

# Evaluating Video Conferencing and Desktop Virtual Platforms for Supporting Remote Classroom Activities

Matin Yarmand, Ru Wang, Haowei Li, Nadir Weibel  
myarmand@ucsd.edu, ruw001@ucsd.edu, hal065@ucsd.edu, weibel@ucsd.edu  
UC San Diego

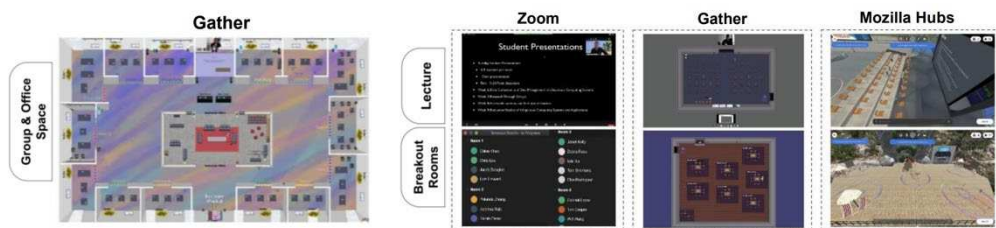
**Abstract:** Facilitating effective classroom interactions is especially challenging in online classrooms where participation is entirely remote and subject to tool features. This work explores three learning platforms during a six-week field study at a college class (N=30 students): video conferencing system, video chat with 2D map, and Desktop VR with 3D map. Post-study interviews and survey results revealed that students strongly preferred the plain video conferencing system for lectures due to superior student-content interactions. Meanwhile, they indicated a higher sense of co-presence and social awareness via top-down viewing in 2D map, shape-changing and moving avatars, and spatial audio. This study suggests tailoring features to optimize one type of interaction informed by characteristics of the learning activities.

## Introduction

When teaching university classes online, many instructors opt in for synchronous approaches due to real-time interaction. When facilitated online, lecture delivery relies on video conferencing platforms which (on the contrary) can offer limited support for other classroom interactions, such as pre/post lecture chats. In addition to video conferencing like Zoom (Yarmand et al., 2021), some works incorporated tools with better flexibility in forming interactions: for instance, Gather – a video call system with 2D map – can facilitate group learning activities more seamlessly (Fitria, 2021). Recent works also used Desktop-VR platforms (Fuller, 2021), that not only promote forming connections, but can also enhance learning experience via realistic 3D environments.

Facilitating classroom interactions is a significant challenge, especially when students' use of technology is discretionary: in video conferencing tools, learners avoid sharing videos which further exacerbates already limited interactions (Yarmand et al., 2021). While prior works explored online classrooms via short-term and single-platform interventions (e.g., Chen, 2003), we present results of a six-week field study with Zoom, Gather, and Hubs, as shown in Figure 1. We investigate how features of these platforms influence classroom interactions.

**Figure 1**  
*Common Space, Lecture, and Breakout Room Environments on Zoom, Gather, and Hubs*



## Methods

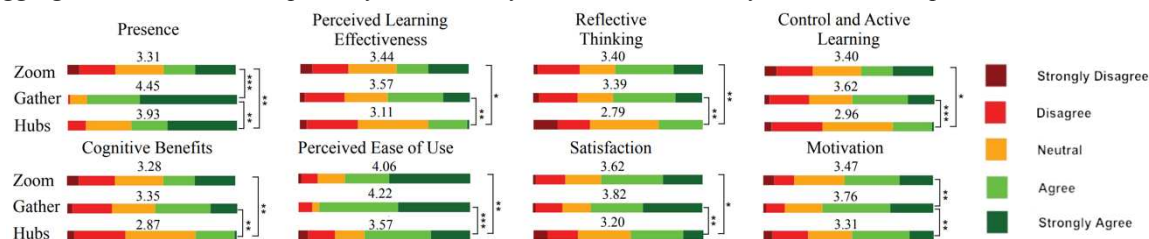
A six-week field study in an Engineering classroom investigated students' perceptions with different platforms. The classes were conducted using the same assigned platform and alternated weekly. The first 15 minutes of class were allocated to optional participation in Gather's spaces, where students could meet up with their peers or the instructor. The last 20 minutes of every week assigned students to discuss a particular topic in breakout rooms.

We collected two data sources. First, weekly surveys assessed perceptions on the assigned platform of the week, administered during the last three weeks. The survey measured eight dimensions of the psychological factors of education (Lee et al., 2010). Cronbach's alpha measured the internal consistency of the questions and determined high reliability scores (>0.7) which prompted Kruskal-Wallis and Mann-Whitney's U tests. Second, after six weeks, all students were invited to participate in semi-structured interviews, of whom four participated (2F, 2M; 21-26 years old). Interviews took 1.5 hours and consisted of three segments for each platform. To enhance recall, each segment took place on the corresponding platform and followed a lecture role-play.

## Results

Figure 2 shows that Gather is generally the most preferred platform. The remaining describes the interview results.

**Figure 2**  
*Aggregated Likert-scale Responses for Each Platform and Dimension of Educational Experience*



Note: extracted from prior surveys (Lee et al., 2010). Bars include mean scores, from 1 (lowest) to 5 (highest).

The participants mentioned that the Zoom interface suits lecture formats well due to “larger screen space for slides” (P2) and “high quality audio” (P3). When comparing Zoom to other modalities – P1 felt less distracted: “everything is black. There is just the video playing. I can more easily pay attention to this.” However, Hubs provided low quality visuals. P2 pointed out that the smaller size of slides made viewing the content more difficult. Other participants added that the contrast between the 2D screen and 3D space created a “twisted plane which had some rotation and affected the quality of the video when sitting in the corner” (P3).

Students benefited from the 2D map portion of Gather mainly due to the ability to move around and gain awareness over other students’ activities: “physical presence was dramatically improved, because there’s a consciousness behind movements. They’re sitting next to me, they *are* there. They did not just join the Zoom call and went to cook lunch” (P1). The 2D map also allowed students to tailor their class activities according to others, such as selectively joining popular discussion groups with more students. Hubs lacked a designated video feature – unlike both Zoom and Gather – which diminished satisfaction in small-group interactions: “It’s basically a phone call and, then I see this little avatar’s head getting bigger and smaller as he’s talking” (P1). The participants also strongly preferred the spatial audio of Hubs which allowed students to “listen to what the professor says to the other teams” (P4) and “help get to know more people in class by listening in” (P2).

## Discussion and conclusion

This study highlights a clear distinction between characteristics of lectures and group interactions which might require different tool features. Aiming to optimize all types of interactions simultaneously can not only introduce unwanted complexity and diminish usability, but also it can degrade the overall educational experience. Designing an ideal platform for remote classrooms requires considering existing trade-offs, aligned with Anderson’s Equivalency Theorem (Anderson, 2003) which states: *meaningful learning is supported as long as one of the three forms of interaction [student-student, student-instructor, and student-content] is at a high level. The other two may be offered at minimal levels, or even eliminated, without degrading the educational experience.*

This study explores classroom interactions by conducting a six-week field study at a university class. Students experimented with lecture and breakout room spaces in three platforms: Zoom, Gather, and Hubs. Interview results and surveys revealed students’ strong preference for attending lectures on Zoom, and higher co-presence and social awareness in Gather and Hubs due to top-down viewing of peers’ movements and spatial audio. This work lastly suggests tailoring tool features to unique classroom activities.

## References

- Anderson, T. (2003). Getting the mix right again: an updated and theoretical rationale for interaction. *The International Review of Research in Open and Distributed Learning*, 4(2).
- Chen, M. (2003). Visualizing the pulse of a classroom. *Proceedings of the Eleventh ACM MM*, 555–561.
- Fitria, T. N. (2021). Creating Sensation of Learning in Classroom: Using “Gather Town” Platform Video Game-Style for Virtual Classroom. *Education and Human Development Journal*, 6(2), 30–43.
- Fuller, E. G. (2021, July). WIP: Mozilla hubs classes fight feelings of isolation and online fatigue. In 2021 ASEE Virtual Annual Conference Content Access.
- Lee, E. A., Wong, K. W., & Fung, C. C. (2010). How does desktop virtual reality enhance learning outcomes? A structural equation modeling approach. *Computers & Education*, 55(4), 1424–1442.
- McAuley, E., Duncan, T., & Tammen, V. (1989). Psychometric properties of the Intrinsic Motivation Inventory in a competitive sport: A confirmatory factor analysis. *Research for exercise and sport*, 60(1), 48–58.
- Yarmand, M., Solyst, J., Klemmer, S., & Weibel, N. (2021). “It feels like I am talking into a void”: Understanding interaction gaps in synchronous online classrooms. The 2021 CHI Conference.