International Research Symposium, 2020, pp. 91 - 100
DOI: https://doi.org/10.62458/CamEd/OAR/Symposium/2021/91-100

CHAPTER 7

Effectiveness of Synchronous Online Learning Compared to Face-to-Face Learning Among Higher Education Students in Cambodia during the COVID-19 Pandemic

Casey Barnett and Yem Bunthorn

INTRODUCTION

Economic Impact of Lost Learning

The International Monetary Fund reported that global gross domestic product (GDP) contracted by 3.5 percent in 2020 compared to positive growth of 2.8 percent in 2019 (International Monetary Fund [IMF], 2021). This economic loss means more people will suffer the effects of poverty. The economic loss is largely due to COVID and its effects which include safety measures such as restrictions on gatherings and movement.

One safety measure implemented by countries has been the prohibition of face-to-face learning in schools. However, the closure of schools may have ongoing negative economic consequences for years to come. A study by the Organisation for Economic Cooperation and Development (OECD) estimates that "due to lost productivity, one year of lost primary and secondary school learning will result in an economic loss equivalent to 202 percent of future GDP" (Hanushek & Woessmann, 2020, p. 9).

Empirical studies are showing that learning loss arising from school shutdowns is proportional to the duration of the shutdown. For example, a study of national exam results for approximately 350,000 students in the Netherlands found that an 8-week shutdown resulted in a learning loss equivalent to the same period of the shutdown (Engzell *et al.*, 2021).

With awareness of the negative effects of lost learning, many countries have encouraged schools and universities to continue teaching online. In Cambodia, the Ministry of Education, Youth and Sport issued an instruction to all educational institutes to end physical classes from 16 March 2020 (Ministry of Education, Youth and Sport [MoEYS], 2020). As of 1 August 2021, the prohibition of face-to-face

learning in Cambodia continues. In place of face-to-face learning, the Cambodian government has encouraged online learning. This raises the question of whether online learning can be as effective as traditional face-to-face learning. Thus, keeping this in mind, we intend to fill up the gaps in knowledge through the present empirical study.

In the following sections of this chapter, we present the literature concerning the effectiveness of online learning in Cambodia and Southeast Asia, followed by research questions and hypotheses, study methodology, results, discussion including conclusion and suggestions for future studies.

LITERATURE REVIEW

Effectiveness of Online Learning

An influential meta-study published by the U.S. Department of Education, *Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Studies*, found that students did modestly better in online learning than with traditional face to face learning (Means *et al.*, 2010). That meta-study identified over one thousand empirical studies published between 1996 and 2008 comparing online learning with traditional face to face learning. After screening the studies for sufficient data, the authors made use of data from 45 studies and found "a significant average effect size of +0.20 in favor of online learning" (Means *et al.*, 2010, p. 18).

The findings of the 2010 U.S. Department of Education meta-study may be of limited applicability to fully online university courses. Of the 45 studies included in the U.S. Department of Education meta-study, only seven of them assessed fully online, full semester-length university courses (Smith & Bailey, 2010). An examination of those seven studies concluded that "there was no significant difference in the effectiveness of online learning versus traditional face to face learning" (Smith & Bailey, 2010, p. 9).

A number of studies conducted since the 2010 U.S. Department of Education meta-study have reinforced the finding that there is no significant difference in learning outcomes when comparing online learning with traditional classroom instruction. For example, Ni (2013) conducted a study comparing three groups of graduate students in online classes with three groups of students in traditional face-to-face classes for a single subject taught by a single instructor; she determined that student performance was independent of mode of instruction. Ni's study also found that there was a higher rate of drop-outs for the online courses in her study; however, she found that "failure rates and drop-out rates for online classes differed according to course subject" (pp. 207–208). A similar study by Paul and Jefferson (2019) assessed the performance of 548 students in an environmental science course taught by a single

professor from 2009 to 2016, finding no significant difference in student performance between online study and face-to-face studies.

In both of these studies, students self-selected the modality of study. This makes it difficult to extrapolate their findings to students in general because students who study better online are likely to have chosen online study and students who study better face-to-face are more likely to have chosen face-to-face study.

Empirical Studies of Online Learning in Cambodia and Southeast Asia

Recent studies of online learning in Cambodia have surveyed students about experiences and challenges rather than assessing learning outcomes compared with a control group. These studies report common challenges of online learning in Cambodia such as limited internet access and interruptions when studying at home (Em, 2021), and student approaches to studying online (Corrado *et al.*, 2021).

Two studies of online learning in Cambodia have reported quantitative data on drop-out or failure rates, with mixed findings. For one online non-credit workshop delivered to 32 Cambodian university students in Siem Reap province, not one student completed the assigned tasks (Crews & Parker, 2017). In contrast, an eLearning project teaching business skills in Cambodia reported "among 272 Cambodian higher education students a drop-out rate of only 11 percent and a failure rate of 14.7 percent among those who completed the course" (Abdon *et al.*, 2007, p. 7).

Studies of online learning in other Southeast Asian countries have also reported mixed effects of online learning versus traditional face to face learning. A study of 261 Thai university students found that self-reported effectiveness of learning was lower with online learning (Janmaimool & Nunsumnanon, 2021). However, it should be noted that in the Thai study, learning effectiveness was a subjective measure reported by students and was not determined with examinations or other objective learning assessment. In contrast, a similar study of 95 university students in Indonesia concluded that students perceived online learning to be effective (Djumingin *et al.*, 2021). Studies in Southeast Asia have included surveys of the perceptions of computer science or technology students; as might be expected, such students were favorably disposed to online learning (Mobo & Sabado, 2019; Al-rahmi *et al.*, 2015).

HYPOTHESES

Contribution to the Literature

This study makes four important contributions to the literature comparing the effectiveness of online learning to face-to-face learning. First, it adds to the few empirical studies of semester-long bachelor degree courses. Most studies of online

versus face-to-face learning do not look at courses that are granted credit towards a higher education degree. Second, this study looks at the effectiveness of online learning for a range of subjects. This is important because it has been shown that there is varying effectiveness of online learning according to course subject. Third, it avoids the potential bias arising from students self-selecting whether to study online or face-to-face learning. This study avoids that bias because the sample of students had no choice of whether to study online or face-to-face. Fourth, to our understanding, this study is the first empirical study of the effectiveness of synchronous online learning versus face-to-face learning in Cambodia. Previous studies in Cambodia have only either surveyed student perceptions or measured performance in online courses without comparison to a control group of face-to-face students.

Research Questions and Hypotheses

We examine the following research questions and null hypotheses:

1. Is there a significant difference in mean final Business Ethics course scores between students in synchronous online classes and students in face-to-face classes?

   $H_{0,be}$: There is no significant difference in mean final Business Ethics course scores between students in synchronous online classes and students in face-to-face classes.

2. Is there a significant difference in mean final Cambodian Business Law course scores between students in synchronous online classes and students in face-to-face classes?

   $H_{0,cbl}$: There is no significant difference in mean final Cambodian Business Law course scores between students in synchronous online classes and students in face-to-face classes.

3. Is there a significant difference in mean final Cambodian Tax course scores between students in synchronous online classes and students in face-to-face classes?

   $H_{0,ct}$: There is no significant difference in mean final Cambodian Tax course scores between students in synchronous online classes and students in face-to-face classes.

4. Is there a significant difference in mean final Computer Science course scores between students in synchronous online classes and students in face-to-face classes?

   $H_{0,cs}$: There is no significant difference in mean final Computer Science course scores between students in synchronous online classes and students in face-to-face classes.

5. Is there a significant difference in mean final Microeconomics course scores between students in synchronous online classes and students in face-to-face classes?

$H_{0,m}$: There is no significant difference in mean final Microeconomics course scores between students in synchronous online classes and students in face-to-face classes.

6. Is there a significant difference in mean final Political Science course scores between students in synchronous online classes and students in face-to-face classes?

   $H_{0,ps}$: There is no significant difference in mean final Political Science course scores between students in synchronous online classes and students in face-to-face classes.

7. Is there a significant difference in mean final Psychology course scores between students in synchronous online classes and students in face-to-face classes?

   $H_{0,ps}$: There is no significant difference in mean final Psychology course scores between students in synchronous online classes and students in face-to-face classes.

As previous studies have found differences in the effectiveness of online learning according to course subject matter, these hypotheses are tested course by course.

METHODOLOGY

Measurement of Learning Outcome Achievement

Achievement of learning outcomes is measured by a cumulative measure of assessments of course learning outcomes. Each course in this study has a specified set of course learning outcomes. Students' achievement of those outcomes is measured by a variety of assessments including participation, assignments, projects, simulations, discussion, midterm exams and final exams. The scores of these assessments are combined into a single measure of achievement of learning outcomes ranging from 0–100. The proportion that each assessment contributes to the final measure of achievement of learning outcomes is different from course to course, but remains the same from teacher to teacher.

Participants

In this research we considered all courses taught in the bachelor of accounting and finance program at CamEd Business School, a private accredited institute of higher education in Phnom Penh, Cambodia. CamEd Business School teaches two semesters per year, from January to June and from July to December. In the January to June 2019 semester, all courses were taught face-to-face. In the January to June 2021 semester, the same courses were taught fully online in a synchronous manner such that students attended class via Zoom or Google Meet for the same number of sessions and hours as they would have in the traditional face-to-face lessons. Therefore,

this study has chosen to compare student performance in the January to June 2019 face-to-face courses with student performance in the January to June 2021 synchronous online courses.

We have included only courses that met the following three conditions:

1. The instructor of the course in each semester was the same.
2. The proportion that each type of learning assessment contributed to the measurement of final course scores remained the same for each semester.
3. The final examination for each course was prepared in a consistent manner as defined by whether the exam was prepared by the institution or prepared by an external party.

Out of 31 courses taught at CamEd Business School in the January–June 2019 and January–June 2021 semesters, there were seven courses that met the three conditions.

Data Analysis

For its simplicity and understandability, we chose to test the mean final scores of students in face-to-face classes with the mean final scores of students in online classes. We chose an independent two-tailed t-test of means, an approach similarly used in a number of earlier studies (Teclehaimanot *et al.*, 2007; Peterson & Bond, 2004). Because we had a relatively large sample size and access to a continuous variable in the form of student final scores, we chose a test of means instead of a chi-square analysis of grade distribution used in some studies (Paul & Jefferson, 2019; Ni, 2013).

All analyses were performed using IBM SPSS with a 5 percent level of significance and course scores as the test variable and the mode of study as the grouping variable. To choose between the student t-test and Welch's t-test for unequal variances, we first conducted Levene's test for equality of variances. For the samples for which equality of variances could not be assumed, we selected Welch's t-test for unequal variances.

The data is available to the public via this link: shorturl.at/etNQW.

RESULTS

Table 7.1 summarizes the course titles, the number of students in each course, the mean final course scores, standard deviations and test values. The mean score in Table 7.1 represents the mean final score for the course. The mean final score for the course is the sum of a variety of learning assessments such as quizzes, participation, assignments, midterm exams, and final exams.

Table 7.1: Sample Size, Mean Course Scores, and Standard Deviations

	Course Title	*Face-to-Face*			*Synchronous Online Learning*			*Levene's Test for Equality of Variances*	
		n	*Mean Score*	*SD*	*n*	*Mean Score*	*SD*	*F*	*Sig.*
1.	Business Ethics	176	81	8.4	293	88	7.1	2.584	0.109
2.	Cambodian Bus. Law	199	81	10.1	302	79	9.7	0.364	0.547
3.	Cambodian Tax	195	79	10.4	167	72	9.7	2.759	0.098
4.	Computer Science	315	76	11.2	332	76	16.7	43.328	<.001
5.	Microeconomics	435	69	13	477	62	12.3	0.538	0.463
6.	Political Science	595	87	9.7	668	84	13.9	55.436	<.001
7.	Psychology	247	75	10.2	363	77	15.3	22.248	<.001

Note: Bus. = Business; SD = Standard deviation
Source: Authors.

As shown in Table 7.1, the mean course scores for two courses improved (Business Ethics and Psychology), the mean course scores for four courses worsened (Cambodian Business Law, Cambodian Tax, Microeconomics, and Political Science), and the mean course score for one course stayed approximately the same (Computer Science). The smallest sample size was 167 students (Cambodian Tax, online learning) and the largest sample size was 668 students (Political Science, online learning).

For each pair of samples, we conducted Levene's test for equality of variances to determine whether equality of variances could be assumed. As shown in Table 7.1, the results of Levene's test were significant ($p < .001$) for Computer Science, Political Science, and Psychology. Therefore, for these three courses, we used Welch's t-test for unequal variances. For the other courses, we used the student's t-test.

As shown in Table 7.2, we do not reject the null hypothesis for three courses; we reject the null hypothesis for four courses. At a 5 percent level of significance, the synchronous online learning mean final scores for three of the seven courses were not significantly different when compared to the face-to-face mean final scores. However, the synchronous online mean final scores for four out of seven courses were significantly different when compared to face-to-face learning. Among these four, three courses show a lower average score for synchronous online learning and one course shows a higher average score for synchronous online learning.

Table 7.2: Independent Samples t-Test for Equality of Means

	Course Title, Assumption of Variances	*t*	*df*	*Two Sided p*	*Mean Difference*	*Reject the Null Hypothesis*
1.	Business Ethics *equality of variances assumed*	–8.796	467	<.001	–6.377	Yes
2.	Cambodian Business Law *equality of variances assumed*	1.286	499	<.199	1.159	No
3.	Cambodian Tax *equality of variances assumed*	6.546	360	<.001	6.963	Yes
4.	Computer Science *equality of variances not assumed*	–0.680	645	.497	–.763	No
5.	Microeconomics *equality of variances assumed*	8.134	910	<.001	6.696	Yes
6.	Political Science *equality of variances not assumed*	3.608	1192	<.001	2.410	Yes
7.	Psychology *equality of variances not assumed*	–1.992	608	0.047	–2.060	No

Source: Authors.

DISCUSSION

The results show that for three of the courses the level of student learning is not significantly different when comparing face-to-face learning to synchronous online learning. However, for four other courses there is a significant difference between student learning in synchronous online learning compared to face-to-face learning.

Based on these results, synchronous online learning has the potential to be:

1. As effective as face-to-face learning (3 of 7 courses in this study)
2. More effective than face-to-face learning (1 of 7 courses in this study)
3. Less effective than face-to-face learning (3 of 7 courses in this study)

The differences in the mean learning achievement as measured by final course scores in this study differ from course to course. This may be due to four key idiosyncratic factors.

First, instructors used different teaching methods and utilized synchronous online teaching tools to a greater or lesser extent. Instructors in this study were teaching

synchronous online for the first time in their careers. Some instructors may have been well versed in synchronous online teaching methods and other instructors may have been less skilled in synchronous online teaching. Instructors making use of online educational tools such as Kahoot!, polleverywhere, Quizizz and exploiting Google classroom functions would be expected to have better results than instructors who simply continued to deliver traditional lectures via an online platform. We would expect differences due to differences in pedagogical approaches to decline over time as instructors and education managers gain experience.

Second, the assessments that contribute to the final course score may not be consistent or objective. It is expected that there is a degree of subjectivity in marking assignments, projects and some exam statements. As a result, some of the variation in mean course scores may be attributed to intentional or unintentional subjective bias when marking and grading student work.

Third, assessments of student learning performed outside of a controlled exam environment may reflect the results of collaborative efforts and not individual student learning. Students working on projects and assignments may receive collaborative assistance from classmates, tutors and academic advisors.

A fourth idiosyncratic factor is the effort of students. When students join a course, they are presented with learning objectives and they are informed about the various assessments they will undergo to earn a course score and grade. Therefore, if students feel that learning in one mode of instruction is insufficient, they may respond by spending more time reading and reviewing to achieve the desired level of learning. This idiosyncratic factor would tend to obscure the differences between synchronous online learning and face-to-face learning.

CONCLUSION

This study has found that it is possible for synchronous online learning to be as effective, more effective, or less effective than traditional face-to-face instruction. On a whole, these findings support the notion that student learning achievement is less dependent on the mode of instruction and more dependent on idiosyncratic features such as instructor pedagogy, course subject, curation of learning activities and use of learning applications for engagement and feedback. Because synchronous online learning can be as effective or more effective than face-to-face learning, it must not be dismissed in favor of face-to-face learning. Educators and policymakers should not regard synchronous online learning as a necessary evil during the COVID-19 pandemic but as a valid mode of instruction that has potential for widespread, ongoing use.

We encourage research into the features of online learning that best contribute to higher levels of student learning achievement. Already, promising research has shown that online learning gamification tools can even enhance face-to-face learning (Holbrey, 2019). If we are able to identify the tools and methods of online learning that result in better learning outcomes, we can better support students. More efficient learning results in a higher level of skills acquired, a more productive workforce, and greater economic growth. Unfortunately, most research into the effectiveness of online learning uses correlational methodological design rather than methodology that determines causal relationships (Lockman & Schirmer, 2020).

Therefore, we propose future studies use methodologies that isolate and identify the idiosyncratic factors that have a causal relationship with online learning achievement. To better isolate idiosyncratic factors, learning achievement can be measured with standardized objective assessments such as final exams instead of potentially less accurate measures such as semester grades. Also, future studies may wish to take measures to reduce or eliminate subjectivity in assessment marking through increased use of objective questions and detailed marking rubrics. To determine causation, researchers may make use of methodological design such as that of Arias *et al.* (2018) which, controlling for factors such as human capital potential and pre-test performance, uses regression analysis with learning achievement as the dependent variable.

REFERENCES

Abdon, R. Buenafe, Ninomiya, S., & Raab, T.R. (2007). e-Learning in higher education makes its debut in Cambodia: The provincial business education project. *International Review of Research in Open and Distance Learning, 8*(1), 1–14. https://files.eric.ed.gov/fulltext/ED496164.pdf

Al-rahmi, W.M., Othman, M.S., & Yusuf, L.M. (2015). The effectiveness of using e-learning in Malaysian higher education: A case study Universiti Teknologi Malaysia. *Mediterranean Journal of Social Sciences, 6*(5), 625–637. https://www.mcser.org/journal/index.php/mjss/article/view/7686

Arias, J.J., Swinton, J., & Anderson, K. (2018). Online vs. face-to-face: A comparison of student outcomes with random assignment. *e-Journal of Business Education & Scholarship of Teaching 12*(2), 1–23. https://files.eric.ed.gov/fulltext/EJ1193426.pdf

Corrado, R., Pretorius, E., & van der Westhuizen, G. (2021). Undergraduate students' experiences of the use of MOOCs for learning at a Cambodian university. *Education Sciences, 11,* 336. https://doi.org/10.3390/educsci11070336

Crews, J., & Parker, J. (2017). The Cambodian experience: Exploring university students' perspectives for online learning. *Issues in Educational Research, 27*(4), 697–719. http://www.iier.org.au/iier27/crews.html

Djumingin, S., Juanda, Maman, M., Haliq, A., & Weda, S. (2021). The effectiveness of online learning during the Covid-19 pandemic at higher education in Indonesia. *Multicultural Education, 7*(5), 361–370. http://ijdri.com/me/wp-content/uploads/2021/05/42.pdf

Em, S. (2021). Challenges of online learning during the COVID-19 pandemic: A survey of Cambodian high school students. *Cambodian Education Forum*. https://cefcambodia.com/2021/07/07/challenges-of-online-learning-during-the-covid-19-pandemic-a-survey-of-cambodian-high-school-students

Engzell, P., Frey, A., & Verhagen, M. (2021). *Learning loss due to school closures during the COVID-19 pandemic*. Proceedings of the National Academy of Sciences of the United States of America. https://doi.org/10.1073/pnas.2022376118

Hanushek, E.A., & Woessman, L. (2020). *The Economic Impacts of Learning Loss.* Organisation for Economic Cooperation and Development. https://www.oecd.org/education/The-economic-impacts-of-coronavirus-covid-19-learning-losses.pdf

Holbrey, C.E. (2020). Kahoot! Using a game-based approach to blended learning to support effective learning environments and student engagement in traditional lecture theatres. *Technology, Pedagogy and Education, 29*(2), 191–202. https://www.tandfonline.com/doi/full/10.1080/1475939X.2020.1737568

International Monetary Fund (2021, January). *World Economic Outlook Update*. https://www.imf.org/en/Publications/WEO/Issues/2021/01/26/2021-world-economic-outlook-update

Janmaimool, P., & Nunsunanon, S. (2021). Online vs. face-to-face lecture courses: Factors impacting the effectiveness of online learning. *Preprints.* https://www.preprints.org/manuscript/202107.0306/v1

Lockman, A.S., & Schirmer, B.R. (2020). Online instruction in higher education: Promising, research-based, and evidence-based practices. *Journal of Education and e-Learning Research, 7*(2), 130–152. https://doi: 10.20448/journal.509.2020.72.130.152

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2010). *Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies*. U.S. Department of Education. https://www2.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf

Ministry of Education, Youth and Sport (2020). Notification on Short School Break and Early End of Studies for Educational Institutions of All Kinds, Both Public and Private, Nationwide. Ministry of Education, Youth, and Sport.

Mobo, D.F., & Sabado, O.G. (2019). An assessment of the effectiveness of e-Learning in AMA Olongapo Campus. *Oriental Journal of Computer Science and Technology, 12*(3), 99–105. http://dx.doi.org/10.13005/ojcst12.03.04

Ni, A.Y. (2013). Comparing the effectiveness of classroom and online learning: Teaching research methods. *Journal of Public Affairs Education, 19*(2), 199–215. https://www.tandfonline.com/doi/abs/10.1080/15236803.2013.12001730

Paul, J., & Jefferson, F. (2019). A comparative analysis of student performance in an online vs. face-to-face environmental science course from 2009 to 2016. *Frontiers in Computer Science, 1*(7). https://doi.org/10.3389/fcomp.2019.00007

Peterson, L.C., & Bond, N. (2004). Online compared to face-to-face teacher preparation for learning standards-based planning skills. *Journal of Research on Technology in Education 36*(4), 345–360. https://doi.org/10.1080/15391523.2004.10782419

Smith Jaggars, S., & Bailey, T. (2010). *Effectiveness of Fully Online Courses for College Students: Response to a Department of Education Meta-Analysis*. Community College Research Center,

Teachers College, Columbia University. https://ccrc.tc.columbia.edu/media/k2/attachments/effectiveness-online-response-meta-analysis.pdf

Teclehaimanot, B., Mentzer, G., & Cryan, R.J. (2007). A comparison of traditional and online classrooms: Student perceptions and learning outcomes. https://www.researchgate.net/publication/237311132_A_Comparison_of_Traditional_and_Online_Classrooms_Student_Perceptions_and_Learning_Outcomes