher academic performance and with higher levels of course satisfaction. We also find that: females are more likely to perceive higher levels of social presence than males across both modalities; seniors are more likely to perceive higher levels of social presence than non-seniors in the face-to-face class; those students with GPAs over 3.5 are more likely to perceive higher levels of social presence than students with GPAs below 3.5; and students in the online section who are over 25 are more likely to perceive higher levels of social presence than are student younger than 25.

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[1] Several meta-analyses do an excellent job of summarizing the research inquiries, designs, and findings of the voluminous literature on social presence since the 1970s. We cite two prominent and recent studies here: Oh et al. (2018) focuses more on the antecedents and predictors of social presence while Richardson et al. (2017) emphasizes the role social presence plays in predicting course satisfaction and perceived and actual learning.

By including several control variables, this study adds to the literature on social presence by analyzing the role of social presence in academic performance and course satisfaction across both online and face-to-face instructional contexts. It also adds to the literature on predictors of social presence, offering insight into demographic correlates to variation in perceptions of social presence. Overall, it highlights the important role of social presence classrooms generally, but in online learning particularly, and encourages inclusion of social presence features in online or hybrid courses as a best practice.

Background:

In the following sections, we trace the concept of social presence and outline the definition we think most useful in this research. We then focus on the two most commonly observed effects of higher levels of social presence: higher levels of academic performance and higher levels of course satisfaction. Then, treating social presence as a dependent variable, we discuss the primary predictors of variation in perceptions of social presence discussed in the literature. Lastly, we discuss the relevant gaps in the literature that we hope to fill— little research that considers perceptions of social presence in relation to both academic performance and course satisfaction across both face-to-face and online sections. And, only a few recent studies that include demographic details in an effort to understand variation in perceptions of social presence.

Defining Social Presence

Social presence as a conceptual category has evolved considerably since it was first introduced by Short, Williams, and Christie (1976) as "the salience of the other in a mediated communication and the consequent salience of their interpersonal interactions (65)." In coining the term, the authors conceptualized social presence as the degree to which a person perceived another person (or persons) as being salient when communicating. They understood the concept as primarily a *quality* of the communication medium, a quality that would vary based on the type of communication medium – e.g. video communication containing higher levels of social presence than text-based communication.

Subsequent research elaborated on this deterministic understanding of social presence in studying the impact of computer mediated communication (CMC) – such as email – on the overall quality of workplace communication. CMC was considered to have very little social presence and, according to some, to be necessarily antisocial and impersonal in nature (Walther 1996; Walther, Anderson, & Park 1994). As CMC use spread however, these assumptions about the necessary absence of its nonverbal and relational cues were questioned. For instance, Gunawardena (1995) argued that users of CMC were able to project their identities whether 'real' or 'pseudo' and feel the presence of the other online. She concludes that even though CMC is considered low in social presence by default, it can be perceived by participants to be interactive, active, interesting, and stimulating if the moderators of CMC promote interaction and collaborative learning (162).

Originally seen as a quality of the medium, later research advocated for Gunawardena's partial de-linking of the concept of social presence from the communication medium, arguing that it was a somewhat separate phenomenon. Incorporating social presence as one of three components in their 'Communities of Inquiry' (CoI) framework, Garrison, Anderson, and Archer (1999) advanced the idea that CMC can support social interaction and that education is inherently a social activity. In so doing, they re-imagined social presence, beyond the 'being there' and 'being real' component, to include the ability of participants to project themselves socially and affectively into a community of inquiry. Garrison and others added more parameters to their definition in the following years, formalizing that the goal of projecting one's identities in an online platform should also serve to further personal and purposeful relationships (Garrison 2007; Garrison et al. 2010).

This relational component to the definition of social presence was eventually echoed by other scholars as well. Swan and Shih (2005) and Swan et al (2008) argue that social presence entails individuals who are affectively or emotionally connected to one another in an online environment. Similarly, Garrison, Anderson, and Archer (2010) and Picciano (2002) add that an emotional sense of belonging is an important indicator of social presence. Thus, both connection and belonging seem necessary for social presence (Tu and McIsaac 2002) but distinctions are carefully made between social presence and community. For instance, Wise (2004) argues that social presence is not the same thing as community. While social presence may be necessary for establishing a sense of community, high levels of social presence does not always entail a sense of community and that the two terms should remain distinct.

There is clearly no one, concise definition of social presence. The term has evolved to account for greater and more varied forms of computer mediated interactions over the last 50 years. The degree of salience – or the 'being real' and 'being there' component in a CMC environment now includes the idea of projecting oneself or one's identity and being perceived as real by others. Beyond this, social presence also entails establishing connections and relationships with others in the CMC environment that entail a sense of belonging. Most recent researchers still highlight Short et al.'s (1976) notion of 'being there' or 'being real' in their definitions but stray far from the deterministic relationship between communication mediums and levels of social presence. How far they stray is the subject of concern among some. Oztok and Kehrwald (2017) argue that formulating a definition more rooted in the original work may be best. We agree and borrow their definition of social presence as "the subjective feeling of being with others in a technologically mediated space; the sense of being there, together when being there does not entail physical presence (263)."

The Impact of Social Presence

The majority of research on social presence looks at its impact on course satisfaction and learning outcomes. A relatively comprehensive and consistent body of literature supports the first of these relationships but evidence is mixed on the relationship of social presence to *actual* academic performance.

Regarding the first relationship, Gunawardena and Zittle (1997) examine how effective social presence is as a predictor of overall learner satisfaction in a text-based medium. They find that social presence accounts for 58% of variance in student satisfaction, along with perceptions of equal opportunity and technical skills predicting about 10% of the variation in satisfaction. Similarly, Strong et al. (2012) find that students' perceptions of social presence and how well the course created a 'learning environment' accounted for 26% of variance in student satisfaction surveys. They suggest that the primary deficiencies in online learning are due to interpersonal and social contexts, or the ability of online course designers and instructors to approximate the in-person dynamic of a traditional classroom (105). Hostetter and Busch (2006) analyze perceptions of social presence in both online and face-to-face course settings and find similar perceptions of social presence across modalities. The authors were among the first to note that similar levels of social presence can be achieved in an online course with the proper design features and instructor interaction. They also confirm earlier findings by Gunawardena and Zittle (1997) that perceptions of social presence strongly predict higher levels of course satisfaction. Overall, the authors determine that around 40% of variation in course satisfaction is explained by perceptions of students' perception of social presence.

Social presence is also claimed to impact learning outcomes. Although measurement of learning outcomes varies somewhat across studies, research more commonly includes *perceived* learning outcomes rather than *actual* learning outcomes (i.e. grades). Perceived learning is generally thought to be a combined measurement of actual learning and a student's level of satisfaction about the course. For example, Richardson and Swan (2003) found a high level of correlation between students who perceived a high level of social presence in an online course were not only more satisfied with their instructor, but also perceived they learned more than students who reported low social presence. Similarly, Cobb (2011) found that perceptions of social presence in an online nursing course were highly correlated to both student satisfaction and perceived learning, showing that 44% of the variance in overall satisfaction and 36% of the variance in perceived learning were explained by social presence. Kang and Im (2013) included social presence as one of several factors in instructor-student interaction that may influence both perceived learning and course satisfaction. They found that five factors – including 'social intimacy' and 'presence of instructor and instructional support' – related to instructional interaction significantly predicted learners' perceived learning achievement and predicted learners' satisfaction.

More uncommon among studies of the impact of social presence are studies analyzing the relationship between perceptions of social presence and measurements of *actual* learning outcomes or, put simply, students' final grades in a course. Research here is less consistent as the relationship of social presence to levels of course satisfaction or *perceived* learning. Early studies, such as Schutte (1997), found that students enrolled in an online social statistics course performed, on average 20% higher than their peers in a traditional classroom setting. And, the author finds that students in the online course had higher perceptions of the importance of peer contact than the face-to-face course, although no test examined this difference against academic performance. Designing a more rigorous test of

the relationship between the 'immediacy' of instructors in an online education context, Rodriguez et al. (2009) find that 'affective learning' – or instruction that places greater emphasis on social presence – significantly predicts cognitive learning. Picciano (2002) designed a study where students were organized into three groups corresponding to their assessment of social presence – low, moderate, and high. The mean scores for both a written assignment and an examination were then tested for significant differences across groups. Picciano found that social presence was not a significant predictor of performance on the examination but that social presence did predict performance on the written assignment. Finally, Hostetter and Busch (2006) and Hostetter and Busch (2013) analyzed perceptions of social presence and a variety of learning outcome metrics and found contradictory results between two studies. In their 2006 research, they find no significant relationship between students' perception of social presence and variation in learning outcomes. Noting a small sample size and limited variation in learning outcomes however, their 2013 research attempted to test the same relationship while addressing these weakness. They used content analysis of graded discussion posts, Rourke et al.'s (1999) social presence indicator coding schema, and a classroom assessment technique to show that measurements of a student's social presence and their perception of social presence corresponded. A regression analysis also indicated that students with higher levels of social presence performed better on the classroom assessment technique. And Finally, Joksimovic (2015) compared students graded online discussion postings to show that students who exhibited certain social presence indicators – such as continuing a thread, complimenting, and expressing appreciation – were significant predictors of student academic performance measured in course grades. They conclude that the ability of "students to project themselves within an online learning community is also a significant predictor of academic performance (13)." And, they conclude that including design features meant to enhance interactions between instructors and students – namely, social presence – are important for better student academic outcomes.

In summary, there seems to be a stark contrast between the surfeit of scholarly attention and the consistency of findings in the research on the impact of social presence on course satisfaction and perceived learning compared with actual learning outcomes. As noted, a more consistent set of findings follows from a more developed literature. On the contrary, there appears to be a rather sparse amount of scholarly attention and conflicting results on the role of social presence in impacting *actual* learning outcomes such as student grades. One possible explanation is that measuring perceived learning often takes the place of measuring actual learning in research on social presence due to the overall focus on the more affective dimension of learning. As Richardson et al. (2010) explain, the outcome measures in a number of studies about online learning are intentionally affective; they are studies concerned with how social presence affected students' perceptions of online courses. Others have noted that actual learning outcomes such as grades vary too much across disciplines and instructors and, as such, are not useful metrics (Arbaugh 2005; Richardson et al. 2010). But, neglecting to study the relationship of social presence and more traditional learning outcomes – in addition to perceived learning outcomes – potentially hampers a more robust understanding of social presence and, in turn, an opportunity to enhance students' *actual* understanding of course content.

Predictors of Social Presence

As noted, the role of communication mediums determining level and extent of social presence is implicit in Short et al.'s (1976) original definition. Early research on this relationship maintained that certain modes of communication engendered different levels of social presence, with few exceptions. Although research since then challenged this deterministic relationship, the medium of communication – or, in our case, the modality of instruction – is still considered the most significant predictor of social presence, with the gold standard being a face-to-face communication or a traditional, classroom-based instructional context (Biocca et al. 2001).

It is important to note however, that how researchers define social presence determines whether they include modality in their research design or data collection. Some research defines social presence *only* in the context of online or hybrid instructional platforms, namely, as the approximation of the *actual* or *real* presence of an instructor in a traditional classroom setting. Since social presence is understood as necessarily a feature of computer mediated communication or instruction, traditional classrooms do not count. On the contrary, other studies include data gathered from traditional classroom settings as a way to compare perceptions of social presence in online and hybrid contexts against what is considered to be the *ideal type.* This study conforms with the latter, including perceptions of social presence across modalities as a way to test whether social presence can be approximated in the online or hybrid format as well as considering the predictors of social presence and the impact of social presence against learning outcomes and course satisfaction.

Among this second body of literature, the vast majority of research on modality differences and social presence arrive at similar conclusions, citing three specific qualities of computer mediated modalities that influence social presence: level of immersion, visual representation, and interactivity. The more immersive a communication medium, the more social presence was perceived (Cummings and Bailenson 2016); the greater the visual representation available, the higher the level of social presence (Kim et al., 2013; Feng et al. 2016); and the greater the level of interactivity the higher the level of social presence (Skalski and Tamborini 2007). Scholars typically design studies comparing CMC and face-to-face interactions, text-based CMC with other forms of audiovisual modalities, immersive virtual environments with non-immersive virtual environments, and different types of virtual environments (Heldal et al., 2005; Johnsen and Lok, 2008).

Beyond the impact of modality, researchers have also considered various demographic characteristics of students' in explaining variation in perceptions of social presence. Two of the most commonly examined individual differences in studies of social presence are the gender and age of students. Often, these two characteristics, as well as additional demographic details, are included in studies to control for their impact on more common relationships such as impact on course satisfaction and learning outcomes. The majority of studies find that females experience higher levels of social presence compared to males (Giannopoulos et al. 2008; Johnson 2011). Additionally, researchers note mixed results for understanding social presence as a function of age. Studies typically include age as a

control variable (Oh et al. 2018) but only a few have found that age predicts varying perceptions of social presence. Siriaraya and Ang (2012) and Felnhofer et al. (2014) both conclude that older students typically report feeling lower levels of social presence in virtual contexts compared with real contexts. Neither of these studies however examines social presence specifically and neither study considers age and social presence in an education context.

Purpose of the Study

The primary purpose of this study is to determine whether perceptions of social presence vary across online and face-to-face delivery modalities. Another dimension of this is to test whether social presence was adequately implemented in an online course compared with perceptions of social presence in the same course taught in a traditional, face-to-face context. Additionally, our second purpose is to determine whether perceptions of social presence impact both student satisfaction with the course and academic performance in the course. A final purpose is to consider what characteristics, if any, help explain varying perceptions of social presence across both online and face-to-face modalities. And lastly, as Rourke (1999) claims, "social presence supports cognitive objectives through it ability instigate, sustain, and support critical thinking in a community of learners (52)." With this in mind, the overall purpose of this research is to better understand social presence as a way to enhance learning environments.

Research Questions

1) Are students' perceptions of social presence in an online class similar to those of students in a face-to-face class?

2) Do students' perceptions of social presence in the course explain their level of course satisfaction?

3) Do students' perceptions of social presence in the course explain their actual academic performance in the course?

4) What variables predict students' perceptions of social presence in both the online and face-to-face course?

Research Design:

Data collection for this research was part of a quasi-experimental research design that replicated a traditional, lecture-based, undergraduate research methods course ("face-to-face") as a distance education hybrid course ("distance-hybrid"). The class was a 300-level (3rd or 4th year) quantitative research methods requirement for a large, US-based, state university's government major.

The distance-hybrid course was developed based on the face-to-face course and was offered to students alongside the face-to-face course during the Summer 2014, Fall 2014, and Spring 2015 semesters. The content of the distance-hybrid course and the face-to-face course are identical except for the delivery modality. Namely, they have the same readings, assignments, length of time to complete assignments, and the exam dates are within a day of each other.

The 'hybrid' component of the distance-hybrid course entailed two different in-person features, one mandatory and one optional. The first required that the initial class meeting be attended in person and that both exams (the mid-term and the final) be taken in a traditional, on-campus classroom setting. The second was an optional, on-campus and in-person lab component run by one of the course's teaching assistants – a Ph.D. student assigned to both face-to-face and distance-hybrid sections. The lab was offered weekly and did not include any structured instructional time but rather followed a 'drop-in' format. The drop-in lab was meant to offer the distance-hybrid students a chance to ask questions about the course content or assignments and generally answer any questions in a more personalized and specific manner while placing the students within a community setting to develop their research skills. Another difference between the face-to-face and distance-hybrid course is a weekly discussion board posting required of the distance-hybrid students. This requirement was designed to replicate the interactive nature of classroom discussion that takes place in the face-to-face sections. This requirement, and the inclusion of the discussion board in general, was an explicit effort to build more social presence into the hybrid courses.

The primary difference between the face-to-face course and the distance-hybrid course was, of course, the delivery modality of course content. The face-to-face course received lecture content delivered in the conventional way, following well-developed outlines and lecture slides in use for several years. For developing the distance-hybrid course, this lecture content was then broken down into multiple 15 to 20-minute video segments featuring voice-over lectures with similar slides and illustrations used in the face-to-face section. Students would typically be responsible for watching 2 to 3 lecture videos per week. Since the course also features software instruction (SPSS) that is taught by a course teaching assistant in the face-to-face sections, lab videos were developed that followed the scripted software instruction portions of the face-to-face course. The distance-hybrid student would watch 1 or 2 lab videos in a typical week as well. Combined, the 3 to 5 videos a student would watch each week would replace the 2 ½ hours of lecture and 50 minutes of lab instruction that the students in the face-to-face section receive.

Instruments, Data Collection, and Coding

Two instruments were developed for the voluntary collection of data from students, a pre-test and a post-test. In advance of collecting data from students, IRB approval was received to study a variety of student outcomes. Informed consent was collected during the first class for both face-to-face and distance-hybrid students in each semester. The pre-test consisted of a series of demographic questions designed specifically to understand the self-selection process more clearly and control for these effects when interpreting results. In

addition, we included a mathematical anxiety rating scale that asked students to rate nine different scenarios involving the use of mathematics, and an additive scale was built based on the estimated amount of anxiety each one produced. The final section on the pre-test was a 20-question assessment of the students' knowledge of basic statistics and research design.

The post-test consisted of the same mathematical anxiety rating scale and the knowledge questionnaire from the pre-test. With the knowledge questionnaire and the mathematical anxiety scale being identical on both the pre-test and post-test, our goal was to compare potential differences after the treatment effects of either the distance-hybrid modality or face-to-face modality.

The post-test contained two new categories of questions, one meant to gauge students' perceptions of social presence and one set of questions asking students to evaluate the course. These questions were meant to capture student's reactions to the course and how it was delivered to allow for comparisons across modalities. The course satisfaction questions were taken from standard course evaluation forms and included six statements about the course that students were to rank on a 5-point Likert scale from 'strongly disagree' to 'strongly agree' (see Appendix B). Additionally, students were asked three open-ended questions about the course, such as what modifications should be made.

Social Presence

To gather information about social presence, we constructed a 5-point Likert scale and asked students to rank six statements about the course from 'strongly disagree' to 'strongly agree'. These 6 questions were recoded to dichotomies with those who agreed or strongly agreed with the statements coded as a 1, and those not expressing agreement coded as 0s. From these six variables an additive index was created that sums the number of agreements to the 6 questions. A score of 0 would mean the student agreed with none of the statement's, and a 6 indicates that they agreed with all of them (see Appendix B).

Dependent Variables

Our three primary dependent variables in this study are academic performance, measured by actual grades in the class, course satisfaction, measured by the posttest questionnaire, and level of social presence, also measured by the posttest questionnaire. We also examine the role that social presence and course modality have in predicting the additional outcomes of the net reduction in mathematical anxiety, and the performance gain students make across a pretest posttest course related knowledge quiz.

Independent Variables

Social presence is our primary independent variable as we are considering whether varying perceptions of social presence impact levels of course satisfaction and academic performance. In addition, we are considering various demographics – age, prior experience

with data analysis coursework, sex, whether or not the student is in the major, and student performance to date in university coursework.

Data Analysis

This section contains the two primary sets of findings: the demographic correlates of social presence (social presence as DV) and the impact of social presence on academic performance, measures of math anxiety, and course satisfaction (social presence as IV).

Correlates of Social Presence

While much of the findings from the previous studies mentioned above about what predicts social presence has rightfully focused on manipulating the communication environment itself (generally greater fidelity of the learning environment the greater the perception of social presence), we examine differences that the students themselves bring to the classroom as potential predictors. As previous studies have found sex and age to predict social presence, we include them in our analysis, but also consider whether they are better students (GPA of 3.5 or greater), major, student performance in other classes, and similar coursework experiences.

An initial look at the data, aggregating across all sections and modalities finds only one statistically significant difference in predicting social presence. In a simple independent samples ttest, males score about 3/4ths of a point lower on the 6-point social presence scale than do females. The differences were not significant for older vs younger students, being a senior vs not being a senior, students registered in a Government related major (and thus the course would be core to their program) vs non-majors, good students vs those who perform less well, or those who took prior research methods courses [see Figure 1].

[Figure 1 about here]
[Table 1 about here]

When looking across modalities, we can see that there are differences in perceptions of social presence for those who took the course in person vs those registered in the distance hybrid option. The difference for males and females observed in the sample as a whole seems to be largely restricted to differences in the face to face section of the course (P<0.05). Differences do emerge between seniors and those of lower ranks among the face to face group, and while not meeting the 90% threshold, seniors scoring 0.64 points higher than underclass students is noteworthy, and further with a 16.6% probability of making a false claim on 101 observations, to dismiss it outright might seem a bit premature – this difference seems likely to emerge fully in a larger sample assuming the distribution holds.

Turning to the distance hybrid group, the originally observed difference between the sexes vanishes, as does the difference between upper- and lower-class ranks. What does emerge for those who took the course online is a difference between better students (GPA 3.5+) and students who do not perform as well over their academic career. The better students

on average agree with an entire item more than the students who have not been as successful (P=0.055). Additionally, it can be observed that older students who take the distance offering also perceive greater social presence than students under 25 years old (P<0.118). While this difference fails to meet the 90% threshold, the difference of 0.9 points on a 6-point scale with only 49 observations again suggests we would be remiss to fail mentioning the difference.

Speculating on reasons for the observed differences may lead to interesting paths for future work. For example, among the face to face group, the differences observed with females perceiving social presence to a greater extent than males is very interesting and may be a product of a long standing gender based socialization process. Seniors perceiving greater social presence may be rooted in the necessity of passing a core course so close to the completion of their degree. This would be possibly similar to the perception of social presence among older students enrolling in the distance hybrid alternative – they have chosen a course modality because it better suits their lifestyle (older students are often full-time employees, have families, etc.), and thus their engagement is a function of the modality's necessity. Finally – perhaps an explanation of the differences in perceptions for the better students is self-fulfilling in some way – they have learned how better to do university coursework in general, thus they will be better at adapting to engaging in a course delivery modality that is different from their other coursework.

Regardless of the explanations, to really unpack what is predicting the perception of social presence, all of these variables need to be placed under inspection in a multivariate framework so their unique contributions can be isolated in a controlled setting. This needs to be done so in a way that also controls for the delivery mode of the course. We estimated the predictors of social presence using TOBIT estimation as the scale is truncated on both the lower and upper boundaries. To adjust estimates to reflect delivery differences that may have occurred across semesters we have taken the further step of clustering standard errors by semester.

[Table 2 about here]

The initial finding that females are more likely to perceive social presence is confirmed by the TOBIT model for all respondents, including the control for course deliver mode (P<0.05), as well as in the model for those taking the course in person (P<0.01). The positive correlation between sex and social performance is the only statistically significant predictor of social presence, and, similar to the bivariate tests, this effect is not observed for the distance hybrid group. For the students taking the distance hybrid option, the only covariates that predicts perceived social presence are having a GPA 3.5 or greater (P<0.001) and being a government major (p<0.1).

As all the covariates are dichotomies, they are scaled the same, and thus we can also compare the magnitude of the coefficients to comment on size of effect. Looking at the distance hybrid model from this perspective tells us that the impact of having a strong GPA has more than 3 times the impact vs knowing if a student is a subject major. Using such a strategy to look at the model that includes a regressor for the modality of delivery we can

make a few observations. First, controlling for the individual characteristics of the students participating in the study, course modality has by far the greatest impact on perceived social presence. While this is to be expected, the coefficient clearly implies that those taking the course in the online hybrid framework definitively feel less like they are interacting with or participating in a larger learning community (B=-2.67, P<0.001). This validates the approach for scholars interested in improving social presence through course feature manipulation that structural differences in the course will have a greater impact on promoting community than differences attributable to the students themselves.

Looking across all three Pseudo R^2 values, one might be struck by how little variation in perceived social presence is explained given our covariates (face to face 0.016, distance hybrid 0.037, and full model including the course modality dichotomy 0.043). The model as a whole which includs the course modality variable explains 2 to 3 times the variation in perceptions of social presence than in the models for the face to face students or the distance hybrid students absent this control.

Using Social Presence as a Predictor of Student Performance

All of the above analyses provide the necessary background to consider the impact of social presence on a student's course performance. Performance here has been conceptualized in 4 ways: reduced levels of mathematical anxiety, the level of knowledge gains, course satisfaction, and the numerical grade from which the student's final letter grade is awarded.

Mathematical Anxiety

The reduction of mathematical anxiety is one of the perceived benefits from effective exposure to data analysis and research methods course offerings. It is believed that by increasing exposure to and practice with the mathematical techniques of quantitative inquiry will reduce the fear that students have in employing numerical literacy across a broad spectrum of instances. Math anxiety was asked in both pretest and posttest, and thus the DV being modelled is the change in mathematical anxiety at the end of the course. A pair of OLS models were estimated to look at the effect of increasing social presence on the reduction of math anxiety at the end of the course. In the first model, only the mode of delivery is controlled for. In the second model the mode of delivery is interacted with social presence to test whether social presence provides a differential impact depending upon the mode of delivery.

[Table 3 about here]

In the non-interacted model, it can be seen that increasing social presence does lead to decreases in mathematic al anxiety (P<0.1) while controlling for the effects of modality, and that modality while controlling for social presence is not a significant predictor of the reduction of mathematic al anxiety. This model only explains about 2.3% of the variation in reducing math anxiety, and moreover the model itself is not statistically significant. When we look at the interacted model, none of the covariates are significant, so we can conclude

that social presence does not depend upon modality to reduce social presence. Looking at the model level statistics, the R^2 has changed very little to 0.024 an increase of a tenth of a percent of variation explained with the interaction. Social presence does not depend on being in class in-person to reduce math anxiety; its marginal impact is largely independent of course delivery method.

Knowledge Gains

The second student outcome tested was knowledge gains based upon a pretest posttest design. A battery of questions was developed to tap knowledge that would be transferred to the student at the conclusion of the course. The knowledge test was derived from the same 20 questions asked at the beginning of and conclusion to the course and was made up of multiple-choice questions typically found on course midterm and final exams. Again, OLS models are run using social presence and course modality as predictors, and then interacting the two.

[Table 4 about here]

Similar to the prior model, social presence is a statistically significant predictor of knowledge gains while controlling for delivery mode ($P<0.05$) but the modality is not a predictor of knowledge gains. When interacted, again we find that the effect of social presence does not depend upon modality. We again see from the model statistics that combined, not a large portion of variance is accounted for by the original model ($R^2 = 0.040$) and very little by way of explanatory power is explained once we interact social presence and course modality ($R^2 = 0.041$).

Course Satisfaction

Predicting course satisfaction is a bit different that the previous two sets of models, and supports previous research that finds positive relationships between social presence and satisfaction. Course satisfaction is built as an additive index from questions that are typically asked on end of term faculty evaluations. As before OLS models are used, first non-interacted and then interacted.

[Table 5 about here]

The social presence index is a statistically significant positive predictor of course evaluations ($P<0.001$) with greater perceptions of social presence predicting more positive faculty evaluations. Controlling for social presence, the modality does not predict the evaluations. Model level statistics for student evaluations are very interesting, as about 34% of the variation in student evaluations of faculty can be explained when we account for the student's perception of being present in the learning environment. When compared to the math anxiety and knowledge gains models the magnitude of effect difference is quite striking and instructive for faculty who aspire to better evaluations: make your students feel a part of their learning environment and they will evaluate you more positively. Taking this a step further, this also speaks to more than just the delivery modality, as there is

discernable variation in engagement even in brick and mortar classroom environments. If experiential learning or flipped classrooms increase perceptions of in person social presence, then there is evidence here that adopting such strategies would benefit faculty evaluations.

In the interacted model we also have some interesting findings. The interaction between social presence and modality is not significant, so the impact on social presence is independent of delivery modality. Again, we find that there is a negligible effect on the R^2 value (still 0.34 rounded), so inclusion of the interaction provides no benefit to the explanatory power of the model.

Student Grades

Probably the most important outcome for many students and faculty alike is performance in terms of grades. The government research methods class upon which this research was conducted calculates a percentage grade before translating that grade into a letter for final student grades. Making the student percentage grade the dependent variable, we again run two models interacting student perceived social presence with the course modality.

[Table 6 about here]

Social presence in the non-interacted model is once again a statistically significant ($P<0.01$) positive predictor of a student's final grade. Controlling for social presence, the modality of the course is again not a predictor of student performance. Looking at model level statistics tells us that about 16.5% of variation in course performance can be explained when we account for social presence and course modality.

Looking at the interacted model for course performance is particularly interesting. The interaction between social presence and modality is statistically significant ($P<0.01$) and this implies a unique effect for the interaction. In other words, while all three regressors in the model are statistically significant (and thus each have a unique contribution) the fact the interaction is significant implies that there is a component where the effect of social presence is different depending on the delivery modality of the course. Moreover, the gains made by increasing social presence for distance students *surpasses* the gains made by face to face students. In other words there is even more to gain thinking about how to improve the perceived fidelity of the learning environment if that environment is virtual. A further bit of evidence supporting this finding comes from comparing the R2 values across the two models. Going from an R^2 of 0.165 to an R^2 of 0.21 suggests that by accounting for the conditional relationship that operates between the delivery modality an a student's perception of social presence explains 6% more variation in student grade performance than looking at a model that includes both variables but doesn't account for this interaction.

Discussion and Conclusions

Our summary of the relevant literature on social presence revealed several understudied dimensions of the research: limited consideration of predictors of social presence, including modality differences, no assessments of course satisfaction and social presence across modalities, and inconsistencies surrounding the relationship of social presence and actual academic performance. The literature is relatively clear on the relationship of certain demographic characteristics and social presence, especially the gender and age (Oh et al. 2018). We added to these demographic predictors of social presence by considering GPA, major, class rank, performance in other classes, and experience in similar coursework (having taking statistics in the past). Testing mean differences and a TOBIT analysis we were able to control for a variety of confounding factors. Gender appeared to be a meaningful predictor of social presence in the face-to-face group not among online students. Rather, students with higher GPAs and who declare a government major are more likely to perceive higher levels of social presence in the online course. Unsurprisingly, modality difference was found to be a consistently significant predictor of social presence. This has implications for future research as it validates efforts by online and hybrid course designers to implement social presence features.

The second part of this inquiry treated perceptions of social presence as the independent variable, testing especially whether it impacted measurements of actual learning outcomes (knowledge gains and course grades), levels of math anxiety, and levels of course satisfaction. First, we find that increased social presence does decrease math anxiety and that its impact on this decrease is largely independent of course modality. The takeaway is that reducing math anxiety can be achieved by increasing perceptions of social presence both in traditional and online education contexts. Second, the impact of social presence on knowledge gains shows similar results, with increased perceptions of social presence being positively correlated with greater knowledge gains regardless of modality. Third, the literature is well developed on the question of whether social presence impacts course satisfaction but lacks controls for course modality. Our model controls for course modality and finds that social presence is a strong predictor of course satisfaction regardless of online or face-to-face classroom settings. Fourth and finally, the literature is relatively mixed on the question of how best to assess learning outcomes, with several scholars noting perceived learning outcomes are superior metrics than actual course grades. This tendency in the literature to neglect the relationship between social presence and actual student grades has led to very few studies and studies that lack sufficient controls. To address this discrepancy in the literature, we find that social presence is a positive predictor of final grades in the class. More interesting, the interaction of social presence and modality is a significant predictor of final grades in the model. Moreover, the gains in final grades made by students in the online course surpasses the gains made by students in the face-to-face course. Thus, implementing social presence in an online environment stands to increase the chance of student success.

Tables and Figures

Figure 1

Demographic Differences for Social Presence Index
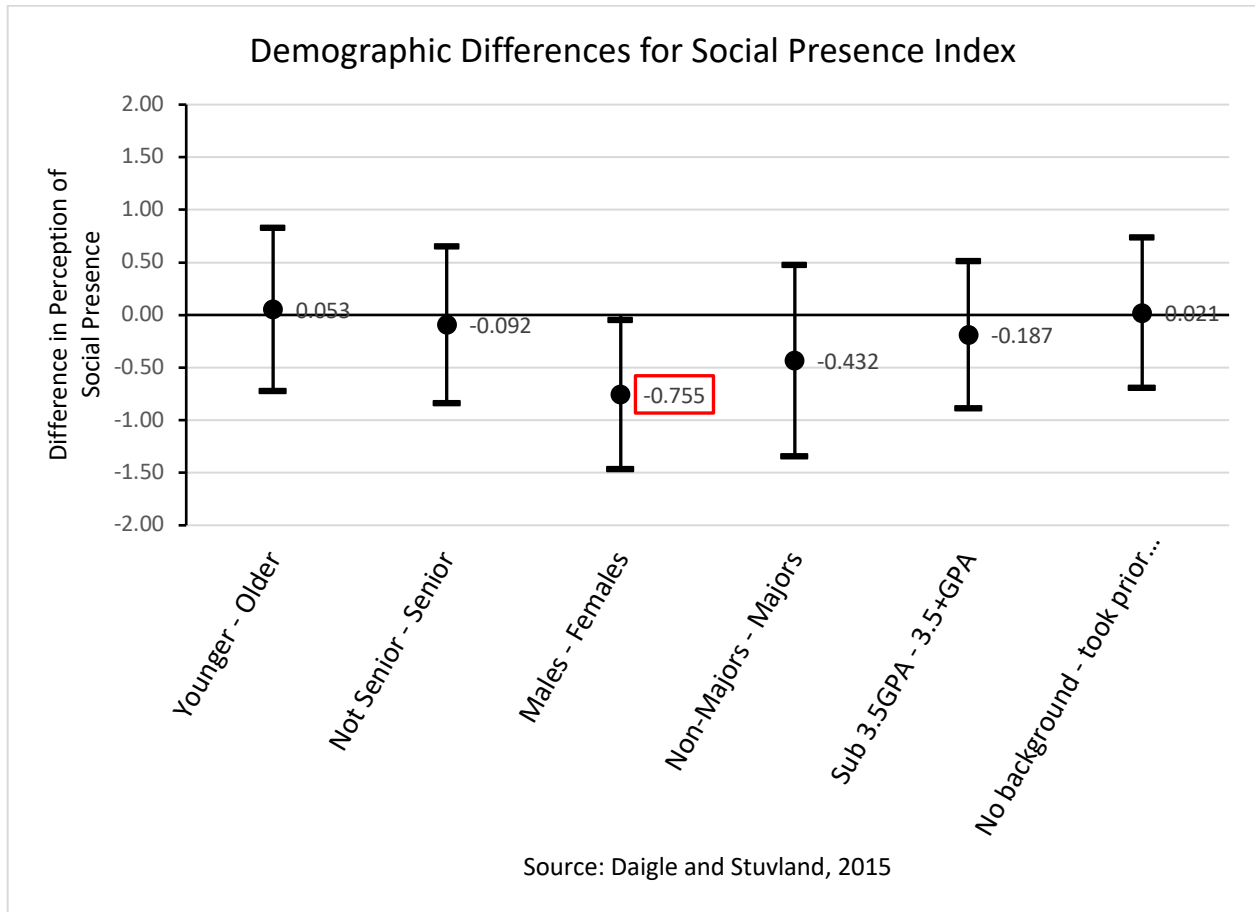
Source: Daigle and Stuvland, 2015

Table 1

Differences in Demographic Backgrounds predicting Perceptions of Social Presence in an Unergraduate Research Methods Class across Educational Modality [a]

Modality	All		Face to Face (Mean=4.04, n=101)[b]		Distance Hybrid (Mean=2.47, n=49)[b]	
	Mean	P diff=0	Mean	P diff=0	Mean	P diff=0
25 years and Younger	3.54	0.892	4.12	0.500	**2.16**	**0.118**
Over 25	3.49		3.79		**3.06**	
Underclass	3.51	0.806	**3.88**	**0.166**	2.48	0.970
Senior	3.60		**4.52**		2.50	
Male	**3.18**	**0.037**	**3.63**	**0.030**	2.43	0.833
Female	**3.94**		**4.54**		2.55	
Not a GOVT major	3.19	0.350	4.08	0.987	2.47	0.976
GOVT Major	3.62		4.07		2.48	
Under 3.5 GPA	3.49	0.598	4.16	0.513	**2.03**	**0.055**
GPA 3.5+	3.63		3.88		**3.10**	
No Previous Stats Course	3.53	0.954	4.16	0.613	2.54	0.814
Previous Stats Course	3.51		3.94		2.40	

(Source: Daigle and Stuvland, 2015)

[a] Difference P-Values of independent sample ttests.

[b] Overall, modality difference of 1.57, P<0.001

Table 2

Tobit Models Estimating Social Presence Index by Course Modality and Demographic Predictors

	Face to Face		Distance Hybrid		Combined	
	Coef.	P	Coef.	P	Coef.	P
Distance Course	---	---	---	---	-2.6695	0.011 **
Older Student	-0.190	0.853	1.071	0.206	0.612	0.320
Senior	1.163	0.334	-0.447	0.559	0.559	0.300
Female	**1.384**	**0.005 *****	0.334	0.760	**1.120**	**0.028 ****
Govt Major	0.200	0.859	**0.482**	**0.054 ***	0.434	0.296
GPA 3.5+	-0.321	0.641	**1.472**	**0.000 *****	0.448	0.153
Background Course	-0.298	0.663	-0.058	0.963	**0.335**	**0.004 *****
Intercept	4.048	0.000	1.152	0.375	3.606	0.000
n	93		43		140	
Pseudo R^2	0.016		0.037		0.043	

(Source: Daigle and Stuvland, 2015)

* P< 0.01, ** P< 0.05, *** P<0.01

Table 3

OLS Predicting <u>End of Course Math Anxiety</u> from Social Presence and Course Modality

	No Interaction		Interacted	
	B	P	B	P
Social Presence (0-6)	-0.149	0.092 *	-0.129	0.226
Distance Offering (0-1)	-0.456	0.259	-0.260	0.709
SP * Distance			-0.067	0.729
Intercept	0.630	0.136	0.547	0.260
n	141		141	
R²	0.023		0.024	
P	0.206		0.352	

(Source: Daigle and Stuvland, 2015)
* P< 0.01, ** P< 0.05, *** P<0.01

Table 4

OLS Predicting <u>Knowledge Gain</u> from Social Presence and Course Modality

	No Interaction		Interacted	
	B	P	B	P
Social Presence (0-6)	0.312	0.041 **	0.283	0.123
Distance Offering (0-1)	-0.311	0.651	-0.593	0.621
SP * Distance			0.095	0.773
Intercept	3.558	0.000 ***	3.677	0.000 ***
n	142		142	
R²	0.040		0.041	
P	0.057 *		0.123	

(Source: Daigle and Stuvland, 2015)
* P< 0.01, ** P< 0.05, *** P<0.01

Table 5

OLS Predicting <u>Course Satisfaction</u> from Social Presence and Course Modality

	No Interaction		Interacted	
	B	P	B	P
Social Presence (0-6)	0.438	0.000***	0.442	0.000***
Distance Offering (0-1)	0.469	0.043**	0.505	0.210
SP * Distance			-0.012	0.915
Intercept	3.245	0.000***	3.231	0.000***
n	149		149	
R²	0.340		0.340	
P	<0.001***		<0.001***	

(Source: Daigle and Stuvland, 2015)

* P< 0.01, ** P< 0.05, *** P<0.01

Table 6

OLS Predicting <u>Final Grade Percentage</u> from Social Presence and Course Modality

	No Interaction		Interacted	
	B	P	B	P
Social Presence (0-6)	2.284	0.000***	1.356	0.027**
Distance Offering (0-1)	-3.109	0.193	-12.480	0.003***
SP * Distance			3.149	0.006***
Intercept	73.957	0.000***	77.726	0.000***
n	144		144	
R²	0.165		0.210	
P	<0.001***		<0.001***	

(Source: Daigle and Stuvland, 2015)

* P< 0.01, ** P< 0.05, *** P<0.01

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Appendix

Instruments: PRE-TEST

I. Background:

1. What is your G#_____

2. In what year were you born?

3. What is your class rank?

    a. Senior
    b. Junior
    c. Sophomore
    d. Freshman

4. What is your gender?

    a. Male
    b. Female

5. Are you a Government major?

    a. Yes
    b. No
       If no, what is your major? _____

6. What is your cumulative GPA (e.g. 3.12)?

7. What is your background in both research methods and statistics? In no more than 3 sentences, explain what courses you have taken, when, and how you expect this course to compare.

II. Mathematical Anxiety Rating Scale:
The following statements describe a math/statistics related situation that may produce anxiety. Please rank each statement according to the below scale:

1	**2**	**3**	**4**	**5**
Low Anxiety				**High Anxiety**

1   2   3   4   5   Being given a 'pop' quiz in a math course

1   2   3   4   5   Taking a final exam in a math course

1	2	3	4	5	Being given a homework assignment of difficult problems that are due the next class meeting
1	2	3	4	5	Realizing you have to take a certain number of math classes to fulfill requirements in your major
1	2	3	4	5	Figuring out sales tax on a purchase that costs more than $1.00
1	2	3	4	5	Totaling up dues and expenses of a club you belong to
1	2	3	4	5	Figuring out your monthly budget
1	2	3	4	5	Reading a cash register receipt after your purchase
1	2	3	4	5	Being given a set of multiplication problems to solve
1	2	3	4	5	Buying a math textbook
1	2	3	4	5	Listening to another student explain a math formula
1	2	3	4	5	Watching someone work with a calculator

III. Knowledge Test:

1. A score that is markedly different from the others in the score distribution is called:

   a. A deviant score
   b. An apex
   c. An outlier
   d. An obstinate
   e. An abscissa

2. The statement that scientific knowledge must be transmissible means that:

   a. Data we use must be made available to others so they can verify our claims.
   b. Findings should be made public to add to the collective base of human knowledge.
   c. The methods of scientific discovery we use must be spelled out in sufficient detail so that others can use the same steps to replicate our findings.
   d. Theories should be expressed as simply as possible to ensure their general application.

3. Statistical inference is:

    a. Used to measure dispersion in the sampling distribution
    b. The estimation of population parameters from sample statistics
    c. A way of estimating probabilistic variation in samples
    d. Using statistics to make inferences about sample values

4. A variable that measures education in number of years is an example of the _____ level of measurement.

    a. Nominal
    b. Ordinal
    c. Interval
    d. Ratio

5. Knowledge that is evaluative, value laden, and concerned with prescribing what *ought* to be is known as _____ knowledge.

    a. Normative
    b. Non-normative
    c. Probabilistic
    d. Non-probabilistic

6. The mean of the sampling distribution of sample means is:

    a. Greater than the population mean.
    b. Equal to the population mean.
    c. Less than the population standard deviation.
    d. Within 2 standard deviations of all outliers.

7. _____ dictates that when given a choice between two compelling explanations, the explanation that relies on fewer explanatory factors is the better choice.

    a. Falsifiability
    b. Parsimony
    c. Induction
    d. Verification

8. Which of the following is the process of selecting observable phenomena that represent concepts in the research process?

    a. Instrumentation
    b. Operationalization
    c. Organization
    d. Measurement

9. The bell curve illustrates which of the following?

    a. Normal distribution
    b. Standard score
    c. Standard deviation
    d. Frequency distribution

10. The level of confidence is a calculated degree of confidence that a statistical procedure conducted with sample data produces a correct result for the _____.

    a. Level of significance
    b. Sample
    c. Sampled population
    d. Sampling distribution

11. In a scatter plot, the vertical axis represents the _____.

    a. Frequency
    b. Value of Y
    c. Value of X
    d. Mode
    e. Independent variable

12. A _____ sample is simply a sample for which each element in the total population has a known probability of being included in the sample.

    a. Probability
    b. Non-probability
    c. Systematic
    d. Stratified

13. Variability refers to:

    a. The precision of the mean
    b. The number of scores in a sample.
    c. The spread of the observed values
    d. None of the above

14. The mathematical term for the variation around the expected value is the _____.

    a. Standard error
    b. Standard deviation
    c. Mean deviation
    d. Sampling frame

15. Scientists believe that their findings are based on _____, systematic observation

    a. Objective
    b. Subjective
    c. Prospective
    d. Retrospective

16. In a sample survey, a question asking whether someone considers themselves to be "lower class", "middle class", or "upper class" would be at which level of measurement?

    a. Nominal
    b. Ordinal
    c. Interval
    d. Ratio

17. A variable that simultaneously seems to cause both the independent and dependent variables is called a(n):

    a. Conditional variable
    b. Intervening variable
    c. Source of spuriousness
    d. Antecedent variable

18. Social scientists use frequency tables, histograms, or box plots to show:

    a. The relation between two variables
    b. The reasoning behind experiments
    c. Specific hypotheses and test their validity
    d. How the data they collect are distributed

19. Which of the following is necessary in obtaining informed consent?

    a. A description of the statistical analyses that will be carried out
    b. A description of the purpose of the research
    c. A description of the reliability and validity of test instruments
    d. A list of publications that the researcher has had in the last ten years

20. Numerical or quantitative indicators such as averages or medians that *DESCRIBE POPULATIONS* are called:

    a. Measures
    b. Parameters
    c. Statistics
    d. Samples

Instruments: POST-TEST

I. Background:

1. What is your G#_____

II. Mathematical Anxiety Rating Scale:
The following statements describe a math/statistics related situation that may produce anxiety. Please rank each statement according to the below scale:

1	**2**	**3**	**4**	**5**
Low Anxiety				**High Anxiety**

1   2   3   4   5   Being given a 'pop' quiz in a math course

1   2   3   4   5   Taking a final exam in a math course

1   2   3   4   5   Being given homework assignments of many difficult problems that are due the next class meeting

1   2   3   4   5   Realizing you have to take a certain number of math classes to fulfill requirements in your major

1   2   3   4   5   Figuring out sales tax on a purchase that costs more than $1.00

1   2   3   4   5   Totaling up dues and expenses of a club you belong to

1   2   3   4   5   Figuring out your monthly budget

1   2   3   4   5   Reading a cash register receipt after your purchase

1   2   3   4   5   Being given a set of multiplication problems to solve

1   2   3   4   5   Buying a math textbook

1   2   3   4   5   Listening to another student explain a math formula

1   2   3   4   5   Watching someone work with a calculator

III. Knowledge test:

1. A score that is markedly different from the others in the score distribution is called:

   a. A deviant score
   b. An apex
   c. An outlier
   d. An obstinate
   e. An abscissa

2. The statement that scientific knowledge must be transmissible means that:

   a. Data we use must be made available to others so they can verify our claims.
   b. Findings should be made public to add to the collective base of human knowledge.
   c. The methods of scientific discovery we use must be spelled out in sufficient detail so that others can use the same steps to replicate our findings.
   d. Theories should be expressed as simply as possible to ensure their general application.

3. Statistical inference is:

   a. Used to measure dispersion in the sampling distribution
   b. The estimation of population parameters from sample statistics
   c. A way of estimating probabilistic variation in samples
   d. Using statistics to make inferences about sample values

4. A variable that measures education in number of years is an example of the _____ level of measurement.

   a. Nominal
   b. Ordinal
   c. Interval
   d. Ratio

5. Knowledge that is evaluative, value laden, and concerned with prescribing what *ought* to be is known as _____ knowledge.

   a. Normative
   b. Non-normative
   c. Probabilistic
   d. Non-probabilistic

6. The mean of the sampling distribution of sample means is:

    a. Greater than the population mean.
    b. Equal to the population mean.
    c. Less than the population standard deviation.
    d. Within 2 standard deviations of all outliers.

7. _____ dictates that when given a choice between two compelling explanations, the explanation that relies on fewer explanatory factors is the better choice.

    a. Falsifiability
    b. Parsimony
    c. Induction
    d. Verification

8. Which of the following is the process of selecting observable phenomena that represent concepts in the research process?

    a. Instrumentation
    b. Operationalization
    c. Organization
    d. Measurement

9. The bell curve illustrates which of the following?

    a. Normal distribution
    b. Standard score
    c. Standard deviation
    d. Frequency distribution

10. The level of confidence is a calculated degree of confidence that a statistical procedure conducted with sample data produces a correct result for the _____.

    a. Level of significance
    b. Sample
    c. Sampled population
    d. Sampling distribution

11. In a scatter plot, the vertical axis represents the ____.

    a. Frequency
    b. Value of Y
    c. Value of X
    d. Mode
    e. Independent variable

12. A _____ sample is simply a sample for which each element in the total population has a known probability of being included in the sample.

    a. Probability
    b. Non-probability
    c. Systematic
    d. Stratified

13. Variability refers to:

    a. The precision of the mean
    b. The number of scores in a sample.
    c. The spread of the observed values
    d. None of the above

14. The mathematical term for the variation around the expected value is the _____.

    a. Standard error
    b. Standard deviation
    c. Mean deviation
    d. Sampling frame

15. Scientists believe that their findings are based on _____ , systematic observation

    a. Objective
    b. Subjective
    c. Prospective
    d. Retrospective

16. In a sample survey, a question asking whether someone considers themselves to be "lower class", "middle class", or "upper class" would be at which level of measurement?

    a. Nominal
    b. Ordinal
    c. Interval
    d. Ratio

17. A variable that simultaneously seems to cause both the independent and dependent variables is called a(n):

    a. Conditional variable
    b. Intervening variable
    c. Source of spuriousness
    d. Antecedent variable

18. Social scientists use frequency tables, histograms, or box plots to show:

    a. The relation between two variables
    b. The reasoning behind experiments
    c. Specific hypotheses and test their validity
    d. How the data they collect are distributed

19. Which of the following is necessary in obtaining informed consent?

    a. A description of the statistical analyses that will be carried out
    b. A description of the purpose of the research
    c. A description of the reliability and validity of test instruments
    d. A list of publications that the researcher has had in the last ten years

20. Numerical or quantitative indicators such as averages or medians that *DESCRIBE POPULATIONS* are called:

    a. Measures
    b. Parameters
    c. Statistics
    d. Samples

IV.   Expectations/satisfaction with the course:

Please use the scale below to answer the following questions:

0	**1**	**2**	**3**	**4**	**5**
Not Applicable	**Strongly Disagree**				**Strongly Agree**

0	1	2	3	4	5	Course requirements/expectations were clear
0	1	2	3	4	5	The instructor helped me to better understand the course material
0	1	2	3	4	5	The instructor was available either in person or electronically
0	1	2	3	4	5	The course grading policy was clear
0	1	2	3	4	5	The instructor made the class intellectually stimulating
0	1	2	3	4	5	The assignments helped me learn the material

Please answer the following questions in no more than 3-4 sentences:

1) This course is offered in both a traditional, lecture-based format and also in an online, hybrid format. In what format did you choose to take this course and for what reasons?

2) What aspects of the course and the way it was taught helped you learn?

3) What modifications do you suggest for the next time the course is taught?

V.   Evaluation of Social Presence:

Please use the scale below to answer the following questions:

0	1	2	3	4	5
Not Applicable	**Strongly Disagree**				**Strongly Agree**

0	1	2	3	4	5	A **('hybrid' or 'lecture')** course is an excellent medium for social interaction
0	1	2	3	4	5	The format of the course contributed to a sense of community
0	1	2	3	4	5	I felt comfortable participating in course discussions
0	1	2	3	4	5	I felt comfortable interacting with other participants in the course
0	1	2	3	4	5	I felt that my point of view was acknowledged by other participants in the course
0	1	2	3	4	5	Overall this course met my learning expectations