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University Student Readiness and Its Effect on Intention to Participate in the Flipped Classroom Setting of Hybrid Learning

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Abstract: The flipped classroom teaching method has existed for many years. Past research indicates that students could have better self-directed learning skills, more in-depth learning, higher satisfaction, and motivation to study through flipped classroom learning. However, some challenges arise for students and teachers, such as student capability; lack of preparation; low motivation to watch pre-recorded videos; and low interaction. During the pandemic period, students began engaging in online or hybrid learning. Fortunately, instructors are familiar with technology. Our study aims to investigate the flipped classroom learning readiness of university students during the pandemic era, both in face-to-face and online mode. The classes were conducted in a hybrid manner, with two groups of students under the same treatment. The results indicate that the intention to participate in the flipped classroom setting is associated with readiness and perceived control. Such an intention is also the same regardless of learning mode. Perceived behavioral control is a partial mediator between student readiness and intention to participate in flipped classroom.

Keywords: hybrid learning; flipped classroom; students' readiness; intention to participate in flipped classroom learning

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1. Introduction

Some universities have a hybrid mode of teaching; that is, students are allowed to choose between the face-to-face traditional classroom or online teaching format based on their needs. This issue will be practical once the Coronavirus disease 2019 (COVID-19) pandemic situation improves. Students are required to attend classes, but some valid reasons prevent them from coming to school; for example, students' family members are in close contact with confirmed cases. This results in students being absent from their classes physically due to quarantine policies. They must stay at home. Meanwhile, some overseas students cannot come due to their own country's pandemic situation. By contrast, some students might not have a good computer, reliable network, or a quiet place. They must therefore come to the campus to attend face-to-face classes.

Blended learning includes both face-to face and online components [1]. Flipped classroom comprises pre-work in a student's own time, followed by in-person sessions. Video viewing has become a popular form of technology in foundation work [2]. When students complete the pre-work, teachers guide students in the classroom through assignments, problem solving, group discussions, and some interactive classroom activities [3]. Is the flipped classroom method the same as blended learning? Blended learning consists of four models: rotation, flex, self-blend, and enriched virtual models [4], p.2. The flipped classroom method is a subset of blended learning.

Video recording is an essential part of the flipped classroom approach [2]. Before the pandemic period, some teachers were hesitant to prepare teaching videos due to technical reasons. During the COVID-19 period, teachers were forced to use online teaching. Most teachers record their lessons for student reviewing. They are trained to be good presenters

when using videos [5]. Students sometimes miss classes and watch recorded videos to catch up. University teachers and students are used to making use of video recordings in their teaching and learning. Previous literature has focused on teachers' readiness for the flipped approach [6,7]. Teachers need to have some technical skills, conceptual knowledge, and pedagogical skills to successfully implement the flipped classroom method. It not only requires one-way communication (from teacher to student) but multi-ways communication. There are a lot of teacher and student interactions, together with students' interaction. Thus, teachers should act as excellent facilitators [5]. The success of flipped classroom depends on student readiness [8]. Exploring students' flipped learning readiness in the higher education sector is a good research topic for scholars.

Studies regarding the learning outcomes of the face to face flipped classroom method and the online flipped classroom have been carried out separately [8,9]. During the pandemic period, classes ran in hybrid mode. A hybrid setting means some students can take the course online, while other students can take the course face-to-face at the same time. Is the effectiveness of the online flipped classroom method the same as that of the face-to-face flipped classroom method in hybrid mode? The current research is probably one of the earliest studies to compare the flipped classroom method in a hybrid setting.

The research questions are listed as follows: (1) What is student readiness in the flipped classroom setting? (2) Is there any association between student readiness and intention to participate in a flipped classroom setting of hybrid learning? (3) Does any difference exist between face-to-face and online students in flipped classroom learning for the association?

2. Literature Review

2.1. Flipped Classroom

Blended learning is composed of asynchronous and synchronous learning. One of its advantages is to give students unique experiences. Teaching and learning strategies are redesigned, and the outcomes are probably significantly better than the traditional approach [10]. Flipped classroom is one of the typical blended learning examples. Students study lecture materials before classes. Teachers can lead students in applying these lecture materials through assignments, problem-solving exercises, and peer interaction activities [11]. Class time is ideal for developing students' high-order thinking [12]. Flipped classroom allows teachers assign reading material and/or students watch videos outside of class and having discussions in class [13]. Thus, the first and most important affordance is video lectures or pre-assigned reading prepared by teachers in advance. Video lectures offer new ways to make use of classroom time [14]. One of the challenges in flipped classroom learning is the lack of students' initiative to study the pre-work or watch the video before the class [15]. The active learning part is important. Student numbers are generally not very large. Thus, students should feel positive peer pressure to prepare something, otherwise there might be dead air in the discussion session [16].

Flipped classroom is not a new concept. The Chinese University of Hong Kong and University of Hong Kong used flipped classroom for some of their classes in 2013 [17]. A meta-analysis of a 10-year research in engineering education shows that the flipped classroom approach is better than traditional lecturing. If instructors offer short recaps of lessons at the beginning of the classes, then the effectiveness of the approach will be enhanced [18].

In the traditional lecture-based approach, students would have to listen to lectures and perform some exercises in tutorials. Some students think that they are the "consumers" and are reluctant to change their learning mode. Moreover, student performance in flipped classroom learning may not be better than that in the traditional approach [19].

Students attending lectures in the traditional classroom setting would undertake some exercises in tutorials of the higher education sector. In contrast, in the flipped classroom setting, students can study lecture videos before they come to class. Students are engaged in undertaking exercises in lectures and tutorial sessions [20]. The findings of using the flipped classroom method are mostly positive. In terms of the learning outcomes of

students, flipped classroom is better than that of traditional classroom teaching in terms of academic performance. Subgroup analysis showed that there is no difference between the flipped classroom method and traditional classroom method in non-United States countries and nursing courses [19]. Some other studies have contrasting results. Although a meta-analysis showed that there was an overall positive effect of the flipped classroom method on learning outcomes, the result was moderated by the subjects. A total of 14 out of 55 studies in a meta-analysis conducted recently showed negative effective sizes for flipped classroom learning. Most of them are in the engineering field. However, confidence intervals included zero and the result was not statistically significant. The field of arts and humanities had the largest positive effect sizes and the result was statistically significant. This was followed by social sciences and sciences, which showed medium positive effective sizes and the result was statistically significant [20]. In contrast, another meta-analysis of engineering students studying under the flipped classroom approach showed an overall better achievement in the flipped classroom compared to the traditional classroom [18]. This is probably due to the fact that [18] included more recent studies in their work.

A few studies have been carried out regarding online flipped classroom settings. It has been found that the online flipped classroom method works. For example, skills obtained in various levels on character building, collaboration, communication, citizenship, critical thinking, and creativity are perceived by university students [8].

2.2. Hybrid Learning

According to the Oxford English Dictionary, "Hybrid" means "Derived from heterogeneous or incongruous sources; having a mixed character; composed of two diverse elements." [21] One of the usual examples is a hybrid car. This is a car with an engine that uses fossil fuel and a motor using electricity. The term "Hybrid" within the education sector today refers to a course that mixes face-to-face with distance learning mode at the same time. That is to say, some students are in face-to-face mode, and the rest of the students are in online mode. They are allowed to exchange freely during the semester in order to provide students with more flexibility.

2.3. Readiness

An increasing number of students accepted online learning for varying reasons [22]. Readiness for online learning has been studied. Factors that contribute to such readiness are self-directed learning, online communication self-efficacy, technology readiness, learner control, and motivation in learning [23,24].

Self-directed learning is where students need to actively participate in the learning process [25]. In flipped classroom learning, students must be self-motivated to watch lecture videos. They may re-watch these videos if they find something interesting or find some parts difficult to follow. They are also expected to write down what they want to discuss when they come back for the lecture.

With the flipped classroom method, students are required to discuss some assigned questions or engage in other activities. Online communication self-efficacy refers to the ability to have an effective discussion in a group manner [26]. Students attending physical classes must also communicate with their fellow classmates either online or face-to-face. According to [27], "technology readiness" implies the ability to use technology comfortably to reach goals. Computers and software are used in the flipped learning method. Thus, some students became accustomed to these advancements during the pandemic period.

Learner control is where students can adjust the pace of their learning [28]. They may watch learning videos during their spare time before class discussions take place. Motivation is recognized as one of the important factors of the learning process [24]. Flipped classroom learning is no exception. Students should think about the answers to the questions assigned to them by watching the given recorded videos.

3. Hypothesis Development

The theory of planned behavior was developed in the 1980s by Ajzen to estimate one's intention in a particular behavior [29]. Many researchers modified the theory to explain one's intention or behavior. Perceived behavioral control is similar to self-efficacy, except perceived behavioral control includes both external and internal factors [30]. Researchers asked students about their intention to join the flipped classroom lesson and did not measure the actual behavior; thus, our model does not contain the behavior construct. Since students cannot choose whether to join the flipped classroom or not, their attitude and subjective norms are replaced by flipped classroom readiness in our research model.

When student readiness is higher, the intention to participate in flipped classroom learning is greater. This is logical, as students equip themselves [17]. Thus, the following is proposed:

Hypothesis 1. *Student readiness is positively associated with the intention to participate in the flipped classroom setting.*

Perceived Behavioral Control

Perceived behavioral control is known as a student's perception of the difficulty of joining in flipped classroom learning. Usually, students expect that they will listen to lectures during class time, but now they must discuss the questions that are assigned to them. Considering that flipped classroom learning is a new ideology to most students, if they prepare well for class, they are more likely to gain the confidence to participate in the class. Thus, we have:

Hypothesis 2. *Student readiness is positively associated with perceived control.*

Once students are confident that they can handle flipped classroom learning, their intention to participate increases. The relationship between perceived behavioral control and intention to participate appears in the theory of planned behavior.

Hypothesis 3. *Perceived control is positively associated with the intention to participate in a flipped classroom setting.*

Our proposed research model is appended below (Figure 1).

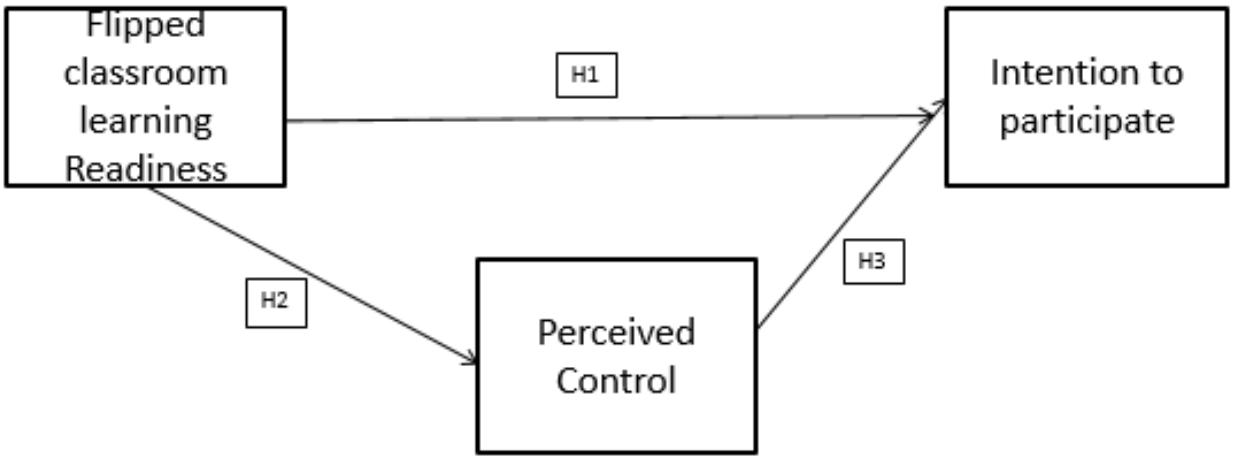

Figure 1. Proposed research model.

4. Methodology

4.1. Research Procedure

Two classes of university students were our respondents. They were randomly divided into two groups: face-to-face and online modes. The classes were conducted to ensure that the two groups of students received the same treatment. Structural equation modeling (SEM) was used with software SmartPLS 3.0. In view of the small sample size of 100, partial least squares (PLS) of SEM was recommended for the current study [31]. The minimum sample size of the survey should be equal to or larger than "10 times the largest number of structural paths directed at a particular construct in the structural model" ([31], p. 20). The number of structural paths used for student readiness was 5, and the sample size should be greater than 50. Thus, PLS–SEM was suitable for this study. Additionally, the population nature was a consideration [32]. Our population was a pool of undergraduate students, a rather homogeneous population.

To test the predictive power of the PLS-SEM model, the out-of-sample method was used. Samples were subdivided into several segments. The hold-out approach was used to run the analysis [33].

4.2. Research Context and Sample

The study was conducted in October 2021. Two classes of students participated in the research. One class consisted of final-year undergraduates, studying Marketing Research. The topic covered was qualitative research. In-depth interviews and observations were conducted. Another class comprised first-year undergraduates studying Managing Organization. The topics covered were external environment and organizational culture and global management. A total of 55 final year students were respondents in the Marketing Research course, and 45 first-year students were respondents in the Managing Organization course. The respondent rate was 80%. The lesson per week was a three-hour session for each subject.

The respondent profile is listed as follows (Table 1).

Table 1. Demographic data of respondents.

Category		Frequency	Percentage %
Gender	Male	40	40.0
	Female	60	60.0
Age	18 or under	11	11
	19 or 20	38	38
	21 or above	51	51
Course	Marketing Research	55	55
	Managing Organizations	45	45
	Total	100	100

Students were given the videos to watch one week before the class. They were notified that they would be taught in a manner different from the traditional format. When they returned to class after one week, the original lecture time was turned into a flipped classroom format. The whole lecture section was divided into three parts. Firstly, the teacher gave a short introduction on the topic. The teacher used video extracts to refresh the students' memory. Secondly, the students were divided into small groups. Each group comprised three to five students. The breakout room function of Microsoft Teams was used to divide students online into several groups, depending on how many students attended at that occasion. Students who attended in the face-to-face mode were subdivided accordingly. One particular question was assigned for each group to work out their solution. They were given around 30 min for discussion; a break was offered afterwards. Finally, each group nominated a student to present their findings. Comments were given immediately by teachers after their presentation. After the class, they were also told to fill in a survey. The

two subjects were delivered by other teachers at the same time, using the traditional lecture and tutorial format. In order to avoid the unequal treatment for the students, two weeks investigation period was adapted.

4.3. Instrument Used and Their Validation

Our readiness scale was adapted from [23]. The original scale reliability was above 0.7. The readiness measurement scale has been used by scholars in the flipped language classroom in the face-to face and online settings [2,17]. Flipped classroom learning in an online setting is a neglected area. Nevertheless, university students' readiness is reported at a high level. Online flipped learning is good for students who have high English proficiency [17].

The same readiness scale items are listed in Appendix A using a seven-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = slightly disagree, 4 = neutral, 5, slightly agree, 6 = agree, 7 = strongly agree).

The measurement model of flipped classroom readiness is illustrated below (Figure 2).

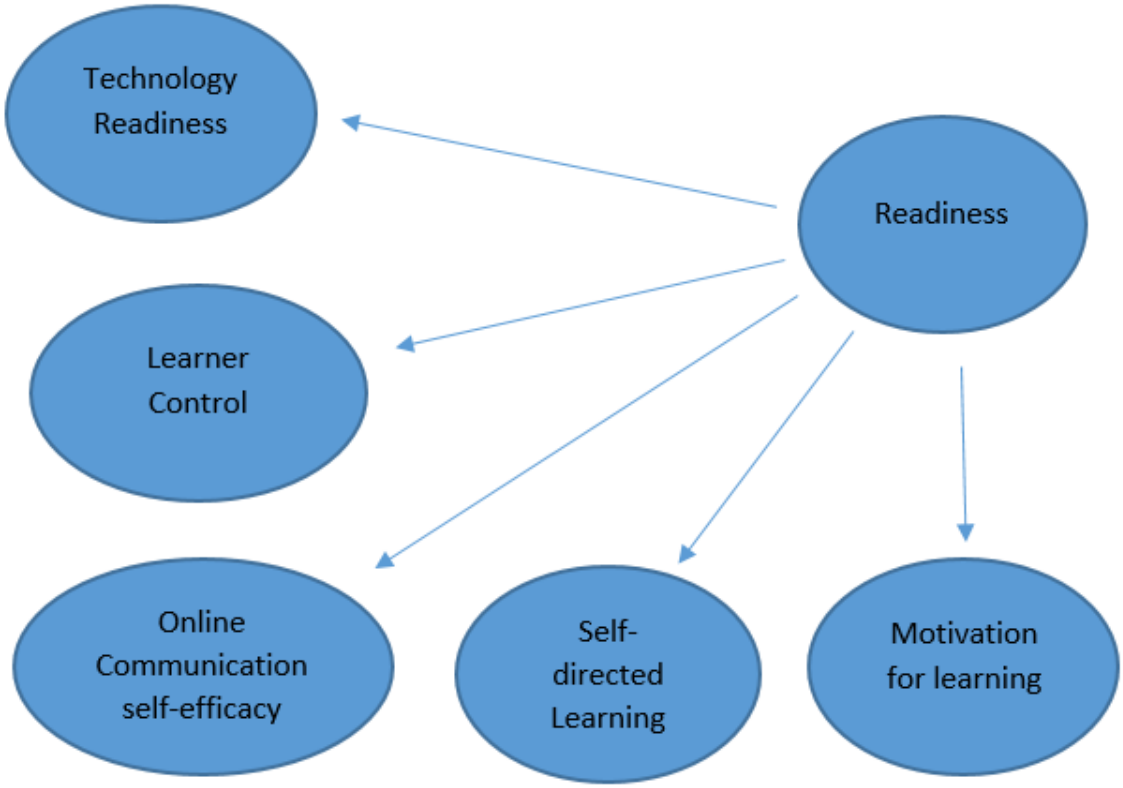

Figure 2. Flipped Classroom readiness measurement model (Source: authors).

Given that the readiness scale of flipped classroom has been established several times by other scholars [2], the first research question is to determine student readiness in the flipped classroom setting. We includes five dimensions, such as self-directed learning; online communication self-efficacy; technology readiness, learner control, and motivation. The perceived control and intention to participate constructs were adapted from [29].

5. Data Analysis

A total of 103 return questionnaires were received. Three of them were incomplete and thus discarded. A total of 100 valid samples from undergraduate students were collected for analysis. Specifically, 40 students were male, and 60 students were female. Descriptive data are presented in Table 2.

Table 2. Descriptive Statistics.

Construct	Mean	Standard Deviation
Technology Readiness	4.844	1.343
Learner Control	4.864	1.269
Online Communication Self-efficacy	4.832	1.341
Self-directed Learning	4.747	1.249
Motivation for learning	4.855	1.275

Seven-point Likert scale was used.

Table 2 shows that the ratings of readiness were close to 5 throughout the scale. That is, students slightly agreed that they were ready for the flipped classroom approach.

Table 3 displays the reflective measurement model assessment of the four constructs. Firstly, the indicator loadings were all over the recommended benchmark of 0.708. Satisfactory results ranging from 0.823 to 0.968 were obtained for the reflective measurement models. These findings indicated that over 50% of the variances of indicators were explained and provided with satisfactory item reliability. Secondly, the Cronbach's alpha (0.947–0.975) of all constructs exceeded the recommended thresholds, also suggesting satisfactory results. Thirdly, the AVE measures of all constructs ranged from 0.792 to 0.927, exceeding the suggested cut-off point of 0.50. This finding reveals that the constructs explained almost 80% of the variance of related items and demonstrated sufficient convergent validity. Lastly, discriminant validity was examined (Table 4). This finding implies that all constructs were reliable and valid. This means the readiness measurement model was validated.

Table 3. Measurement model assessment.

Construct	Item	Loading	Cronbach's Alpha	Composite Reliability	AVE
Technology Readiness	TR1	0.926	0.956	0.964	0.792
	TR2	0.909			
	TR3	0.932			
	TR4	0.875			
	TR5	0.882			
	TR6	0.880			
	TR7	0.823			
Learner Control	LC1	0.894	0.970	0.975	0.849
	LC2	0.929			
	LC3	0.937			
	LC4	0.927			
	LC5	0.896			
	LC6	0.936			
	LC7	0.928			
Online Communication Self-efficacy	OC1	0.934	0.957	0.967	0.854
	OC2	0.922			
	OC3	0.924			
	OC4	0.925			
	OC5	0.915			
Self-directed Learning	SL1	0.865	0.964	0.970	0.801
	SL2	0.866			
	SL3	0.867			
	SL4	0.906			
	SL5	0.929			
	SL6	0.910			
	SL7	0.909			
	SL8	0.906			

Table 3. *Cont.*

Construct	Item	Loading	Cronbach's Alpha	Composite Reliability	AVE
Motivation for learning	ML1	0.922	0.975	0.979	0.849
	ML2	0.904			
	ML3	0.926			
	ML4	0.940			
	ML5	0.913			
	ML6	0.938			
	ML7	0.918			
	ML8	0.923			
Perceived Control	PC1	0.935	0.947	0.962	0.864
	PC2	0.933			
	PC3	0.936			
	PC4	0.913			
Intention	IT1	0.963	0.960	0.974	0.927
	IT2	0.956			
	IT3	0.968			

Table 4. Discriminant validity assessment.

Constructs	1	2	3	4	5	6	7
1. Intention	0.963						
2. Learner control	0.790	0.921					
3. Motivation	0.761	0.836	0.923				
4. Online Comm	0.790	0.915	0.841	0.924			
5. Perceived Con	0.890	0.802	0.757	0.791	0.929		
6. Self Learning	0.751	0.840	0.841	0.872	0.752	0.895	
7. Technology	0.805	0.790	0.752	0.807	0.807	0.768	0.890

Subsequently, the structural model was assessed.

The structural model was supported with satisfactory results. Firstly, the R^2 value of intention was 0.816; thus, 81.6% of the variances were explained, indicating a moderate result. Secondly, the Q^2 value of intention was 0.710, suggesting the large predictive relevance of the path model. Finally, all f^2 effect sizes of the predictor construct ranged from 0.156 to 0.636, indicating small to large effect sizes on the dependent construct, intention.

Path coefficients and *t*-values were evaluated by conducting a bootstrap analysis with 5000 subsamples for the 100 cases. Figure 3 shows the PLS model result.

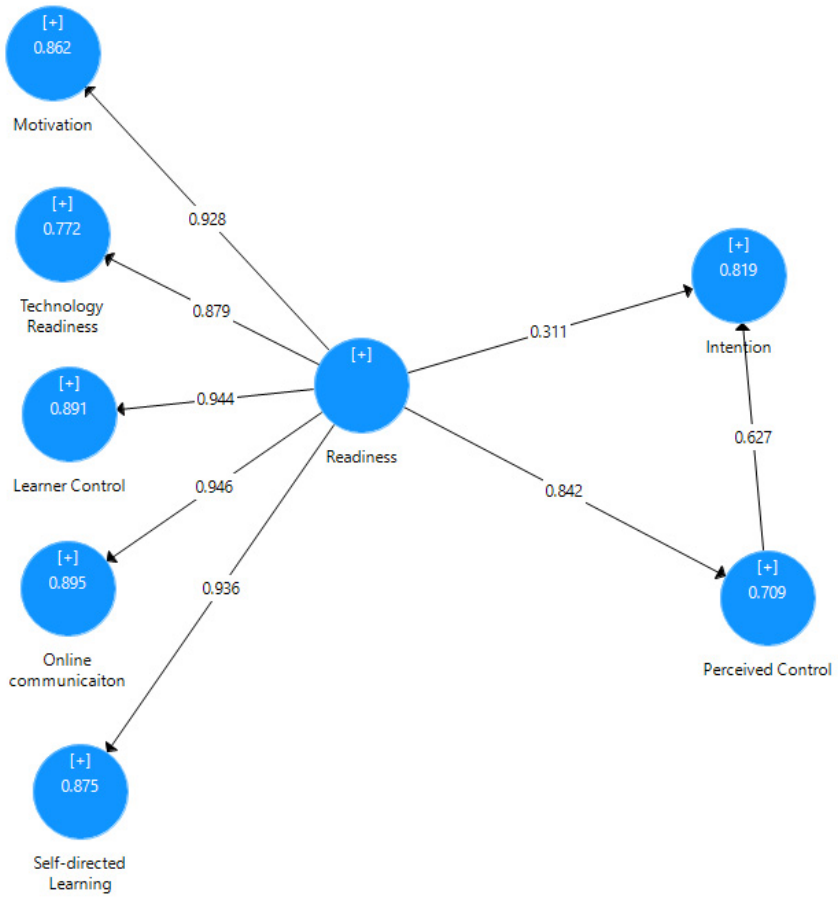

Figure 3. PLS model (source: authors).

6. Results

Intention to participate in flipped classroom learning was the outcome of the conceptual model. Readiness and perceived control were considered the antecedents. The following hypothesis test results addressed the direct relationship among these constructs (Table 5).

Table 5. Hypothesis test results.

Hypothesis	Item	(β) Path Coefficient	*t*-Value	*p*-Value	Result
H1	Readiness >> Intention	0.311	2.309	0.021 *	Supported
H2	Readiness >> Perceived Control	0.842	16.135	0.001 ***	Supported
H3	Perceived Control >> Intention	0.627	4.616	0.001 ***	Supported

(Bootstrap samples = 5000, n = 100 cases). * $p < 0.05$; *** $p < 0.001$.

All the hypotheses were supported. Student's readiness was positively associated with intention to participate in flipped classroom learning and perceived behavioral control, which proved there was a positive association with intention to participate.

6.1. Predictive Assessment of Intention to Participate in the Flipped Classroom Construct—PLSpredict

We also checked for the predictive power of our model. Following the procedure demonstrated in [33], the results are listed in Table 6.

Table 6. PLSpredict out of-sample predictive ability of intention.

Construct	Indicator	PLS-SEM		LM	PLS-SEM Minus LM
		RMSE	Q^2 Predict	RMSE	RMSE
Intention	IT1	0.854	0.636	1.100	−0.246
	IT2	0.904	0.642	1.200	−0.296
	IT3	0.827	0.671	1.206	−0.379

Firstly, all the Q squares of the indicators of our construct (intention) had to be greater than zero. As presented in Table 5, all Q square figures were greater than zero. Secondly, the residual histogram of each indicator showed that all the indicators were normally distributed. Thirdly, root mean square error (RMSE) had to be used. The differences between RMSE from PLS–SEM and linear regression (LM) were all negative. That is, the RMSE value of LM was greater than that of the RMSE of PLS–SEM. We concluded that the model has highly predictive power [33].

6.2. Multiple Group Analysis

The two classes were delivered in a hybrid format. Students were treated exactly the same throughout the course. A total of 54 students joined the discussion part online, whereas 46 students participated in the face-to-face classroom. They were treated as two specific groups, and multiple group analysis was programed to test whether differences exist among the three hypotheses. The results of the analysis between online and face-to-face settings were shown to be insignificant.

6.3. Additional Analysis

The structural model was tested with control variables, including age, course, and gender. A small change was observed in the R-square of the intention to participate in flipped classroom learning, from 0.815 to 0.819. The effects of control variables were insignificant. Endogeneity was not an issue to the model (Figure 4) [34].

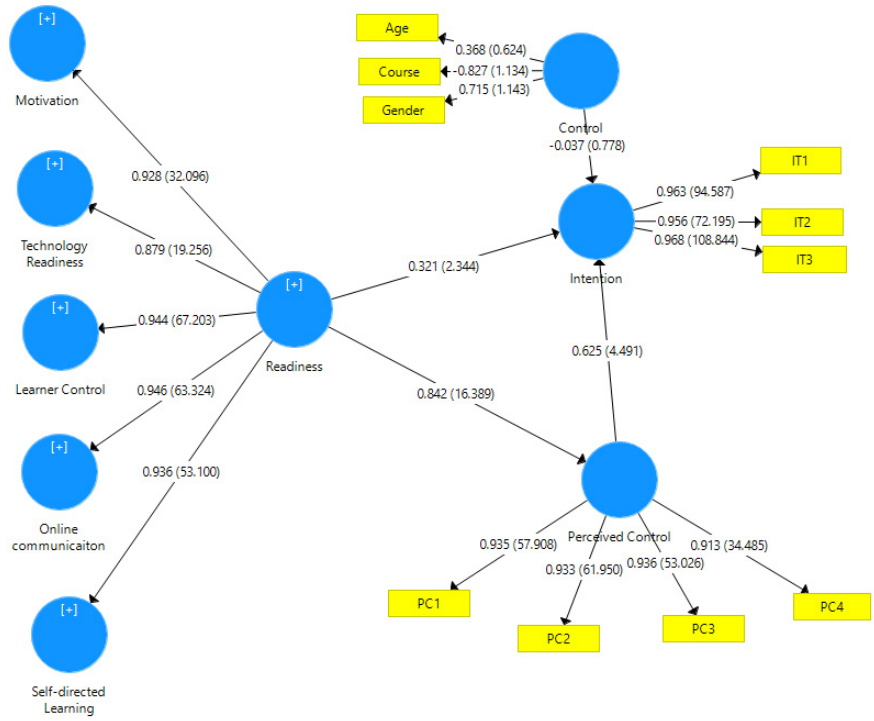

Figure 4. Additional analysis.

7. Discussion

As expected, the flipped classroom readiness scale was validated by our data. In general, students were found to be ready for the flipped classroom setting. This result for face-to-face flipped learning agreed with [2]'s finding in foreign language classrooms. Our findings also agree with previous results for online flipped learning on language classes [17]. Moreover, we extended our online flipped learning result from language classes to business classes. Compared to pre-COVID period, students have become accustomed to watching video lectures during the pandemic period and discussing content with their classmates in an online setting [5]. If they turn up physically in the classroom, then teachers can solve their problems. Common problems are that they do not understand questions, or they are unfamiliar with the provided videos.

Students must be well prepared to have a high intention to participate. The preparation work includes technology readiness, online communication self-efficacy, self-directed learning, learner control, and motivation. Students nowadays can easily watch videos using their mobile phones. These videos should not be too long, around 15 min would be the ideal timing. If videos have too much content, then then they must be divided into several clips. Students who participate in the face-to-face mode usually have smartphones or iPads; thus, they can communicate with their classmates online efficiently.

With technological tools, students can control their learning. However, challenges exist for weak students who are unfamiliar with the content. Weak students feel better when they listen to other students' presentations and the comments given by the teacher. With online learning experience for the past two years, students are better equipped to learn things on their own. What remains is the motivation to study. The purpose of videos is to increase interest in certain topics, rather than transmit knowledge through textbooks. Thus, teachers are not advised to use PowerPoint presentations daily. Instead, teachers must devise some interesting cases to present and let students carry out exercises.

Perceived behavioral control from students is relatively important. It is a crucial mediator between student's readiness and intention to participate in flipped classroom learning. In this approach, students are required to join discussions in preassigned lecture time. Students can choose their own pace in watching videos and joining discussions, either through online or face-to-face. Questions for discussions were uploaded on the learning management system platform, along with the videos. Students anticipate what will happen during the lecture time.

Other flexible approaches can be used, including further group or individual exercises that could be delivered later. Sometimes, teachers go through the remaining materials during tutorial sessions. In summary, teachers become facilitators more than traditional lecturers. The whole learning process is transformed into more active and more student-centered learning [3].

8. Managerial Implications

The foundation work in flipped classroom includes online modules, readings and possibly some videos [20]. Institutions in the higher education sector should consider online flipped classroom learning, possibly making use of Small Private Online Courses (SPOCs) and Massive Open Online Courses (MOOCs). Some of the available videos are suitable for both courses. SPOCs and MOOCs require students to watch videos, perform some exercises, and engage in other activities, if possible [35]. MOOCs offer readings and problem sets. During tutorials, additional exercises can be carried out to strengthen students' understanding. Studies conducted in medical training settings found that MOOCs with the flipped classroom method would enhance the teaching and learning effectiveness for physicians who are undergoing training. A MOOC is a relatively new way to learn a course in a standalone way. When MOOCs included the flipped classroom method, those videos were used in the pre-class activity. There were interactions among students and interaction between learners and teachers [36].

Artificial intelligence may provide support in flipped classroom, especially in online mode. Artificial intelligence is the form of using the computer to simulate a human being's logical reasoning, thinking, and problem-solving abilities. Big data, cloud computing, and financial technology are used in the artificial intelligence platform. It could solve the problems of poor communication and weak interaction [37]. Students who participate in flipped classroom learning sometimes have their own questions, as they must understand materials themselves. Chatbots can be used to answer students' questions frequently; for example, the chatbots can answer 24 h a day and seven days a week. Teachers can easily set such a program up today, with no need of programming language. Chatbots ease the workload of teachers. Some students feel pressured to ask teachers, especially Asian students. With chatbots, no pressure is felt. Students learn to be flexible in their learning habits.

9. Conclusions

On business courses, students are found to be ready with flipped classroom learning. The flipped classroom readiness scale is validated in this study. The readiness components are self-directed learning, online communication, self-efficacy, technology readiness, learner control, and the motivation in learning. When students are fully equipped, they are more likely to participate in flipped classroom learning activities. This is because flipped classroom learning requires a high level of participation compared to the traditional lecture learning method. It is supported by the results presented.

Perceived behavioral control is a partial mediator between student's readiness and intention to participate in a flipped classroom. The direct effect from students' readiness on their intention to participate in flipped classroom and the indirect effect via mediator on perceived behavioral control were all found to be significant. If students know how to participate in a flipped classroom session, their intention to join the class will be higher. In traditional lessons, students are expected to listen and write down notes during the lesson. In flipped classroom, students are required to carry out pre-class activities and actively join the discussion during class. Intention to participate in flipped classroom is the same, regardless of the flipped classroom learning mode, face-to-face or online. Students probably suggest their own opinion or answers with less embarrassment in an online situation. This study contributes to existing literature asserting that the discussion or problem solving aspects of learning can still be carried out in online mode. During the pandemic, teachers could be worried about the implementation of flipped classroom, as it might not work in online mode. It has been proven in this study that the flipped classroom method is not affected by its delivery mode.

However, this research has certain limitations. The sample was restricted to university students in Hong Kong only, the flipped classroom method was also only implemented for two weeks. This might result in students not having the time to become accustomed to the method. In addition, the subjects involved were only business courses. Courses from other fields, such as sciences, humanities, and social sciences, could be included in future research, especially research concerning online mode. A dependence on answers in Liker-type scale questions is another disadvantage; thus, reverse statement is one of the solutions to prevent this problem. Moreover, the time duration can be extended to one semester, as students need time to adapt to the changes in the new learning mode. Finally, there could be a social desirability bias, which would affect the answers in the survey, leading to inaccuracies.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Measurement items.

Construct Name	Items
Technology Readiness	I prefer to use the most advanced technology available Technology gives me more freedom of mobility I feel confident that machines will follows through with what you instructed them to do In general, I am among the first in my circle of friend to acquire new technology when it appears I enjoy the challenge of figuring our high-tech gadgets There should be caution in replacing important people-tasks with technology because new technology can breakdown or get disconnected If I provide information to a machine or over the internet, I can never be sure it really gets to the right place
Learner Control	I am able to acquire knowledge from flipped classroom easily I am able to explore more information related to flipped classroom from other means of learning (e.g., videos, games and discussion) I am able to linkage the information learnt from the flipped classroom Flipped classroom provides the chance for me to reflect what I learned Flipped classroom provides clear guideline on learning The tools or technologies used in flipped classroom facilitate learning and interaction I am satisfied of the information delivery channels
Online Communication Self-efficacy	Flipped classroom provides the chances for me to express my opinions Flipped classroom offers the opportunity for me to interact with fellow students informally (e.g., online chat room or forum) Flipped classroom provides enough collaborative activities I enjoy participating in flipped classroom activities I have a sense of belonging to the flipped classroom
Self-directed Learning	I regularly learn things on my own outside of class I am better at learning things on my own than most students I am very good at finding out answers on my own for things that the teacher does not explain in class If there is something I do not understand in a class, I always find a way to learn it on my own I am good at finding the right resources to help me do well in school I view self-directed learning based on my own initiative as very important for success in school and in my future career I am very motivated to learn on my own without having to rely on other people I like to be in charge of what I learn and when I learn it
Motivation for learning	I am motivated when I can complete the tasks distributed in flipped classroom successfully I am motivated when I have the ability to complete the tasks successfully I am interested in flipped classroom content, and it motivates me to learn from the flipped classroom Improving my competence and knowledge in this flipped classroom motivates me to learn The knowledge learnt from flipped classroom provides insights or long-term benefits to me, it motivates me to study in this flipped classroom

Table A1. *Cont.*

Construct Name	Items
	I am motivated by flipped classroom, because I would have strong relationship with my teacher I am motivated by flipped classroom, because I would have strong relationship with my fellow classmates I am glad that I feel connected to the flipped classroom
Perceived Control	I know how to learn in flipped classroom I know what to learn in flipped classroom If I want to, I would not have problems in flipped classroom learning I have full control in flipped classroom learning
Intention	I intend to participate more in flipped classroom learning I intend to learn more in flipped classroom learning I intend to learn from flipped classroom

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