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Lecturers' perceptions of flipped learning in higher education: A case study on flipped classroom implementation in Singapore Polytechnic

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Keywords

Flipped classroom;
flipped learning;
higher education;
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Abstract

Higher education institutions have adopted flipped learning in recent years, and it is worthwhile to examine how the users have perceived such a change. While many research studies focused on students as participants, this study examines the lecturers' perception of flipped learning. Findings in the study showed that both lecturers' perceived student behaviour and instructional consideration had a significant and positive effect on student learning. The study also attempted to examine whether lecturers' experience in flipped learning would moderate instructional consideration and student learning. Results showed that lecturers' experience in flipped learning had no influence on instructional consideration and student learning.

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Introduction

In early 2020, education institutions worldwide were faced with an unprecedented challenge in the wake of massive school and university closures as part of the efforts to contain the spread of COVID-19 (UNESCO, 2020). Responses in higher education were diverse, ranging from approaches in which established courses were offered through online meeting platforms like Zoom and Microsoft Teams to redeveloping course curricula in a fully online, self-directed format (Crawford et al., 2020). Many studies have also emerged around the globe because of the COVID-19 situation on how different lesson deliveries had effects on student learning. For instance, Campillo-Ferrer and Miralles-Martínez (2021) investigated the effectiveness of the flipped classroom model on student motivation and learning during the COVID-19 pandemic. Latorre-Cosculluela et al. (2021) analysed the effectiveness perceived by university students of flipped learning for the development of 21st-century competencies. Elkhatat and Al-Muhtaseb (2021) discussed how hybrid online-flipped learning pedagogy for teaching laboratory courses mitigated the pandemic COVID-19 confinement and enabled effective sustainable delivery.

Flipped learning has become one of the viable options as education institutions adopt alternative ways to continue teaching and learning to reduce the face-to-face contact given the COVID-19 situation (Tang et al., 2020). The approach provides students with direct access to video lectures, slides, and other teaching resources on online educational platforms (Bergmann & Sams, 2012). Flipped learning allows structured independent learning, allowing teachers to provide feedback and assistance through innovative resources and learning management systems in parallel with the implementation of collaborative problem-solving activities and group discussions in face-to-face lessons.

Literature review

Flipped classroom refers to a blended learning strategy where students watch video instruction or engage in online learning activities meant for whole-group consumption on their own time, opening class time to individual support and higher-level engagement with the concept (Aghaei et al. 2019; Gündüz & Akkoyunlu 2019; Yang & Chen 2019). The term flipped classroom was coined in 2012 by two high school chemistry teachers, Bergmann and Sams (2012), who began teaching with this model in 2007. Since then, the Flipped Learning Model has spread to many other teachers and instructors within K-12 and college and university settings. Sams and Bergmann started the Flipped Learning Network™ in 1992 to provide educators with the necessary knowledge, skills, and resources to implement the Flipped Learning Model (Sherrow et al., 2016). Educators, scholars, researchers, practitioners, technologists, and thought leaders in flipped learning formed the Flipped Learning Global Initiative (FLGI) in 2016 (Birgili et al., 2021). FLGI supports the adoption of flipped learning worldwide, and it contributed to replacing the term "flipped classroom" with "flipped learning". The change in terminology reflected an expanded understanding of flipped learning as an approach independent of teaching and learning environments, rather than a class organisation like in a physical classroom. In a flipped learning setting, instructors make lessons available to students wherever convenient. Instructors may deliver this information by recording and narrating screencasts, demonstrating, explaining concepts using computers, creating videos of themselves teaching, or creating online video lessons. Students can watch the videos or screencasts repeatedly as they need to, enabling them to be more productive learners in the classroom (Sota, 2016). As direct instruction is delivered outside the group learning space, instructors can use in-class time to engage and provide them with individualised support (McDonald & Smith, 2013).

There is an imperative need to distinguish between flipped learning and blended learning. The difference is that flipped learning refers to offering pre-class materials online and using class time for interactive and constructivist learning. In contrast, blended learning encompasses online and face-to-face learning (Greener, 2015). Saichaie (2020) attempted to explain that blended learning involves a learning environment that combines face-to-face instruction with technology-mediated instruction. It is a mixture of face-to-face and online instruction where student seat time is not replaced, but the learning process is redesigned. On the other hand, flipped learning inverts the traditional use of class time so that activities that have traditionally taken place inside the classroom take place outside the classroom and vice versa. According to Saichie (2020), flipped learning is relatively less reliant on technology than blended learning.

There have been many studies on the perception of flipped learning in the last two decades, many focusing on the students' perception. For the discussion of this paper, we will focus on teachers' perceptions of flipped learning in higher education. A few studies in Europe were conducted to examine teachers' perceptions of flipped learning. For instance, a study on 356 Italian teachers' perceptions of flipped learning found that the approach had a significant positive effect on implementing personalised students' learning (Bevilacqua & Campión, 2019). 69.7% of the teachers stated they could better differentiate their teaching through flipped learning. In comparison, 26.6% affirmed that they could differentiate slightly better, while only 3.6% were barely able or unable to differentiate better. In another study with 316 teachers from various educational centres in Spain, the results indicated that students' participation had improved (Belmonte et al., 2019). The interaction between those involved in the teaching and learning processes also improved. The teachers mentioned that students' interaction and self-esteem showed improvement. Most significant in the findings was an improvement in teachers' overall satisfaction and the communication between the students.

In the US K-12 education context, Gough et al. (2017) surveyed 44 teachers from Southwest and South-Central Minnesota. The participants generally agreed that flipped classrooms benefitted absent and struggling students. According to the study, the teachers agreed that learning was easier for absent students due to the availability of video lectures. The teachers also perceived that flipped classrooms promoted active learning and personalised learning and improved student-to-teacher interaction and

time for learning.

In Malaysia, 206 English as a second language (ESL) lecturers from four different universities participated in a study on their intention to use flipped learning (Abu Rahman et al., 2021). The study revealed that only social influence was a significant factor influencing lecturers' intention to use flipped learning. Interestingly, performance expectancy, defined as the degree to which the lecturers believed flipped learning would help them achieve academic teaching goals, was a non-significant factor influencing the intention to use flipping learning.

In Abuhmaid's (2020) study, flipped learning model was referred to as a new and unpopular among teachers in Jordan. 126 teachers from six educational governorates in Amman who had implemented flipped learning participated in the study investigating teachers' perception of the impact of flipped learning on students' learning, teachers' role, and challenges facing its implementation. The findings showed that the teachers believed flipped learning potentially improved students' engagement and self-confidence during class time. However, while teachers were able to observe the impact of flipped learning on students' attention, enjoyment, achievement, and behaviour in the classrooms, it was hard to notice its impact on issues such as creativity and higher-order thinking. In that study, the teachers believed that flipped learning enabled them to help struggling students and made their job easier.

Cheng et al. (2020) reviewed 100 highly cited articles related to flipped learning. They discovered that more than half of the research participants were highly educated students (78%), followed by junior high students (8%), elementary school students (5%) and senior high students (4%). Studies on teachers' perceptions on flipped learning are few. Most studies on teachers' perception of flipped learning had pre-service teachers as surrogates instead of actual full-time teachers (Almodaires et al., 2019; Hao & Lee, 2016; Heron & Thompson, 2019; Ozudogru & Aksu, 2020; Yoshida, 2016; Yurtseven et al., 2021). While the authors attempted to examine studies on flipped learning conducted during the Covid-19 pandemic, we found more research on students' perceptions (Hew et al., 2020; Izagirre-Olaizola & Morandeira-Arca, 2020; Karalis & Raikou; 2021; Latorre-Cosculluela et al., 2021; Sosa Díaz et al., 2021; Umar & Ko, 2022). Divjak et al. (2022) conducted a systematic literature review of studies covering online flipped learning approaches in higher education during the pandemic. Among the 205 publications, it was revealed that those who had used flipped learning in face-to-face or blended learning environments continued to use them in online environments more than those who had not used it before. The researcher posted possible questions for future research, such as the effectiveness of flipped learning for various courses and contexts, student engagement, cognitive and emotional aspects, and students' data protection. Collado-Valero et al. (2021) studied the frequency of flipped classroom implementation before and during social distancing by university professors from the Faculty of Education Sciences of the University of Malaga, Spain. The results revealed a significant increase in the frequency of flipped classroom sessions during the Covid-19 pandemic. The data also showed a significant increase in the quantity and variety of didactic resources, mainly those related to flipped learning, with video and audio files. As the number of studies on teachers' perception is few and between, our study focused solely on how lecturers perceived the flipped learning teaching approach.

Proposed research model

To examine lecturers' perception of flipped learning, we propose a research model to measure how student learning is influenced. There were several considerations when designing flipped learning in the classrooms (Gough et al., 2017; Kim, 2017; Koh et al., 2021). We hypothesise that instructional consideration and student behaviour influence how students learn. The proposed research model for the current study is shown in Figure 1. The following are the research questions:

RQ1: Do lecturers perceive positive student behaviour and effective flipped lesson design as predictors of student learning?

RQ2: Do lecturers' flipped classroom experience contribute to better lesson design and student learning?

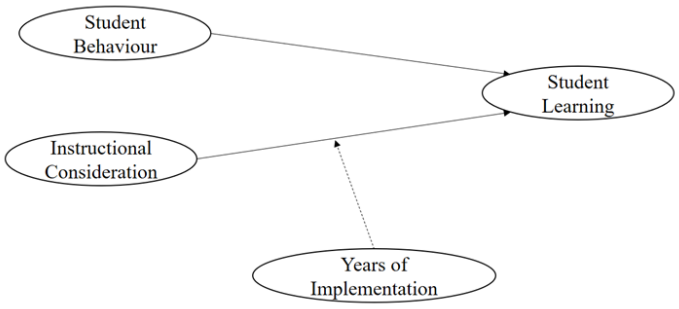

Figure 1. Proposed research framework.

Student behaviour as a predictor of student learning

In this study, we define student behaviour as a student's response to a stimulus that may be an action, person or a learning object in the learning environment. Student behaviour thus is stimulus-driven responses that occur specifically during a lesson or how students are acting during the lesson in response. When Ning and Downing (2011) examined the interrelationship between the student learning experience and study behaviour with 541 students from a university in Hong Kong. Results demonstrated that student perception of the learning experience predicted study behaviour and significantly predicted academic results. The findings were similar to a later study by Tokan and Imakulata (2019). Based on responses from 229 students from the University of Nusa Cendana, Indonesia, the findings revealed that learning behaviour significantly influenced students' learning achievement. Therefore, we hypothesised the following:

H1: Student behaviour has a positive and significant effect on student learning

Instructional consideration as a predictor of student learning

We refer to instructional consideration as the decisions needed in the learning design to support student learning in this study. They include decisions about the lesson content, structure, timing, pedagogical strategies, sequence of learning activities, assessment types, and the nature of the technology used to support learning. In the study by Rienties and Toetenel (2016) with 111,256 Open University UK students, it was found that the learning design was significant in predicting and understanding student learning behaviour and performance in blended and online learning environments. These findings are similar to a later study by Alvarez-Bell et al. (2017) with 111 undergraduates from a public university in North Carolina, US. In that study, it was found that students' perception of the course and perceptions of the extent to which instructional guidance was provided significantly predicted student learning. Therefore, we hypothesised the following:

H2: Instructional consideration has a positive and significant effect on student learning

Flipped learning experience as moderator between instructional consideration and student learning

Past studies have shown that the relationship between teacher efficacy and students' academic achievement depended on the length of teachers' professional experience. Teaching experience is positively associated with student learning (Kim & Seo, 2018; Podolsky et al., 2019). Jahanbani Ghahfarokhi and Mavroudi (2020) interviewed experienced university teaching staff and found that emphasis on discussion among students during flipped learning in-class time was essential, and that was similar to the suggestion from the literature. Sointu et al. (2022), in their study on the key factors leading to the successful implementation of flipped classrooms, identified experienced teaching as the second-best predictor. Tawafak et al. (2020) had included teaching experience as a moderator in their study on how technology-enabled learning improved accreditation performance. The 104-participants study revealed that teacher experience moderated the relationship between e-learning use and student perception. Therefore, we hypothesised the following:

H3: Years of flipped learning implementation have a moderating effect on the relationship between instructional consideration and student learning

Method

An email invitation was sent out to potential participants in Singapore Polytechnic, and 247 responded. All 247 participants completed the online questionnaire. The study's objectives were shared in the invitation email and before the start of the online questionnaire.

Instrumentation

The instrument used in the study included seven items and utilised a six-point Likert scale. The instrument's validity was established by basing the items on an adaptation from the study by Gough et al. (2017). The instrument went through a critique process before it was emailed to the participants. The panel members for the critique included six educators who were not part of the studied population. The panel included four educators who had implemented a campus-wide flipped learning approach and two educational technologists experienced in flipped learning in the classrooms. There were three items each in the exogenous measures, Student Behaviour and Instructional Consideration and one item in the endogenous measure, Student Learning. Regarding the endogenous measure of Student Learning, while a single-item measure might not be typical, it has been used in many past studies in the educational contexts (Atroszko, 2014; Atroszko et al., 2019; Ginns & Barrie, 2004; Leung & Xu, 2013; McDonald et al., 2019). The final survey instrument is shown in Table 1.

Table 1. Survey instrument.

Construct	Item
Student Learning	1. Students learn better through flipped learning (for e.g. better engaged, increased retention of knowledge and ability to apply concepts)
Student Behaviour	2. In flipped learning, students have opportunities to develop a sense of responsibility for their learning.
	3. In flipped learning, students have opportunities to develop better peer relationships through collaborative learning.
	4. In flipped learning, students are better prepared for my lessons.
Instructional Consideration	5. Flipped learning allows me to have increased interaction with students.
	6. Flipped learning allows for more active learning activities.
	7. Flipped learning allows me to provide students the support they require.

Procedures

Given the busy schedules of the lecturers, the online questionnaire was left open for a month to ensure that all lecturers had enough time to complete the survey. The study objectives were shared in an invitation email. Participation in the online questionnaire was voluntary and anonymous.

Results

The descriptive statistics and bivariate correlations for the path analysis are shown in Table 2. All initial screening analyses performed suggested that path analysis was acceptable, indicating that there was no significant violation of assumptions with regard to non-normality, non-linearity, or extreme scores.

Table 2. Descriptive statistics and bivariate correlations between constructs.

Construct	*M*	*SD*	1	2	3
1. Student Behaviour	4.328	.983	--	.866**	.845**
2. Instructional Consideration	4.408	1.044		--	.842**
3. Student Learning	4.240	1.089			--

*** Significant at the .01 level*

Model fit

For the validation, the fit of the research model was examined through confirmatory factor analysis (CFA). The factor structure of the seven-item scale was examined using the popular statistical modelling software IBM SPSS AMOS 28.0. CFA was conducted to estimate the quality of the factor structure and factor loadings by testing the fit between a proposed measurement model and the data statistically (Albright & Park, 2009; Bollen, 1989; Hair et al., 2006; Kline, 2005). CFA was also used to estimate the validity of the constructs and test for the model fitness on the data. Five absolute-fit indices assessed the model fit: (1) Degree of Freedom (c2/df), (2) Root Mean Square Error of Approximation (RMSEA; Steiger, 1990), (3) Goodness-of-Fit (GFI), (4) Comparative Fit Index (CFI; Bentler, 1990) and (5) Tucker-Lewis fit index (TLI; Bentler & Bonett, 1980). Table 2 shows the fit indices for the proposed research model and its acceptable fit. The values are above the recommended thresholds, for acceptable model fit ($\chi 2$= 25.057, p < .001; $\chi 2/df$ = 2.278; RMSEA = .074; GFI = .971; CFI = .990, TLI = .980). These results indicate that the measurement model achieved a good fit. An internal item consistency test was conducted for the overall model with a Cronbach's Alpha coefficient attaining .925 (Cronbach, 1951).

Table 3. Goodness-of-fit indices for survey instrument.

Measure	Threshold	Values / Fit
χ^2		25.057
df		11
Degree of Freedom (χ^2/df)	< 3 good; < 5 sometimes permissible	2.278
p-value	< 0.05	.0001
RMSEA	< 0.05 (good); 0.05 to 0.10 (moderate); > 0.10 (bad)	.074
GFI	> 0.95	.971
CFI	> 0.95 (great); > 0.90 (traditional); > 0.80 (sometimes permissible)	.990
TLI	> 0.9	.980

Note: Adapted from Hair, J. F., Anderson, R. E., Babin, B. J., & Black, W. C. (2010). Multivariate data analysis: A global perspective (Vol. 7); Kline, R. B. (2005). Methodology in the social sciences; McDonald, R. P., and Ho, M. H. R. (2002). Principles and practice in reporting structural equation analyses. Psychological Methods, 7(1), 64.

The path analysis indicated that student behaviour had a highly significant positive effect on student learning (β = .738; ρ < .001) (Figure 2). Instructional consideration also had a significant and positive effect on student learning (β = .67; ρ < .001). For the interaction analysis between years of flipped learning implementation and instructional consideration predicting student learning, the direct effect of years of implementation on student learning, based on standard scores, was not significant (β = .316; ρ > .05). The direct effect of instructional consideration on student learning, based on standard scores, was significant (β = .793; ρ < .001). The interaction between instructional consideration and years of implementation predicting student learning based on standard scores was not significant (β = -.209; ρ > .005). Hence, the moderating effect of years of implementation on the relationship between instructional consideration and student learning was non-significant. The test results for the variables are summarised in Table 4.

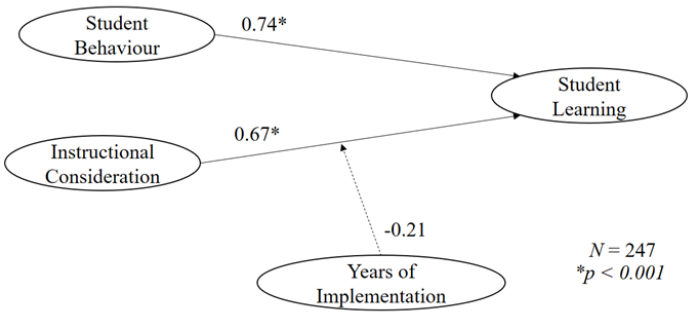

Figure 2: Path analysis.

Table 4. Unstandardised and standardised factor loadings.

Hypothesis	Path	Unstandardised Estimate	Standardised Estimate	S.E.	C.R.	*P*	Result
H1	Student Behaviour → Student Learning	.544	.738	.059	9.156	***	Significant
H2	Instructional Consideration → Student Learning	.595	.674	.074	8.033	***	Significant
H3	Instructional Consideration (Z-Score) → Student Learning (Z-score)	.793	.793	.052	15.140	***	
	Years (Z-score) → Student Learning (Z-score)	.233	.233	.232	1.003	.316	Not Significant
	Instructional Consideration x Years (Z-score) → Student Learning (Z-score)	-.046	-.209	-.905	.366	.366	

Discussion

The results from CFA indicated that the proposed research model has a good model fit. Although Gough et al. (2017)'s adapted instrument was designed to examine K-12 teacher perceptions regarding the flipped classroom model, it was robust enough to be adapted for use in the higher education context. What was added to the current study was the inclusion of the moderation variable, experience in flipped learning. We attempted to examine if lecturers' experience in flipped learning implementation significantly affected their student learning.

This study examines if lecturers perceive positive student behaviour and effective flipped lesson design as predictors of student learning. The path analysis results showed that

student behaviour and instructional consideration had a significant positive effect on student learning. Flipped learning approach requires students to take a greater responsibility during pre-class activities, such as watching a video or studying lecture notes beforehand. As such, student behaviour becomes a vital factor in the successful lesson delivery that leads to student learning. The findings are similar to those reported by Ning and Downing (2011) and Tokan and Imakulata (2019). However, Bond (2020) posited that the flipped learning approach is not the immediate solution to learning as students display different forms of behavioural disengagement. Flipped learning would not make students who did not do homework suddenly start doing homework. Some students did not perceive videos prepared for the flipped classroom as having the same level of importance as other forms of homework, while others skipped through parts of videos. Bond (2020) further suggested that having an initial adjustment period was needed for students to become accustomed to the flipped learning approach. For instance, students needed an initial period of adjustment on getting started to learn independently and as part of a group.

Flipped classroom lessons can be designed in various ways. The findings showed that instructional consideration in how lecturers designed their flipped learning lessons impacted how students learn. This finding is in line with past studies that lesson design significantly affected student learning (Alvarez-Bell et al., 2017; Rienties & Toetenel, 2016). Blau and Shamir-Inbal (2017) suggested a new design model of flipped learning. They discussed the importance of including technologies in promoting higher-order thinking skills as presented in Bloom's taxonomy. The newly designed model emphasised the vital role of technology in supporting successful learning and functioning in the digital era. In addition, the new design model places a particular emphasis on technology-enhanced embedded assessment, combining individual reflection with peer feedback, collaboration, and co-creation of course content and of learning outcomes by students in order to develop regulation strategies in both individual learning (i.e. self-regulation) and teamwork (i.e., co-regulation and shared regulation).

While we attempted to investigate if lecturers' experience in flipped classroom implementation significantly affected student learning, the moderation analysis results showed otherwise. Like the study findings by Leis and Brown (2016), after comparing a teacher with flipped learning experience and another without, learning outcomes in both student groups improved to similar degrees. The researchers concluded that regardless of the teacher's experience, flipped learning was an ideal approach to increase the possible amount of individual coaching in the classroom, bringing about more efficient learning.

Conclusions and recommendations

While flipped learning has grown in popularity in higher education, research is still needed to support educators transitioning their teaching to a flipped learning approach. Research has indicated that learner outcomes will improve if instructors in higher education maximise students' learning experiences by using the implementation data to drive those decisions and effectively shift student accountability for learning using flipped methods (Brewer & Movahedazarhouligh, 2018). Such data could be collected from flipped classrooms to improve instruction. For instance, more learning analytics data had been collected to help give insights into better flipped learning implementation in the classroom (Jovanović et al., 2017; Lin & Hwang, 2018; Montgomery et al., 2019; Sun et al., 2019).

While the adapted instrument from Gough et al. (2017) is adept for this current study, the targeted participants were K1-12 schoolteachers. Most flipped learning studies were based on primary and secondary education (Lindeiner-Stráský et al., 2020; O'Flaherty & Phillips, 2015). A limitation one may argue is that there is a difference in the student demographics where the study is based (i.e. flipped learning for 17-19 years old). The current study was conducted in a higher education institution where the pedagogical approaches and expectations differed from the K1-12 context. The recommendation for future study would be to extend the current modest research model of four constructs to include additional factors that potentially influence student learning in flipped classrooms.

Another limitation is that this study was conducted during the period when educational institutions were rapidly changing their methods of lesson delivery amid the Covid-19 pandemic. The data collected were from lecturers conducting flipped classroom lessons for more than a year. While the study revealed insightful findings, no data was collected prior to Covid-19 for comparison. The current study was also only conducted within an educational institution in Singapore and would benefit by expanding its participant base to other institutes of higher learning in other countries. Also, the current quantitative study would benefit by adding a qualitative aspect by conducting interviews with lecturers to get their opinions and views on flipped learning.

The current study established that student behaviour is an essential element in successfully implementing flipped learning classrooms. Many earlier research proposals examined self-regulation in flipped learning in the literature (Leong et al., 2019; Shyr & Chen, 2018; Sun et al., 2017; Zainuddin & Perera, 2018). One of the critical directions for future flipped learning research is to dissect student behaviour into self-regulated factors further. Adding new variables like self-regulation or self-directed learning to the existing adapted model can further enrich current flipped learning studies and provide a more in-depth understanding of how learners perceive and participate in flipped learning classrooms.

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