

Technology acceptance of augmented reality to attitude and self-efficacy in learning English

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Abstract

This study examined the effects of the technology acceptance of augmented reality on attitude and self-efficacy in learning English and modelled the direct and indirect effects. It employed non-experimental, analytic survey research with structural equation modelling. Two hundred and fifty-seven participants completed the survey questionnaire. Data analysis used SmartPLS to examine the outer loading, validity and reliability, R square, path coefficients, specific indirect effects, total effects, and model fit. Structural equation modelling (SEM) showed that perceived usefulness has no significant effect on attitude and self-efficacy, while perceived ease of use has a significant effect on attitude but no significant effect on self-efficacy. Perceived enjoyment has a positive correlation with attitude and self-efficacy. This study provides empirical facts that support and contradict previous relevant studies on the technology acceptance on attitude and self-efficacy in using augmented reality technology for language learning. The results of the study also contribute ideas on how technology can be anchored not only from technological but also from cognitive and affective perspectives as well.

Keywords: technology acceptance; augmented reality; attitude; self-efficacy

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The emergence of technology can accelerate language learning. At the same time, learners can have resistance to new technology in terms of adoption for learning (Álvarez-Marín et al., 2021). Many new technologies are varied and unpredictable with their technological innovations. Fascinating choices of emerging technology to assist language learning activities may be overwhelming (Kessler, 2018). Therefore, analyzing the factors regarding the acceptance of technology is crucial.

One of the current technologies in language learning is augmented reality technology (AR). There are ample augmented reality applications designed to facilitate learning based on the learners' characteristics and abilities in language learning such as AR gaming for learning (Zuo et al., 2022) and speech-altered augmented reality as a foreign language learning tool (Che Dalim et al., 2020). Yet, the actual system use as the end-point should be examined as the behavioural intention of the learners is the key factor to use the technology. The technology acceptance model (TAM) should be modelled to describe how the learners accept and use the technology. Technology Acceptance Model (TAM; Davis, 1989) is one influential model with two principal factors affecting someone's specific purpose to use technology, namely perceived usefulness and perceived ease of use (Charness & Boot, 2016). Reciprocally, perceived enjoyment is inseparable as the reflection of learners' experience in perceived ease of use; thus it can be referred as a determinant concept for motivating learners to use the technology (Venkatesh, 2015).

The first predicting factor of how learners accept the technology for their learning is perceived usefulness. According to Davis (1989), perceived usefulness refers to the extent to which a person conceives that utilizing a certain technology would improve his or her learning. This variable can predict the continuous intention of language learners to technology application in language learning (Wang et al., 2022). It implies that how learners decide to use or not to use the technology is resulted from the extent they are confident the technology can assist better performance for their learning.

The second predictor in the technology acceptance is perceived ease of use. Perceived ease of use refers to the point to which a person conceives that using a particular system would be free of effort (Davis et al., 2020). Perceived ease of use underpins the learners' expectation to put less effort when using the technology for their learning (Al-Gahtani, 2016).

Another subsequent element in the technology acceptance is perceived enjoyment. Perceived enjoyment is defined as the point to which the action using a specific technology is perceived to be enjoyable, aside from any performance implication resulting from technology use (Venkatesh, 2015). It is similar to intrinsic motivation that naturally directs performance from the learners, as theorized by Davis et al. (2020).

The technology acceptance in this study focused on a marker-based augmented reality application called augmented reality based on content-language integrated learning for learners in learning English especially in the reading activity. The attributes of the technology acceptance enlisted are perceived usefulness, perceived ease of use, and perceived enjoyment. Other variables of the study are the attitude and self-efficacy of the learners who learn English at the tertiary level.

As one latest innovative technology, augmented reality can contribute to new opportunities in educational settings (Erbaş & Demirel, 2019). Augmented reality combines aspects of ubiquitous, tangible and social computing, which provides technological affordance with an interactive point of view (Alzahrani, 2020). Augmented reality can be vastly mediated in diverse technology such as web and android-based applications. It is believed that augmented reality for language learning can posit a brand new model, progressive and innovative multimedia learning ambience due to the interaction between virtual materials and physical scenes (Chen et al., 2020). A language learning atmosphere with augmented reality can produce immersive and rich teaching and learning processes (Cai et al., 2022).

Empirical evidence depicts that reading with augmented reality technology can explore learners' motivation and attitude based on the cognitive load (Cheng, 2017) and help learners achieve an advanced level of reading savvy and cognitive discovery permanency (Bursali & Yilmaz, 2019). However, the integration of augmented reality cannot merely rely on technical factors. Attitude and self-efficacy as cognitive, affective, and behavioural attributes also play an influential factor in determining success in language learning. Oz et al. (2015) proved that the inquiry of attitude factor in the nature of using technology for language learning could improve the language learning process and outcome.

According to Getie (2020), attitude is the dimension of emotional engagement that influences behavior, inner mood, and learning. This is a key factor that enables language educators and learners to acknowledge because it can influence second language acquisition. Language attitude can be a predictor that affects students' manner in learning the language, including learner personality (Getie, 2020). Learners with strong beliefs can attain a positive and valued outcome as the positive attitude propels the behaviour (Oz et al., 2015).

Learners' attitudes regarding their skills and knowledge in language learning are substantial leading to productive learning practices (Zhang, 2022).

The notion of self-efficacy is popularly known as the perspicacity of potentialities on how the learners perceived the level of difficulty and degree of confidence to perform the task. Self-efficacy refers to learner' experiences of worth to improved and successful performance and capability (Panadero et al., 2017). Self-efficacy foci emphasize learners' belief that their capability to be successful in applying strategies that entail a high level of self-efficacy will lead to remarkable achievement in language learning (Cong & Li, 2022). When learners acquire self-confidence with favourable performance, they assume to gain successful performance in their learning (Nguyen et al., 2022).

Previous relevant studies showed a positive implication on perceived usefulness and attitude, respectively on technology disposition and innovation for engineering students (Álvarez-Marín et al., 2021; Pan, 2020). In the same vein, augmented reality application could increase students' interest, attitude, and willingness in a reading activity in English as a foreign language (EFL) class settings (Ebadi & Ashrafabadi, 2022). Augmented reality as emerging technology also has a great potential to enhance language learning, particularly in learners' performance, motivation, effectiveness in the classroom, and digital technology and language pedagogy (Scrivner et al., 2017). An empirical study by Lai et al. (2019) showed that learners' achievement in the reading competence domain and motivations gained significantly with augmented reality-based reading.

To address the gap, this current study investigates the technology acceptance model based on the implementation of augmented reality designed based on content language integrated learning for reading activity in English for Specific Purpose (ESP) classes at an Indonesian university. The AR application was designed for teaching English in Non-English Department based on a convergent dual focus: content and language. The AR application needs investigation in terms of perceived usefulness, perceived ease of use, and perceived enjoyment. Most importantly, the study elicited the cognitive factors of learning a foreign language such attitude and self-efficacy of the learners for continuous and sustainable use.

Regarding the preceded ideas, this study aims to achieve the following objectives: examine if perceived usefulness affects the attitude and self-efficacy of the learners in using augmented reality in the reading activity, examine if perceived ease of use affects the attitude and self-efficacy of the learners in using augmented reality in the reading activity, examine if perceived enjoyment affects the attitude and self-efficacy of the learners in using augmented reality in the reading activity, examine if perceived usefulness affects self-efficacy mediated by attitude, examine if perceived ease of use affects self-efficacy mediated by

attitude, examine if perceived enjoyment affects self-efficacy mediated by attitude, and formulate a significant model using structural equation modelling.

Several theoretical assumptions were taken as considerations before formulating the hypothesis. The first is the measurement of the exogenous variables such as perceived usefulness, perceived ease of use, perceived enjoyment, and two endogenous variables, namely: attitude and self-efficacy. The second is the sample size which covers the total population of the learners who experienced AR application in learning English. The last one is the measurement of the causal linkage of variables in this study.

The formulated hypotheses are as follows: hypothesis 1 (H1): perceived usefulness will have a significant effect on attitude of the learners in using augmented reality in reading activity, hypothesis 2 (H2): perceived usefulness will have a significant effect on self-efficacy of the learners in using augmented reality in reading activity, hypothesis 3 (H3): perceived ease of use will have a significant effect on attitude of the learners in using augmented reality in reading activity, hypothesis 4 (H4): perceived ease of use will have a significant effect on self-efficacy of the learners in using augmented reality in reading activity, hypothesis 5 (H5): perceived enjoyment will have a significant effect on attitude of the learners in using augmented reality in reading activity, hypothesis 6 (H6): perceived enjoyment will have a significant effect on self-efficacy of the learners in using augmented reality in reading activity. hypothesis 7 (H7): perceived usefulness will have a significant effect on self-efficacy mediated by attitude, hypothesis 8 (H8): perceived ease of use will have a significant effect on self-efficacy mediated by attitude, and hypothesis 9 (H9): perceived enjoyment will have a significant effect on self-efficacy mediated by attitude

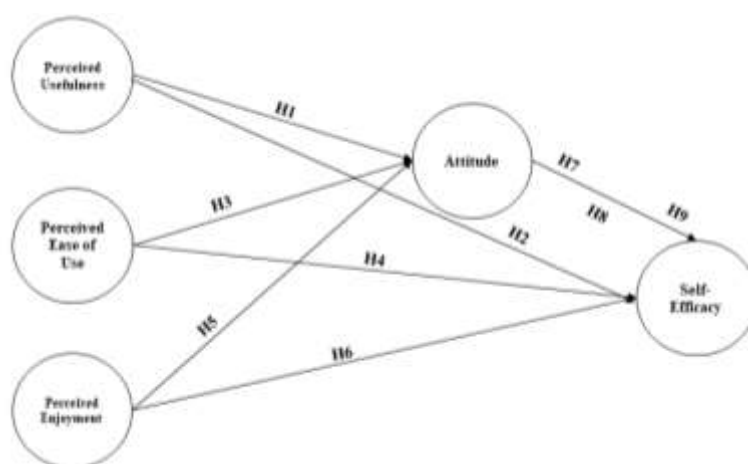


Figure 1. Proposed Model

METHOD

This study used a non-experimental, analytic survey research design to test the proposed equation modelling and the effects of perceived usefulness, perceived ease of use, perceived enjoyment, attitude, and self-efficacy of the learners in using augmented reality application in learning English.

This study used a non-randomized convenience sampling method using snowball sampling with the study inclusion limited to the learners at English for Specific Purposes in Non-English Department at an Indonesian university. The study has 257 respondents. The students were the second-semester students of English for Specific (ESP) class at Non-English Department at one private university in Indonesia. They were inclusively selected as they experienced using augmented reality based-reading applications as assisted technology. The learners employed are those who experienced augmented reality application in reading activity at ESP class for one semester. After having experienced augmented reality in two consecutive meetings in two weeks intervals, they were asked to fill in the questionnaire to posit their ideas regarding its implementation in the end of the final meeting.

Questionnaires are employed to investigate the impact of three exogenous variables: perceived usefulness, perceived ease of use, perceived enjoyment, and two endogenous variables, namely: attitude and self-efficacy of the learners in using augmented reality applications in learning English. Perceived Usefulness (PU) consists of a 10-item survey, Perceived Ease of Use (PEOU) consists of a 5-item survey, Perceived Enjoyment (PE) with a 5-item survey, Attitude (A) consists of a 5-item survey and Self-Efficacy (SE) consists of a 5-item survey. All variables use Likert-scale criteria: strongly agree (5), agree (4), neutral (3), disagree (2), and strongly disagree (1). The validity and reliability are established on quality criteria: convergent and discriminant validity and composite reliability. Valid criteria are based on average variant extracted (AVE) > 0,05 and outer loading > 0,07. Reliable criteria are based on Cronbach's alpha > 0,06 and composite reliability > 0,07 (Hair et al., 2017).

For data analysis, the study used Microsoft's Excel program to tabulate the item questionnaire from Google Forms. Structural equation modelling (SEM) is used to examine the conceptual model of the effect of perceived usefulness, perceived ease of use, perceived enjoyment, and attitude and self-efficacy. The study used Partial Least Square structural equation modelling (PLS-SEM) with SmartPLS with a P-value of < 0,05 to determine the effects of the significant findings (Hair et al., 2017).

FINDINGS

To answer the stated objectives of the study, the first early step was to determine the validity and reliability of the questionnaire items. As the outer loadings of each indicator of both exogenous and endogenous variables are greater than 0.7, the validity requirement is fulfilled for each factor requirement of perceived usefulness, perceived ease of use, perceived enjoyment and attitude and self-efficacy as well. Initially, the indicators of perceived usefulness consisted of 10 items of questionnaires, but six were omitted to ensure the validity of running the validity test.

Table 1. Outer Loadings

	Attitude	Perceived Ease of Use	Perceived Enjoyment	Perceived Usefulness	Self- Efficacy
AT_1	0.765				
AT_2	0.845				
AT_3	0.869				
AT_4	0.862				
PEOU_1		0.835			
PEOU_2		0.831			
PEOU_3		0.824			
PEOU_4		0.754			
PEOU_5		0.823			
PE_1			0.758		
PE_2			0.802		
PE_3			0.795		
PE_4			0.887		
PE_5			0.703		
PU_1				0.802	
PU_2				0.803	
PU_3				0.747	
PU_4				0.743	
SE_1					0.800
SE_2					0.744
SE_3					0.762
SE_4					0.835
SE_5					0.762

To ensure the internal consistency of scale items of the variables, the construct reliability and validity were assessed. Based on the output of the average variance extracted (AVE), the values were higher than $> 0,05$. All items of variables are classified as valid for discriminant validity. For robust analytic research findings, the reliability was examined based on Cronbach's Alpha $> 0,06$ and composite reliability $> 0,07$. All variables are desirable to be reliable based

on Table 2. Table 2 illustrates indicators of valid and reliable measures of constructs observed in this study.

Table 2. Construct Reliability and Validity

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Attitude	0.856	0.861	0.903	0.699
Perceived Ease of Use	0.873	0.878	0.907	0.663
Perceived Enjoyment	0.849	0.859	0.893	0.626
Perceived Usefulness	0.793	0.822	0.857	0.599
Self-Efficacy	0.840	0.841	0.997	0.610

The next statistical measure was R Square to examine the proportion of the variance of the endogenous variables, namely, attitude and self-efficacy. It is presented to provide an estimate of the relationships among variables as well as to examine the predictions of the date. Attitude could be considered relatively low with R Square value of 0.481, while self-efficacy qualifies as relatively good with R Square value of 0.749. Both attitude and self-efficacy were determined by perceived usefulness, perceived ease of use, and perceived enjoyment. Based on R square, the attitude was slightly less influenced than self-efficacy because the value of interpreted R square has a moderate value, while self-efficacy has a strong effect as its value is above 0.7.

Table 3. R Square

	R Square	R Square Adjusted
Attitude	0.481	0.465
Self-Efficacy	0.749	0.738

The linear regression weights must be tested to examine the causal linkage or correlation between exogenous and endogenous variables. The effects of significant findings are based on a P-value of < 0.05 (Hair et al., 2017). A P-value shows the differences of the sample mean from the groups whether it can equal or extreme than the observed value. From the P Values, perceived usefulness has no statistically significant effect on attitude (0.964) but has a significant effect on self-efficacy (0.043). Similarly, perceived ease of use has no significant effects on self-efficacy (0.361) while perceived enjoyment has significant effects on attitude (0.000). As an endogenous variable, the attitude has a significant effect on self-efficacy (0.000).

Table 4. Path Coefficients

	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values
Perceived Ease of Use -> Attitude	0.415	0.413	0.085	4.888	0.000
Perceived Ease of Use -> Self-Efficacy	0.077	0.067	0.084	0.914	0.361
Perceived Enjoyment -> Attitude	0.329	0.327	0.094	3.515	0.000
Perceived Enjoyment -> Self-Efficacy	0.169	0.178	0.082	2.068	0.039
Perceived Usefulness -> Attitude	0.005	0.007	0.100	0.045	0.964
Perceived Usefulness -> Self-Efficacy	0.136	0.138	0.067	2.028	0.043

The total effects can be broken into two parts, namely indirect and direct effects. Specific indirect effects show the mediation effect from exogenous variables, namely perceived usefulness, perceived ease of use, and perceived enjoyment, and endogenous variables, namely, attitude and self-efficacy. Perceived usefulness has no significant effect on self-efficacy mediated by the attitude with P-Value (0.965). While perceived ease of use has a significant effect on self-efficacy mediated by the attitude with P-Value (0.000). In the same vein, perceived enjoyment has a significant effect on self-efficacy mediated by the attitude with P-Value (0.001).

Table 5. Specific Indirect Effects

	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values
Perceived Usefulness -> Attitude -> Self-Efficacy	0.003	0.003	0.069	0.044	0.965
Perceived Ease of Use -> Attitude -> Self-Efficacy	0.278	0.276	0.061	4.544	0.000
Perceived Enjoyment -> Attitude -> Self-Efficacy	0.221	0.219	0.069	3.202	0.001

In this analytic research, the total extent to which endogenous variables and the predictors as exogenous variables were examined. Statistically, perceived usefulness has no significant effect on attitude (0.964) and self-efficacy (0.143). Perceived ease of use has a significant effect on attitude (0.000), and self-efficacy (0.001). Additionally, perceived enjoyment has a significant effect on attitude (0.000) and self-efficacy (0.000). In the similar manner, attitude has a significant effect on self-efficacy (0.000).

Table 6. Total Effects

	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values
Perceived Ease of Use -> Attitude	0.414	0.413	0.085	4.888	0.000
Perceived Ease of Use -> Self-Efficacy	0.355	0.342	0.104	3.427	0.001
Perceived Enjoyment -> Attitude	0.329	0.327	0.094	3.515	0.000
Perceived Enjoyment -> Self-Efficacy	0.389	0.398	0.103	3.785	0.000
Perceived Usefulness -> Attitude	0.005	0.007	0.100	0.045	0.964
Perceived Usefulness -> Self-Efficacy	0.139	0.141	0.095	1.467	0.143

The ultimate section of this analysis is referring to the standardized root mean square residual (SRMR) as a measure of model criterion. It is used as a measure of goodness to avoid the errors of model specification (Henseler et al., 2014). The value of SRMR shows that 0.077 is less than 0.10 which means that the model has fulfilled the goodness of fit measure (Henseler et al., 2014; Hair et al., 2017).

Table 7. Model_Fit

	Saturated Model	Estimated Model
SRMR	0.077	0.077
d_ULS	1.655	1.655
d_G	0.842	0.842
Chi-Square	426.716	426.716
NFI	0.720	0.720

The following figure is the assembled bootstrapping which includes outer loadings, path coefficient, specific indirect effects, and total effects on pre-assumed causal correlation. Figure 2 illustrates the structural equation model after estimation.

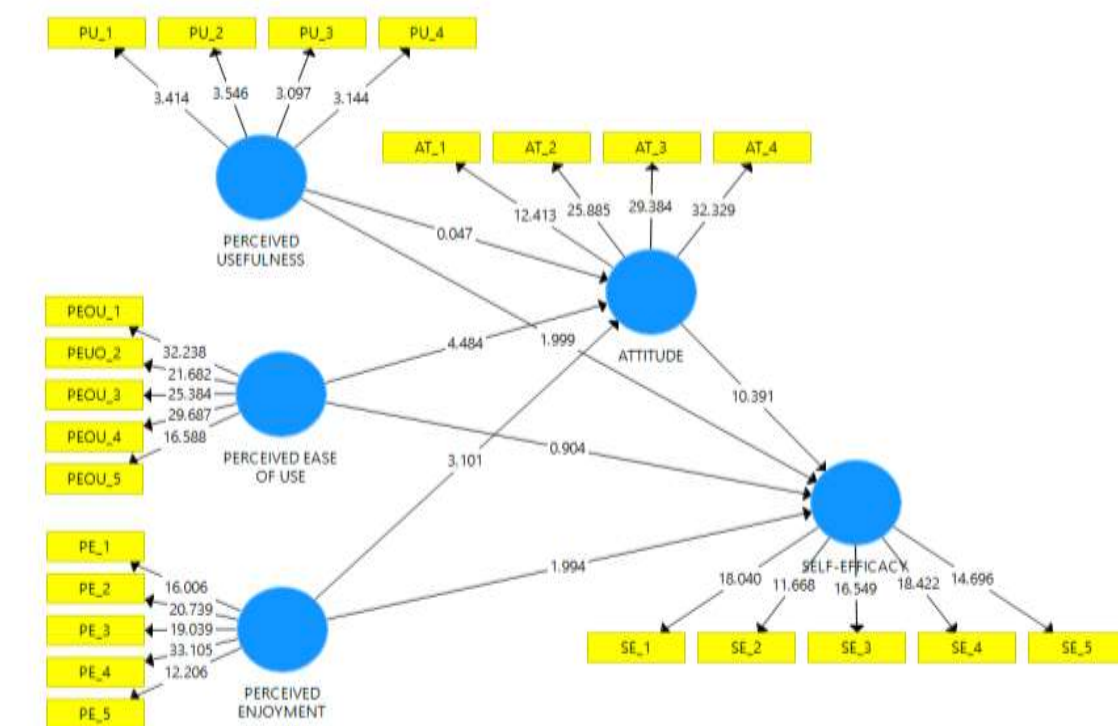


Figure 2. The Formulated Structural Equation Model

DISCUSSION

This study examines the technology acceptance i.e. perceived usefulness, perceived ease of use (Davis et al., 2020) and reciprocally perceived enjoyment (Venkatesh, 2015). All hypotheses were accepted, except the first and the second hypothesis. Regarding the results illustrated in Table 6, it can be seen that there is no statistically significant effect of perceived usefulness on the attitude of the learners as can be noticed in the P-value ($0.964 < 0.005$). Although, they have a positive correlation as in Table 3. This study revealed that perceived usefulness is not a significant predicting element on the learners' attitude to use augmented reality for their English language learning. In the context of this study, the learners with low proficiency skills and homogenous abilities are prone to disregard perceived usefulness that relates to the performance improvement (Yulian et al., 2022). Another predictor namely perceived enjoyment plays influential factor how the learners accept the technology for their learning. It is in accordance with Pan (2020) that attitude in the technology acceptance model has an affective factor as an intervening variable. The findings also corroborated with a previous study by Alfadda & Mahdi (2021) that there is a robust correlation of self-efficacy with the technology acceptance model predicting factors (perceived usefulness, perceived ease of use, and perceived enjoyment) to the learners when adopting technology in language learning. Yet, their study

proved that perceived usefulness has a considerable and strong correlation with attitude which contradicts the findings of this study.

Perceived enjoyment in the scope of this study replicated a previous empirical study that the learners' perspective on enjoyment correlated positively with self-efficacy, but for the learners who have a major in the English department (Kassem, 2021). In the case of the TAM instruments particularly for perceived enjoyment, it is comparable to the research findings by Cabero-Almenara et al. (2019) who revealed that perceived enjoyment has positively contributed impact on academic performance mediated by augmented reality technology. Consistent with previous study Zhou et al. (2022), perceived enjoyment was identified as effective determinant of learners' motivation to utilize the platform. Educators can attempt to engage the learners with activities technology (herewith augmented reality) so that they can perceive enjoyment and pleasure to interact with learners and to focus on interaction (Esteban-Millat et al., 2018).

The findings of the study can also be corroborated by some previous studies. Related literature has shown that language learners have a positive attitude towards technology use in language learning. Cheng (2017), for example, described that learners have positive attitudes toward reading books with augmented reality based on perceived control and perceived usefulness. Álvarez-Marín et al. (2021) conceptualized a model of technology acceptance model with subjective standards, technology affirmation, technology innovation, and attitude. This current study extends the previously proposed model of technology acceptance model that affects attitude and self-efficacy reciprocally in the learners' language learning, particularly in the reading activity with augmented reality. Moreover, a relevant study reported that the easiness of augmented reality can provide entertainment for the students, improve reading comprehension as well as reading attitude and enhance students' academic development (Çetinkaya et al., 2021). It is in the same vein as another study by Wedyan et al. (2022) that augmented reality in language learning can also reduce learners' anxiety in language learning and boost their creativity so that learners have a positive attitude using augmented reality for English language learning.

This study has some implications for language educators who utilize technology for language learning. In order to improve the quality of language learning mediated by technology such as augmented reality, language educators should emphasize a comprehensive predicting factor in technology integration in language classrooms. Apart from the technical factors using the technology, other determinants in language learning are worth considering particularly how the technology can reinforce the motivation and attitude of the learners to use the technology. Attitude and self-efficacy as cognitive, affective, and behavioural

attributes also play an influential factor in determining success in language learning.

CONCLUSION

This study examines the effect of the technology acceptance, namely perceived usefulness, perceived ease of use by Davis et al. (2020), and perceived enjoyment by Venkatesh (2015) on attitude and self-efficacy in the use of augmented reality application-based reading activity of the learners in learning English. First, the linear regression of the path coefficient illustrates that perceived usefulness has no significant effect on attitude and self-efficacy, while perceived ease of use and perceived enjoyment have significant effects on attitude and self-efficacy. Second, the finding underpins the specific indirect effects mediated by self-efficacy. It replicated the causal linkage that perceived usefulness has no a significant effect on self-efficacy mediated by attitude. In contrast, both perceived ease of use and perceived enjoyment have significant effect on self-efficacy mediated by attitude. Third, as exogenous variable, attitude has significant effect of self-efficacy on the use of augmented reality technology. The last is examining the model (fit) criterion referred to standardized root mean square residual (SRMR). The value of SRMR shows that the model is fit for the proposed model and observed correlation. The main purpose of this study is to examine the effects of technology acceptance of the integration of technology in language learning with attitude and self-efficacy as the underlying non technological factors. The comprehensive implication is that understanding these factors can help language teachers to identify and select the relevant pedagogical strategies when implementing technology for language learning particularly for those who learn English as a foreign language. The future inquiry can be extended in bigger scope with larger sample size to leap robustness understanding on technology acceptance model in language learning. Future research may also enrich the effect of intervening and moderating variables in using augmented reality for language classrooms for example with the phenomenological case.

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