

# Technology Acceptance Model on Augmented Reality-Based Reading Application to Attitude and Self-Efficacy of EFL Learners

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## Technology Acceptance Model on Augmented Reality-Based Reading Application to Attitude and Self-Efficacy of EFL Learners

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### Abstract

This study aimed to examine the effects of the technology acceptance model on augmented reality-based reading application to attitude and self-efficacy of EFL learners and modelled the direct and indirect effects using structural equation modelling. An augmented reality application based on content language integrated learning was designed to probe the effect of the technology acceptance model on attitude and self-efficacy. A theoretical model was hypothesized by employing 257 EFL learners as the sample. The study proves that perceived usefulness has no significant effect on attitude and self-efficacy, while perceived ease of use and enjoyment have a positive predictive correlation on attitude and self-efficacy. This study provides empirical facts that support and contradict previous relevant studies on the technology acceptance model on attitude and self-efficacy in using augmented reality for language learning. The results of the study also contribute ideas on how technology can be anchored not only from technological perspectives but also from cognitive and affective perspectives as well.

**Keywords:** TAM; augmented reality; attitude; self-efficacy (3-5 keywords)

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The emergence of information, communication, digital, and multimedia 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, examining the factors affecting the acceptance of technology is crucial.

One of the current technologies in language learning is augmented reality technology. There are ample augmented reality applications designed to facilitate learning based on the learners' characteristics and abilities in language learning. 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 intention 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 a determinant concept for motivating learners to use the technology (Venkatesh, 2000).

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 degree to which a person conceives that utilizing a particular technology would enhance his or her job performance. 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 due to the extent they are confident the technology can assist better performance for their learning.

The second predictor in the technology acceptance model coined by Davis (1989) is perceived ease of use. Perceived ease of use refers to "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989). Perceived ease of use underpins the learners' expectation to put less effort when using the technology for their learning (Chang et al., 2012).

Another subsequent element in the technology acceptance model is perceived enjoyment. Perceived enjoyment is defined as "the extent to which the activity using a specific technology is perceived to be enjoyable, aside from any performance implication resulting from technology use" (Venkatesh, 2000). It is similar to intrinsic motivation that naturally directs performance from the learners, as theorized by Davis et al. (1992).

The technology acceptance model in this study focused on a marker-based augmented reality application called augmented reality based on content-language integrated learning for EFL learners in the reading activity. The variables of the technology acceptance model enlisted are perceived usefulness, perceived ease of use, and perceived enjoyment. Other variables of the study are the attitude and self-efficacy of EFL learners 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 (Kesim & Ozarslan, 2012). 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 a higher level of reading comprehension and learning permanency (Bursali & Yılmaz, 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 Brown (2000), attitude is the dimension of emotional engagement with combined feelings and relationships among the community. 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 to attain and accomplish action toward performances (Bandura,



1986). 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 impact on perceived usefulness and attitude, respectively, regarding technology disposition and innovation for engineering students (Álvarez-Marín et al., 2021). In the same vein, augmented reality application could increase students' interest, attitude and willingness in a reading activity in 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 experimental 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 study investigates the technology acceptance model based on the implementation of augmented reality 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 with a convergent dual focus: content and language. The AR application needs investigation in terms of perceived usefulness, perceived ease of use, perceived enjoyment, attitude and self-efficacy of the EFL learners for continuous and sustainable use. Based on the preceded ideas, this study aims to achieve the following objectives:

1. Examine if perceived usefulness affects the attitude and self-efficacy of EFL learners in using augmented reality in the reading activity.
2. Examine if perceived ease of use affects the attitude and self-efficacy of EFL learners in using augmented reality in the reading activity.
3. Examine if perceived enjoyment affects the attitude and self-efficacy of EFL learners in using augmented reality in the reading activity.
4. Examine if perceived usefulness affects self-efficacy mediated by attitude
5. Examine if perceived ease of use affects self-efficacy mediated by attitude
6. Examine if perceived enjoyment affects self-efficacy mediated by attitude
7. Formulate a significant model using structural equation modelling.

The formulated hypotheses are as follows:

Hypothesis 1 (H1): Perceived usefulness will have a significant effect on attitude of EFL learners in using augmented reality in reading activity.

Hypothesis 2 (H2): Perceived usefulness will have a significant effect on self-efficacy of EFL learners in using augmented reality in reading activity.

Hypothesis 3 (H3): Perceived ease of Use will have a significant effect on attitude of EFL learners in using augmented reality in reading activity.

Hypothesis 4 (H4): Perceived ease of Use will have a significant effect on self-efficacy of EFL learners in using augmented reality in reading activity.

Hypothesis 5 (H5): Perceived enjoyment will have a significant effect on attitude of EFL learners in using augmented reality in reading activity.

Hypothesis 6 (H6): Perceived enjoyment will have a significant effect on self-efficacy of EFL 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

Hypothesis 9 (H9): Perceived enjoyment will have a significant effect on self-efficacy mediated by attitude

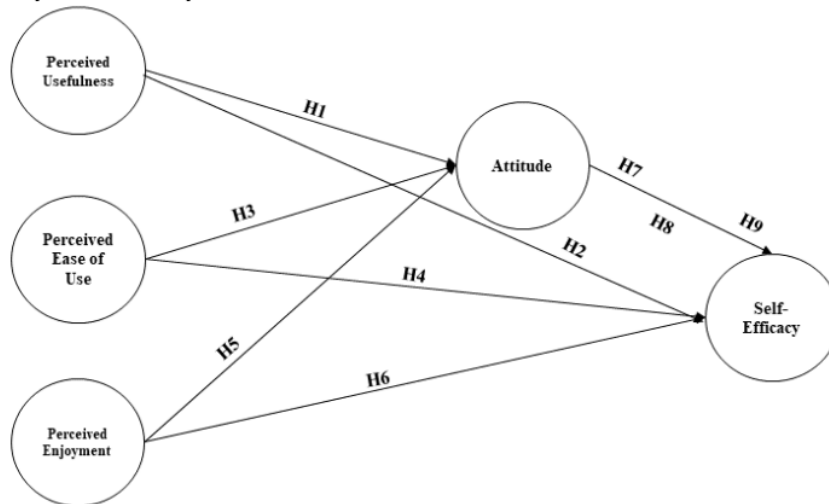


Figure 1. Proposed Model

## METHOD [BOOK ANTIQUA 12 CAPITAL BOLD]

This study employed 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 EFL learners in using augmented reality application.

This study used a non-randomized convenience sampling method using snowball sampling with the study inclusion limited to EFL learners at English for Specific Purposes in Non-English Department at an Indonesian university. The EFL learners employed are those who experienced augmented reality application in reading activity at ESP class for one semester.

Questionnaires are used to investigate the effects of three independent variables: perceived usefulness, perceived ease of use, perceived enjoyment, and two dependent variables, namely: attitude and self-efficacy of EFL learners in using augmented reality applications. **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 5 Likert-scale criteria: strongly agree (5), agree (4), neutral (3), disagree (2), and strongly disagree (1). The validity and reliability are based 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 [BOOK ANTIQUA 12 CAPITAL BOLD]

The survey has 257 respondents. The students were the second-semester students of the 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 majority of them have homogenous English proficiency skills.

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 enjoyment 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 the 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. 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. 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 influenced by perceived usefulness, perceived ease of use, and perceived enjoyment.

<sup>3</sup>  
 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). 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). Both perceived ease of use and perceived enjoyment have significant effects on attitude (0.000) and self-efficacy (0.361). As an endogenous variable, attitude has a significant effect on self-efficacy (0.000).

<sup>3</sup>  
 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 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 significant effects 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
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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). While 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. The value of SRMR shows that 0.077 is less than 0.10 which means that the model has fulfilled goodness of fit measure (Henseler et al., 2014; Hu & Bentler, 1999).

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

## **DISCUSSION [BOOK ANTIQUA 12 CAPITAL BOLD]**

This study examines the technology acceptance model i.e. perceived usefulness, perceived ease of use (Davis, 1989) and reciprocally perceived enjoyment (Venkatesh, 2000). All hypotheses were accepted, except the first and the second hypothesis. Regarding the results shown in table 6, it can be seen that there is no statistically substantial effect of perceived usefulness on the attitude of EFL learners as can be noticed in the P-value ( $0.964 < 0.005$ ). Although, they have a positive correlation as in Table 3. It means that hypothesis 1 is rejected. This study revealed that perceived usefulness is not a significant predicting factor on EFL learners' attitude to use augmented reality for their learning. EFL learners with low proficiency skills and homogenous abilities are prone to disregard perceived usefulness that relates to the performance improvement. Other predictors namely perceived ease of use and perceived enjoyment play influential factor how the EFL 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 EFL 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 context of this study replicated a previous study that EFL learners perspective on enjoyment correlated positively with self-efficacy, but for EFL learners who have a major in the English department (M. Kassem, 2021). In the case of the TAM instruments particularly for perceived enjoyment, it is similar 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.

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 students 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 EFL learners' language learning, particularly in the reading activity.

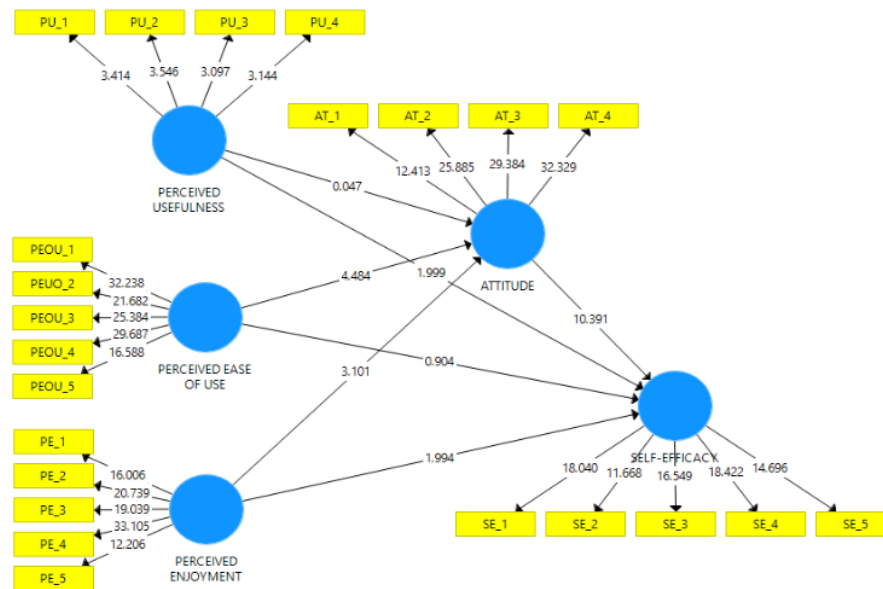


Figure 1. The Formulated Structural Equation Model

## CONCLUSION [BOOK ANTIQUA 12 CAPITAL BOLD]

This study examines the effect of the technology acceptance model, namely perceived usefulness, perceived ease of use by Davis (1989), and perceived enjoyment by Venkatesh (2000) on attitude and self-efficacy in the use of augmented reality application-based reading activity in EFL learners. 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. On the other hand, 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 in terms of using 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 principal objective of this study is to examine the effects of technology acceptance model on 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 study can be extended in bigger scope with larger sample size to leap robustness understanding on technology acceptance model in language learning.

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Appendix 1 (if any)

Appendix 2 (if any)

Appendix 3 (if any)

# Technology Acceptance Model on Augmented Reality-Based Reading Application to Attitude and Self-Efficacy of EFL Learners

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