A Comparative Analysis of Business Students' Performance and Perception on Online vs. Face-to-Face Peer-Assisted Learning

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Abstract—This paper first compares the academic performance of business students who participated in online and offline peer-assisted learning during 2018–2022. The purpose of the study was to evaluate if quantitative academic result was impacted by the mode of delivery. Interviews were then conducted with students who attended/taught both modes of classes to solicit their personal qualitative feedback. Key research questions and issues to be studied include: (1) any objective difference in academic performance (as measured in course GPA) between students attending online and face-to-face sessions; (2) any perceptible difference in learning effectiveness; and (3) any perceptible difference in communication with both leaders and peers during class. After investigation, it was found that both delivery modes offered a similar level of student academic performance and learning experience, and there was no evidence to suggest that peer-assisted learning was impacted by the mode of delivery. Reasons could be concluded as small class size, high level of technological literacy, and voluntariness. Though student interviewees mostly agreed that both online and face-to-face peer-assisted learning were equally effective, if they were to choose between the two, all of them would opt for physical classes as they stimulated greater learning motivation.

Keywords—face-to-face education, online education, peer-assisted learning

I. INTRODUCTION

The global pandemic COVID-19 created turbulent changes in the education system worldwide. Many teaching and learning activities have switched from traditional face-to-face setting to pure online, or mixed-mode delivery to maintain social distancing. Other forms of multimedia education including asynchronous learning (recorded lectures), flipped classroom, and blended learning are as well increasingly prevalent with technological advancement. Previous studies investigated the impact of online teaching and learning activities compared with face-to-face learning but there is yet to have conclusive consensus on which one is more effective. Some supported that offline teaching yielded better

attentiveness, better understanding level and communication with teachers [1]; while some were more inclined to online teaching as it delivered better outcome and generated higher engagement and satisfaction [2–5]. However, most of the research, regardless of study discipline, focused on regular, large-size lecture; few have evaluated the effectiveness of small-group peer-assisted learning. Moreover, a lot of these researches did not provide a clear definition of "online education": some perceived it to be synchronous and some included both asynchronous (pre-recorded videos or lecture recordings) and synchronous learning activities. This study adds to the existing literature by investigating and assessing the influence of online (synchronous) peer-assisted learning scheme by evaluating business students' academic performance. Interviews were conducted with both students and peer leaders who participated in both online and offline classes to solicit their feedbacks.

A. Background

The Talent and Education Development Office (TED) of City University of Hong Kong (CityU) runs and coordinates the Peer-Assisted Learning with Supplemental Instruction (PALSI) scheme for more than 20 years (https://www.cityu.edu.hk/ted/palsi/). The scheme was first introduced to CityU in 2000 as Supplemental Instruction (SI) scheme, and later renamed to PALSI in 2007 to emphasize the importance of peer learning approach [6]. The scheme aims to support and enhance undergraduate students' learning by offering regular out-of-class review sessions. PALSI sessions are scheduled once a week, from week 4 to week 12, for every participating course. A total of 9 sessions are conducted each semester. The review sessions are led by PALSI leaders – senior students who have completed and performed well in that course. Small class size for each review session is maintained to encourage and facilitate leader-student interaction. A typical session is kept at 1 PALSI leader to 8 students.

Even though student participation in the scheme is voluntary, there is still an overwhelming demand for the scheme. In a typical academic year, there are close to 1000 student enrolments from more than 50 different courses. The effectiveness of the PALSI scheme on student

learning has been studied extensively over the years. It is reported that the scheme leads to improving student academic performance, enhancing learning motivation, and increasing learning competence across different disciplines [7–9]. However, all these studies are based on the face-to-face mode of peer-assisted learning. The impact of the online mode of PALSI to student learning has never been studied. Thus, it is valuable to investigate the usefulness of online peer-assisted learning and to compare the results with those found in face-to-face mode.

B. Research Questions

In this study, we aimed to investigate business students' performance and perception on online vs. face-to-face peer-assisted learning by evaluating if there is (1) any objective difference in academic performance (as measured in course GPA); (2) any perceptible difference in learning effectiveness; and (3) any perceptible difference in communication with both leaders and peers during class.

II. LITERATURE REVIEW

Online teaching and learning activities have always been one of the focal points of research in the education field. Over the years, numerous studies had compared the academic outcomes, perceptions, preferences, and satisfaction between online and offline classes across disciplines. One key advantage of online classes, as supported by previous research, was flexibility in time schedule [10, 11]. The availability of lecture recording, which is mostly absent in face-to-face class, was also found to enhance learning performance [12, 13]. Contrarily, there were strong arguments supporting in-classroom learning, including easier group collaboration and greater knowledge attainment [14, 15].

A few meta-analyses have reviewed and compared online and offline classes in undergraduate education from 1990 to 2020. The earlier meta-analysis studied 86 studies from over 15,000 participants from 1990 to 2002, concluding that the academic performance of distance education was better than face-to-face classes [16]. Another meta-analysis focused on nursing education evaluated 19 papers from 1995–2013, concluding that online clinical education was no less effective than physical class [12]. A recent meta-analysis has concluded 91 research between 2000–2020, and 41% of studies supported online education as a better option, while 18% said face-to-face was better, with the remaining 41% found no significant difference between the two [14]. Comparing only the academic outcomes of online and offline education, it appeared that online learning was yielding better performance compared with traditional face-to-face class.

Apart from learning effectiveness and outcome, there was also immense research investigating other learning elements, which include student's satisfaction and learning motivation. It was found that students were generally less motivated in online courses as they lacked interpersonal contact with both the peers and instructors [17, 18]. The presence of peers and instructors became vague in online setting [5, 10, 19]. As such, students tend to perform worse, and have lower satisfaction in learning.

III. METHODOLOGY

This study took place in a medium size research intensive university in Hong Kong. Seven core business courses participated in the study. They are compulsory courses for all business students. The topics covered by the courses include accounting, management, microeconomics, macroeconomics, and business statistics. A total of 6 semesters from academic year 2018–2022 were used in this study. Within the said data collection period, 1,870 PALSI students were studied.

In the academic year of 2020–2021, the University implemented the study at home policy due to the outbreak of COVID-19. Under this policy, all classes, tutorials, and student activities have to be delivered online, including all PALSI sessions. The research team took this opportunity to explore the influence of online delivery on academic performance by comparing the Grade Point Average (GPA) of PALSI students across semesters. All the GPA data was extracted directly from the grade reporting system managed by Academic Regulations and Records Office (ARRO). Students, course instructors, and program office were aware that GPA data would be collected anonymously when they decided to join the PALSI scheme.

Table I summarizes the mode of delivery for the PALSI sessions studied. Three semesters of both online and offline sessions were studied. The aim is to evaluate if there is any impact in academic performance between face-to-face and online PALSI sessions.

TABLE I. MODE OF PALSI SESSIONS DURING 2018–2022

Academic year & Semester	Mode of PALSI sessions
2018–2019 Sem A	Face-to-face
2018–2019 Sem B	Face-to-face
2019–2020 Sem A	No classes conducted – classes cancelled due to ongoing protests in Hong Kong
2019–2020 Sem B	No classes conducted – classes cancelled due to outbreak of COVID-19
2020–2021 Sem A	Pure online via Zoom (study at home policy during COVID-19)
2020–2021 Sem B	Pure online via Zoom (study at home policy during COVID-19)
2021–2022 Sem A	Face-to-face
2021–2022 Sem B	Pure online via Zoom

After analyzing the available quantitative data on academic performance, interviews were arranged with PALSI leaders and students who participated in both online and offline classes to further investigate the possible reasons and to gather their qualitative feedbacks. The survey was designed to cover aspects including course design, interaction with the leader and peers, individual learning, and learning outcomes [20, 21].

IV. RESULTS & DISCUSSION

A. Academic Performance of Online vs Face-to-Face Peer Assisted Learning

To investigate the academic performance between face-to-face and online PALSI sessions, the percentage of A-range PALSI students and overall GPA mean of PALSI students across semesters were analyzed. Referring to the research question, if there is any impact on academic performance due to difference in mode of delivery, it will be observable with more data points over the average line for any particular mode of delivery.

Considering A-range PALSI students first, there was no overwhelming evidence that either online or offline sessions yielded higher percentage of A-range students. In most of the courses, there seemed to be no observable patterns even within the same mode of delivery. However, it is worth to take note that for Course 4 and Course 7, traditional face-to-face PALSI sessions yield slightly higher percentages of A-range students than online delivery; while for Course 5, online sessions yield better academic results in terms of GPA. Similar conclusion can be derived for the average GPA results of PALSI students.

Table II provides a brief summary of the comparison.

TABLE II. COMPARISON SUMMARY OF FACE-TO-FACE AND ONLINE PALSI SESSIONS

Course	Percentage of A-range PALSI students	Mean GPA score of PALSI students
Course 1	No observable pattern	No observable pattern
Course 2	No observable pattern	No observable pattern
Course 3	No observable pattern	No observable pattern
Course 4	Face-to-face better	No observable pattern
Course 5	Online better	No observable pattern
Course 6	No observable pattern	No observable pattern
Course 7	Face-to-face better	Face-to-face better

Independent t-tests were then conducted to compare the combined GPA results of online and f2f PALSI sessions. Results were included in Table III below.

TABLE III. INDEPENDENT T-TEST RESULTS

Course	Mode of delivery	Mean	SD	p-value
1	F2f	3.216	0.6128	0.4513
	Online	3.2602	0.5485	
2	F2f	3.2751	0.7189	0.3822
	Online	3.3538	0.6447	
3	F2f	3.2539	0.8033	0.4522
	Online	3.1829	0.7761	
4	F2f	3.4574	0.4968	0.091
	Online	3.3285	0.6165	
5	F2f	3.3758	0.5918	0.6195
	Online	3.3291	0.7004	
6	F2f	3.3414	0.6435	0.6222
	Online	3.3914	0.5199	
7	F2f	3.4648	0.6253	0.0001
	Online	3.1712	0.5736	

In both comparisons, only course 7 demonstrates a significant difference between online and f2f PALSI sessions – favoring f2f classes. Therefore, it was not evident to conclude for all business courses studied that either mode of delivery was better. This is in line with some previous studies comparing final grades of online and face-to-face class across disciplines [22–28], and also consistent with the "no significant difference phenomenon" raised by Russell [29]. The study continued to investigate if there is a perceptible difference in learning from the perspectives of students. Interviews were conducted with PALSI students and leaders who attended/taught both face-to-face and online PALSI sessions.

B. PALSI Students' Perceptions on Online vs Face-to-Face Peer Assisted Learning

All 3 interviewees agreed that both online and face-to-face classes were equally effective in learning from the leaders. However, all of them were more inclined to physical PALSI sessions whenever possible, as it facilitated a better learning atmosphere and provided better learning motivation. Students felt that they would easily lose focus in online classes.

Students pointed out that the nature of PALSI was to support and supplement regular lecture learning – material covered in PALSI classes was mostly key takeaways of lecture class. Since those learning materials were already covered once in lecture class, students would possess a general understanding of the coursework, and can focus more on practicing questions. Therefore, if PALSI leaders were able to provide sufficient practice questions and guidance in solving the problems, the mode of delivery did not impact much on direct learning effectiveness. However, students felt strongly that they were much more motivated and attentive in face-to-face classes than in online environment because of the personal connection established in physical setting. For instance, students could take a look at what others were doing in class, or the way they were attempting the questions. These were not possible in online classes even when cameras were turned on, as the camera would not be able to clearly capture student's notes. Moreover, before and after the session, they would mingle with the class and establish social contact, which further motivated them to attend class (instead of skipping class). Similarly, in face-to-face classes, students said they would initiate a short discussion with the one sitting next to them when in doubt. This was in line with what previous literature has suggested – peer interaction in class would have a positive impact on learning outcomes [5, 17–19]. Conversely, in online classes, students would prefer doing their own work as they felt awkward to send a direct, private message to any particular student – which also leads to another finding on class dynamics.

Students perceived both online and face-to-face classes as equally engaging when considering the interaction with leaders. When leaders prompted a question, students would be able to contribute their inputs either by directly voicing up in class, or by typing in chat messages in online classes. Some students might even find typing in chat messages more comfortable than face-to-face classes as it was less intimidating. Despite this, online classes were significantly inferior to face-to-face classes in terms of peer interaction. In a physical class, when leaders raised a question and asked for students' input, it would easily turn into a network of discussion – where students would

comment or add on previous student's arguments. Free flow of ideas was initiated. However, in online classes, students observed that to be more of a one-way communication between any student and the leader. They tend to only address the leader's initial questions by replying in the chat messages – some even send a private chat message to the leader instead of sending a public message to the whole class. As suggested by previous literature [19, 30, 31], there were six major types of interactions between teacher, learner and content. The interactions include teacher-learner, learner-content, teacher-content, teacher-teacher, learner-learner, and content-content. If the communication became solely between individual learner and teacher, peer-to-peer learning would be substantially weakened, negatively impacting learning effectiveness [19].

C. PALSI Leaders' Perceptions on Online vs Face-to-Face Peer Assisted Learning

2 leaders were interviewed. They both strongly agreed that there was no observable difference in delivering their own material as a teacher in either mode, yet, there was significant difference and difficulty in managing in-class activities.

Leaders noted that they almost kept the same class structure regardless of the mode of delivery – spending the first 30 minutes going through key concepts/ideas, another 60 minutes practicing questions and solutions, and the remaining time for questions about assignments or other coursework. The key difference between online and face-to-face classes would be the participation rate. Leaders found online chat messages were the most responsive, followed by directly voicing up in face-to-face classes, and the least engaging as voicing up in online classes. Although online messaging was more engaging than face-to-face classes, leaders also identified that the communication of online classes tends to be more one-way – that is, the communication is mostly between the leader and the student. There was rarely a network of discussion where students added in or followed up with what their fellows had said. It was also hard for leaders to initiate small group discussion or groupwork with the limitations in online setting. This observation was in line with the interview results with students.

As PALSI is not a regular credit-bearing course, there is no incentive for students to turn on the camera for participation or attendance grades. That said, leaders found it very hard to encourage students to turn on their cameras. Leaders reported that in most of the online sessions, cameras were always off for all students. Their communication relied primarily on chat messages, and occasionally by voicing up. It was difficult for leaders to actively track students' attentiveness, and their progress in attempting the given questions. In physical setting, leaders could walk around the classroom to see students' work and give timely support; but in online classes, if students did not turn on their cameras and did not proactively voice up their issues, leaders could hardly follow their progress and check up their work.

V. IMPLICATION

Despite there was insignificant evidence that either mode of delivery yields better academic results, from the interviews with PALSI students and leaders, they generally agreed that face-to-face classes were more interactive and could facilitate better learning atmosphere. The interviews with students also shed insights on the reason why academic performance of PALSI students did not seem to be impacted much by the mode of delivery. The students discussed about 3 important factors, namely class size, technological literacy, and voluntariness.

A. Class Size

Class was limited to 1 leader to 8 students for all PALSI sessions unless there were extenuating circumstances. Both student and leader interviewees mentioned that personal interaction was crucial in enhancing overall learning atmosphere and effectiveness. Therefore, classes of smaller size can better provide individualized attention to students even in online setting. Leaders would be able to spend more time with each student to understand their issues. Student interviewees suggested that a class size of less than 10 students would be good enough to sustain learning quality. Some also added on the nature of course material – for courses with strong quantitative focus, it will be better to have even small class size, like 1 leader to 4–6 students. Leaders will be able to spend more time going through individual mistakes in calculation. For courses with strong qualitative focus, the current class size of no more than 8 students will be appropriate.

B. Technological Literacy Level

No interviewees reported major difficulties or hindrance to learning in online setting. They all used Zoom prior to online PALSI sessions. However, online classes did require a more delicate and thoughtful set-up to mimic a physical classroom setting for both leaders and students. For example, leaders described that they would first use a laptop to join the zoom meeting, then link another tablet device for drawing annotated diagrams and to preview screen-sharing. If only one device was used, they might not be able to provide the best learning support. From the perspectives of students, sometimes they found it inconvenient to type mathematical symbols like square root ($\sqrt{}$), Greek characters like α, β in chat messages. Though this could easily be resolved by using full English names (e.g., instead of using α, students can enter as "alpha"), this could pose possible hindrance in willingness to answer questions via chat messages.

C. Voluntariness

Student interviewees all regarded themselves as a more motivated learner compared with other non-PALSI students. As PALSI is a purely voluntary programme, students who opt to join in the scheme tend to be more hard-working and therefore, more willing to go the extra mile to compensate any subtle difference between online and face-to-face classes. This trait could be further extended to intrinsic learning motivation and motivation gained in face-to-face classroom. When students are more

motivated to learn, they are more likely to put in extra effort to learn and communicate.

Apart from the above 3 major factors, student interviewees pointed out that the personality of leaders could also determine whether the mode of delivery will impact academic performance. Students described their leaders as knowledgeable, proactive, communicative, and caring. In the interviewees, it was noted that the communication tended to be only between students and leaders in online classes – peer interaction was mostly absent. Student interviewees felt that if leaders were more encouraging and approachable, they would be less intimidated to ask and answer questions in online discussions. It was also suggested that turning on the camera would enhance a sense of personal touch and improve the presence of peers and instructors in online classes.

VI. LIMITATIONS

Causality conclusion cannot be made as there was no randomization in research subjects. Students were not randomly assigned to be in PALSI sessions, or non-PALSI sessions. Students who opt to join in the scheme tend to be more hard-working and therefore, more willing to go the extra mile to compensate any subtle difference between online and face-to-face classes. This study did not account for the difference in course instructor, PALSI leader, teaching strategy, and other instructional aspects (course design and structure, learning content, assessment components, etc.). All these factors could have impacted the effectiveness of either online and offline PALSI.

VII. CONCLUSION

From the data analysis and interviews, academic performance was not significantly impacted by the mode of delivery. However, both students and leaders preferred face-to-face PALSI sessions over online ones, as online classes were significantly inferior to face-to-face classes in terms of peer interaction. From students' perspectives, physical classes allow better communication and they tend to be more focused in class. Having peers sitting right next to them would also facilitate discussion and build a better learning atmosphere. From leaders' perspectives, it would be far easier for them to actively check on students' progress and to provide prompt support. In online classes, they regarded themselves as a more "passive" leader – only when students voice up their issues would they be able to provide guidance.

Despite the perceptible difference in face-to-face and online sessions, objectively, students' academic performance did not seem to be impacted. As concluded from the interviews, class size played an important role in whether online teaching delivery can completely replace offline, face-to-face classes. Needless to say, both leaders and students would have to transcend from old learning habits to the new, digitalized learning environment.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Ka-Yan So analyzed the data and wrote relevant parts of the paper. Pit Ho Patrio Chiu oversaw the research and supplemented information on the background and history of PALSI. All authors had approved the final version.

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