A Comparative Study of the Self-efficacy of Undergraduate Students Under Dual-mode Teaching

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Abstract

Dual-mode teaching, which provides both face-to-face and online teaching synchronously at a course, has been adopted in HKU for almost a year. Although it provides the maximum flexibility in accommodating students' needs, a challenge has been raised on whether the learning experience of the online group and the face-to-face group can be the same. To understand whether the current learning experience aligns with the aim, this study investigated if there was a difference in self-efficacy for learning between undergraduate students from the online group and those from the face-to-face group. The data collection was done in a two-phase approach. Quantitative data was first collected in the form of online questionnaires, and qualitative data were collected in the form of phone interviews subsequently. The main finding was that there was no significant difference in students' self-efficacy among those using different participation modes. This may suggest that the discrepancy of learning opportunities in both modes was limited. A majority of students also expressed their preference for dual-mode teaching over either pure online mode or pure face-to-face mode, regardless of their choices. It may represent that dual-mode teaching is a promising design to serve students better.

Introduction

Dual-mode teaching has been introduced to some courses in HKU since the first semester of 2020-2021. It aims at allowing students in both modes to achieve equivalent learning outcomes while providing maximum flexibility and accommodating students' needs (Beatty, 2019). Nonetheless, we have observed that there is a discrepancy in the learning experience of the online group and the face-to-face group. For example, the lecturer may have the tendency to interact with the students in the lecturer hall more often. Questions raised in the chatroom on zoom might also be neglected unintentionally. This leads to a different learning experience between students among different groups, which may significantly influence their learning self-efficacy.

This study was to determine whether the current learning experience aligns with the aim. Apart from quantitative research, qualitative responses were recorded by phone interviewing the undergraduate students, which aimed at collecting constructive feedback for their learning experiences under dual-mode teaching, so that future improvements could be made more easily. It is believed that this research is pivotal as it helps ensure and create an equal learning environment.

Research Question

Our research question was that, under dual-mode teaching, is there a difference in self-efficacy for learning between undergraduate students from the online group and those from the face-to-face group?

The key terms in our research question are defined as follows:

1. ***Self-efficacy***
   Self-efficacy refers to "the judgments of one's capability to organize and execute the courses of action required to produce given attainments" (Bandura, 1997). Students with a high sense of self-efficacy believe they can manage their time effectively, organize their work, minimize distractions, set goals for themselves, monitor their comprehension, ask for help when necessary, and maintain an effective work environment (Usher, 2012).

2. ***Dual-mode***
   Dual-mode teaching, also known as Hybrid-Flexible (HyFlex), provides both online and classroom-based instruction in a course (Beatty, 2019). The principles of dual-mode teaching include learner choice, equivalency, reusability and accessibility. (Beatty, 2019; Centre for the Enhancement of Teaching and Learning, 2020).

3. ***Online group***
   In this study, this group referred to the undergraduate students who stayed overseas, or joined Zoom classes for 60% or above of the time. They are mainly students currently staying in other countries, and local students who decide not to attend face-to-face lectures.

4. ***Face-to-face group***
   In this study, this group referred to the undergraduate students who returned to campus for classes for 60% or above of the time

Objectives

There were two objectives for this study.

- To investigate self-efficacy for learning of HKU undergraduate students under dual-mode teaching.
- To investigate factors hindering or facilitating students' overall learning experiences in dual-mode teaching.

Hypothesis

We hypothesized that the level of self-efficacy would differ with the choice of teaching mode, either online mode or face-to-face mode.

Literature Review

As most of the undergraduate courses were delivered online in the early stage of the COVID-19 outbreak, researchers were very interested in the association between self-efficacy and online learning (Kuo et al., 2014; Tanis, 2020). Aguilera-Hermida (2020) showed that college students' self-efficacy may decrease due to the sudden change to online learning without adequate preparation during the pandemic and resulting in poor engagements.

When mitigation efforts gradually contained the virus, some higher education institutions decided to resume limited face-to-face classes. Dual-mode teaching was introduced for those who were having mandatory quarantines, being located in a different country, or getting fear of the virus to continue learning. Although this provides the greatest flexibility, it is hard to ensure that all students have equal opportunities to participate effectively in all the learning activities and assessments (Ferrero, 2020). Teaching teams may need to spend extra effort in providing ways for students to join course sessions in both teaching modes while achieving equivalent learning outcomes in both modes. As a result, studies about dual-mode teaching under the pandemic focused more on teaching self-efficacy (Ma et al., 2021; Okoye et al., 2021), instead of students' self-efficacy.

The most relevant study was conducted by Kohnke and Moorhouse (2021) in Hong Kong, which looked at students' postgraduate perspectives after attending a course delivered through dual-mode teaching (HyFlex). It suggested that participants enjoyed its flexibility while communication challenges were raised between students with different modes. However, the study did not concentrate on self-efficacy and only viewed a small sample size at a course level.

Overall, the main shortcomings for the above-mentioned studies are focusing on online learning, teaching self-efficacy, and small sample-sized at a course level. To fill the research gaps, the current study investigated the learning self-efficacy of undergraduate students from all faculties under dual-mode teaching.

Research Methodology

An explanatory-sequential approach was used in this research, meaning that both quantitative and qualitative data were collected in this research. The data-collection was done in a two-phase approach. Quantitative data was first collected in the form of online questionnaires, and qualitative data was collected in the form of phone interviews subsequently, which was used to aid our interpretation and clarification of the results from the quantitative data analysis (Edmonds & Kennedy, 2017). In our research design, equal emphasis was placed on both qualitative and quantitative data.

Research Method/Tools

A scale measuring self-efficacy for learning developed by Klobas et al. (2007) was used as a questionnaire for the research. The concurrent validity of the scale was 0.22 ($n = 164$, $p < .01$). The scale was slightly modified, with a scale measured on a 11 point scale ranging from 0 (I am definitely not able to do this) to 10 (I definitely can do this) to a scale measured on a 6 point scale ranging from 0 (strongly disagree) to 6 (strongly agree) (See Appendix 1). The reason for the adjustment was due to the fact of eliminating a "neutral" response, which could help differentiate participants' choices with a comparatively more obvious preference of agreeing or disagreeing the corresponding statement.

In our follow-up interview, phone calls were initiated and 7 structured questions were asked in total. All questions were asked in order to gain a deeper understanding of their learning experiences under dual-mode teaching. Phone-calling was used to interview them as the method of data collection for its convenience and immediate responses, which facilitates both the interviewee and interviewers.

For the questions asked in the follow-up interview, the results from the questionnaire measuring students' self-efficacy were evaluated and it was found that the self-efficacy was stable and had no significant differences. Therefore, details and activities that happened during dual-mode teaching were asked to find whether these activities match the design and management of dual-mode teaching at HKU (Part 3 from https://www.cetl.hku.hk/dualmode/framework/).

Data collection and analysis

Quantitative analysis

Figure 1

Participants' year of study distribution (survey)

Frequencies of Year

Levels	Counts	% of Total	Cumulative %
1	23	25.6%	25.6%
2	16	17.8%	43.3%
3	24	26.7%	70.0%
4	21	23.3%	93.3%
5	6	6.7%	100.0%

This figure illustrates the distribution of the year of study among participants who conducted the survey.

Figure 2
Participants' faculty distribution (survey)

Frequencies of Faculty

Levels	Counts	% of Total	Cumulative %
Architecture	2	2.2%	2.2%
Arts	13	14.4%	16.7%
Business & Economics	6	6.7%	23.3%
Dentistry	4	4.4%	27.8%
Education	5	5.6%	33.3%
Engineering	9	10.0%	43.3%
FBE & Faculty of Law	1	1.1%	44.4%
Law	4	4.4%	48.9%
Medicine	13	14.4%	63.3%
Science	15	16.7%	80.0%
Social Sciences	18	20.0%	100.0%

This figure illustrates the distribution of faculty among participants who conducted the survey.

The data collection for the survey started on 22th May and ended on 31st May (10 days). The majority of participants were recruited through the mass email sent by the common core office. After deleting the duplicated data and extreme values, a total of 90 valid responses were used in the analysis (See Figure 1 and 2 for the distribution of year of study and faculty respectively), of which 30 participants chose face-to-face mode, while the rest of the participants chose online mode. Jamovi (version 1.6) was used for the statistical analysis.

Qualitative analysis

Figure 3
Participants' year of study distribution (follow-up interview)

Frequencies of Year of study

Levels	Counts	% of Total	Cumulative %
1	7	33.3%	33.3%
2	5	23.8%	57.1%
3	2	9.5%	66.7%
4	5	23.8%	90.5%
5 or above	2	9.5%	100.0%

This figure illustrates the distribution of the year of study among participants who conducted the interview.

Figure 4

Participants' faculty distribution (follow-up interview)

Frequencies of Faculty

Levels	Counts	% of Total	Cumulative %
Arts	3	14.3%	14.3%
Business & Economics	1	4.8%	19.0%
Dentistry	1	4.8%	23.8%
Education	3	14.3%	38.1%
Engineering	2	9.5%	47.6%
Medicine	5	23.8%	71.4%
Science	3	14.3%	85.7%
Social Sciences	3	14.3%	100.0%

This figure illustrates the distribution of faculty among participants who conducted the interview.

In the follow-up interview, 30 participants were randomly selected from the survey respondents, of which 10 from the face-to-face group and the rest were from the online group. Starting on 1st June, we contacted the selected participants through email and invited them to sign up for the follow-up interview with a google form attached. This form collected their availability of having the interview and other personal information. A total of 23 respondents were received. Later, our team called all the participants according to their availability, with each phone interview taking less than 10 minutes. Only 21 people answered the phone call, in which 8 of them were from the face-to-face group and 13 of them were from the online group (See Figure 3 & 4 for the distribution of year of study and faculty respectively). All the conversations during the phone interviews were typed as brief interview transcripts. Thematic analysis was used for analyzing the qualitative data.

Findings

Quantitative analysis

Figure 5

Descriptive table for survey questions (also shown in Appendix 3)

Descriptives

	Groups	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Finding	Info-processing	SUM
N	Face-to-Face	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	Online	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Mean	Face-to-Face	4.70	3.83	4.10	4.03	3.93	4.53	4.30	4.30	3.70	3.93	4.80	3.80	3.93	4.53	4.30	3.57	4.40	4.03	3.80	3.97	4.33	4.13	4.47	3.83	4.07	4.27	4.00	20.7	52.7	112
	Online	4.60	3.57	4.25	4.02	3.60	4.25	4.28	4.05	3.95	3.70	4.70	3.77	3.97	4.30	4.60	4.08	4.28	4.17	4.08	3.87	4.50	3.53	4.57	4.18	4.20	4.22	4.03	20.5	52.6	111
Median	Face-to-Face	5.00	4.00	4.50	4.00	4.00	5.00	4.50	4.00	4.00	4.00	5.00	4.00	4.00	4.50	4.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	4.50	4.00	4.00	4.00	4.00	21.0	54.0	116
	Online	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00	21.0	53.5	114
Standard deviation	Face-to-Face	1.18	1.44	1.24	1.13	1.20	1.11	1.21	1.24	1.26	1.34	1.06	1.54	1.34	1.04	1.26	1.17	1.04	1.13	1.30	1.40	1.49	1.43	1.22	1.42	1.28	1.17	1.26	4.77	11.5	23.2
	Online	1.22	1.03	0.856	0.911	1.22	1.00	1.01	1.14	1.23	1.32	0.997	1.14	1.04	1.15	0.807	1.17	0.993	1.08	1.06	1.21	1.20	1.48	1.11	1.21	0.988	1.06	1.06	4.30	8.75	17.9

This figure illustrates the descriptive analysis of the survey.

Figure 6

Independent sample t-test on self-efficacy between face-to-face group and online group

Independent Samples T-Test

		Statistic	p		Effect Size
Q1	Mann-Whitney U	863	0.741	Rank biserial correlation	0.04167
Q2	Mann-Whitney U	764	0.227	Rank biserial correlation	0.15111
Q3	Mann-Whitney U	893	0.953	Rank biserial correlation	0.00778
Q4	Mann-Whitney U	900	1.000	Rank biserial correlation	5.56e-4
Q5	Mann-Whitney U	752	0.192	Rank biserial correlation	0.16500
Q6	Mann-Whitney U	778	0.278	Rank biserial correlation	0.13556
Q7	Mann-Whitney U	886	0.901	Rank biserial correlation	0.01611
Q8	Mann-Whitney U	808	0.414	Rank biserial correlation	0.10278
Q9	Mann-Whitney U	797	0.362	Rank biserial correlation	0.11500
Q10	Mann-Whitney U	812	0.439	Rank biserial correlation	0.09833
Q11	Mann-Whitney U	871	0.798	Rank biserial correlation	0.03222
Q12	Mann-Whitney U	897	0.982	Rank biserial correlation	0.00333
Q13	Mann-Whitney U	895	0.968	Rank biserial correlation	0.00556
Q14	Mann-Whitney U	831	0.535	Rank biserial correlation	0.07722
Q15	Mann-Whitney U	769	0.234	Rank biserial correlation	0.14556
Q16	Mann-Whitney U	661	0.034	Rank biserial correlation	0.26611
Q17	Mann-Whitney U	874	0.814	Rank biserial correlation	0.02944
Q18	Mann-Whitney U	817	0.462	Rank biserial correlation	0.09222
Q19	Mann-Whitney U	773	0.260	Rank biserial correlation	0.14167
Q20	Mann-Whitney U	854	0.686	Rank biserial correlation	0.05167
Q21	Mann-Whitney U	871	0.801	Rank biserial correlation	0.03222
Q22	Mann-Whitney U	694	0.073	Rank biserial correlation	0.22944
Q23	Mann-Whitney U	849	0.650	Rank biserial correlation	0.05667
Q24	Mann-Whitney U	765	0.231	Rank biserial correlation	0.15000
Q25	Mann-Whitney U	852	0.672	Rank biserial correlation	0.05333
Q26	Mann-Whitney U	869	0.785	Rank biserial correlation	0.03444
Q27	Mann-Whitney U	890	0.929	Rank biserial correlation	0.01167
Finding	Mann-Whitney U	893	0.952	Rank biserial correlation	0.00833
Info-processing	Mann-Whitney U	893	0.952	Rank biserial correlation	0.00833
SUM	Mann-Whitney U	895	0.969	Rank biserial correlation	0.00556

This figure illustrates the result of the difference in self-efficacy between face-to-face group and online group with independent samples T-test.

For individual items, there was no significant effect of self-efficacy on modes of teaching except for the question “it is always easy for me to understand new information, even on a topic that does not interest me very much” (Question 16). For this question, the independent-samples t-test indicated that scores were significantly higher for online group (M = 4.08, SD = 1.17) than for face-to-face group (M = 3.57, SD = 1.169), U = 661, p = .034, d = 0.27. In addition, no significant difference was detected when the sum of the score in self-efficacy was calculated, despite the face-to-face group (M = 111.60, SD = 23.19) scored higher than the online group (M = 111.32, SD = 17.897). Even though some questions were separated into two parts, finding and info-processing, using Rasch analysis solution for analysis (See Appendix 1), no significant difference was found.

Figure 7
ANOVA - Sum of scores

ANOVA - SUM

	Sum of Squares	df	Mean Square	F	p
Year	1795	4	449	1.17	0.331
Residuals	32693	85	385		

This figure sums up all the scores of each individual participant and compared with their year of study.

The main effect of self-efficacy on the years of study was not significant, $F(4, 85)=1.17$, $p=0.331$.

Figure 8
ANOVA - Info-processing

ANOVA - Info-processing

	Sum of Squares	df	Mean Square	F	p
Year	437	4	109.3	1.17	0.329
Residuals	7930	85	93.3		

The figure illustrates the result between self-efficacy and questions with a theoretical basis of information processing.

The main effect of self-efficacy on information processing was not significant, $F(4, 85)=1.17$, $p=0.329$.

Figure 9
ANOVA - Finding

ANOVA - finding

	Sum of Squares	df	Mean Square	F	p
Year	46.0	4	11.5	0.573	0.683
Residuals	1708.2	85	20.1		

The figure illustrates the result between self-efficacy and questions with a theoretical basis of finding.

The main effect of self-efficacy on information processing was not significant, $F(4, 85)=0.573$, $p=0.683$.

Qualitative analysis

The results from thematic analysis indicated that students choose face-to-face mainly for four reasons. Firstly, it is the *amount of interaction required by the nature of the course*. Some students study language courses which require lots of interacting practices and rehearses, and some social work courses require students to attend face-to-face lectures as there are many role-play sessions and involve a lot of interacting activities. Therefore, the nature of the courses is one of the reasons students choose face-to-face mode. Secondly, students reported that *an appropriate level of pressure* is needed for them to perform better, as numerous students and the course lecturer/professor is presented in front of the students, but online learning conversely encourages shyer students to engage more in discussions, as online learning can usually speak with camera off. Thirdly, some students chose face-to-face mode due to the *short commute*, as some of them live in halls or lives near campus that makes no difference or only a small difference between attending face-to-face classes or online classes. Lastly, pandemic leads to a difficult situation for students to meet new friends at school or even in their social life, some students thus reported that they hope to *socialize more* and interact with people with similar majors.

In some courses, students reported that recorded lectures will be provided after class, they may even skip their classes for their personal schedule, such as going for part-time, especially some students reported a huge time gap between their lessons. Online learning therefore makes their lives more flexible and easily managed.

For the advantage and disadvantage of dual-mode teaching raised by their students that contribute to their understanding of course content, there were more cons than pros in general. Most students reported that enormous technical difficulties have been encountered, such as students or professors who forgot to share screens, the breaking up of audio, which altogether leads to delay of classes. Moreover, some professors did not follow rules and did not upload their recorded lectures which made students unable to revisit and revise their course content, which negatively affected their grades. In addition, some students reported poor interaction with others as a result of a silent breakout room, which differs from face-to-face interactions that easily assemble discussions. During class participation, although students reported a generally less attentive status due to more distractions in online learning, they reported they were more likely and brave to speak up compared to face-to-face mode, despite, students who were more engaged in discussions felt embarrassed when no one speaks in breakout room, they would eventually stop talking and no discussions were held at last. Moreover, although it makes raising questions easier by asking through chat box, some students reported professors would focus more on face-to-face mode and often neglect students on zoom, such as missing their questions, problems, and concerns about their learning. In the course of class activities, students revealed a newly

adapted learning style, which is website teaching as an interesting way to learn. For instance, courses that involved communicating with clients were conducted through zoom, which is different from the traditional practice of facing clients in person. Among these courses, website teaching also allowed students to learn to conduct surgery online instead of carrying out clinical training, and some science students suggested this kind of practice could be adopted in the future.

Concerning students' assessment, almost all students reported a negative view on it. Firstly, it was found that students find it more difficult to find suitable groupmates online compared to face-to-face mode, and they have to ask through chat box or through email to find groupmates without any background information on each other. Secondly, some practical courses with many experiments were cancelled, thus, students could not gain enough hands-on experience by carrying out experiments. Despite the unfortunate situation, some students would prefer online lab experiments to escape from the difficulties faced by carrying out complicated experimental procedures in person that may influence their skills marks.

In order to improve dual-mode learning, some more engaged students suggested turning on cameras, in order to force students to participate more actively to facilitate effective discussions. Apart from this, some students reported having not enough interactions, they suggested lecturers/professors using games such as kahoot or menti to make classes more interesting and interactive. In order to deepen students' memories, they hoped lecture recordings will be always uploaded and available for students to revisit and revise, no matter under dual-mode teaching or under pure online mode teaching. These altogether are expected to enhance students' self-efficacy in their learning.

Discussion

The hypothesis that the choice of different modes of learning entails different self-efficacy is rejected. The choice of learning mode, i.e. face-to-face or online, does not predict the level of self-efficacy. In the following, the insignificant results will be explained by qualitative data and retrospection on research design.

Firstly, we have not reached the minimum sample size as suggested by the a priori power analysis. Eventually, we reached 90 participants (30 for the face-to-face group, 60 for the online group). According to the post hoc power analysis, the research merely reached a 5% power, which is extremely low and might entail type 2 error, meaning an increased chance in yielding a false negative result.

Moreover, it has also come to our attention when conducting phone interviews, that the term 'dual-mode' has created misunderstanding. For example, there are medical students who generally participate in classes face-to-face, but due to the pandemic situation, some clinical courses had been conducted via zoom. There are also 'online students' who have not taken any dual-mode courses this semester, and have only taken pure online courses. Self-efficacy is a

malleable construct which is subject to change under different contexts. This led to two problems. Firstly, the misunderstanding leads to a much larger sample size in the online group and may lead to difficulties in statistical analysis. Secondly, the learning experience of students from pure online courses, or that of students who occasionally learn via online, cannot be generalised into the learning experience under dual-mode learning. Nonetheless, the problem was discovered at a late stage, and it is impossible to get in touch with all of the participants, due to the anonymous nature of the research, to check whether they understood the term correctly.

As aforementioned, students also pointed out that the nature of course and assignment influence their choices of mode of learning. For example, in some of the courses that require less interaction and discussion, students may not feel the necessity to return to campus. Also, there were students who thought that there are actually more interactions via zoom when compared to face-to-face learning, as some students may be too shy to speak up in lecture halls. Thus, learning via zoom actually helped those students to engage in in-class discussions and interaction with lecturers. Some students, on the other hand, pointed out that learning in the lecture hall gave the pressure, which was conducive to learning. A lot of students also pointed out that pre-recorded lectures are beneficial for revision, which is usually not provided in traditional face-to-face classes.

Bottom line is, most students can always switch modes according to the learning experience and expectation. Although it is also noteworthy that there are students who are forced into learning via online, for example overseas students, and students who do not have time to commute due to the schedule. For most students who had chosen either mode, it was the choice which suited their preference and learning approach the best. Students also had little complaint about the learning experience in dual-mode, and our prediction that online students might be neglected does not ring true in most of the participants. Therefore, it is conceivable that there is no significant difference in the face-to-face and online group. The result also matched that of other similar researches, which also yielded no significant difference" in student performance among those using different participation modes, and self efficacy is an accurate predictor of performance (Miller, Risser, & Griffiths, 2013)

To sum up, students interviewed by us, regardless of their choice of online mode, have generally expressed their preference for dual-mode teaching over either pure online mode or pure face-to-face mode. This was supported by a similar research conducted by Gobiel-Proulx (2019), pointing out that the HyFlex format is greatly appreciated by the students. There are also students suggesting that mixed mode can be delivered in the form of pre-recorded lectures assisted by face-to-face small group learning, i.e. tutorials. Some students also pointed out that dual-mode teaching opens the door for teaching in future, as it saves commute time and provides flexibility in arranging the schedule. This result has corroborated the goal of dual-mode teaching, which is to provide learning activities and experience in both modes which lead to equivalent learning outcomes.

Limitations & Delimitations

An important issue that happened was some students had misunderstood the meaning of dual-mode teaching with other teaching modes, such as blended teaching when completing the survey. We realized this situation until we conducted the follow-up interviews, and we immediately added a part to explain dual-mode teaching deeply in each interview. However, it was difficult to measure the error this misunderstanding had created in the survey results.

On top of that, several students pointed out that the quality of teaching in dual-mode hinged on how the lecturer delivered the course content. For example, in some courses, online students were neglected, while in other courses, the lecturer managed to coordinate both online and face-to-face teaching with novel approaches. Thus, confounding variables as such affect the internal validity of the research. In order to improve the fairness, reliability and validity of the research, and establish a clearer understanding between mode of teaching and self-efficacy, it would be better to do the research within one dual-mode course.

Improvement

Several improvements on research methodology are suggested from this study, which could be the basis for additional research. To balance the number of participants in online mode and face-to-face mode, it is suggested to conduct class announcements for increasing chances to get participants who choose face-to-face mode in future research. Apart from that, a pilot study can be conducted prior to the actual research. This may allow a more accurate estimation of the effect size and thus, a more accurate a priori power analysis can be conducted.Furthermore, it is suggested to take into account more confounding variables. It is believed that other confounding factors, such as gender, GPA, etc., can be collected to get a more complete picture of the effect of dual-mode teaching. Lastly, longitudinal studies can be done to investigate the relationship between academic self-efficacy and dual-mode teaching. This research mainly focuses on the learning experience in the last semester and relied heavily on self-reported measurements. It is suggested to investigate the long-term effect on self-efficacy under dual-mode teaching while adding other variables such as the academic performance in dual-mode teaching courses to reduce bias.

Conclusion

This study investigated the effect of the self-efficacy of undergraduate students under dual-mode teaching, which has been adopted since the first semester of 2020-2021. A survey was first conducted to understand the self-efficacy under dual-mode teaching and then followed by in-depth phone interviews to further find out whether these activities match the design and management of dual-mode teaching at HKU. The main finding of “no significant difference” in students’ self-efficacy among those using different participation modes may support that dual-mode teaching increases students’ flexibility in terms of accessing learning while maintaining equal learning opportunities. In the follow-up interviews, although some experienced technical challenges in dual-mode teaching courses which negatively affected their

learning experience, most of the participants held positive attitudes towards dual-mode teaching. With the uncertainty of new variants of the coronavirus, it is believed that dual-mode teaching is a very promising design to serve students better and can become a regular option for teaching teams to adopt in undergraduate courses.

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Appendix 1

Survey questions which adopted from Klobas et al. (2007)

No.	Question	Theoretical basis
1	I am able to organize my activities so that I can meet all course deadlines.	
2	Soon after the end of a lesson, I am able to remember all of the key concepts.	Info Processing
3	I can understand all of the key concepts covered in my course.	Info Processing
4	I am able to explain to my fellow students, in a way they can understand all of the key concepts covered in a course.	Info Processing
5	After sitting an exam, I am able to remember all of the key concepts covered in the course.	
6	When I find something new about a topic that I am studying, I am able to connect it with other things that I know about the topic.	Info Processing
7	When the media carries a report about something that I am studying, I can always use my knowledge of the subject to interpret the report.	
8	I always know how to get up to date on a topic if my knowledge of it is dated.	Info Processing
9	Even when I haven't participated in a lesson, I can always understand the concepts covered in the lesson by reading a textbook.	Info Processing
10	I am always able to find material in the library about a subject that interests me.	Finding
11	I am always able to find more detailed information on the Internet for a topic that interests me.	
12	I am never embarrassed to ask the teacher for clarification.	
13	I am always able to identify the most appropriate person to help me resolve a problem related to my study.	
14	I am always able to evaluate the quality of fellow group members' contributions when I participate in group activities.	Info Processing
15	I am always able to relate the notes I have made during a lesson with the topics covered in the course text or readings.	

16	It is always easy for me to understand new information, even on a topic that does not interest me very much.	Info Processing
17	It is always easy for me to connect new information about a topic that interests me with other pieces of information.	
18	During a course, if we are given a new task to complete, I can always complete it by applying the knowledge that I obtained from lessons.	
19	Soon after the end of a lesson, I am always able to distinguish the most important concepts from concepts of less importance.	Info Processing
20	If, as part of a course, I participate in a forum or online discussion, I am always able to identify those messages which will improve my understanding of the material covered in the course.	
21	I am always able to decide whether to go to the library or use the web, based on the type of information that I am seeking.	Finding
22	I always find it easy to join a group of fellow students to study or complete course activities.	Finding
23	I am always able to identify useful information on the web for an essay.	Finding
24	I am always able to use the library and library services to select appropriate books and articles for an essay.	Finding
25	After a lesson, I am always able to integrate concepts described by the teacher with those presented in course texts and readings.	Info Processing
26	When I write an essay for a course, I am always able to incorporate knowledge gained from other sources.	Info Processing
27	I am always able to help other students solve problems based on concepts described in a lesson.	Info Processing

* For items from the 18 item Rasch analysis solution.

Appendix 2

Follow-up interview questions for students

1. What did you choose for courses with dual-mode teaching in the last semester, online or face-to-face?
2. Compared to another, why did you choose this mode?
3. How did the use of dual-mode teaching positively or negatively contribute to your understanding of the course content? How did it contribute to your overall learning experiences in this course? Can you please elaborate on that?
4. Do you think the learning activity under dual-mode teaching helps you understand the course content better? Not as well? Can you explain?
5. In your opinion, how could the course have been modified to enhance the learning value under dual-mode teaching?
6. Aside from the learning value, was the use of the dual-mode teaching generally a more positive or less positive learning experience for you? What specific aspects did you find more positive or less positive about it? Why do you think that is the case?

Appendix 3

Descriptive analysis of survey questions

Descriptives

	Groups	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16
N	Face-to-Face	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	Online	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Mean	Face-to-Face	4.70	3.83	4.10	4.03	3.93	4.53	4.30	4.30	3.70	3.93	4.80	3.80	3.93	4.53	4.30	3.57
	Online	4.60	3.57	4.25	4.02	3.60	4.25	4.28	4.05	3.95	3.70	4.70	3.77	3.97	4.30	4.60	4.08
Median	Face-to-Face	5.00	4.00	4.50	4.00	4.00	5.00	4.50	4.00	4.00	4.00	5.00	4.00	4.00	4.50	4.00	4.00
	Online	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	5.00	5.00	4.00
Standard deviation	Face-to-Face	1.18	1.44	1.24	1.13	1.20	1.11	1.21	1.24	1.26	1.34	1.06	1.54	1.34	1.04	1.26	1.17
	Online	1.22	1.03	0.856	0.911	1.22	1.00	1.01	1.14	1.23	1.32	0.997	1.14	1.04	1.15	0.807	1.17

Descriptives

	Groups	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Finding	Info-processing	SUM
N	Face-to-Face	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	Online	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Mean	Face-to-Face	4.40	4.03	3.80	3.97	4.33	4.13	4.47	3.83	4.07	4.27	4.00	20.7	52.7	112
	Online	4.28	4.17	4.08	3.87	4.50	3.53	4.57	4.18	4.20	4.22	4.03	20.5	52.6	111
Median	Face-to-Face	4.00	4.00	4.00	4.00	5.00	4.00	4.50	4.00	4.00	4.00	4.00	21.0	54.0	116
	Online	4.00	4.00	4.00	4.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00	21.0	53.5	114
Standard deviation	Face-to-Face	1.04	1.13	1.30	1.40	1.49	1.43	1.22	1.42	1.28	1.17	1.26	4.77	11.5	23.2
	Online	0.993	1.08	1.06	1.21	1.20	1.48	1.11	1.21	0.988	1.06	1.06	4.30	8.75	17.9