


Depreciating the online experience: Relative evaluation of social presence in online, hybrid, and offline course environments

Philipp Matter¹, Ninja Leikert-Boehm ¹ and Peter Heinrich¹

Abstract: COVID-19 accelerated the shift to online and hybrid instruction. While the literature shows that online courses can often perform as well as in-person classes, it is difficult to establish social presence, an important predictor of learning outcomes, at a distance. In this paper, we present exploratory observations of online, hybrid, and in-person environments of three courses at a Swiss university from 2021 to 2022. We were interested in our students' perceptions of social presence in and between courses. The results show significant differences in course ratings and suggest carry-over effects between different course modalities, such that students who attend a course in person systematically rate online courses lower than students who attend only online. These effects disappear when courses are delivered exclusively in person.

Keywords: Social presence, teaching modalities, online teaching, hybrid teaching, in-person teaching

1 Introduction

With the onset of the COVID-19 pandemic, classroom activities around the world quickly shifted to online settings. While this allowed instruction to continue, it radically changed the social environment of the classroom to a dispersed crowd of individuals rather than a collective learning community of students.

Research has shown that, in most cases, online instruction should perform as well as face-to-face (in-person) instruction, especially in terms of learning outcomes [e.g., DS21a, MM21]. Recently, Daigle and Stuvland [DS21b] compared learning outcomes between face-to-face and hybrid courses. They found that modality was not a significant predictor of learning performance. However, consistent with other research [Ho13], learning performance was significantly predicted by social presence. Since the characteristics of the learning environment (“sociability”) can influence social presence [Kr07], modality may indirectly influence learning outcomes.

Thus, to equalize outcomes, addressing the potential gap between modalities is important. To investigate this gap, we launched an exploratory observational study to compare three

¹ Zurich University of Applied Sciences, School of Management and Law, Theaterstrasse 17, 8401 Winterthur, {philipp.matter, ninjairina.leikert-boehm, peter.heinrich}@zhaw.ch, <https://orcid.org/0000-0002-8815-0198>

courses in our master’s degree program in Information Systems. During the pandemic, we were particularly interested in the differences between online and hybrid modalities, which allowed for in-person instruction despite contact restrictions, as some of the participants were able to attend online. Our school introduced this option in the fall semester of 2021/22. In the fall semester of 2022/23, all courses were again taught exclusively in person, so we could compare the evaluations of online and hybrid courses with their “offline” (i.e., in-person) counterparts.

Accordingly, the guiding research question of our study was as follows: *How do ratings of social presence of online or hybrid courses differ from those of in-person classes?*

Our findings suggest that perceptions of social presence may not only vary across course modality but may also be influenced by differences in modality, such that future course design should also consider the learning environments of other courses in the semester program.

2 Related work

Since the initial conception of the theory of social presence by Short et al. [SWC76, p. 65] as the “degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationship”, it has been extensively applied in the field of computer-mediated communication (CMC) with different definitions and conceptualizations [KXW22, Re03a]. More specifically, it has been characterized as “the degree to which a person is perceived as a ‘real person’ in mediated communication” [Gu95, p. 151] or the “sense of being with another” [BHB03, p. 456].

The concept of social presence is closely related to connectedness [Re03a], which is a fundamental factor of human motivation [BL95] and confers mental and physical health benefits [HSG08]. Furthermore, research suggests that feeling “connected with” (connectedness) or “being with” others (social presence) is more important for building empathy than “being there” (spatial presence) [Pi21].

Social presence has been studied extensively in the context of online learning. It has been shown that there are many strategies for creating social presence in online environments, such as participation and interaction, course design, delivery, feedback, and management by the instructor [Ar03, WB19, LD18]. Social presence has been found to be a strong predictor of student satisfaction [Bu12, Co09, GZ97] and perceived learning [RS03].

Positive effects have also been found for actual learning outcomes; Hostetter [Ho13] noticed a significant relationship between high social presence and higher performance ratings, and Daigle and Stuvland [DS21a] found that social presence was a significant predictor of knowledge gains. The latter also suggest that by increasing perceived social presence, the performance of students attending online can be matched to that of students attending in person. Daigle and Stuvland [DS21b] compared learning outcomes between

face-to-face and distance-hybrid courses. While they found no evidence that modality predicted student performance, the perception of social presence was a significant predictor of academic performance. However, the positive relationship between social presence and learning outcomes is not undisputed [WB19].

The findings of Daigle and Stuvland [DS21b] also suggest that students are more satisfied in courses where they perceive a stronger sense of community. This is also reflected in Garrison et al.'s "community of inquiry" [GAA99]. In addition to social presence, it suggests two elements that are essential to the educational experience: cognitive and teaching presence.

Cognitive presence refers to a sequence of practical inquiry from a triggering event (leading to a state of dissonance or discomfort) to the exploration of information, its integration into an idea or concept, and the resolution of the problem [GAA99, pp. 98-99]. It was operationalized by Law et al. [LGL19] as the suitability of the learning environment to enable efficient knowledge acquisition, exploration of information with different means of learning (e.g., videos, discussions), linking of information learned from the course, and reflection and integration of ideas into solutions. Kang et al. [KKP08] found that cognitive presence predicted academic achievement, and Shea and Bidjerano [SB09] found that 70 percent of the variation in cognitive presence could be modeled based on the teacher's ability to facilitate teaching and social presence.

Teaching presence includes instructional management (e.g., curriculum), the building of understanding (i.e., productive and valid knowledge acquisition), and direct instruction (e.g., facilitating reflection and discourse with constructive feedback) [GAA99, pp. 101-102]. It was operationalized as participants' perceptions of clarity of guidelines, distribution of moderate tasks, degree of innovation in course structure, tools or technologies used to facilitate learning and interaction, and as satisfaction with information delivery channels [LGL19]. Kim et al. found that instructor teaching quality was a strong predictor of both social presence and learning satisfaction [KKC11].

Kreijns et al. investigated the role of computer-supported learning environments for social presence [Kr07]. They found that such environments can vary widely in their sociability, i.e., their ability to facilitate sound social spaces that are "characterized by affective work relationships, strong group cohesiveness, trust, respect and belonging, satisfaction, and a strong sense of community" [Kr07, p. 179]. Thus, they hypothesize that sociability affects social presence and social interaction: higher sociability leads to more social interaction, which in turn leads to sound social spaces. Such relationships are supported by several studies [Gö20, WB17].

Finally, and importantly, social presence is mostly hypothesized to lead to more positive social outcomes, which may not always be true [OBW18, p. 25]: individuals who are less socially oriented or who feel uncomfortable during social interactions may benefit less from increased social presence.

3 Study design and procedure

We explored our research question with three courses in our master's program in Information Systems in the fall semesters of 2021/22 (*Semester S1*) and 2022/23 (*Semester S2*).²

The courses were selected according to their modality: in general, in *S1*, the courses were offered online. We selected IT Security (*ITS*) because it was offered as a hybrid course, and two online courses (Enterprise Architecture *EPA*, Project and Change Management *PCM*) to be able to detect possible effects within the same modality. In *S2*, all courses were delivered only in person (i.e., on-site). All course features were the same in both semesters, with one exception: for organizational reasons, in *S2* *EPA* and *PCM* offered 7 double units instead of 14 single units (with no changes in other aspects). All courses in both semesters were rewarded with three credit points (ECTS). The course characteristics are summarized in Tab. 1.

Students were surveyed at the end of each semester using an online questionnaire distributed through the central learning management system. All students were invited to participate in the survey, resulting in a total of 97 (*S1*) and 59 (*S2*) participants. 30 students from *S1* completed the survey in full (30.93% response rate), and 17 students from *S2* (28.81% response rate).

The online questionnaire consisted of a general section to collect participant information (class affiliation, academic background, employment status). In addition, specific questions were asked per course (i.e., three times in total; one block of questions per course to avoid relative evaluations), including the number of course units attended and the use of video cameras during online classes.³

Reflecting the exploratory nature of our study and its aim to learn about students' perceptions in different course environments, the main questions were based on notions of social presence and related or influencing variables:

- We used the 18 items of the community of inquiry scale of Law et al. [LGL19] to measure the perceived *social presence*, *cognitive presence*, and *teaching presence* as well as students' subjective *performance*.
- To assess the perception of the different learning environments that affect social presence, we used the *sociability* scale of Kreijns et al. [Kr07], with 10 items.

The items of each scale variable were rated on 5-point Likert scales (1 = do not agree at all; 5 = fully agree). The results for each scale variable were aggregated as the average of the individual responses. We conducted the following analyses and tests.

² At our business school, students are divided into classes of about 50 people. As a result, the three courses were attended and evaluated by two classes per semester.

³ Results on camera use (*Semester 1* only) are presented in [LMH23].

	Enterprise Architecture (EPA)	IT Security (ITS)	Project and Change Management (PCM)
Syllabus	Modeling of enterprise architectures	Technical foundations of IT security	Leadership, change, and multi-project management
Teaching concept	Flipped classroom	Synchronous lectures and exercises	Synchronous lectures and exercises
Teaching modality	<i>S1</i> : Online (MS Teams), <i>S2</i> : in-person	<i>S1</i> : Hybrid (online via Cisco Webex or in person), in-person (<i>S2</i>)	Online (<i>S1</i> , Zoom), in-person (<i>S2</i>)
Attendance	Voluntary, 14 units (<i>S1</i>), 7 double units (<i>S2</i>)	Voluntary, 14 units	Voluntary, 14 units (<i>S1</i>), 7 double units (<i>S2</i>)
Grading	Written final exam	Written final exam	Group assignments and online test
Recording	All units were video recorded (<i>S1</i> only)	All units were video recorded (<i>S1</i> only)	Units were not recorded

Tab. 1: Course characteristics

For *S1*, we divided the online questionnaire participants ($n = 30$) into an online group and an in-person group based on their modality of participation in *ITS*. Thus, the online group included all participants that attended *ITS* as well as *EPA* and *PCM* online ($n = 12$). The in-person group included all participants who attended *ITS* in person and the other courses online ($n = 18$). We tested the normality of our dependent variables using Shapiro-Wilk tests. All variables were normally distributed, except for *PCM sociability* in the online group ($W(12) = 0.844$, $p = 0.031$) as well as *EPA performance* ($W(18) = 0.858$, $p = 0.012$) and *ITS performance* ($W(18) = 0.895$, $p = 0.048$) in the in-person group.

To test for differences in course ratings *between* the groups, we used independent t-tests (two-sided) for the normally distributed variables and Mann-Whitney *U* tests (two-sided) for their non-normally distributed counterparts. Differences in ratings *within* groups were tested using ANOVAs with repeated measures for all normally distributed variables, and Friedman tests for non-normally distributed variables. For pairwise comparisons of non-normally distributed variables for significant group differences (according to Friedman tests), we first checked the symmetry of variable differences between courses using boxplots. Variables with symmetric differences were further analyzed using Wilcoxon signed-rank tests, and sign tests were used for all other variables.

For *S2*, we also tested the normality of our dependent variables using Shapiro-Wilk tests. Except for *PCM teaching presence* ($W(17) = 0.884$, $p = 0.037$), all dependent variables were normally distributed. Differences in ratings between the courses were tested using ANOVAs with repeated measures for all normally distributed variables, and a Friedman test for *teaching presence*.

All statistical analyses were conducted using SPSS version 28. Due to the exploratory nature of our study, we analyzed all data without multiplicity adjustments [BL01, p. 344]. All significant results should therefore be regarded as preliminary, i.e., the corresponding hypotheses need to be tested in further confirmatory studies.

Finally, some remarks about test power are warranted. Our study was observational rather than experimental, i.e., we could not control for many aspects of the courses, particularly enrollment and class size. Cohen [Co77] suggests aiming for a test power of 0.8, i.e., an 80% chance of achieving statistical significance. A sensitivity analysis⁴ of our study using G*Power version 3.1.9.7 [Fa09], following Lakens [La22, pp. 14-15], shows that our study had 80% power to detect large effects. In *Semester 1*, the study was able to detect effect sizes of at least $d = 1.08$ and $d = 1.11$ for the independent t-tests and Mann-Whitney U tests, respectively. For our ANOVA tests of the online group and the in-person group, the smallest detectable effect sizes were $f = 0.47$ and $f = 0.37$, respectively. In *Semester 2*, our ANOVA test could detect effects of at least $f = 0.44$.

Consequently, all observed effect sizes (see results) were smaller than the smallest detectable effect sizes in our study. However, our statistical tests indicated statistically significant results with medium to large effect sizes. We argue that these are of considerable practical value, even in an exploratory setting. For *Semester 2*, we found no statistically significant differences for any measure, with observed effect sizes below the smallest detectable effect sizes. We acknowledge that it is possible that there were smaller effects in Semester 2 (as opposed to the large effects seen in Semester 1) that our study was unable to detect.

4 Results

4.1 Differences between online and hybrid courses (*first semester, SI*)

Almost half of the participants came from class A ($n = 13$) and half from class B ($n = 17$). Exactly half of the respondents reported a technical background and the other half reported none. The majority of participants reported working part-time (80%); few worked full-time (13.33%), and two participants did not provide any information.

Most of the participants attended classes regularly, except for *PCM_online*⁵. Unlike the other two courses, which had end-of-semester exams, *PCM_online* exams were administered during the semester, so students often attended only the classes that were relevant to them.

For our research question, we analyzed whether the course ratings of participants who

⁴ The authors would like to thank an anonymous reviewer for suggesting that sensitivity analysis is preferable to post hoc power analysis.

⁵ For the sake of clarity, we will indicate the modality of the course in addition to the abbreviation for *SI*.

attended mainly online differed from those of participants who attended mainly in person (based on their attendance in the *ITS_hybrid* course). The analysis was conducted from two perspectives:

(a) Differences between groups: We found no significant differences between the online and in-person groups, with two notable exceptions. First, the mean ratings for *sociability* were statistically significantly higher for *ITS_hybrid* in the in-person group than in the online group, with a large effect size ($t(28) = -3.291, p = 0.003, d = 0.84$), i.e., participants who attended *ITS_hybrid* primarily in person perceived higher sociability than participants who attended the same course online (Fig. 1 and Fig. 2).

Second, although the mean ratings for *cognitive presence* were higher for all courses in the online group than in the in-person group, only for *EPA_online* were these differences statistically significant with a medium effect size ($t(28) = 2.408, p = 0.023, d = 0.61$), meaning that participants who attended all courses online perceived higher cognitive presence in *EPA_online* than those who attended *ITS_hybrid* in person.

For *social presence*, we could not find any statistically significant differences between the two groups (Fig. 3 and Fig. 4).

(b) Differences within groups: Regarding our within-group analyses, we found significant differences for the in-person group but none for the online group, i.e., the participants who attended *ITS_hybrid* in person rated their experiences differently for each of the three courses, while online participants showed no significant differences.

For the in-person group, we found statistically significant differences in reported *sociability* ($\chi^2(2) = 23.444, p < 0.001$) (see Fig. 2). Post hoc analysis using Wilcoxon signed-rank tests revealed that sociability ratings were significantly higher for *ITS_hybrid* than for *EPA_online* with a large effect size ($Z = -3.727, p < 0.001, r = -0.88$) and also higher for *PCM_online* than for *EPA_online* with a large effect size ($Z = -3.078, p = 0.002, r = -0.73$). An exact sign test revealed that sociability ratings were significantly higher for *ITS_hybrid* than for *PCM_online* with a large effect size ($p = 0.008, r = 0.67$).

We also found differences in reported *social presence* for the in-person group (see Fig. 4). Using an ANOVA with repeated measures with a Greenhouse-Geisser correction, the mean scores for social presence in the in-person group were statistically significantly different ($F(1.715, 29.150) = 8.535, p = 0.002$) with a large effect size ($\eta^2_p = 0.334$). Post hoc analysis revealed that social presence was statistically significantly higher for *ITS_hybrid* compared to *EPA_online* (0.722 (95% CI, 0.39 to 1.05), $p < 0.001$) and for *ITS_hybrid* compared to *PCM_online* (0.478 (95% CI, 0.03 to 0.92), $p = 0.037$).

A statistically significant difference was also found for the reported *performance* of the in-person group ($\chi^2(2) = 13.875, p < 0.001$). Post hoc analysis using a Wilcoxon signed-rank test showed that ratings were significantly higher for *ITS_hybrid* than for *EPA_online* with a large effect size ($Z = -2.986, p = 0.003, r = -0.70$). An exact sign test revealed that performance ratings were also significantly higher for *ITS_hybrid* than for *PCM_online*

with a large effect size ($p = 0.006$, $r = 0.56$). Due to the anonymity of the survey, we were not able to relate these self-assessments directly to course grades. Therefore, we cannot make any assertions about possible differences in objective performance.

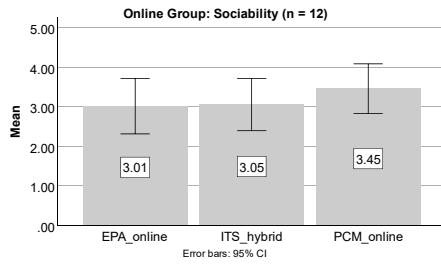


Fig. 1: Evaluation of sociability (online group)

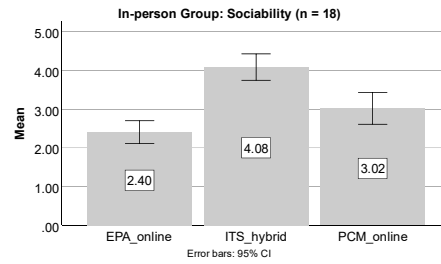


Fig. 2: Evaluation of sociability (in-person group)

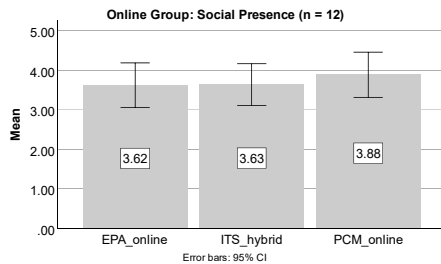


Fig. 3: Evaluation of social presence (online group)

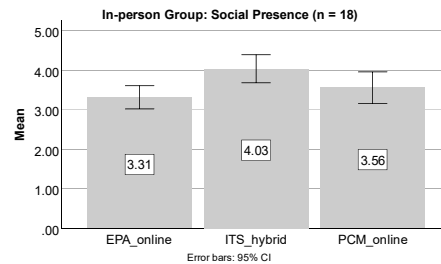


Fig. 4: Evaluation of social presence (in-person group)

4.2 Differences between in-person courses (second semester, S2)

Almost half of the participants came from class A ($n = 8$) and half from class B ($n = 9$). The majority of the respondents reported having a technical background (76.5%) and working part-time (94.1%). Most of the participants attended classes regularly, except for PCM as in the first semester (S1).

Regarding our main dependent variables, we found no effects between the three in-person courses. The ANOVAs with repeated measures revealed no statistically significant differences for *sociability* ($F(1.366, 21.855) = 2.597$, $p = 0.112$; with Greenhouse-Geisser correction; $\eta^2_p = 0.140$), *social presence* ($F(1.411, 22.578) = 1.630$, $p = 0.219$; with Greenhouse-Geisser correction; $\eta^2_p = 0.092$), *cognitive presence* ($F(2, 32) = 0.049$, $p = 0.925$; $\eta^2_p = 0.003$) and *performance* ($F(2, 32) = 0.559$, $p = 0.572$; $\eta^2_p = 0.034$). The Friedman test for *teaching presence* also showed no statistically significant differences between the courses ($\chi^2(2) = 2.935$, $p = 0.23$, Kendall's $W = 0.086$).

5 Discussion

We found significant differences in our students' subjective course ratings in the first semester depending on whether they participated in the courses only online (online group) or in a mix of online and in-person (in-person group). These differences in ratings, however, disappeared when all courses were delivered in person in the second semester.

If there were systematically large differences between the better-rated course in the first semester (*ITS*) compared to the other courses (*EPA* and *PCM*), we should have detected these differences in the second semester as well. Since all relevant factors except the modality of the courses did not change, we suggest that the modality caused or moderated these differences.

In the first semester, ratings for the sociability of the *ITS_hybrid* course were significantly higher for in-person and online participants, and by a considerable margin. Sociability is defined as the extent to which students perceive the environment as conducive to sound social spaces [Kr07]; the in-person group rated this environment much more favorably for *ITS_hybrid* than for the other courses. Personal contact and interaction seem to play an important role here – this is also reflected within the group regarding the evaluation of the social presence, i.e., the participant's perceived ability to relate to and interact with their classmates [LGL19]. This aspect of interaction could also explain the significantly higher sociability of *PCM_online* compared to *EPA_online*: in the former, students had more opportunities to work together in groups than in the latter.

Such differences were also observed between the groups. Students of the in-person group rated the sociability of *ITS_hybrid* higher than online participants and rated the other courses lower, although the differences were not statistically significant. These results were similar for social presence.

We suspect that there may have been a (negative) carry-over effect between courses, such that the more “social” experience of in-person attendance was established as a benchmark for the online courses, which were therefore systematically depreciated. Of course, ratings of social presence were also quite positive for the online-only courses; however, possible influences between different modalities should be considered when designing blended model curricula.

Sociability is also considered influential for social interaction, which in turn is a dominant factor influencing learning performance [Kr07]. Indeed, the evaluation shows that students who attended *ITS_hybrid* in person rated their performance in this course much higher than in their other (online) courses.

Next, we would like to draw attention to those aspects that were *not* rated differently in the two semesters. Surprisingly, we generally found no significant differences in the ratings of cognitive presence (with one exception) and teaching presence. Cognitive presence refers to a student's ability to construct meaning, e.g., through discussion and

reflection, and has been found to correlate strongly with social presence and teaching presence [SB09]. We found that cognitive presence was rated only slightly higher for all courses in the online group than in the in-person group (statistically significant only for *EPA_online*). In general, this could be related to a better match of social and learning preferences for the online group: in the online-only courses, less socially oriented individuals who preferred online to in-person interaction [OBW18, p. 25] or who generally sought less connectedness [Re03b] may have found a more appropriate setting for their learning, while the in-person group was constrained to participate online. This could also explain why the ratings for *ITS_hybrid* were very similar for both groups: each group was able to choose according to their preferences. Finally, the significant difference in *EPA_online* may also have been due to the flipped classroom design, which emphasized individual, self-directed work.

Teaching presence refers to the overall course design (content, learning activities, interaction) and facilitation by the lecturer; it is a strong predictor of perceived learning and student satisfaction [LGL19]. We found no differences in the ratings of this aspect, either within or between the groups. Given the differences in the content and structure of the courses and the fact that they were taught by different lecturers, we found this rather surprising. This was particularly true for *ITS*, which was focused primarily on in-person participation with an additional online option; again, we found no differences in the ratings. Overall, we suspect that cognitive presence and teaching presence depend more subtly or indirectly on social presence and the course setting (i.e., online or in-person).

6 Conclusion

The demand for flexible course modalities has increased in recent years and has been further accelerated by COVID-19. In our study, we examined how course modality affected participants' perceived social presence, which research has shown to be a strong predictor of learning outcomes.

While we found no differences in course ratings when all courses were delivered in person, we found significant differences for different modalities (online and hybrid). Students rated sociability and social presence differently depending on whether they had taken courses primarily online or one of the courses in person, such that the online experience was significantly depreciated. Such possible carry-over effects between modalities are particularly important to consider in mixed-modality curricula, which we expect to become increasingly important in the future.

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