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Effectiveness Of Small Private Online Course (SPOC)-Based Flipped Classroom Of Language Learning Among Higher Education Students

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EFFECTIVENESS OF SMALL PRIVATE ONLINE COURSE (SPOC)-BASED FLIPPED CLASSROOM OF LANGUAGE LEARNING AMONG HIGHER EDUCATION STUDENTS

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ABSTRACT

Higher education has undergone a significant shift towards learner-centered education in recent decades. The flipped classroom model and challenging traditional structures transform the role of teachers from lecturers to facilitators. This method, which is gaining widespread attention, particularly in language courses for postgraduate students, has been explored for its effectiveness. This study focused on postgraduate students at Universiti Putra Malaysia and employed quantitative methods. The research is framed around the Technology Acceptance Model (TAM). The research identifies key factors influencing SPOC flipped classroom effectiveness, including these factors: self-efficacy, teacher behaviour, characteristics of instructional materials, cognitive usefulness, cognitive ease of use, attitude towards learning, and intention to learn. Findings indicate an active impact on efficiency in learning. The research model aligns well with the study's purpose, suggesting avenues for enhancing postgraduate language learning within SPOC flipped classrooms. The study proposes suggestions for enhancing postgraduate language learning in SPOC flipped classrooms.

Keywords: Learning effectiveness, Higher education, flipped classroom, postgraduate students, learner-centred.

1. Introduction

In the past few years, university teaching has become more focused on the student. Language classes are moving away from traditional lecture-based methods and toward new ones like the flip classroom (Ćirić et al., 2020). In particular, the combination of SPOC and flipped teaching provides a new way to build a more personalized and interactive language learning environment (Fields et al., 2021).

The SPOC-based flipped classroom idea combines regular lectures with online. learning. This is a huge step forward in the technology used in schools. Instead of strict plans and standard training (Hollister et al., 2022), this mixed method lets teachers work around limited time and space to give each student a unique learning experience (Li et al., 2024). Cécilia et al. (2021) found that this approach got students more involved, made them think more critically, and helped them learn more deeply by using interactive and configurable parts. According to Wang et al. (2023), this mix is meant to make a learning setting that is student-centered, proactive, and personalized. Peng and Wang (2024) say that SPOC is necessary to make and give high-quality course materials and make teaching methods better. Using both SPOC and online courses together can make learning more flexible and individualized, get around classroom limitations in terms of time, space, and material, and completely change the way universities teach.

But putting the SPOC-based open classroom into practice brings up a lot of important questions. According to Namaziandost et al. (2020), students who lack confidence in their abilities are less likely to engage with the pre-course content, a crucial component of the SPOC model of flipped classroom learning. Teachers also may not properly guide students through the online parts of the SPOC, which can make it hard for students to connect with the digital materials (Fitria, 2022). Additionally, poorly made SPOC content can be too hard for students to handle, especially when the materials don’t match their specific language learning goals (Jia & Zhang, 2021). These problems are made worse in postgraduate language education, where the literature mostly ignores the need for specialized material and more advanced ways of teaching.

Three important study gaps need to be filled. First, most flipped classroom studies are in STEM fields, but there aren’t many structured studies of language learning (Qi et al., 2024; Jiang et al., 2020). According to Lu and Samah (2024), advanced students' specific needs are still not being taken into account, even though they are better at taking charge of their own learning. Third, empirical evidence remains limited regarding how language-specific factors (teacher conduct, material characteristics, self-efficacy) impact SPOC-flipped classroom success (Chen et al., 2023).

This study addresses these gaps by investigating the effectiveness of SPOC-based flipped classrooms for postgraduate language learners at Universiti Putra Malaysia. Grounded in the Technology Acceptance Model (TAM), the research has three primary objectives: (1) to assess current levels of key learning factors including self-efficacy, teacher behavior, instructional material quality and so on; (2) to validate a TAM-based structural model for this educational context; and (3) to identify the most significant predictors of learning effectiveness. The findings will provide both theoretical insights into the application of TAM in postgraduate language education and propose strategies and recommendations to optimize the efficacy of the flipped classroom paradigm that is based on SPOC

The following questions will guide this investigation:

1. What is the level (self-efficacy, teacher behaviour, characteristics of instructional materials, cognitive usefulness, cognitive ease of use, attitude towards learning, and intention to learn) of SPOC-based flipped classroom language learning?
2. Does the proposed TAM-based structural model exhibit adequate fit indices for explaining learning effectiveness in SPOC-based flipped classrooms?
3. Which factors (self-efficacy, teacher behaviour, characteristics of instructional materials, cognitive usefulness, cognitive ease of use, attitude towards learning, and intention to learn) play a significant role in shaping the efficacy of the SPOC-based flipped classroom learning model?

2. Literature review

2.1 Flipped Classroom Model in Higher Education

The flipped classroom model has witnessed a surge in popularity within educational settings, particularly in higher education. This pedagogical approach involves students engaging independently with course materials, often through Small Private Online Courses (SPOCs), prior to in-person discussions. Studies have shown that integrating SPOCs in higher education can significantly enhance students' language learning proficiency by promoting active engagement and self-regulated learning (Wu et al., 2018; Xue & Dunham, 2021). The flexibility of this model caters to the diverse needs of postgraduate students, accommodating their busy schedules (Wu, 2023). However, the successful adoption of this model necessitates addressing technical (Wang, 2022) and educational difficulties, stressing the necessity of additional studies examining its effects in the long run.

2.2 SPOC-Based Flipped Classroom and Language Learning

The specifics of language teaching provide classroom flipping a special benefit. SPOC-based flipped classrooms have been demonstrated to greatly boost students' language output possibilities and raise interaction time during class by 40 to 60% (Liu, 2021). Students can concentrate on advanced language activities like debates and speeches by learning fundamental facts including vocabulary and grammar in advance (Zhu, 2022). For graduate students, it is a model for satisfying the linguistic needs of the area in professional contexts such as academic writing and conference presentations (Zheng & Lee, 2023).

But there are also big problems with putting it into action. New ways of learning can have a big effect on students' self-efficacy because they can make them feel both empowered and anxious. The study on the daily experiences of students and teachers in Shenzhen, China (Zheng et al., 2024b) shows that this variation can make it harder for students to finish their advanced preparation, especially those who aren't good with technology. It is also looked at how innovative teacher behavior affects students' academic self-efficacy. This shows that while innovative teaching can make students more goal-oriented, it may not directly lead to higher self-efficacy (Maun et al., 2023). Numerous studies have shown that teachers find it hard to adjust to new ways of teaching. Studies on teacher growth and the process of teacher change (Stein & Wang, 1988) show that teachers often have trouble switching from traditional methods to new ones. Itis even

harder to make this change because teachers have to change how they do things in the classroom to fit local situations (Sansom, 2017). Multiple types of graduate students require adaptable lesson plans, especially when using new tools and teaching methods. Implementing digital tools and engaging learning platforms can be hard because they need to be flexible to meet the needs of all students (Tkachenko, 2024) according to a study on innovations in higher education.

2.3 SPOC-Based Flipped Classroom and Constructivist Principles

SPOC-based flipped classrooms adhere to constructivist learning concepts by promoting student-centered engagement, active involvement, and collaborative knowledge construction (Chen, 2020). The fusion of Small Private Online Courses (SPOCs) alongside in-person sessions accommodate varied educational preferences and intensifies the process of learning (Wen & Wu, 2022). Technology is critical in this method, so much so that it's essential to understand if learners are receptive to digital educational devices. As a conceptual basis for studying the influence of perceived user friendliness and utility on learners' attitudes and planned use of educational technology, the Technology Acceptance Model introduced by Venkatesh and Davis (2000) is used. Application of the TAM on the SPOC -flipped classroom teaching yields insight about the elements that affect learner involvement with learning and outcome.

2.4 The Technology Acceptance Model (TAM) in SPOC-Based Flipped Classrooms

This investigation uses the theoretical framework developed by Davis in the late '80s named TAM to understand how the cognitive usefulness and ease of use of a technological tool affects the learners' embrace and study habits. However, within the space of SPOC based flipped instruction, there are several key components that greatly influence the educational productivity of the scholars; personal agency, pedagogical conduct, quality of teaching aids, mental utility, and mental accessibility. Bandura's concept (1977) of self-efficacy asserts that scholar's strong beliefs in their scholarly abilities have a strong impact on their academic push and achievements. In SPOC-based flipped classroom learning, this belief in one's ability is particularly paramount as it forecasts the preparedness of the scholar to participate with digital interfaces and the ability of the scholar to skillfully operate in an online educational landscape (Zhu et al., 2023). With the transition from traditional to flipped pedagogical approaches, the success of the scholar becomes dependent upon their reliance on education technology.

Within the context of SPOC based flipped classrooms, the role of the educators change dramatically from just the provider of the knowledge to learning facilitators. In such an environment, effective teaching conduct is prompt in its guidance, beneficial in its feedback, and wants to keep schooling students' journey. Everywhere social research has been conducted, we see a high direct correspondence between the amount of the instructor's facilitation and the engagement of students, and consequently their educational outcomes (Cerezo et al., 2024). The highlighted point is that such professional growth programs are important for making teachers capable of solving flipped classrooms.

In SPOCs, the result is an academic achievement through the exact formulation of educational objects. Aspects of these educational tools that clearly affect their cognitive usefulness and ease of use of learners are the engagement capacity, multimedia incorporation, and regulation of mental workload. It is also revealed by academic research that not only does multimedia and interactive enriched content increase students' rate of participation and knowledge acquisition but they also

learn it better (Kabilito, 2024). Thus, curriculum developers and field experts need to work together in the development of educational content related to SPOC.

The TAM framework identifies cognitive usefulness and ease of use as core motivators for the embrace of technological tools in learning settings (Davis, 1989). Within the realm of SPOC-based flipped classroom teaching, the importance of these mental considerations is heightened, as they profoundly affect the learners' intention to engage with the interactive learning interface. The effectiveness of the reversed teaching format is largely determined by the learners' view of the digital aids' contribution to language mastery and the ease of maneuvering through the educational space.

The success of SPOC-based flipped classrooms is significantly influenced by students' attitudes toward learning, as implied by Ajzen's (1991) Theory of Planned Behavior. A positive attitude toward learning leads to more inspiration and participation in the online and direct interaction parts of the flipped method. The research has found that students have done better in such classrooms (Fuertes et al., 2023) for the reason that they have had an optimistic mindset of technology-aided education.

In environments where SPOCs are used to change the dynamic of a classroom, the drive to study is a critical link between the perspectives of learners and the manifestation of their learning activities. According to Ajzen (1991), the actual performance of a behavior will depend on the intention to engage in the behavior, which, in turn, can serve as a suitable means to measure how committed and involved a student is in the class. Frequent use of the learning platform is another indicator that involvement in dialogue is robust, as is its use for accomplishing tasks, and this is associated with a strong language learning aspiration and is significant in improving language skills.

This agrees with TAM (Davis, 1989), whereby perceived usefulness and ease of use will influence the adoption and learning of technology. Ajzen's (1991) Theory of Planned Behavior also supports the inclusion of attitude and intention to learn, as students' intentions serve as strong predictors of their actual engagement in learning tasks. The study tries to verify a TAM-based structural model that incorporates the following dimensions: self-efficacy, teacher behavior, instructional materials, cognitive usefulness, cognitive ease of use, attitude toward learning, and intention to learn in the SPOC-based flipped classroom. By examining these factors, the research seeks to determine their influence on the overall efficacy of SPOC-based language learning among postgraduate students.

2.5 The proposed TAM-based structural model

This research developed a structural model based on the Technology Acceptance Model to depict the interplay among self-efficacy, teacher behavior, instructional material characteristics, cognitive usefulness, cognitive ease of use, attitude toward learning, intention to learn, and learning effectiveness. This figure shows these associations (Figure 1), focusing on technology acceptance and its impact on learning actions and results. The objective is to present a comprehensive framework for understanding how SPOC-focused inverted classrooms can facilitate language learning achievement in tertiary education.

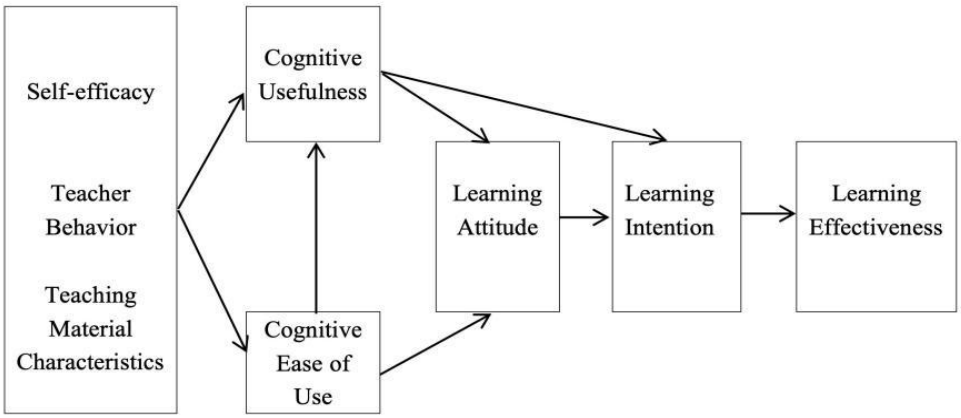

Figure 1: Seven Dimensions of the SPOC Flipped Classroom Learning Model

This pedagogical strategy will serve as a tool for Grockit's gain in this ultra-competitive market, and it will be highly impactful for Postgraduate students who are eager for a very flexible and highly specialized educational path. This innovation will transform the SPOC-based flipped classroom into a more dynamic and engaging learning in addition to the fact that this is essential in higher academic learning. This educational method not only gives the students to develop superior critical analysis and troubleshooting skills, but also complies with the main objective of the university sector of preparing the students to battle and solve complicated situations in real lives. Using Structural Equation Modeling (SEM) and the TAM in the investigation, the model under consideration is endorsed. This analytical approach allows these relationships between many components affecting educational outcomes in SPOC influenced reversed learning environments to be explored in detail and understanding on the improvement of teaching in virtual spaces to support purposes of advanced scholarly efforts.

3. Methodology

To examine the factors influencing the effectiveness of SPOC based flipped classroom as a learning context in post graduate language learning, this work used Structural Equation Modeling (SEM) through a quantitative correlational research approach. The strength of this approach lies in its flexibility and ability to test complex theoretical frameworks. SEM allows to examine multiple relationships simultaneously, both direct and indirect effects, which is a major step up from basic regression models. An approach to evaluation of correlations among an important number of constructs was mainly accomplished by SEM hypothesis testing and measurement validation (CFA).

3.1 Population and sampling

The study group included postgraduate students of Universiti Putra Malaysia who have been enrolled in SPOC based flipped classes. As Estrada et al. (2019) study indicated, if flipped classrooms are effective in improving academic performance, therefore graduate students with their rich academic background can follow this strategy, and, thus, extrapolating from the fact that graduates find it easier to adopt the transition to a flipped classroom and online learning. At the same time, Ogden and Shambaugh (2019) show how these flipped classroom techniques can be adapted to address individual learning requirements, something that might be advantageous for postgraduate students able to be self-directed learners. On the basis of these rationales, the present

investigation has selected postgraduate students as the subject group to evaluate the effectiveness of open classrooms driven by SPOC.

In this study, a simple random sampling technique was used to select students who were registered in SPOC-based flipped classroom language learning programs at the postgraduate level at Universiti Putra Malaysia (UPM). This university has been proactive in integrating online learning into its educational framework, particularly through platforms like PutraBLAST and initiatives such as PutraMOOC. These tools have been instrumental in facilitating blended and fully online courses, especially during periods necessitated by events like the COVID-19 pandemic (Wong & Khambari, 2021). This ensured that all participants would have had enough experience with the SPOC-based flipped classroom so that a more realistic understanding of factors affecting learning efficacy was taken into account.

With a total population of approximately 10,047 postgraduate students at UPM, we aimed to select a sample of 384 participants (Given that the degree of confidence is 95% and the confidence interval is 5%). Each student in the population had an equal chance of being selected. This method guaranteed that our sample was representative of the larger population, allowing us to analyze the effectiveness of SPOC-based flipped classroom learning on individual language learning metrics, dissect the effectiveness of various dimensions, and unravel the intricate interplay between these dimensions. This study mined for participants who completed an online questionnaire through the link, using the collected data consisting of 471 UPM postgraduate students. Every response provided was rewarded with a lottery that the respondent could enter once finished. From among these 410 had one or more experiences with an SPOC based flipped classroom course which left us with 410 valid responses.

3.2 Research instrument

The research instrument used in this study was a modified questionnaire originally developed by Zheng (2016), which itself was adapted from various well-established scales. The questionnaire was designed to measure key constructs related to the effectiveness of SPOC-based flipped classrooms, including self-efficacy, teacher behaviour, instructional material characteristics, cognitive usefulness, cognitive ease of use, attitude toward learning, intention to learn, and learning effectiveness.

Table 1: Reliability and Validity of the Questionnaire

Variable	Cronbach's Alpha	KMO
Self-efficacy	0.776 0.639 0.746	0.678
Teacher behavior	0.848 0.889 0.838 0.873	0.814
Teaching material characters	0.718 0.744 0.690	0.712
Cognitive usability	0.837 0.820 0.848	0.749
Cognitive usefulness	0.755 0.746 0.756	0.721
learning intent	0.834 0.801 0.769	0.728
Learning effectiveness	0.836 0.825 0.817 0.807	0.811

To ensure the validity and reliability of the adapted questionnaire in the current study, pilot testing has been done prior to issuing the official questionnaire. Table 1 indicates that the questionnaire possesses strong reliability and validity, making it suitable for use as a research instrument in this investigation. The final questionnaire used a 5-point Likert scale, ranging from 1 = Strongly Disagree to 5 = Strongly Agree, to measure participants' perceptions of each construct.

3.3 Data collection technique

This study employed online data collection, a popular survey tool for distributing, collecting, and processing questionnaire responses, to collect data. It can automate data collection to ensure accuracy and ease of access for participants and researchers. The questionnaire link was distributed through WeChat and WhatsApp to ensure target group contact.

A six-week data collection phase in November 2023 yielded 471 responses. After excluding 61 incorrect responses due to incomplete answers or failure to meet participation standards, the dataset included 410 valid responses.

3.4 Data Analysis

Investigating the study's numerical components requires quantitative data analysis. This is done with AMOS 28.0 and SPSS 26.0, the Social Sciences Statistical Package.

SPSS handles initial data handling and statistical analyses. Each variable's central tendency, dispersion, and score distribution are summarized using descriptive statistics. Inferential statistical tests are performed in SPSS to assess teaching model efficacy hypotheses and analyze correlations. AMOS Version 28.0 was used for SEM and CFA. Before utilizing traditional goodness-of-fit indices, the measurement model was tested by CFA to ensure the observed variables accurately

matched the theoretical components. The model suited well based on predefined criteria after SEM was used to analyze structural links between latent and observable variables.

This analytical approach is implemented to evaluate the overall research model, integrating the relationships between latent and observable variables. The significance of path coefficients is tested to determine the strength and direction of hypothesized relationships.

4. Results and findings

4.1 Demographic information

Table 2: Frequency Analysis Results

Item	Option	Freq	%	C. %
Age	18-24	164	40.000	40.000
	25-34	161	39.268	79.268
	35-40	85	20.732	100.000
Gender	Male	197	48.049	48.049
	Female	213	51.951	100.000
Semester	1	102	24.878	24.878
	2	57	13.902	46.098
	3	132	32.195	70.976
	4	119	29.024	100.000
Frequency	Almost every session	121	29.512	29.512
	Most sessions	103	25.122	54.634
	About half of the sessions	90	21.951	76.585
	Few sessions	82	20.000	96.585
	Rarely	14	3.415	100.000

Table 2 shows that from the perspective of the distribution of the age repondents, “18-24” years old constitutes forty percent of the total, 25-34 year olds made up another 39.27% of the sample and 35-40 years old the rest. This finding is consistent with Schmid & Kratzer’s (2022) study on digital natives’ preference for blended learning and may reflect the natural adaptability of young learners to technology-mediated modes of instruction. When it comes to gender, the highest percentage of “Female” constitutes 51.95%. The percentage of males in the sample was 48.05 percent. This indicates that the sample size collected was fairly evenly divided between men and women. The distribution by semster was: 102(24.878%) first semester, 57(13.902%) second semster, 132(32.195%)third semster, 119(29.024%) fourth semster. Over thirty percent of the samples are considered to be “third semester” when seen from the standpoint of semester. A significant portion of the students (29.512%) participates in almost every session, indicating a high level of engagement with the SPOC-based flipped classroom model. Most sessions are attended by 25.122% of the students, and about half of the sessions are attended by 21.951% of the students, showing a consistent level of participation across these categories. Few sessions are attended by 20% of the students, and rarely by only 3.415% of the students, suggesting that the majority of students are actively participating in the SPOC-based flipped classroom. This phenomenon confirms the advantages of SPOC flipped classroom in maintaining learning continuity.

4.2 Level of SPOC-based flipped classroom language learning effectiveness (RQ1)

Table 3 presents the descriptive statistics of key dimensions, where the "Level"classification reflects the magnitude of mean scores on a 5-point Likert scale (Joshi et al., 2015):

High = 75th percentile (≈3.75 on 5-point scale)
Moderate = 25th-75th percentile (≈2.5-3.75)
Low = <25th percentile

Table 3: Descriptive Analysis of Dimensions in SPOC-Based Flipped Classroom

	N	Minimum	Maximum	Mean	Std. Deviation	Level
Self_Efficacy	410	1.00	5.00	3.646	0.964	Moderete
Teacher_Behavior	410	1.00	5.00	3.840	0.902	High
Characteristics_of_Instructional_Materials	410	1.00	5.00	3.815	0.909	High
Cognitive_Usefulness	410	1.00	5.00	3.838	0.890	High
Cognitive_Ease_of_Use	410	1.00	5.00	3.794	0.891	High
Attitude_towards_Learning	410	1.00	5.00	3.888	0.803	High
Intention_to_Learn	410	1.00	5.00	3.863	0.910	High
Learning_Effectiveness	410	1.00	5.00	3.832	0.881	High

Most dimensions (e.g., teacher behavior, learning attitudes) in Table 2 show mean scores ≥ 3.75 (High), with low standard deviations (SD < 1.0), indicating uniformly positive perceptions among students. Self-efficacy as an outlier, the moderate mean (3.646) suggests room for improvement, while its slightly higher SD (0.964) hints at potential variability in student confidence levels. This indicates that while most students demonstrate baseline confidence, systematic differences in self-perceived capability may exist. Targeted interventions—such as scaffolded practice or mastery modeling (Bandura, 1997)—should be investigated to reduce this variance.

4.3 Structural Equation Modeling

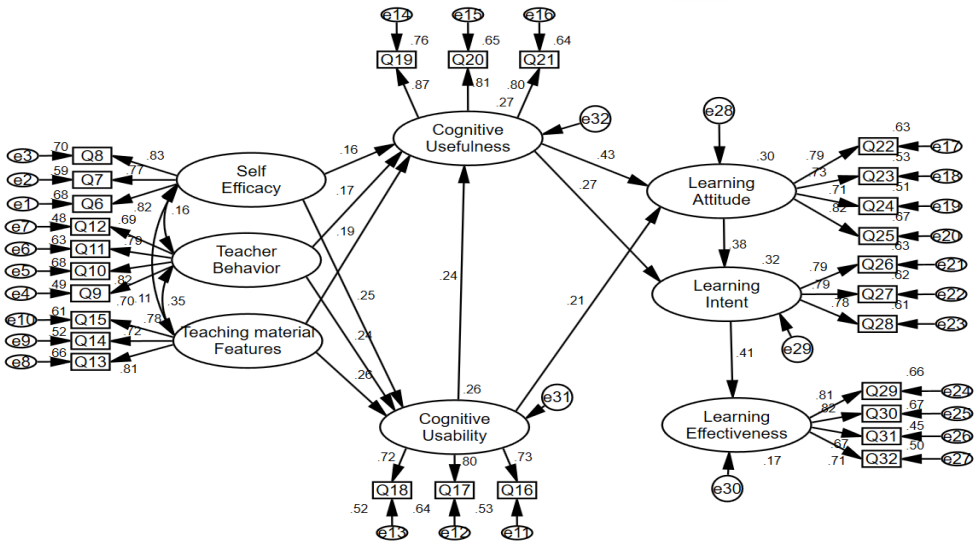

Figure 2

4.3.1 Structural Model Fit: This section presents the research data regarding the model's fit, indicating to the reader whether the model in this study satisfies the research requirements based on the data. This section will address research question 2: Does the proposed structural model (based on TAM) exhibit adequate fit indices for explaining learning effectiveness in SPOC-based flipped classrooms?

Table 4: Structural Model Fit

Fit Indices	Acceptable Range	Indicators
CMIN		474.900
DF		309
CMIN/DF	<5	1.537
GFI	>0.9	0.922
AGFI	>0.9	0.904
RMSEA	<0.08	0.036
IFI	>0.9	0.967
NFI	>0.9	0.910
TLI(NNFI)	>0.9	0.962
CFI	>0.9	0.966
SRMR	<0.08	0.048

The data in Table 4 indicates that the CMIN/DF ratio is 1.537, the GFI, AGFI, NFI, TLI, IFI, and CFI exceed 0.9, and the RMSEA is 0.036, rather than 0.08. This model can be considered to have an adequate fit; as most fitting indicators meet the norms of general SEM research.

4.3.2 Factors influence the effectiveness of SPOC: This section discusses the factors that determine the effectiveness of the SPOC-based flipped classroom paradigm. This section will address RQ3: Which factors (self-efficacy, teacher behaviour, characteristics of instructional materials, cognitive usefulness, cognitive ease of use, attitude towards learning, and intention to learn) play a significant role in shaping the efficacy of the SPOC-based flipped classroom learning model?

It can be concluded from the above table 5 that Self_Efficacy has a significant positive effect on Cognitive_Usability in this study (β=0.250, $P < 0.001$). Teacher_Behavior had a significant positive effect on Cognitive Usability (β=0.240, $P < 0.001$). Teaching_material_Features had a significant positive effect on Cognitive_Usability (β=0.260, $P < 0.001$), and the R square of the model interpretation was 26.4%. Self_Efficacy had a significant positive effect on Cognitive Usefulness (β=0.161,$P < 0.01$). Teacher_Behavior had a significant positive impact on Cognitive_Usefulness (β=0.172,$P < 0.01$) Teaching_material_Features had a significant positive impact on Cognitive_Usefulness (β=0.1) 85,$P < 0.01$), Cognitive_Usability has a significant positive impact on Cognitive_Usefulness (β=0.238,$P < 0.001$), and the R square of the model interpretation is 27.2%. Cognitive_Usability has a significant positive influence on Learning_Attitude (β=0.428,$P < 0.001$) Cognitive_Usability has a significant positive influence on Learning_Attitude (β=0.211,$P < 0.0$) 01), the model interprets R square as 30.4%. Learning_Attitude has a significant positive impact on Learning_Intent (β=0.379,$P < 0.001$), Cognitive_Usefulness has a significant positive impact on Learning_Intent (β=0.273,$P < 0.001$). The model interprets R square as 32.5%. Learning_Intent has a significant positive impact on Learning_Effectiveness (β=0.406,$P < 0.001$), and the interpreted R square is 16.5%.

Table 5: SEM Path Coefficient

			Estimate	S.E.	C.R.	P	SE	R2
Cognitive Ease of Use	<---	Self_Efficacy	0.236	0.054	4.360	***	0.250	0.264
Cognitive Ease of Use	<---	Teacher_Behavior	0.371	0.097	3.825	***	0.240	
Cognitive Ease of Use	<---	Characteristics_of_Instructional_Materials	0.296	0.072	4.108	***	0.260	
Cognitive Usefulness	<---	Self_Efficacy	0.156	0.054	2.918	0.004	0.161	0.272
Cognitive Usefulness	<---	Teacher_Behavior	0.273	0.049	2.894	0.004	0.172	
Cognitive Usefulness	<---	Characteristics_of_Instructional_Materials	0.216	0.070	3.079	0.002	0.185	
Cognitive Usefulness	<---	Cognitive_Ease_of_Use	0.244	0.068	3.599	***	0.238	
Attitude towards Learning	<---	Cognitive_Usefulness	0.321	0.046	7.018	***	0.428	0.304
Attitude towards Learning	<---	Cognitive_Ease_of_Use	0.162	0.047	3.435	***	0.211	
Intenttion to Learn	<---	Attitude_towards_Learning	0.393	0.068	5.758	***	0.379	0.325
Intenttion to Learn	<---	Cognitive_Usefulness	0.213	0.049	4.351	***	0.273	
Learning Effectiveness	<---	Intention_to_Learn	0.417	0.060	6.911	***	0.406	0.165

Many important discoveries and model explanatory power are identified. It was found that cognitive usefulness and ease of use are important factors in technology acceptance models (TAM) (Zobeidi et al., 2023) and cognitive usefulness has a big effect on the explained variation of learning attitude (30.4%). Behavioral intention explains 32.5% of variance, compared to 25% in traditional TAM research (Kalayou et al., 2020). This suggests that adding self-efficacy and social impact can increase the model's prediction power (Kumar et al., 2020).

SPOC flipped classroom instruction should prioritize practical presentation and interactive teaching material design, according to the results. Research shows that system qualities and the user interaction improve user engagement and intention to use educational technologies (Al-Sayid & Kirkil, 2025). Technical operation instructions and value explanations also affect perceived simplicity and usefulness, which affects behavioral intention (Al-Emran et al., 2020). Structured task design boosts learners' self-efficacy and encourages technology use (Kumar et al., 2020). In conclusion, cognitive usefulness, self-efficacy, and interactive design can improve educational models that predict learning attitudes and behavioral intentions. This provides a clear direction for optimizing SPOC teaching.

5. Discussions

This study systematically examines the application effect of SPOC flipped classroom in postgraduate language education.

5.1 Applicability of the Technology Acceptance Model (TAM)

In terms of the applicability of the technology acceptance model (TAM), the study confirmed the significant influence of cognitive usefulness (β =0.321) and cognitive ease of use (β =0.244) on learning attitudes, a finding that validates the classical theory of Davis (1989). What is more noteworthy is that the influence of teacher behavior (β =0.371) transcends the technical factors themselves, which is in sharp contrast to the relevant research in STEM fields (Mutambara & Bayaga, 2021), and supports Khajavy et al. (2021)'s view on the particularity of language education. The statistical analysis revealed that the graduate student group exhibits a distinct sensitivity in perceiving teaching value, as evidenced by the attitude (β =0.393) and intention (β =0.417) results, hence corroborating the findings of Johnson and White (2021) in their study involving a student cohort.

5.2 Teacher behavior and self-efficacy as key factors

In terms of teacher behavior and self-efficacy, the study found that teacher behavior was the strongest predictor (β = 0.371), which strongly supported Farhana Jumaat & Che Lah's (2022) findings on the critical role of teacher scaffolding in technology-enhanced language learning. At the same time, the 'moderate' level of self-efficacy (M = 3.646) found in the study contrasts interestingly with the generally higher levels of technical confidence reported in STEM contexts (Martha, et al., 2023), providing empirical support for Zheng et al.'s (2024a) recently proposed language learning anxiety in digital environments' theory. Together, these findings suggest that pedagogical competence and learner psychological factors may outweigh purely technical considerations in determining the success of flipped language classrooms.

5.3 The importance of learning materials to achieve high learning effectiveness

The findings regarding instructional material design are equally significant. The data revealed that material characteristics (β = 0.296) significantly contributed to cognitive usefulness. While high-quality materials (M = 3.815) showed a positive correlation with learning outcomes, the study emphasized that these materials must synergize with teachers' scaffolding. These results not only validate Zhambylkyzy & Molotovskaya's (2022) theory of 'authentic materials facilitating language output', but also indicate that relying solely on content quality is insufficient - it must be combined with progressive task design strategies. The findings generally align with Mayer's (2020) multimedia learning principles but particularly highlight the need for enhanced 'social presence' in language SPOCs through designs like virtual peer assessment. This perspective contributes meaningfully to Huang & Annamalai's (2024) study on learning engagement. Together, these results present concrete guidance on material design in language-focused SPOC courses.

5.4 Cognitive Usefulness is more influential than Cognitive Usability in shaping attitudes and motivation

The results also suggest that cognitive usefulness has stronger effects than cognitive usability on students' attitudes and motivation (β =0.321 vs. β =0.244). However, even with the ease of use remaining an important thing that supports technological adoption, students value the perceived benefit of using a system for learning outcomes over its usability. That means that people in modern language education spaces care more about how technology helps them do better at school

and learn in general, as opposed to just how easy it is to use. For this reason, educational technology must be designed to optimize cognitive usefulness in terms of the integration of meaningful content, pedagogical support, and interactive learning features without attaining technical improvements.

Findings also show that cognitive usefulness plays a stronger role in shaping students' attitudes and motivation than cognitive usability ($\beta = 0.321$ vs. $\beta = 0.244$), as Venkatesh and Davis (2000) derived with their extended Technology Acceptance Model. Ease of use is still one of the important factors in terms of promoting the adoption of the technology (Mayer, 2019), but students will choose a system they perceive as beneficial in terms of achieving their learning outcomes rather than on the basis of system usability. It means that students in language education environments are most attentive not to the ease of use of technology in their learning but rather its contribution to academic achievement and learning experience, which is substantiated in current educational AI research (Hwang et al., 2020). Thus, educational technology should create, whenever possible, educational hotness through its capacity to present relevant material, add pedagogical assistance, and address speculative findings.

5.5 Implications

The following theoretical implication may be drawn from the empirical findings of this study. First, they reinforce and extend the Technology Acceptance Model (TAM) by demonstrating that cognitive usefulness ($\beta=0.321$) consistently outweighs ease of use ($\beta=0.244$) in shaping learning attitudes and motivation, particularly in skill-based disciplines like language education. This challenges the common assumption in STEM-focused flipped learning research (Gong et al., 2023) that usability factors dominate acceptance decisions. Second, the study contributes to the Theory of Planned Behavior showing that postgraduate students' plans to behave are mostly influenced by how much they value learning ($^2=0.417$) rather than how convenient the technology is. Third, the results suggest the need for discipline-specific adaptations of TAM, where human factors (teacher behavior, $\beta=0.371$) and authentic material design ($\beta=0.296$) serve as critical external variables that enhance core TAM constructs in language learning contexts.

The findings of this study have important, practical implications for using the SPOC-based flipped classroom instructional model in teaching and learning. Given that teacher behavior exerts a stronger influence than technical factors in shaping students' learning attitudes in this study, educators should prioritize active instructional engagement in SPOC flipped classrooms. It includes personalized feedback, scaffolding techniques and interactive teaching methodologies for the maximum student motivation and participation (Yaseen et al., 2025). The focus on pedagogical strategies rather than mere technical expertise should be emphasized in the training programs in order to ensure that an instructor adequately facilitates learning in the context of technology-enhanced environments. Teachers should take into account their students' diversity of experiences and needs, when creating and applying the model. It might necessitate helping more technophobic older students or adjusting to be more learner-friendly. In group projects and practical activities, teachers should facilitate and guide. To succeed, the flipped classroom needs high-quality, easily accessible teaching resources.

Learning materials should be high-quality and authentic, but also designed to work in concert with teacher guidance. As Engeness (2022) said, educators should be trained in creating or curating materials that align with progressive task design principles, ensuring that content is both engaging and pedagogically sound. Designers should develop authentic, discipline-specific resources (e.g.,

academic writing templates and debate simulations) rather than generic content and incorporate multimedia elements (e.g., video annotations and interactive exercises) to enhance engagement while maintaining pedagogical value.

The confirmation of TAM's applicability in SPOC flipped classrooms for postgraduate language education suggests that educators should focus on enhancing the perceived usefulness and ease of use of the technology. However, the significant influence of teacher behavior underscores the necessity for teacher training programs specifically tailored to integrate technology effectively into language instruction. This may involve workshops on how to leverage SPOC platforms to enhance learning experiences and encourage interaction. Additionally, since graduate students are particularly sensitive to the value of teaching, according to what Jia found in 2022, educators should clearly communicate the benefits of SPOC technology to foster positive attitudes and intentions towards its use.

6. Limitations and Suggestions for Future Study

To ensure the flipped classroom works well, it's crucial to have high-quality instructional resources that are easy to access. Recent studies show that the SPOC platform makes it easier to present interactive, multimedia-rich content, which greatly improves the learning experience (Srivastava & Srivastava, 2024). However, the present study did not examine the possible impacts of students' academic specializations, which could have resulted in varying learning experiences and outcomes among different disciplines. Future studies need to conduct comparative studies across disciplines (e.g., comparing language learners with engineering students) to identify discipline-specific barriers and enablers.

The flipped classroom model that uses SPOC depends significantly on teachers. Their skill in becoming facilitators leading discussions, handling group dynamics, and offering tailored support greatly impacts student outcomes (Xu, et al., 2023). To improve teachers' facilitation skills, we should create thorough professional development programs. These programs ought to concentrate on enhancing instructors' skills in managing various small group scenarios and making the most of digital resources.

Students' involvement and achievement in a SPOC-based flipped classroom depend on self-efficacy. Results from this study demonstrate that self-efficacy for moderate and relationships fall behind the moderate. Increasing the confidence and motivation of students can be done through approaches like scaffolding and gamification, e.g., achievement milestones or badges, continuous feedback, and tailored learning pathways. Furthermore, ensuring that these interventions are individualized to aspects of different academic areas is more effective.

Real time feedback mechanisms are crucial for instructing in a way to address the needs of the individual student (Pinheiro et al., 2021). Timely support is provided through automated feedback tools with organized teacher feedback sessions so that students receive help when they need it as they adapt their learning strategies (Cassano et al., 2023). Additionally, research regarding how responses in behaviour and preferences for feedback from feedback differ between the different academic disciplines will aid in the development of better and more effective tailored feedback systems.

In sum, a SPOC-based flipped classroom model has the potential to increase learning outcomes in higher education. Strategies to maximize this approach can be achieved through the provision

of high-quality teaching resources, effective teacher role support, and maximum self-acquisition of efficacy. Research in this topic should ideally compare the differences in final learning outcomes and student satisfaction between these strategies and others in the future.

7. Conclusion

Thus, this paper applied a TAM and an SEM on postgraduate language acquisition by using SPOC-based flipped classrooms. The study found that learning attitudes, learning intentions, and learning outcomes were all affected by teaching support factors like teacher behavior and the quality of teaching materials, as well as technology acceptance factors like how useful and easy to use technology was seen to be. This helped us learn more about how SPOC flipped classrooms work and how to make them work better. If this approach to language teaching results in the students in higher education being able to not only learn but also participate and constitute critically of it, then this will imply the findings. Teacher demeanor, quality of teaching resources, cognitive relevance and self-efficacy are some important elements of educational achievement. These elements were formed by the level of the students' drive and attitude towards studying. Thus, the success of the SPOC-based flipped instruction depends on its level of coordination of the instructional design, teacher support, and student preparation, as well as the sophistication of the technology. This provides a theoretical framework as well as a practical road map for applying this flipped learning style in higher education to provide real value in the language acquisition. The results agree with the implication that all graduate students should learn language using technology in something in a more individualized, engaging, and efficient way using technology, which should not be seen as an end in itself but rather as a tool.

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