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Coffeehouse as classroom: Examining a flexible and active learning space from the pedagogy-space-technology-user perspective

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This study draws on the analysis of 56 hours of classroom video recordings and daily room usage checklists as well as interview data from students and faculty teaching in a large, flexible, technology-rich, and collaborative classroom, "Collaboration Café." The goal is to explore faculty practices and student perspectives to increase our understanding of pedagogic interactions and the use of space and technology in active learning spaces. Informed by the updated version of Radcliffe's Pedagogy-Space-Technology (PST) framework, we argue the pivotal role of actors (i.e., faculty and students) in an active learning environment to use technology, space, and pedagogy in ways which foster learning. The discussion highlights that the faculty's choice of instructional technique shapes active and collaborative learning behaviors in the classroom. Also, student perspectives provided evidence for satisfaction with room features such as fluidity versatility, and scalability.

Introduction

Space has an undeniable influence on shaping technical, psychological, and social practice (Massey, 2005). Learning space, for example, is considered "the third teacher" that conveys specific meanings, symbols, and educational expectations (Rinaldi, 2006). According to Mulcahy and colleagues (2015) "Learning spaces are no longer a 'container' for human activities, a product (architectural design, a built space) which can be appropriated by their teacher and student users and that can impact on learning outcomes." (p. 580). Therefore, learning space design is pivotal for students to participate in active learning.

Adoption of active learning spaces has gained momentum in higher education institutions (Talbert & Mor-Avi, 2019) as many academic institutions strive to promote student involvement in collaboration and in the learning process (Bolden et al., 2017). The literature with positive gains of active learning spaces in terms of student achievement (Cotner et al., 2013; Freeman et al., 2014; Swanson et al., 2019), student engagement (Clinton & Wilson, 2019; Griffith, Vercellotti & Folkers, 2019; Mui et al., 2019), and reducing achievement gaps in STEM courses (Lugosi & Uribe, 2020; Theobald et al., 2020).

However, multiple studies report that students and faculty hold less favorable affective reactions toward active learning spaces and activities. For example, Smith and Cardaciotto (2011) compared undergraduate students' engagement in active learning instruction and teacher-centered instruction in a large introductory psychology course. Study findings showed that the students in the active learning environment had a lack of satisfaction with the active learning activities. The authors argued that students in an active learning class might have resented the required intellectual effort. In a similar vein, Bolden and colleagues (2017) reported that "Contrary to the expectation, data indicate student learning and motivation were stronger in the lecture hall, where students' active engagement was reported to have occurred less frequently" (p. 149). As for the faculty, lack of time (Sabagh & Saroyan, 2014), lack of training (Brownell & Tanner, 2012), and fear of low teaching evaluations (Henderson, Kahn & Dancy, 2018) are among the factors that hinder faculty use of active learning strategies in higher education. Additionally, as Boys (2009) argued, if the social, technical, and pedagogical affordances within the space are not acknowledged by faculty and students, a disconnect between the intent of the room design and outcome is unavoidable.

Therefore, it is critical to empirically examine the instructional interactions, movement, and use of technology in an active learning classroom to better understand the potential influences of space on student learning and faculty teaching experiences. In this study, we investigated the use of a large, flexible, technology-rich, and collaborative classroom called Collaboration Café. Our purpose was to use qualitative and quantitative research paradigms to identify

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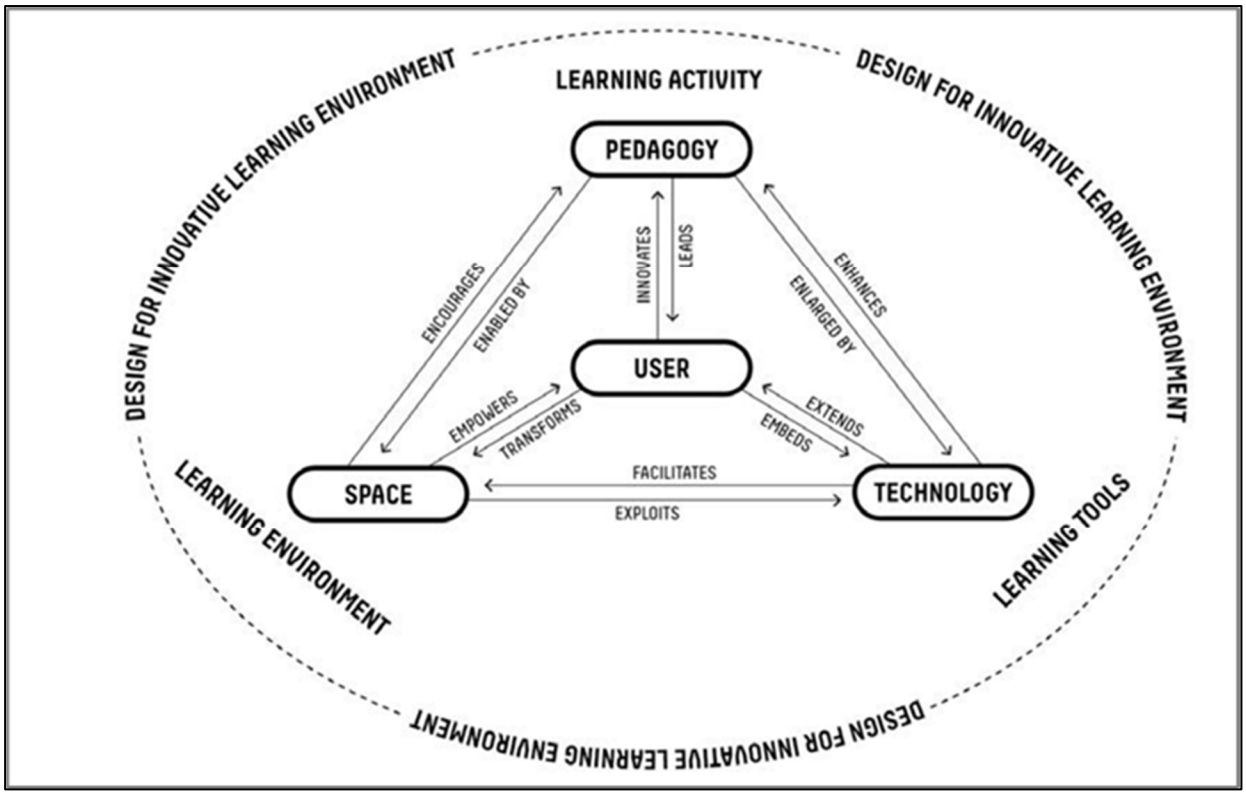


***Figure 1*. PSTU model updated based on Radcliffe's PST framework by Manciaracina (2019)**

how space was used by faculty and students to achieve their instructional goals.

Active learning space design: Pedagogy-Space-Technology (PST) perspective

The pedagogy-space-technology (PST) framework developed by David Radcliffe and colleagues (2008) highlights the significance of the nexus between the pedagogical, technological, and spatial aspects of teaching and learning spaces:

> … use of a space will influence the desired pedagogy. A learning space irrespective of its intended use will tend to shape what people do in it and hence the patterns of teaching and learning. Similarly, a particular space places constraint (or presents opportunities) for the introduction of certain types of technology while a given technology can impact how a space is used by teachers and students. (p. 6)

The PST framework has been used by several scholars in distinct classroom design projects. For example, Ng (2015) from Charles Darwin University built an online moot court for law school students following the PST guidelines. The purpose was to help students gain skills such as teamwork, effective communication, and dealing with interruptions in a virtual space. Ng (2015) argued that the PST framework provided a well-balanced approach that emphasized the three aspects equally in an online class.

In a classroom renovation project titled, "From swimming pool to Collaborative Learning Studio" Lee, Morrone, and Siering (2018) used the PST framework to investigate the effectiveness of a large technology-enriched active learning space at Indiana University. The findings of this qualitative study suggested that "ongoing pedagogical and technological support is needed [for faculty] for successful implementation that maximizes use of the space" (p. 22).

In a case study, Manciaracina (2019) implemented the PST framework in the School of Design of Politecnico di Milano to build innovative spaces for design school students. He proposed adding another element, the user, to the model due to the core role of those actors in the learning environments. Figure 1 is the updated version of the PSTU model as presented by Manciaraciana. In this model, the actors such as directors, students, teachers, and tutors are placed as the focal point of the model since they have the power to activate new relationships with pedagogy, space, and technology.

Previous literature shows that the learning environment is formed by the continuous interaction between the physical space, technological affordance, and pedagogical choice. The

actors who are a part of the learning process also form an integral component of the learning environment. Their willingness to recognize and embrace the existing resources fosters or diminishes the learning.

In this project, we focused on the behaviors of the actors (i.e., faculty and students) in an active learning classroom, Collaboration Café, to capture, interpret, and report their use of technology, space, and pedagogy over an 8-week period in a Midwest University in the United States. The following research questions guided this inquiry:

1. How do faculty and students interact in the Collaboration Café?
2. How do faculty and students use technology and space in the Collaboration Café?
3. How do faculty and students perceive classroom space and activities in the Collaboration Café?

Research methods

The study used a Mixed-Method Research (Creswell & Plano Clark, 2018) approach, utilizing quantitative methods such as classroom recordings and daily room usage checklist as well as qualitative methods including email interviews and researchers' informal field notes. This research design enabled us to obtain detailed contextualized information in the Collaboration Café and to better understand the complexities of space and technology used by students and faculty. All participant names are pseudonyms; no actual faculty or student names are used in this article.

Participants

During the Spring 2020 semester, 14 faculty taught in the Collaboration Café. Two of 14 faculty agreed to be video recorded while teaching and to complete daily room usage checklists throughout the semester. One faculty member (Ada) from the School of Informatics taught a Web Design Course in the Collaboration Café. The second faculty member (John) in the School of Public Health taught a Recreational Therapy Course. Additionally, a third faculty member (Megan), from the Media School, only agreed to complete the room usage checklists for her Politics and the Media course.

In order to obtain a richer understanding of faculty and student experiences and perceptions in the Collaboration Café we sent interview requests to all 14 faculty members teaching in the space. In addition to Ada and Megan, three more faculty responded, via email, to our open-ended questions regarding what worked well and what did not work well? in the Collaboration Café. Similarly, out of 248 students who were sent the survey, 10 students responded to the same open-ended questions in Qualtrics, an electronic survey platform,. Table 1 details the number of participants for each data collection tool.

Table 1: **The number of study participants for each data collection tool**

Participants	*Classroom Recording*	*Room Usage Checklist*	*Open-ended Survey*
Ada	✓	✓	✓
John	✓	✓	
Megan		✓	✓
3 Faculty			✓
10 Students			✓
Total:	**2**	**3**	**15**

Study design and procedures

After obtaining IRB approval, faculty recruitment emails were sent to 14 faculty who taught at the Collaboration Café at the beginning of the Spring 2020 semester. Two faculty volunteered to participate in the study and they announced to their students that the class would be recorded. The faculty gave all students the option to sit behind the camera if they felt uncomfortable being filmed. If those students were unintentionally filmed during the class activities, they were not included in the data analysis. In addition, a researcher from our team visited the classroom and after describing the study purpose and procedures, collected student consent forms for the class recordings. Three faculty completed daily use checklists that asked what technology was used, whether collaborative activities were employed, and how effective the technology was in supporting the instruction after each class. Both faculty and students were contacted again in Week nine, just after the shift from face-to-face to online instruction occurred due to the COVID-19 pandemic and were asked follow-up questions about their experiences in the room via email.

The setting of the Collaboration Café

The Collaboration Café is equipped with movable chairs and tables to allow easy maneuvering for group work and flexible seating opportunities within the space. In addition, the room contains soft and colorful sofa seating with small coffee tables that provide a coffee house feel. The abundance of natural light as well as limestone accents support this less formal learning atmosphere. The technology in the room includes portable whiteboards for students' use, a large projection screen, a teacher's station, and power outlets on the floor. The room capacity is 49. Figure 2 presents the room layout from different angles.

Data analysis

Video analysis

Fifty-six hours of classroom video recordings from three undergraduate classes (2 sections of Ada and 1 section of

Figure 2**. The setting of the Collaboration Café from different angles**

John) were analyzed using the methodological framework proposed by Lee, Arthur, Morrone (2017) to analyze classroom video surveillance data. This framework was developed to minimize the potential bias in self-reported data in an earlier study conducted in the Collaboration Café.

Five coding rules were followed. First, the video was segmented into one-minute pieces. Second, the speed of the video was set to two-time fast motion (i.e., 2X). Next, it was scanned for variation until we arrived at the presence of particular pattern. Then once a new activity was detected (e.g., the instructor started a group activity, asked a question, visited a small group, played a video, etc.), the speed was set back to normal speed (i.e., 1X) and we then reviewed and coded it by listening to the audio and observing each detail. Lastly, a color-coded Microsoft Excel sheet was used. Lee et al. (2015) divided this scheme into three main categories including *interaction*, *technology*, and *movement*. In the interaction category, while dark blue means the lack of active learning, light blue refers to a high level of activity as presented in Figure 3.

The frequency and percentage of each input were calculated using the pivot table feature under the Insert Menu of MS Excel. Table 2 details the subcategories of the Interaction, Technology, and Movement.

Interview analysis

Interviews were analyzed, using the content analysis technique, to systematically identify, organize, and understand faculty and student interview data (Mayring, 2004). Since the interview responses were received either by email or in written format, we could easily categorize the content under two main categories: situations in which the Collaboration Café worked well and situations in which the Collaboration Café did not work well.

Room usage checklists

Weekly submitted checklists by three faculty were recorded in an MS Excel sheet. The frequency of the reported technology usage and collaborative class activities was calculated using the =*sum* formula in Excel.

Table 2. **Coding scheme and descriptions**			
Interaction		**Technology**	**Movement**
T_prep:	Teacher's preparation behaviors. Example: Turning on the computer and introducing a new activity.	T_proj	T_stand_by
T_direct inst:	Teacher's direct instruction behaviors. Example: PowerPoint presentation	T_whiteboard	T_roaming_active
T_monitoring:	Teacher's classroom observation behaviors while students are working on a task.	T_comp	S_roaming_active
T_consulting:	Teacher's advisory behaviors. Example: Visiting small groups and talk with them during group work.	T_smartphone	A_roaming
I>S:	Refers to interactive dialogs where the instructor talks more than students.	S_laptops	
S>=I:	Refers to interactive dialogs where the instructor talks more than or equal to students.	S_whiteboard	
S*GRP:	Refers to students' group work.		
T=Teacher; S=Student; A=Teaching assistants			

Figure 3. **A sample color-coded data for the Interactivity category.**

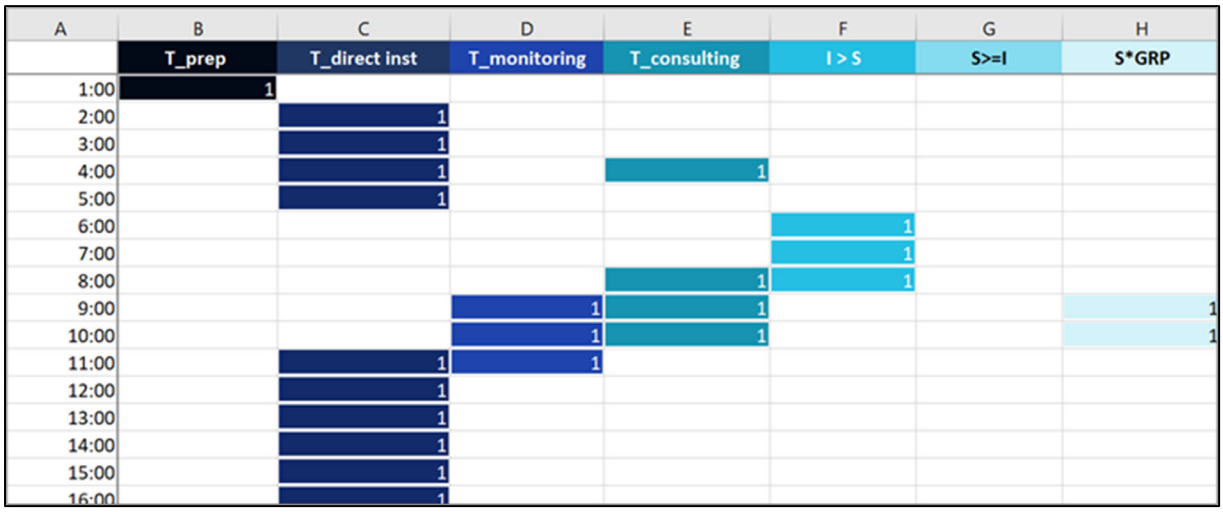
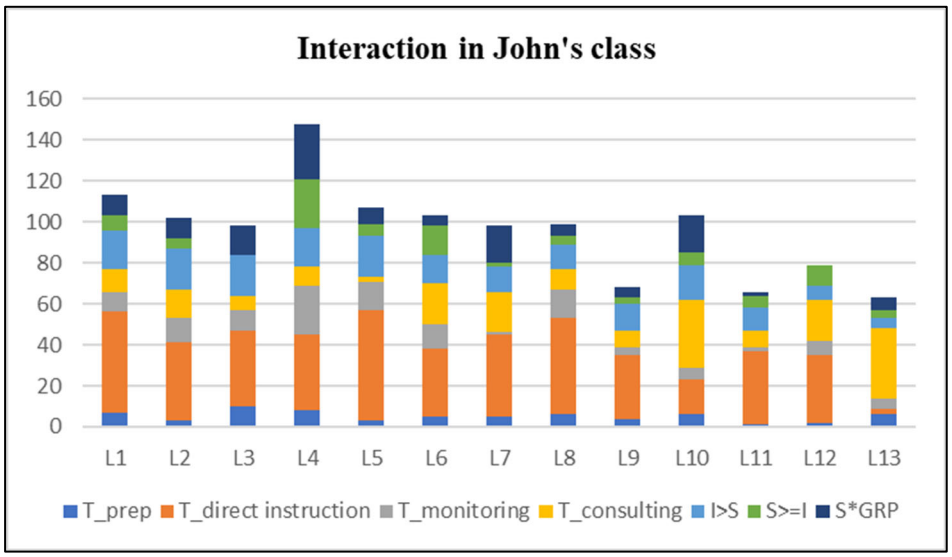
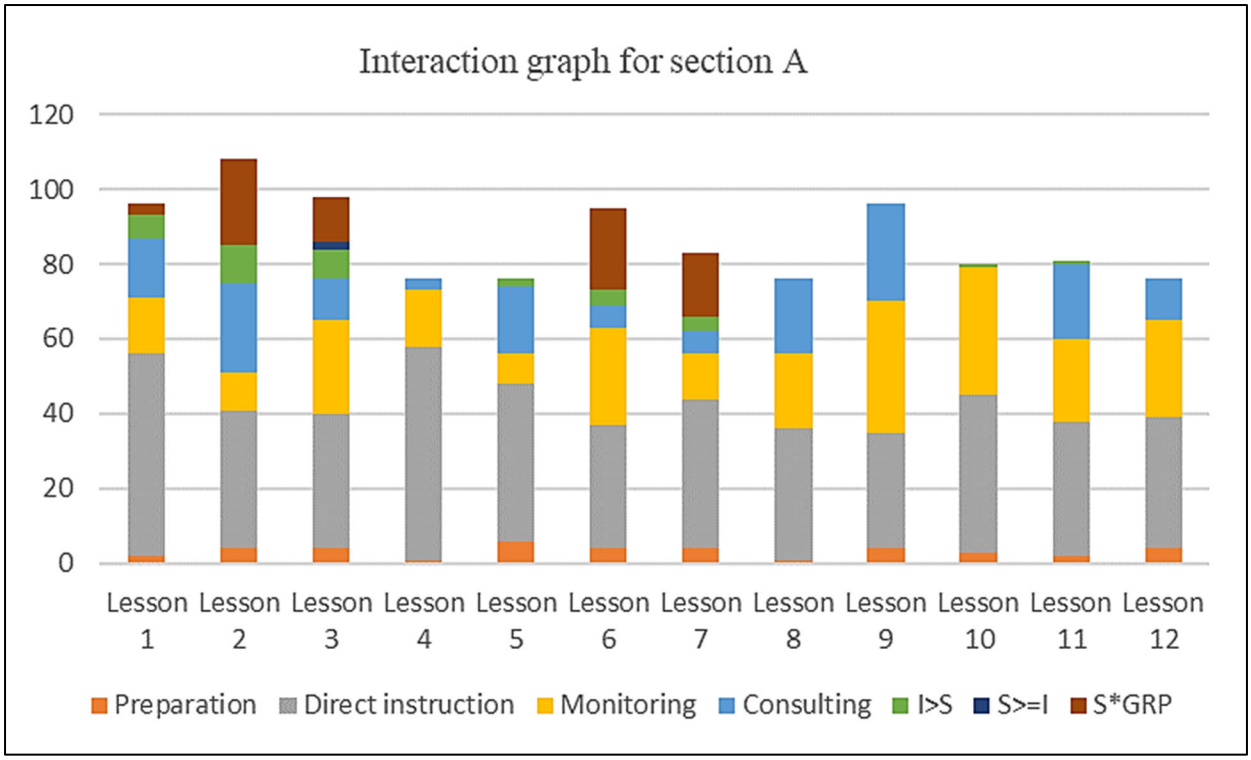
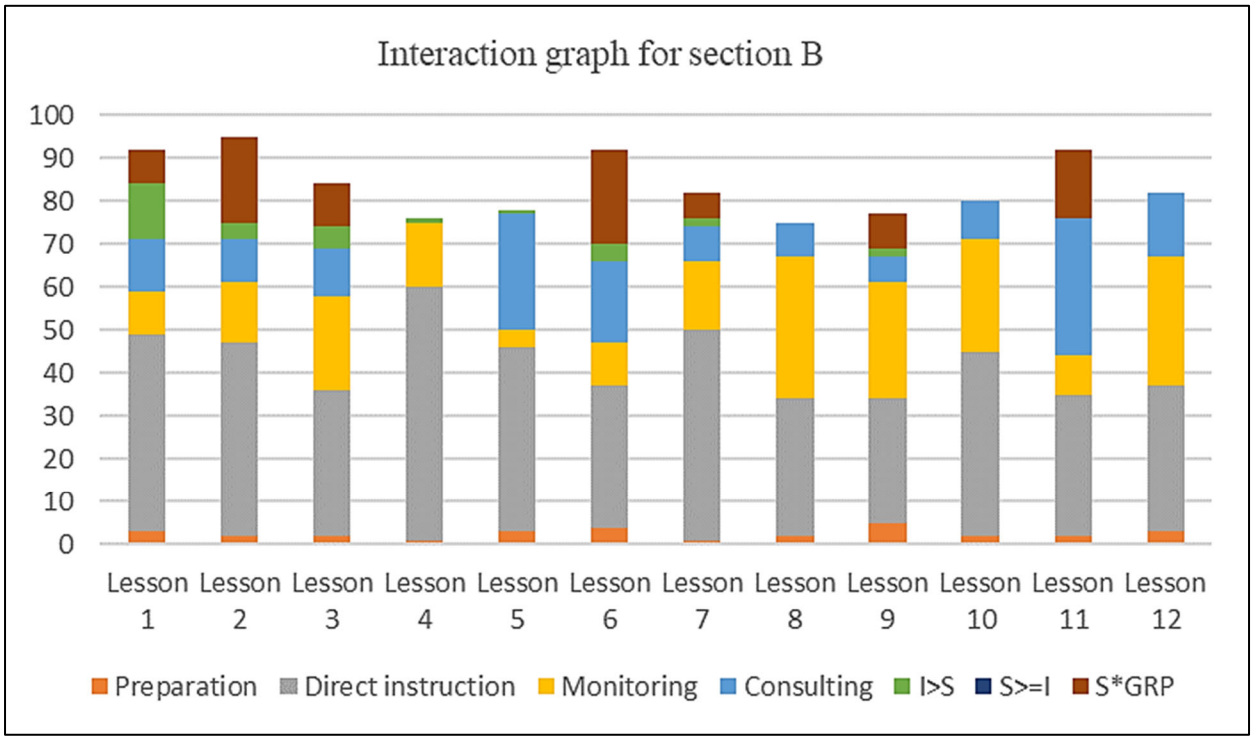


Figure 4. **Interaction graph of John's class**







***Figures 5a and 5b*. Interaction graphs of Ada's class for section A and section B**

Trustworthiness

To ensure the trustworthiness of the qualitative data coding process for video recordings and interviews, three main strategies were used: (1) debriefing by colleagues wherein the coding scheme and issues during the coding and reporting phase were discussed in five monthly research group meetings with colleagues who are expert in active learning research in higher education; (2) using a published coding scheme that was proposed in a peer-review journal article for the video analysis; and (3) using repeated data coding technique as a strategy for intra-reliability as suggested Mackey and Gass (2005). The lead researcher coded the same data twice within four months. This iterative process enabled us to find new insights. For example, the movement of the teaching assistants was not coded in the first round since it was not noted in the original coding scheme of Lee et al. (2015). However, after capturing the critical role of teaching assistants in the learning environment, a third category *assistants roaming active* was been added to the movement category in the second round.

Results

RQ1. How do faculty and students interact in Collaboration Café?

The analysis of classroom video recordings showed that direct instruction and monitoring behaviors are the most prevalent pedagogic approach used by both faculty, John and Ada. As detailed in Table 3, John used 455 (36.5%) times **direct instruction** over 13 lessons, followed by 196 (15.7%) times **consulting** and 189 (15.2%) times **interactive dialogs** where John talks more than students. Figure 4 visualizes the frequency of all interaction types during each week.

Likewise, Ada used 478 (45.9%) times **direct instruction** in section A and 480 (47.8%) times in section B over 12 lessons. Different from John, she used 248 (23.8%) times **monitoring** in section A and 216 (21.5%) times in section B followed by 161 (15.5%) **consulting** in section A and 157 (15.6%) in section B as presented in Table 4. Figures 5a and 5b visualize the frequency of all interaction types during each week.

RQ2. How do faculty and students use technology and space in Collaboration Café?

John's recreational therapy course

The projector is the most prevalent technology (54.5%) used by John over 13 weeks. Showing PowerPoint presentations and playing educational videos were among the most frequent activities. Interview videos with experts and how-to videos regarding recreational activities were the most frequent topics. Additionally, John always used a clicker during the presentations, so his time to using the teacher's computer decreased. The most frequently used second technology in the room was **student laptops** (35.0%). Figure 6 illustrates the weekly distribution of all technologies while Table 5 shows percentages and frequencies.

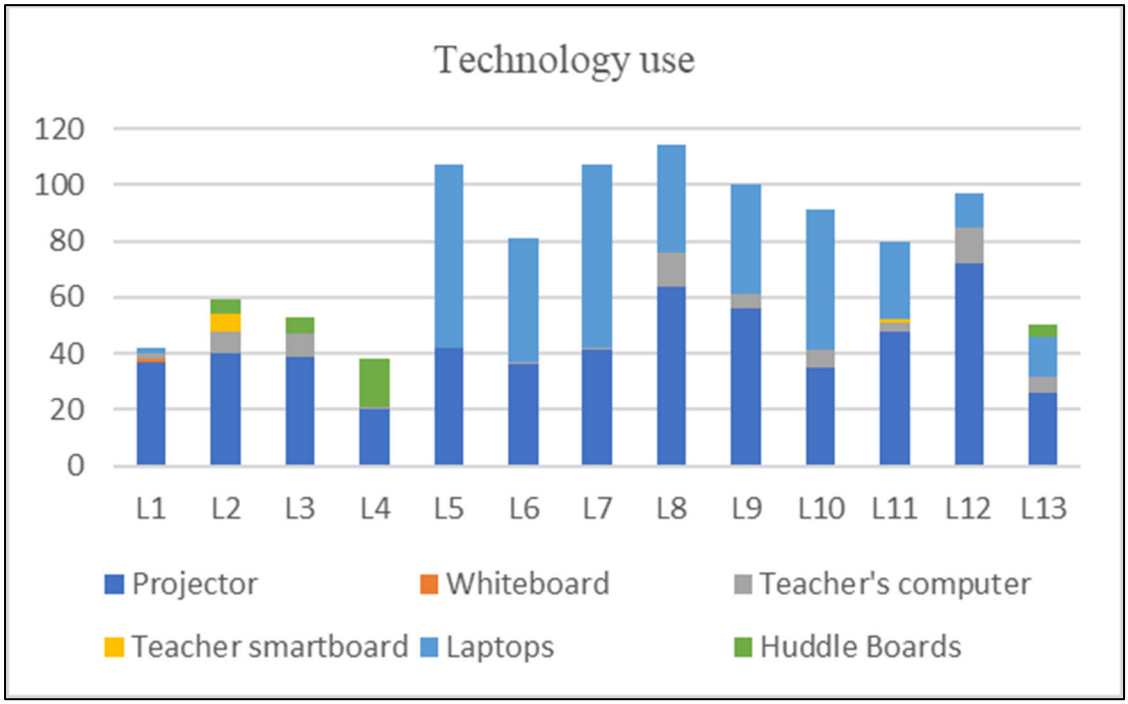


Figure 6. **Technology use graph of John's recreational therapy classes**

Table 3. **The interaction frequency and percentage of John by lesson number**														
Interaction	**Lesson 1**	**Lesson 2**	**Lesson 3**	**Lesson 4**	**Lesson 5**	**Lesson 6**	**Lesson 7**	**Lesson 8**	**Lesson 9**	**Lesson 10**	**Lesson 11**	**Lesson 12**	**Lesson 13**	**Total ***
T_prep	6.2% 7	2.9% 3	10.2% 10	5.4% 8	2.8% 3	4.9% 5	5.1% 5	6.1% 6	5.9% 4	5.8% 6	1.5% 1	2.5% 2	9.5% 6	5.3% 66
T_direct instruction	43.4% 49	37.3% 38	37.8% 37	25.0% 37	50.5% 54	32.0% 33	40.8% 40	47.5% 47	45.6% 31	16.5% 17	54.5% 36	41.8% 33	4.8% 3	**36.5%** **455**
T_monitoring	8.8% 10	11.8% 12	10.2% 10	16.2% 24	13.1% 14	11,7% 12	1.0% 1	14.1% 14	5.9% 4	5.8% 6	3.0% 2	8.9% 7	7.9% 5	9.7% 121
T_consulting	9.7% 11	13.7% 14	7.1% 7	6.1% 9	1.9% 2	19.4% 20	20.4% 20	10.1% 10	11.8% 8	32.0% 33	12.1% 8	25.3% 20	54.0% 34	**15.7%** **196**
I>S	16.8% 19	19.6% 20	20.4% 20	12.8 19	18.7% 20	13.6% 14	12.2% 12	12.1% 12	19.1% 13	16.5% 17	16.7% 11	8.9% 7	7.9% 5	**15.2%** **189**
S>=I	6.2% 7	4.9% 5	---	16.2% 24	5.6% 6	13.6% 14	2.0% 2	4.0% 4	4.4% 3	5.8% 6	9.1% 6	12.7% 10	6.3% 4	7.4% 92
S*GRP	8.8% 10	9.8% 10	14.3% 14	18.2% 27	7.5% 8	4.9% 5	18.4% 18	6.1% 6	7.4% 5	17.5% 18	3.0% 2	---	9.5% 6	10.3% 129
Total**	100% 113	100% 102	100% 98	100% 148	100% 107	100% 103	100% 98	100% 99	100% 68	100% 103	100% 66	100% 79	100% 63	100.% 1247

***Row total**
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Table 4. **The interaction frequency and percentage of Ada by lesson number**

Interaction	Section No	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5	Lesson 6	Lesson 7	Lesson 8	Lesson 9	Lesson 10	Lesson 11	Lesson 12	Total *
Preparation	A	2.1% 2	3.7% 4	4.1% 4	1.3% 1	7.9% 6	4.2% 4	4.8% 4	1.3% 1	4.2% 4	3.8% 3	2.5% 2	5.3% 4	3.7% 39
	B	3.3% 3	2.1% 2	2.4% 2	1.3% 1	3.8% 3	4.3% 4	1.2% 1	2.7% 2	6.5% 5	2.5% 2	2.2% 2	3.7% 3	3.0% 30
Direct instruction	A	56.3% 54	34.3% 37	36.7% 36	75.0% 57	55.3% 42	34.7% 33	48.2% 40	46.1% 35	32.3% 31	52.5% 42	44.4% 36	46.1% 35	**45.9%** 478
	B	50.0% 46	47.4% 45	40.5% 34	77.6% 59	55.1% 43	35.9% 33	59.8% 49	42.7% 32	37.7% 29	53.8% 43	35.9% 33	41.5% 34	**47.8%** 480
Monitoring	A	15.6% 15	9.3% 10	25.5% 25	19.7% 15	10.5% 8	27.4% 26	14.5% 12	26.3% 20	36.5% 35	42.5% 34	27.2% 22	34.2% 26	**23.8%** 248
	B	10.9% 10	14.7% 14	26.2% 22	19.7% 15	5.1% 4	10.9% 10	19.5% 16	44.0% 33	35.1% 27	32.5% 26	9.8% 9	36.6% 30	**21.5%** 216
Consulting	A	16.7% 16	22.2% 24	11.2% 11	3.9% 3	23.7% 18	6.3% 6	7.2% 6	26.3% 20	27.1% 26	---	24.7% 20	14.5% 11	**15.5%** 161
	B	13.0% 12	10.5% 10	13.1% 11	---	34.6% 27	20.7% 19	9.8% 8	10.7% 8	7.8% 6	11.3% 9	34.8% 32	18.3% 15	**15.6%** 157
I>S	A	6.3% 6	9.3% 10	8.2% 8	---	2.6% 2	4.2% 4	4.8% 4	---	---	1.3% 1	1.2% 1	---	3.5% 36
	B	14.1% 13	4.2% 4	6.0% 5	1.3% 1	1.3% 1	4.3% 4	2.4% 2	---	2.6% 2	---	---	---	3.2% 32
S>=I	A	---	---	2.0% 2	---	---	---	---	---	---	---	---	---	0.2% 2
	B	---	---	---	---	---	---	---	---	---	---	---	---	0.0% 0
S*GRP	A	3.1% 3	21.3% 23	12.2% 12	---	---	23.2% 22	20.5% 17	---	---	---	---	---	7.4% 77
	B	8.7% 8	21.1% 20	11.9% 10	---	---	23.9% 22	7.3% 6	---	10.4% 8	---	17.4% 16	---	9.0% 90
Total**	A	100% 96	100% 108	100% 98	100% 76	100% 76	100% 95	100% 83	100% 76	100% 96	100% 80	100% 81	100% 76	100% 1041
	B	100% 92	100% 95	100% 84	100% 76	100% 78	100% 92	100% 82	100% 75	100% 77	100% 80	100% 92	100% 82	100% 1005

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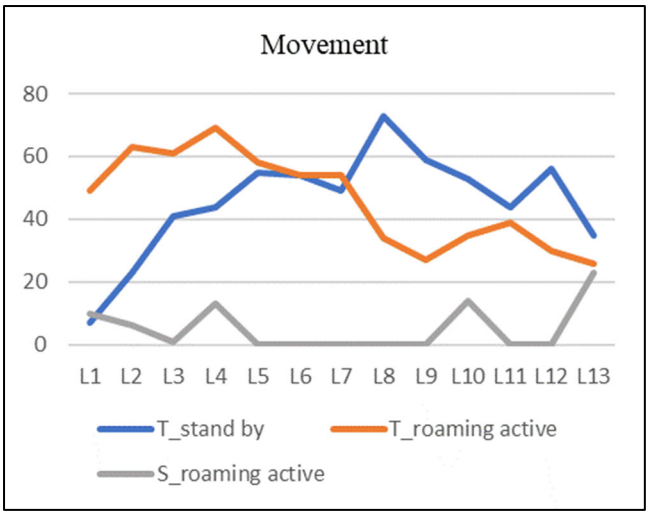
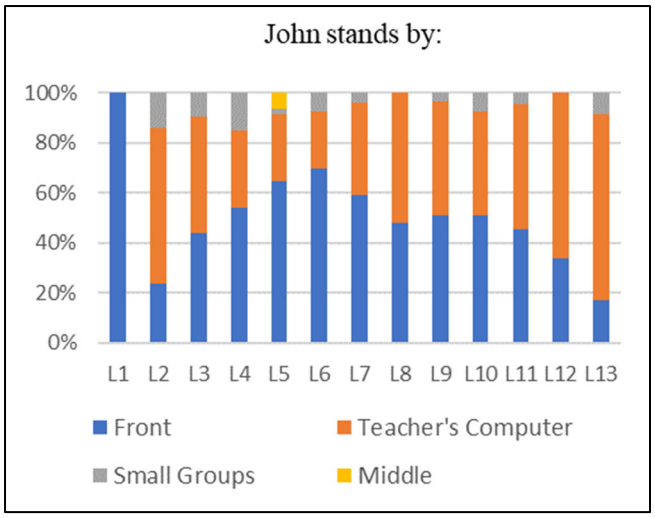
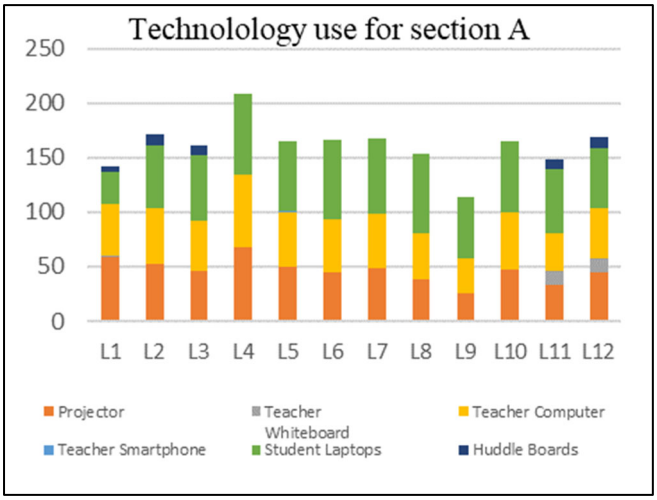
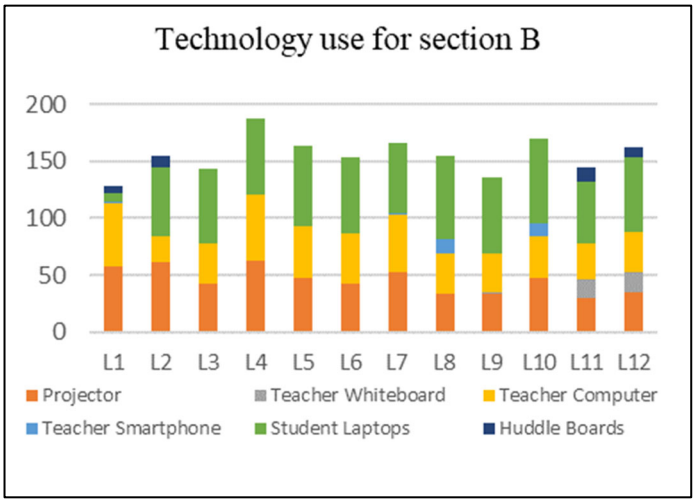




Figures 7a and 7b. **Movement patterns in John's class**





Figures 8a and 8b. **Technology use graph in Ada's two sections**

The use of space was investigated by coding the movement of faculty, students, and teaching assistants. Findings showed that John spent almost half of his time roaming in the room (46.6%) and standing by (46.1%) specific locations including the front area, teacher's computer, small groups, and middle area as detailed in Figures 7a and 7b and Table 6.

Ada's Web design course

Student laptops, (Section A, 38.2%; Section B 39.3%), **teacher's computer** (Section A, 29.4%; Section B, 24.2%), and **projector** (Section A, 29.1%; Section B 29.2%) were the most frequently used technologies in Ada's two sections of the Web design course. Since the course requires students to write their own HTML code, the high use of laptops is not unexpected. In terms of collaboration, during several weeks Ada asked the students to use a huddle board (portable white board) (2.2%) to discuss some coding issues before working on the laptops. However, this technology usage represents a very small amount of total technology usage. Figures 8a and 8b illustrate the weekly distribution of all technologies for both section A and section B.

In terms of use of space, Ada (Section A, 24.9%; Section B 25.0%) and her seven teaching assistants (Section A, 16.3%; Section B 21.2%) were the roaming actors in the space through the 12 lessons. The teaching assistants sat on sofas to monitor the students when they were not roaming. Students' active time was only 2.6% in Section A and 1.5% in Section B. Findings also indicated, similar to John, Ada spent almost half of her time standing by different locations (Section A, 56.2%; Section B, 50.4%) as detailed in Figure 9. The teacher's computer is the most frequently used spot followed by small groups where Ada visited and stood by

Table 5. **The technology usage frequency and percentage of John by lesson number**

Technology	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5	Lesson 6	Lesson 7	Lesson 8	Lesson 9	Lesson 10	Lesson 11	Lesson 12	Lesson 13	Total*
T_projector	88.1% 37	67.8% 40	73.6% 39	50% 20	39.3% 42	44.4% 36	38.3% 41	56.1% 64	56.0% 56	38.5% 35	60.0% 48	74.2% 72	52.0% 26	**54.5% 556**
T_whiteboard	2.4% 1	---	---	5.0%	---	---	---	---	---	---	---	---	---	0.1% 1
T_computer	4.8% 2	13.6% 8	15.1% 8	2.5% 1	---	1.2% 1	0.9% 1	10.5% 12	5.0% 5	6.6% 6	3.8% 3	13.4% 13	12.0% 6	6.5% 66
T_smartboard	--- ---	10.2% 6	---	---	---	---	---	---	---	---	1.25% 1	---	---	0.7% 7
S_laptops	4.8% 2	---	---	---	60.7% 65	54.3% 44	60.7% 65	33.3% 38	39.0% 39	54.9% 50	35.0% 28	12.4% 12	28.0% 14	**35.0% 357**
S_whiteboard	---	8.5% 5	11.3% 6	42.5% 17	---	---	---	---	---	---	---	---	8.0% 4	3.1% 32
Total**	100% 42	100% 59	100% 53	100% 40	100% 107	100% 81	100% 107	100% 114	100% 100	100% 91	100% 80	100% 97	100% 50	100% 1021

****Row total***
*****Column total***

Table 6. **The movement frequency and percentage of John by lesson number**

Movement	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5	Lesson 6	Lesson 7	Lesson 8	Lesson 9	Lesson 10	Lesson 11	Lesson 12	Lesson 13	Total*
T_stand by	8.4% 7	25.0% 23	39.8% 41	34.9% 44	48.7% 55	50.0% 54	47.6% 49	68.2% 73	68.6% 59	52.0% 53	53.0% 44	65.1% 56	41.7% 35	**46.1% 593**
T_roaming active	70.5% 49	68.5% 63	59.2% 61	54.8% 69	51.3% 58	50.0% 54	52.4% 54	31.8% 34	31.4% 27	34.3% 35	47.0% 39	34.9% 30	31.0% 26	**46.6% 599**
S_roaming active	21.1% 10	6.5% 6	1.0% 1	10.3% 13	--	---	---	---	---	13.7% 14	---	---	27.4% 23	5.2% 67
Total**	100% 95	100% 92	100% 100	100% 126	100% 113	100% 108	100% 103	100% 107	100% 86	100% 102	100% 83	100% 86	100% 84	100% 1285

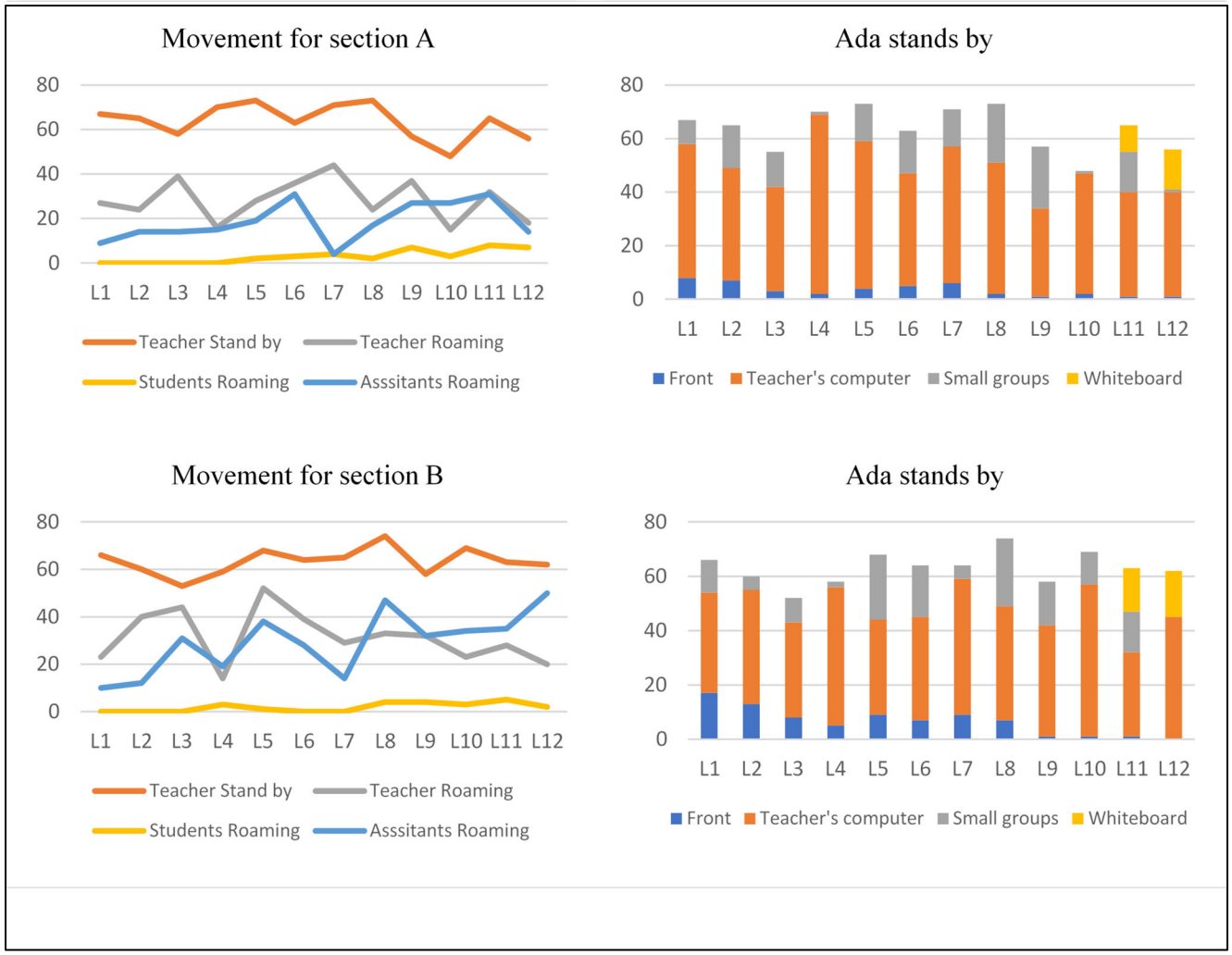


Figure 9. **Movement pattern in two sections of Ada's Web design course**

while monitoring or consulting students. The front area between the projector curtain and student tables is Ada's third most frequented popular spot. Whiteboards, on the other hand, were not used until the last two weeks.

Room usage checklists

The findings of the 23 room usage checklists submitted by three faculty showed that the projector was the most frequently used technology as observed in the classroom recordings. The use of standard white boards and huddle boards were the second most used technology reported by the faculty. Table 7 presents the aggregated results of technology usage frequency.

In addition, checklists indicated that instructor-led lecture was the most prevalent instructional activity noted by the faculty. Class-wide discussion, group projects, student work on laptops, and moving furniture for the group activities were the other interactions taking place during class. Table 8 displays the aggregated results of instructional activity frequency.

RQ3. How do faculty and students perceive classroom space and activities in Collaboration Café?

Seamless transition between activities in the Collaboration Café

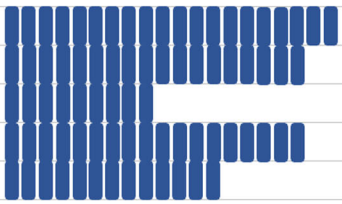
Room size, natural light, as well as small movable tables and chairs were stated as effective and efficient components of the Collaboration Café by the faculty.

For example, Peter from the Geography department noted that the large room layout allowed him to lecture while walking, "I like the size of the room and the natural light. It worked out for me as I lecture walking and don't rely much on PPT." Another faculty member from the geography department, Martin stated that the consistent natural light coming from windows worked well with different instructional modes such as lecturing with PPT or group

Table 7. **Aggregated room usage checklists for the technology usage**

Technology	Frequency
Projector	
Standard white boards	
Huddle boards (portable white boards)	
Touch Screen Computer Screen	N/A
Solstice (wireless screen share)	N/A
Other	N/A

Table 8. **Aggregated room usage checklists for instructional activities**

Instructional Activities	Frequency
Lecture (for sustained periods)	
Class-wide discussion	
Students moved furniture for group work	
Students worked on group projects during class	
Students used laptops for class activities	
Students presented/shared work using projection equipment	N/A
Other	N/A

discussion. He noted that he did not have to adjust the lighting when class activities changed.

Small movable tables, on the other hand, were commended by two faculty due to their role in the easy transition between group activities and individual activities. Ada explained this flexibility:

> I have students work both individually and in groups and that room lets us transition seamlessly between students working on their own (because there is space for us to see their screens and help each one), and groups working at tables with whiteboards or on a laptop or in a discussion. I love 102 [Collaboration Café] because it works and doesn't detract or take time from what we need to do, and the white [huddle] boards and space allow us flexibility when we need to switch gears."

In a similar vein, Jasmine who taught Politics and the Media, an undergrad course, shared an example on how she utilized the space and small tables in a class workshop that requires group discussion and video recording:

> This room worked well for students to complete a group recorded discussion comparing objective and nonobjective news stories and word clouds created from those stories about the president's impeachment. Leading up to the assignment students could work around the tables in small groups preparing for the assignment and could record their discussions during a class workshop.

Students' responses to the open-ended survey questions revealed that easy navigation, the versatility of the space that allows for multiple uses, collaboration with peers, the amount of natural light, and accessibility of the power outlets are the reported useful features of the Collaboration Café. The following excerpt shows a student's satisfaction with the instructor's easy navigation between the tables:

> We did daily group discussions about our readings/lecture notes, and the layout of the classroom made this much easier, especially since our professor liked to stop in and chat with each group. There was enough space that she could easily roll around the room in her chair and get from one table to the next to talk to groups.

In terms of versatility, two students student stated that "being able to switch around the table arrangements as needed (and particularly if they had already been changed in another class) was great" and the presence of "the small

whiteboards and grouped tables made the small group discussions easier. Everyone easily passed around whiteboards to write on them."

Three students indicated the importance of the community-driven atmosphere built by the Collaboration Café. One student said, "I really liked this room. It created a sense of unity and made me feel as though I could participate. I feel as though I got to know my classmates better as a result of the setup." It is also noted that the ability to "sit with the same groups each time, which helped us develop a rapport and improved the quality of our discussions overall." Another student pointed out the role of the space for easy communication with his instructors:

> …with the arrangement of chairs it made it well accessible to communicate with the professor during lecture but also made it so I never felt like their eyes were darting at me (like in the large lecture halls) also the power outlets were incredibly useful.

Challenges in the Collaboration Café

In addition to a variety of benefits that the flexible room allowed, two faculty indicated that the lack of a focal point was a challenge in the Collaboration Café. Joe, who taught a Chinese Politics course, reported that he would prefer a traditional classroom since the room configuration distracts the students from his lecture:

> I typically conducted class as a traditional lecture, and I felt like the way the projection system was set up didn't really create a focal point for the lecture, since students could look in all sorts of directions. I didn't really enjoy teaching there, would prefer a traditional classroom

Likewise, Peter complained about the fact that students cannot see the instructor simultaneously when he used the projector screen or whiteboards on the different walls of the room.

> The limited mobility of the podium block [s] the students' view of the screen or whiteboard. Though the tables are great for group activities they prevent all students simultaneously viewing all the whiteboards and taking notes. In other words: there are always students with their backs toward some whiteboard.

One student's response was also in parallel with the challenges stated by the faculty members Peter and Joe regarding the facing different directions. She said that "I personally dislike that we were all facing different directions. The instructor would have to walk around the class all day to make sure people were paying attention, which made it hard to follow him and take notes." She added that "we weren't allowed to use technology though, so I don't think he was letting us use this room to its full capabilities." It is important to note that some faculty's rules about not using technology (e.g., laptop, smartphone) and furniture such as sofa seating is an important finding criticized by the students, "I liked the amount of natural light, and initially liked that there were couches, but we weren't allowed to use them."

Another student noted that the lecture heavy instruction did not allow them to get the full benefit of the room's capabilities:

> I think the style of the classroom did not greatly impact the teaching of this course, compared to a traditional classroom. This is because the course is lecture heavy and had occasional group interaction There was a lot of space and unused potential. It was not used very differently than other classrooms, besides the small whiteboards.

In addition to the lecture heavy instruction, the room capacity was also stated as a drawback that disrupts the purpose of this active learning classroom:

> I really liked the layout of this classroom for the class I was taking, though I don't think this layout would work well for classes of more than 30-40, as it starts to get somewhat difficult to control. Even in my class, which I believe had roughly 30 people, it was easy for students to be on their phones or browsing on their laptops the whole class without the professor noticing. I think this layout would be ideal for classes of 20 or less, but even as someone who was interested in the class I found it difficult to focus on the professor when many of the students sitting around me were on their phones/laptops.

Discussion and Conclusion

In this article we examined the nexus between the pedagogical interactions, physical movement, and use of technology in an active learning classroom. In particular, we were interested how the users in an active learning environment construct or influence the relations between pedagogy, space, and technology informed by the updated PSTU framework (Manciaracina, 2019).

Our classroom recordings and interviews with faculty and students consistently suggested that active learning tends to occur when the faculty rely less on PowerPoint presentations and acknowledge the role of the spatial and technological affordances of a classroom. In other words, the faculty's choice of instructional technique shapes the use of space and technology, as well as students' active and collaborative

learning behaviors in the classroom. This finding indicates the significance of sustained and intentional faculty development to enhance classroom success in innovative learning and teaching spaces (Morrone et al., 2017).

When faculty explained their positive experiences in the Collaboration Café, they mostly highlighted the efficiency of the room, for example, easy transitions between activities and the lack of the need to adjust lighting between activities because of to access to natural light. As for negative experiences, faculty wanted to ensure that all content was covered via direct instruction and were concerned that the amount of time spent on each activity could hinder that. (We did find that the most commonly adopted instructional strategy involved lecturing.) This finding brings to mind a previous study that discusses factors preventing faculty from embracing active learning strategies such as fear of low teaching evaluations (Henderson, Kahn, & Dancy, 2018), such that, faculty seem to focus more on the competency of their teaching performance than the students' involvement and movement. As argued by Manciaracina (2019), the activities in the innovative learning spaces are not independent of the actors, such as employers, department chairs, directors, review committees, parents, students, or the instructor, who are involved in the learning process directly or indirectly. Therefore, the institution's culture around teaching and learning is pivotal to the faculty's instructional choices (Author, 2017). In a quasi-experimental study, Brooks and Solheim (2014) found that student learning can significantly improve when faculty refine their course activities based on the physical environment of the teaching space. Contrary to this finding, our faculty interviews captured a tension between teaching habits and the physical environment. For example, one faculty member said that they did not let room configuration dictate their teaching. Another faculty member stated their doubts about changing how they prepared for class each year, based on the room they would be teaching in.

Our argument is neither a call for faculty to change their notion of teaching nor a suggestion that direct instruction is less effective. Rather, it is an empirical observation that suggests that faculty and students do not benefit from the full capacities of an active learning classroom when faculty prioritize lecturing. Student perspectives did provide evidence for student satisfaction with the flexible space features such as fluidity (i.e., the flow of the objects, individuals, sound, and air), versatility (i.e., allowing multiple purposes), and scalability (i.e., the capability of the space to expansion or contraction). Therefore, balancing the lecturing approach with active learning opportunities seems to have the potential to enhance student satisfaction. For example, our participant, Ada, who taught a Web design course used direct instruction heavily at the beginning of the semester and then gradually started using consulting and monitoring strategies through the middle of the semester, such that her active movement behaviors as well as students' collaborative activities increased. Likewise, Naeem Syeda and colleagues (2020) found that students' perception of the community significantly increased due to the seating style when they analyzed the effects of active spaces on computer science students. Indeed, for college courses such as Web design, programming, and information technologies that require algorithmic thinking, troubleshooting, and brainstorming, it is crucial to provide students with opportunities to interact with peers, faculty, and teaching assistants. In our study, Ada occasionally asked students to work on huddle boards with their groups before they start coding on their laptops. It is important to note that Ada's teaching assistants moved around and helped students during these activities. Teaching assistants are important facilitators in large active learning classrooms (Ruder and Stanford, 2018). Our study also suggests a need for understanding how the practices and roles of teaching assistants in the space impact the active learning experiences of the students.

Limitations

The findings of this study should be considered within the context of its limitations. The first is the duration of the data collection process. The video recordings only captured twelve weeks of the semester because face-to-face instruction stopped in March 2020 due to the COVID-19 pandemic. Another limitation concerns the unique nature of the classes that were observed. For example, the subject area, curriculum design, and teaching experience of the instructors might be an important factor that influenced the faculty members' active teaching practices were outside the scope of this article.

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