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Evaluation of engagement in learning within active learning classrooms: Does novelty make a difference?

May Lim Sok Mui
Singapore Institute of Technology

Guiller Augustin Cea Carpio
Singapore Institute of Technology

Chee Ming Ong
Singapore Institute of Technology

This cross-sectional study examines students' and faculty members' perceptions on their use of active learning classrooms in a university in Singapore. The study targets students (398) and faculty (6) who use active learning classrooms - Applied and Collaborative learning Environment (ACE) rooms. It investigated whether novelty to the learning environment plays a part in the perceptions and experiences of the rooms, through the Active Learning Classroom (ALC) Survey. Results reveal that effective utilisation, room/course fit, student-centred activities in the ACE room all play major roles in increasing student engagement and learning; yet no difference in the first-time or repeated student-users' experience.

Introduction

A conducive active learning classroom (ALC) allows students to enhance their learning capabilities to a higher level. Physical or virtual spaces can bring a significant impact to learning by bringing people together to encourage exploration, collaboration, and discussion. In the same way that it can also usher silence and disconnectedness among its users (Oblinger, 2006). The emergence of ALCs in colleges and universities has flipped the source of information from the faculty to the student. Based on the constructivist theory, active learning suggests that students must create their own knowledge in order for learning to persist (Dori & Belcher, 2005). As students are focused on creating and discovering their own knowledge, active learning classrooms create an environment of interaction. In comparison to traditional classrooms, active learning classrooms that facilitate social interaction may affect student engagement and learning outcomes (Walker & Baepler, 2017). In addition, engagement is usually conceived as having a positive association with academic achievement, including learning outcomes as well as completion, persistence, time to degree, etc. (Appleton et al., 2006; Christenson & Thurlow, 2004).

May Lim Sok Mui is Director of Centre for Learning Environment and Assessment Development, Singapore Institute of Technology.

Guiller Augustin Cea Carpio is Research Officer of Centre for Learning Environment and Assessment Development, Singapore Institute of Technology.

Chee Ming Ong is Learning Designer of Centre for Learning Environment and Assessment Development, Singapore Institute of Technology.

Parsons (2016) in her study involving round table classroom design, explained that both students and instructors expressed that physical, built learning spaces positively influenced dialogue. Moreover, classrooms and informal gathering areas were also effective for small group discussions, debates, and dialouges. Yang et al. (2013) stated that student perceptions of their learning environments were highly reliant on spatial and ambient attributes. Spatial attributes pertain to room layout and furniture while ambient attributes pertain to temperature and quality. Moreover, non-classroom factors contributed important contextual fingerprints for student perceptions of classroom attributes, especially for visibility, acoustics and furniture.

In a study by Horne et al. (2012) about the use of Transform, Interact, Learn, Engage (TILE) classrooms at the University of Iowa, which also relates to rooms designed to support active-learning teaching strategies, students who use TILE classrooms received, on average, higher grades than those who previously took the same courses with the same instructor in a traditional classroom.

Indeed, ALCs offer more conducive learning environments not only to the students, but also to the faculty. But its full capacity and technological edge over traditional classrooms may not be fully tapped unless the faculty has the usage knowledge. Bines and Jamieson (2013) concluded that not all teachers would easily adapt to take full advantage of the options offered by these spaces, although these collaborative spaces provide new opportunities for interactive learning. Therefore, it is important to conduct workshops or other forms of training activites targeted at assisting teachers explore the spaces and consider how a collaborative approach may enhance their learning objectives and their students' learning experience.

In the same manner, Horne et al. (2012) suggests that in order to enhance students' interests in TILE classrooms, support in instructors' process of designing learning activities for TILE classrooms and collaborative learning through adequate use of technology must be promoted. In order for TILE classrooms to be fully maximised, a successful support model must include a system for helping instructors plan their learning activities, aside from outlining methods to help them use technology. Likewise, they found that faculty members must be engaged early on in the process of instructional design through a model for training, even before their first class. Beery et al. (2013) also stressed the need for active learning strategies to be more accessible to all teachers. Neill and Etheridge (2008) agreed that to promote awareness of the room and its features, an effective communication strategy is needed. This would in turn further cultivate interest among faculty to use the room and to make better use of its functionality and features. These literature emphasizes the need to conduct teacher training as an important element of active learning. On the other hand, Freeman et al. (2014) concluded that future research should focus on the relative efficacy of different active-learning approaches rather than comparing it with lecture since the positive impacts of active learning versus lecture are already well established.

There are three objectives in the study 1) to assess the students and faculty's perception on how the ACE rooms supported various aspects of learning; 2) to examine the difference between first time versus repeated users' learning experience; and 3) to collect feedback on the active learning classroom. Koch et al. (2018) summarised that an increased motivation to something, or an increased perceived usability of something, on the account of its newness pertains to the novelty effect. Furthermore, novelty effect was primarily present in two scenarios: (1) initially, after a system's deployment, and (2) when changes are made to the system's state. Thus, it is hypothesised that due to the novelty effect, first time users' may engage more in the learning experience and rate the learning space more positively in promoting different aspects of learning.

This paper is significant as it contributes towards the knowledge on the specific aspects of learning that an active learning classroom helps promote. The study included students and faculty from a wide variety of courses. It examines whether novelty plays a part in shaping the learning experience of learners. The paper will also provide insights on aspects of learning experience that can be enhanced when using active learning classroom.

Context of study

Applied & Collaborative Learning Environment (ACE) rooms

A total of four ACE rooms are included in this study. Three are large rooms (SR1N, SR2N, SR3H) that can accommodate 80 – 100 students each, whereas one is smaller (SR1R) which can accommodate 50 students. The furniture in each ACE room is grouped with each cluster having access to a computer-on-wheel (COW) consisting of a mini PC with a large touch-screen monitor (43 or 48 inch) mounted on a mobile cart with wireless accessories such as keyboard, mouse and stylus. The classroom furniture consists of individual 700mm x 500mm tables or 1800mm x 600mm long tables on wheels that can be arranged in clusters ranging from 7 seats (in the smaller rooms) to 10 (in the larger rooms) or rearranged to other configurations as required (Figure 1). The general layout is illustrated in Figure 2. The faculty's console is able to broadcast to the COWs as well as display student work to other COWs wirelessly during classes using a software-based solution, Net Support School Version 12.

Figure 1. **ACE room furniture configuration**

The Learning Space Rating System (LSRS), version 2 (Brown et al., 2017) is used to rate the room by a group of staff (including University faculty, Estate and IT professionals) and an external overseas consultant who is part of the LSRS development team and an active contributor to Educause. The ACE room received a score of 43.8, which is equivalent to 66% of the total credit for a best practice design.

The Learning Space Rating System (LSRS) is meant to provide a framework to measure the potential performance of a learning space. It helps to assess what the space enables learners and instructors to do in it and is designed to serve as a way to measure progress toward designing learning spaces that support active learning and engagement.

Faculty training and support

The preparation of faculty to teach and facilitate student learning in an ACE room is deemed to be crucial for the successful implementation of the facilities and classroom technology. The initial launch of the ACE room focused on staff and student awareness. A launch event showcasing the "Applied & Collaborative Learning Environment" was used to gain the interest of various stakeholders, including faculty, students and university staff supporting teaching and learning in the university. The launch was done in a carnival style to allow stakeholders to immerse in the classroom on the launch day, in order to learn about ACE rooms in general and interact with the classroom technology. Students were encouraged to use the ACE room when a class is not in progress, and faculty interested to use the room for their classes can arrange for scheduled classes or ad-hoc bookings. Subsequent awareness is promoted through the faculty teaching induction programme where the sessions are held in the ACE room, for new faculty to experience how technology can be used in the class to facilitate learners' engagement.

Prior to the faculty members' use of the ACE rooms for their classes, hands-on training was provided by the learning designers from the teaching and learning unit on a small group or one-to-one basis so they are familiarised with the classroom technology. The learning designers would make appointments with all faculty who are timetabled to use the room. The learning designers were also on hand to help faculty who would like to collaborate on the lesson planning process to encourage learning that is active and collaborative. Last but not least, the faculty received support in terms of technical help from the IT Helpdesk as well as learning designers providing learning support with the classroom technology on their first few lessons in the ACE rooms when necessary.

Figure 2. **General layout of the ACE room (SR1N)**

Methodology

Ethics

This study has been approved by Singapore Institute of Technology's Institutional Review Board and have complied with Singapore's Personal Data Protection Act of 2012. The researchers ensured that no participant is identified in the reporting of the results of this study.

Design, Sample, Setting

Using a descriptive, cross-sectional design, data were purposely collected within second trimester of academic year 2017, among students enrolled at Singapore Institute of Technology who were using the ACE rooms, across six different courses, along with the faculty who facilitate each class. The study took place in the later half of the trimester, ensuring students had adequate experience in the learning space before attempting the surveys. A total of 398 students and six faculty members participated in the study. A total of four rooms (SR1N, SR2M, SR3H, and SR1R) with an active and collaborative learning design were included in this study.

Instrument

A questionnaire adapted from STSS Research Project Faculty Survey, Office of Information Technology, University of Minnesota (2012) was used in this study. The questionnaire was divided into two main parts. The first part comprised of the participants' demographics and items pertaining to classroom utilisation, effective use and course fit. The second part progresses further on their qualitative feedback on situations that made the room work well, did not work well, and their overall thoughts. Comprising of Likert-type items, statements pertaining to classroom utilisation, and effective use and course fit were scored as follows: Strongly agree = 4; Agree = 3; Disagree = 2; Strongly disagree = 1. A Cronbach's alpha of .95 was identified in this study, indicating adequate reliability.

Data collection and analysis

Faculty members who were timetabled to use the ACE rooms were asked for voluntary participation in the study. With informed consent, the research officer visited their classes to conduct the survey among the students and the faculty teaching in the class. The survey was collected online via a platform called Qualtrics. Descriptive and inferential statistics were used to analyse the quantitative data with the aid of SPSS.

Results

Students and faculty demographics

This section focuses on the basic information of our participants. Table 1 summarises the demographics of the participants. The students and faculty were from six different courses, thus, representing the results of their perceptions and feedback beyond a particular discipline. Among the participants, 51.8% of the students had experiences using the active learning classrooms prior to the current course. The active learning classrooms were novel to the rest of the students.

As shown in Table 1, the majority of the students (57.0%) expected to have a grade of A in the courses they were taking. For the faculty, the percentages of their years of experience were across all ranges. Interestingly, the majority of the faculty sees themselves on the introvert spectrum (83.3%) while only one perceived him/herself to be extroverted.

In-class active learning activities that occurred during the trimester

To give an overview of the type of active learning activities that occurred in the ACE rooms, the students were asked to estimate the frequency they engaged in different types of activity across the 12 weeks of teaching in a trimester. As shown in Table 2, the majority of the students were engaged in the in-class active learning activities at least 2 or more times in the trimester. An example of such learning activities is "Discussed ideas from your readings or course with other students during class."

Perception of how active learning classroom support learning

Table 3 shows the perceptions of students and faculty members (italicised statements) on the extent to which the ACE rooms supported various aspects of learning (e.g., engagement, confidence). For the students, the statements which garnered the highest average ratings for the students were: *promotes discussion* (3.28); *helps me develop connections with my classmates* (3.17); and *offers a physically comfortable learning environment* (3.13). On the other hand, the statements which received the lowest average rating were: *helps me develop confidence in writing* (2.84); *helps me develop professional skills that can be transferred to the real world* (2.91); and *makes me want to attend class regularly* (2.94).

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Table 1. Participants' demographics (N = 398, students; 6, faculty members)

Sources	Groups	Student	Faculty
		% (n)	% (n)
Course/Cluster/ Module	Food Tech/Chemical Engineering and Food Technology/FTE (Year 2)	14.3 (57)	16.7 (1)
	Information Security/InfoComm Technology/ICT (Year 2)	22.9 (91)	16.7 (1)
	Pharm Engr/Chemical Engineering and Food Technology/PHE (Year 2)	16.6 (66)	16.7 (1)
	Telematics/InfoComm Technology/TLM (Year 1)	20.6 (82)	16.7 (1)
	Sustainable Infrastructure Engineering/Engineering/SIE (Year 2)	13.1 (52)	16.7 (1)
	Civil Engineering/Engineering/CVE (Year 1)	12.6 (50)	16.7 (1)
Room use prior to the course	Yes	51.8 (206)	66.7 (4)
	No	48.2 (192)	33.3 (2)
Grade expectation	A	57.0 (227)	
	B	34.7 (138)	
	C	6.8 (27)	
	D	0.5 (2)	
	E	0.3 (1)	
	F	0.8 (3)	
Teaching experience	Less than 1 – 3 years		33.3 (2)
	4 to 6 years		33.3 (2)
	7 to 9 years		33.3 (2)
Degree of introversion-extroversion	Highly introvert		16.7 (1)
	Moderately introverted		16.7 (1)
	Somewhat introverted		50.0 (3)
	Neither introverted nor extroverted		16.7 (1)

Table 2. Frequency of student-centred activities in the ACE room during the trimester

Activities	5 or more times per trimester	2 to 4 times per trimester	Once per trimester	Never
	% (n)	% (n)	% (n)	% (n)
Asked questions during your class.	32.9 (131)	44.0 (175)	12.3 (49)	10.8 (43)
Made a presentation in your class.	17.3 (69)	53.3 (212)	18.6 (74)	10.8 (43)
Contributed to class discussions that occurred during your class.	27.4 (109)	50.3 (200)	14.6 (58)	7.8 (31)
Helped explain course ideas or concepts to other students in your course.	22.6 (90)	50.0 (199)	14.8 (59)	12.6 (50)
Discussed ideas from your readings or course with other students during class.	31.2 (124)	48.0 (191)	10.6 (42)	10.3 (41)
Worked with other students on projects during your class.	44.2 (176)	42.2 (168)	8.5 (34)	5.0 (20)

Table 3. The extent to which the ACE rooms supported various aspects of learning

Factors	Statements	Student	Faculty
		M (SD)	M (SD)
Confidence	Helps me *(my students)* develop confidence in working in small groups.	3.11 (.54)	3.33 (.51)
	Helps me *(my students)* develop confidence in analysing.	2.97 (.56)	2.67 (.51)
	Helps me *(my students)* develop confidence in presenting.	2.97 (.57)	3.00 (.00)
	Helps me *(my students)* develop confidence in writing.	2.84 (.60)	2.17 (.41)
	Improves my *(my students')* confidence that (*they)* can speak clearly and effectively.	2.95 (.61)	3.17 (.41)
Engagement	Promotes discussion *(among students).*	3.28 (.58)	3.67 (.52)
	Encourages my *(students')* active participation.	3.12 (.56)	3.00 (.63)
	Helps me *(my students)* develop connections with my *(their)* classmates.	3.17 (.54)	3.33 (.52)
	Engages me *(my students)* in the learning process.	3.08 (.51)	3.50 (.55)
	Helps me develop connections with my instructor *(student).*	2.95 (.63)	3.50 (.55)
Enrichment	Increases my *(students')* excitement to learn.	2.99 (.55)	2.83 (.41)
	Helps me *(my students)* develop professional skills that can be transferred to the real world.	2.91 (.59)	2.83 (.41)
	Enriches my learning experience.	3.07 (.52)	3.50 (.55)
	Makes me *(my students)* want to attend class regularly.	2.94 (.59)	2.17 (.41)
Environment	Offers a physically comfortable learning environment.	3.13 (.56)	3.33 (.52)
Flexibility	Facilitates multiple types of learning activities.	3.12 (.52)	3.17 (.41)
	Nurtures a variety of learning styles.	2.97 (.56)	3.00 (.00)
Interaction	Enables me *(my students)* to communicate effectively.	3.12 (.55)	3.33 (.51)
Learning	Enables me *(my students)* to locate and critically evaluate information.	3.00 (.56)	3.00 (.63)
	Helps me *(my students)* to define issues or challenges and identify possible solutions.	3.05 (.63)	3.00 (.63)
	Prepares me *(my students)* to implement a solution to an issue or challenge.	2.95 (.55)	2.50 (.55)
	Helps me *(my students)* to examine how others gather and interpret data and assess the soundness of their conclusions.	3.03 (.59)	2.67 (.52)
	Deepens my *(my students')* understanding of a specific field of study.	2.97 (.56)	2.83 (.41)
	Assists me *(my students)* in understanding someone else's views by imagining how an issue looks from his or her perspective.	3.00 (.56)	3.17 (.75)
	Helps me *(my students)* to grow comfortable working with people from other cultures.	3.03 (.56)	3.17 (.41)
	Encourages me *(my students)* to create or generate new ideas, products, or ways of understanding.	3.00 (.55)	3.00 (.63)
	Prompts me *(my students)* to incorporate ideas or concepts from different courses when completing assignments.	3.00 (.55)	2.67 (.82)
	Enabled the instructor *(me)* to make intentional connections between theory and practice in this course.	3.02 (.56)	3.13 (.66)

**italicised statements were items in the faculty's survey*

As for the faculty, the statements which received the highest average ratings were: *promotes discussion* (3.67); *engages my students in the learning process*; *helps me develop connections with my students*; *enriches my learning experience* (all at 3.50); and *helps my students develop connections with their classmates*, *offers a physically comfortable learning environment, enables my students) to communicate effectively* (all at 3.33). Meanwhile, statements which received the lowest average rating were: *helps my students develop confidence in writing* and *makes my students want to attend class regularly* (both at 2.17); and *prepares my students to implement a solution to an issue or challenge* (2.50).

Interestingly, both groups of respondents perceived the ACE rooms to promote discussion (engagement), offer physical comfort (environment) while in the learning environment, and help in the development of connections (engagement), within their top three. On the other hand, the development of confidence in writing (confidence) and

making students attend class regularly (enrichment) both fell within the bottom three statements. Noticeably, almost all the statements under the factor 'engagement' received a high average rating, suggesting that ACE rooms meet the objective of promoting student engagement through active learning.

Effective use and room/course fit

With the intention to collect feedback on the active learning space, this section gives emphasis to the effective use and room/course fit of the ACE room. Particularly, the students and faculty were asked on their perceptions about the effective use of technology and the appropriateness of the room to their course. As shown in Table 4, both the students and the faculty agreed that the ACE room was appropriate to their particular courses (3.08 and 3.17, respectively).

The results suggest that in one way or another, the faculty had been quite effective in using the ACE room's salient features in delivering their lessons, although it can be noted that the student's average rating still sits relatively in the middle of the 'Agree' range which leaves room for improvement. Suggestions for improvement are provided in qualitative feedback that are discussed later. As supported by the qualitative results which will be discussed later, some students perceived the ACE rooms to be effective for group activities but not when they used mainly for didactic teaching.

First time versus repeated users' learning experience

Lastly, this section examines the difference between first time versus repeated users' learning experience in the ACE rooms. As shown in Table 5, there was no significant difference ($p = 0.74$) between the two groups in the extent to which they perceive the ACE rooms as supporting various aspects of learning. This was contrary to the hypothesis and suggested that the students were not rating the experience positively due to the novelty effect.

Table 4. Student and faculty's perceptions on the effective use and room/course fit in the ACE room

Factors	**Statements**	**Student**	**Faculty**
		M (SD)	**M (SD)**
Effective use	The instructor is effective in using the technology available in the classroom for instructional purposes. *I was able to effectively to use the technology available in the classroom for instructional purposes.*	3.03 (.63)	2.83 (.75)
Room/course fit	This classroom is an appropriate space in which to hold this particular course.	3.08 (.61)	3.17 (.75)
Effective use	The instructor is effective in using the classroom for instructional purposes. *I was able to effectively to use the classroom for instructional purposes.*	3.07 (.59)	3.17 (.41)
Room/course fit	The in-class exercises for this course are enhanced by the features of this classroom.	2.98 (.66)	3.17 (.75)
**italicised statements were items in the faculty's survey*			

Discussion

Features of active learning classroom that promotes engagement within students

When students and teachers work together for a variety of educational approaches which uses their intellectual effort, 'Collaborative learning' usually comes into mind. Most of the activities during this partnership focuses on searching for solutions, meanings, or in creating a product (Smith & MacGregor, 1992). From the study, both faculty and students scored higher in items that were related to engagement with classmates e.g. "*promotes discussion*"; "*helps me develop connections with my classmates*". This suggests that the ACE room meets its purpose in encouraging collaborative learning. The aligned top rated items suggest that students experienced what the faculty aimed to achieve in the collaborative learning experience. As Gokhale (1995) mentioned, in collaborative learning, when a student is responsible for his or her learning, and thinks of the learning of others in the group, their learning becomes successful.

A few features of the classroom supported engagement in collaborative learning. First, cluster seating helps in promoting interaction among the students. One of the students reported: "*It aids in small group discussions because of the way the tables are arranged (facing each other) and the computer screen easy for all to access when we do PowerPoint presentations together etc. It's also helpful when another group is presenting from where they are seated and it is easy for us to be able to view their screen and presentation slides. Classroom is also just the right size, allowing anybody who projects their voice to be heard easily.*" Second, technology such as a large screen that enable the group to focus on the same screen, or screen

sharing among groups, enabled ease of communication and hence enhance collaboration. A student reported: "*There is easy communication within the group during group discussion where the screen can be shared and displayed within the group.*" A second student also commented "*Very helpful for project discussion where the COW was used to project the work onto the screen where everyone can discuss on how to improve at the same time.*"

While cluster seating has its advantage in promoting collaboration, it can worsen the learning experience if the instructor choses to spend most time in didactic teaching. When faculty spent a large amount of time lecturing in front, instead of facilitating active learning activities, a common weakness of the room was related to students back-facing the faculty. Sometimes, instructors are obligated to stay at the podium area to gain an easy and quick access to class materials or technologies connected to classroom projection (Henshaw et al., 2011). Qualitative feedback are as follows: *When the lecturer is explaining things on the white board at the front, the people back facing the white board have difficulties taking down notes while looking at the white board.* Another student reported: "*During lecture time, students who sit facing the opposite won't face the lecturer, thus is less engaged."*

The students also provided feedback that it was "*Easy to lose focus if the lecturer only stays at his table during class*". These highlights that if faculty spend a large amount of time remaining in front of the room and present information, instead of moving around to engage and interact with students, the cluster seating can serve to be a disadvantage. These findings support Benoit and College's (2017) study, which states that since some instructors prefer to lecture more than others, the students are bound to face forward in order to engage themselves during the lecture.

For faculty who prefers to lecture, or classes that are better delivered in the form of a lecture, perhaps it should be highlighted that the ACE room is unconducive for this purpose, and they are better off in a traditional lecture theatre designed for students to face the podium.

Table 5. Comparison between first time and repeated users' learning experience in the ACE room

	Factors	**Student users** First time (n=192); Repeated (n=206)	**M (SD)**	**t-value**	**Sig.**
Extent to which ACE rooms supported various aspects of learning	**Confidence**	First time users	2.95 (.45)	.43	.51
		Repeated users	2.99 (.46)		
	Engagement	First time users	3.12 (.42)	.12	.73
		Repeated users	3.12 (.42)		
	Enrichment	First time users	2.95 (.44)	.31	.58
		Repeated users	3.00 (.46)		
	Environment	First time users	3.11 (.58)	.06	.80
		Repeated users	3.15 (.54)		
	Flexibility	First time users	3.06 (.44)	.08	.78
		Repeated users	3.03 (.48)		
	Interaction	First time users	3.13 (.57)	1.17	.28
		Repeated users	3.12 (.53)		
	Learning	First time users	2.97 (.41)	.13	.72
		Repeated users	3.04 (.44)		
	Aspects of learning Overall	First time users	3.01 (.38)	.13	.74
		Repeated users	3.05 (.40)		
Effective use		First time users	3.00 (.55)	1.06	.30
		Repeated users	3.10 (.57)		
Room/course fit		First time users	3.00 (.56)	.34	.56
		Repeated users	3.07 (.56)		
Overall		First time users	3.00 (.51)	.45	.50
		Repeated users	3.08 (.53)		
α= 0.05					

It's the choice of learning activities rather than novelty

Contrary to the hypothesis, the student first time users rated their learning experience very similar to those of repeated users. In other words, the novelty effect of using such a room for learning did not result in a difference in their learning experience as we hypothesised. This emphasized that it is the choice of learning activities within the space that shaped their experience rather than the perceived newness or novelty of the space.

In this study, students who used ACE rooms reported experiencing collaborative learning activities regularly. More than 70% of students reported that they explained course ideas or concepts to other students in the course. More than 75% of students reported that they contributed to class discussions that occurred during class and more than 80% students reported working with other students on projects during class. In addition, as faculty are regularly engaging the students in collaborative learning activities, the novelty effect was not a determining factor in their learning experience and engagement. Umbach and Wawrzynski (2005) discussed that when a faculty in an institution engages students both in and out of the classroom, and enriches their educational experiences, the students felt a strong sense of support and tend to be active in their learning. Indeed, faculty behaviours and attitudes play an important role on student learning and engagement.

Importance of Technology

While there was only one item on the survey that specifically asked about technology, "*The instructor is effective in using the technology available in the classroom for instructional purposes*", and questions on technology were not specifically solicited, the researchers were surprised to see that a high percentage of qualitative feedback were about technology. Students highlighted how the use of technology such as the large computer of wheels supported them in their collaborative experience:

> *It has the computer on wheels, which allows us to share information with groupmates on a large screen instead of crowding over a single computer.* (Student's comment)

> *When we need to discuss in group and use computer for research.* (Student's comment)

> *It is a lot easier for me to share my laptop screen with my classmates and teacher so everyone is able to participate actively during the discussion.* (Student's comment)

At the same time, the students also reported struggles frustration created by technology:

> *The screens cannot work due to some cable fault.* (Student's comment)

> *The professor might be pointing to the screen at the front but it does not reflect on our interactive screen.* (Student's comment)

This finding highlights that the choice of technology to support the physical infrastructure is important. While technology can support learning, when they fail, they can frustrate both students and faculty, especially when the learning activities are planned around using the technology. It is important to maintain the technology regularly. In addition, equipping the faculty with the skills to use the technological tools is also instrumental. In order for faculty to implement the technological tools, the end user needs to know how the technology works and how it can be used—hence the importance for faculty training and development. In a different study, it was also indicated that when given enough guidance, examples, and remedial support, the faculty would eventually adapt to the technological tools (Keengwe, Kidd, & Kyei-Blankson, 2009).

Recommendations

First, in encouraging a more common usage of active learning classrooms, it is important to communicate the study results to the wider community on what students found useful to their learning and the challenges they faced when the unsuitable teaching methods such as conducting long lectures in such environments occur. It should be underscored that it is not the novelty effect that results to a positive experience, rather, it's the importance of designing active learning activities that can be optimized in such learning environments. The use of change management principles and ensuring regular communication is key to transforming culture (Hayes, 2010) and this can apply to changing traditional teaching practice too. Second, in terms of technology, there is a need to closely monitor the users' experience and maintain technology in these classrooms. For example, while the individual table microphones were available in some rooms, there were hardly any mention of them used. Faculty may not be aware of them or the way to encourage students to use them. A simple suggestion such as the use of a digital pointer instead of the laser pointer on the main screen can also improve students' learning experience especially those back-facing faculty. Another suggestion could be the use of visualizer (document camera) instead of white board when writing and explaining the material. Recommendations in the form of visual aids or user guides of what students find helpful can be placed in the

room as a simple reminder. Third, while Asian students are often perceived as reserved and less interactive in classrooms (Biggs, 1991), the study suggests that students also enjoyed active learning in the classroom, especially interacting and learning from peers. Therefore, there should be more promotion of such active learning space in Asia to encourage discussions and debates among students.

Limitations

There are several limitations in the study. The sample size of the faculty is small and therefore statistically, it is not possible to understand whether faculty's introversion affects the extent they use active learning activities and interact with students. The difference between the faculty first time and repeated users was not determined due to the same reason. Second, the sample of students who used the rooms did not include Year 3 and 4 students. This may limit the generalization of the findings to students in the senior years.

However, the use of large screens and seating arrangements that promote interaction are common among active learning classrooms in many higher institutions, therefore, findings regarding first time versus repeated user as well as feedback relating to common features of active learning classrooms that promotes engagement can be applied to other institutions.

Future research directions

While the study reported that most students have active engagement in class, we have not examined the effect of this to their learning outcomes. For future research directions, an experimental design of comparing the learning outcomes of students who were engaged in the ACE room versus a traditional classroom can be helpful, particulary comparing on outcomes such as critical thinking and communication which are promoted through peer engagement. A focus group or interview with faculty who used the room can also provide more insights on the reasons why they practiced in certain ways. This can help gather recommendation to train other faculty or improve gaps in the room learning environment.

Conclusion

One of the students' comments nicely conclude the reseachers' perspective: *"Good if class requires group work but bad for lectures"*. It is important for active learning classrooms to be used for the purpose they were designed for. This emphasizes the importance of faculty training and development, both in the design of active, collaborative learning activities as well as effective use of technology, and faculty-driven activities to enhance learning. Merely creating space without supporting faculty to use them can be problematic. It is also encouraging to know that it is not the novelty effect that resulted in positive experiences, highlighting that repeated users of such learning environments can still experience positive learning engagement in active learning classrooms. This evaluation study helps identify strengths of the room that should be communicated to other faculty to encourage the use of ALC and gaps that can be addressed by the university to further enhance students' learning experience.

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