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PARENTS' INFLUENCE ON THE AUGMENTED REALITY (AR) IN SCIENCE SUBJECT: PRE-SCHOOL EDUCATION LEVEL

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ABSTRACT

Various technologies and e-learning tools have been adopted in the teaching and learning process. This transformation has affected teachers, students, parents, school management and other stakeholders. This research aims to investigate Malaysian parents' awareness, attitudes, social influence and willingness in shaping their perception toward the adoption of augmented reality (AR), embedded in science subjects at the level of pre-school education. In this research, 210 parents with children studying in the kindergartens responded to the questionnaire. The Partial Least Square Structural Equation Modelling (PLS-SEM) is employed in this study to analyze the proposed external factors of the adoption of AR technology in science subjects at pre-school education. The results show that parents' attitudes and their awareness of AR technology positively affect their perception of adopting AR technology.

Keywords: augmented reality; parent influence; pre-school; science subject; technology acceptance model

INTRODUCTION

The evolution of science and information technology has profoundly influenced our daily lives and activities, culminating in the Industrial Revolution 4.0, which has transformed conventional business models and industrial practices. The education industry is no exception to this transformation. Contemporary studies have shown that technology-embedded education has revolutionized the traditional, monotonous teaching and learning process into an innovative and interactive mode that encourages student participation (Shapley et al., 2011). Technology-Enhanced Learning is a conceptual framework suggesting that technology can facilitate the creation of new knowledge through interaction with data in the learning environment. Learning activities require comprehension, and technology provides the necessary tools and environments for this process (Lorusso et al., 2018).

Educational technologies used by stakeholders include multimedia, internet, computers, mobile devices, games, and augmented reality (AR) (Martin et al., 2011). Recently, AR has gained extensive attention and interest from researchers in the education field. Augmented reality (AR) is a technological innovation that allows individuals to perceive virtual objects seamlessly integrated within the real world (Azuma, 1997; Redondo et al., 2020). This technology merges virtual and real objects, providing an unparalleled level of realism. In AR environments, users can interact with virtual objects using real objects, eliminating the need for complex and costly input devices (Wojciechowski et al., 2004). AR environments support various dimensions of learning, such as spatial ability, practical skills, conceptual comprehension, and inquiry-driven activities (Cheng & Tsai, 2016).

Among the stages of student learning, the pre-school period is crucial for children to learn new concepts by discovering and exploring their environment. Holt (1991) stated that a child who is naturally curious and excited about exploring their surroundings is likely to become an innovator in the future. AR applications are readily accessible to enhance pre-school children's cognitive development and education by providing an engaging and unique learning experience that blends the real and virtual worlds (Oranç & Küntay, 2019). Besides conventional teaching and learning processes, Lin et al. (2015) commented that AR technology can increase learning autonomy among students.

Cooperative learning with family involvement enhances the development of science process skills among children, and this cooperative learning should be popularized and included in pre-school education (Ulutaş & Kanak, 2018). Parents' involvement in children's pre-school learning is indisputably important. Nurturing future scientists and innovators is crucial for a country because innovation boosts productivity and economic growth. Parents can help increase technology acceptance in education by encouraging information literacy, offering technological resources, generating learning opportunities, and articulating their values and goals for their children's ICT use (Dalim, Kolivand, Kadhim, Sunar & Billinghurst, 2017).

However, not all parents trust the adoption of AR in education. Lampard, Jurkowski, and Davison (2013) found that parents worried about the negative impacts of technology, such as prolonged screen time affecting children's eyesight and physical activities like exercise, creative play, or social engagement. Breland, Fox, and Horowitz (2013) also discovered that parents are concerned about children's addiction to technology and negative exposures to the internet. In short, parents' perception and willingness to accept new technology are crucial factors affecting the adoption or refusal of AR technology in education. Parents also believe that AR learning could reduce their children's imagination, which stems from traditional text reading. Moreover, the novelty effect may draw children's attention away from reading books and toward AR mobile devices (Cheng, 2017).

Given the importance of parents' perception and willingness in adopting new technology and their involvement in pre-school education, this research aims to reveal the effect of Malaysian parents' attitudes, awareness, and willingness on adopting AR technology in their children's learning in science subjects at the pre-school education level. The contributions of this study are twofold. First, it aims to address the existing research gap by investigating parents' attitudes, awareness, and willingness to embrace AR as a supplementary learning tool for their children. Second, the empirical findings could show whether Malaysian parents generally favor or oppose AR technology adoption for children's study, potentially promoting the development and entrepreneurial opportunities related to the production of AR technology.

LITERATURE REVIEW

According to past studies by Rapti, Sapounidis, and Tselegkaridis (2023), Gan and Balakrishnan (2018), Ma et al. (2016), and Lin, Chen, and Chang (2015), AR technology has been found to effectively complement the conventional monotonous teaching and learning process by creating a more engaging and interactive environment in education (Gan & Balakrishnan, 2018; Ma et al., 2016; Shapley et al., 2011). AR technology allows students to seamlessly combine virtual learning environments with the real world, enhancing their understanding of the topics learned. For instance, medical education has been revolutionized by the implementation of emerging educational technology, enhancing training and practices in emergency medicine (Vozenilek et al., 2004).

Furthermore, Huang, Li, and Fong (2016) found that all stakeholders, such as class educators, principals, ICT educators, and parents, recognized the benefits of AR in facilitating the teaching and learning process and showed a high level of acceptance for this emerging technology. A study by Redondo et al. (2020) evaluating the learning of English as a foreign language for pre-school students using AR revealed a significant enhancement in students' motivation levels and active engagement in class activities compared to students who continued their learning using traditional methods. Vivianti and Ratnawati (2021) reached similar results when they studied pre-school students' learning processes in recognizing vegetables through an AR educational game. Additionally, researchers in Turkey (Düzyol et al., 2022) and Hong Kong (Huang et al., 2016) discovered similar results.

Parent's Attitude

As one of the important stakeholders in the education industry, the roles and perceptions of parents toward the use of emerging technology in education are central research issues in the literature. For instance, Cascales et al. (2013) showed that parents generally favor the use of AR as a learning tool among preschoolers in Spain, as it offers several benefits in terms of enhancing creativity, reading and writing proficiency, and self-learning. Similarly, Papadakis et al. (2019) found that parents in Greece tend to show positive attitudes toward the adoption of smart mobile technologies in their children's education. The research outcomes of Cascales et al. (2013) and Papadakis et al. (2019) are further supported by Deng and Cho (2021), who documented similar results in their study on parents of pre-school children in South Korea.

Genc (2014) conducted a study in Turkey focusing on the utilization of digital tools among pre-school-aged children and found some interesting results. Firstly, Genc found that only 26.56% of parents feel positive toward the use of mobile technology in school, while almost half (46.88%) of the 85 participating parents feel negative about the same statement. The negative sentiment is mainly explained by the potential harms caused by excessive use of mobile gadgets, including adverse effects on eyesight and body posture, and the ability of children to engage in social interactions.

The studies reviewed above show that positive attitudes of parents generally induce favorable perceptions toward new technology.

Social Influence

Social influence can be another external factor affecting parents' overall perception of AR technology. Social influence refers to the ways in which people's attitudes, beliefs, behaviors, and emotions can be shaped by the presence or actions of others in a social context (Venkatesh et al., 2003). Many studies have examined the role of social influence in shaping perceptions and behaviors regarding emerging technology (Yuan et al., 2015; Sharma et al., 2015; Alzeban, 2016; Tarhini et al., 2017). However, the potential impact of social influence on parents' perceptions of AR technology has been relatively less discussed.

Social influence can manifest in various forms, ranging from indirect, subtle persuasion to direct pressure (Venkatesh et al., 2003). The direct influence of social factors on behavioral tendencies is supported by the idea that individuals may be swayed by the opinions of others, leading them to adopt specific behaviors even against their own preferences. This may be particularly relevant in the context of AR technology adoption, as AR is often perceived as a type of influential technology rather than purely utilitarian technology (Saprikis et al., 2020). Therefore, this study hypothesizes that social influence is a significant factor in shaping parents' overall perceptions of AR technology.

Parents' Awareness

The potential role of parents' awareness of AR technology in pre-school education is also limited. Genc (2014) partly discusses the potential influence of parents' awareness of a particular technology on their overall perception of the same technology. The author shows that most participating parents who expressed negative sentiments toward the use of mobile technology in schools failed to provide satisfactory reasons to support their perceptions. Similarly, Papadakis et al. (2019) found that parents' positive attitudes are dependent on their educational background and age, with younger and relatively well-educated parents showing more favorability.

More recently, Kingston and Paulraj (2024) found that personal awareness significantly influences attitudes towards eco-friendly packaging. Therefore, if parents are aware of the AR elements in their children's learning, they are likely to have a positive attitude toward these AR elements in their children's education.

THEORETICAL FRAMEWORK

There are several prominent theoretical approaches related to the intention to adopt technologies in education, namely the Diffusion of Innovation (DOI) Model by Everett Rogers (1962), the Unified

Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh, Morris, Davis, and Davis (2003), and the Technology Acceptance Model (TAM) by Davis (1986).

The DOI model explains the passage of a new idea through five stages of adoption by different individuals. These stages include innovators at the early stage, followed by early adopters, the early majority, the late majority, and finally, laggards (Rogers, 1962). DOI also focuses on how technology spreads through cultures and has been widely employed across disciplines such as public health, corporate sectors, and media to examine the level of innovation adoption among different individuals (Iqbal & Zahidie, 2022). Although DOI provides a broad view of the innovation adoption process, it can be complex to apply and may overlook decision-making at the micro level.

The UTAUT model, developed by Venkatesh et al. (2003), predicts user behavior in accepting and using technology or systems. This model focuses on four constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions. Performance expectancy examines the perceived usefulness of the technology, effort expectancy refers to the perceived ease of use, social influence refers to the degree to which individuals believe important others think they should use the technology, and facilitating conditions refer to the belief that there are technical resources to support the technology's use. UTAUT also includes moderating variables such as gender, experience, and voluntariness of use.

TAM focuses on how users accept and use new technology and systems, including two core constructs: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). PU and PEOU are similar to performance expectancy and effort expectancy, respectively, in UTAUT.

Upon reviewing the DOI, UTAUT, and TAM models, it can be summarized that DOI provides a macro-level view of the spread of innovation adoption by categorizing adopters into five stages. UTAUT offers a comprehensive framework that includes attributes and moderating variables influencing technology acceptance and use at the individual level. In contrast, TAM is a simpler model than UTAUT and helps explain users' perceptions of usefulness and ease of use of specific technology or systems and their acceptance of said technology. Although UTAUT includes social influence as a main variable, it lacks an attitude variable, which is considered a factor that might impact the behavioral intention of using a particular technology. Therefore, researchers reveal that TAM is the most influential model that suits the purpose of this research.

Technology Acceptance Model (TAM)

This study employs the Technology Acceptance Model (TAM) to explain parents' awareness and intention to incorporate AR as an augmented teaching aid over time. Based on the initial TAM shown in Figure 1, the external variable is the indicator contributing to the attitude toward using a new technology. Perceived usefulness and perceived ease of use might mediate the effect of external variables on the attitude toward using a new technology. Further investigation will extend from "attitude toward using" to "behavioral intention to use" the technology and ultimately to "actual behavior" upon using the technology.

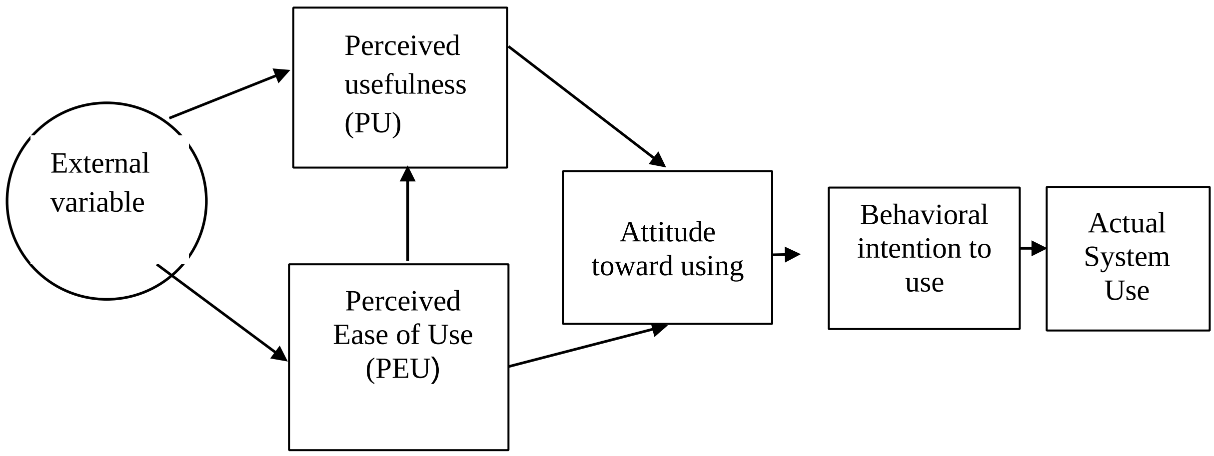
Perceived usefulness (PU) is determined by perceived ease of use (PEU) and users' belief that the system would enable them to gain positive benefits in the learning process with minimal effort (Davis, 1989). Several studies have extensively investigated PU and PEU and found convincing evidence that both positively influence computer acceptance (Yuen & Ma, 2002; Liaw & Huang, 2003; Lin & Wu, 2004) and the acceptance of electronic Word of Mouth (eWOM) (Mensah, 2020). Caffaro et al. (2020) also proved that PU encouraged farmers in Northwest Italy to adopt technology in their farming.

Additionally, this study focuses on investigating parents' inclination to use AR; therefore, the variable of actual AR system usage will be omitted from this study.

Following a comprehensive review of relevant literature, the research framework and hypotheses of this study are formulated accordingly. Figure 2 below displays the research framework, which is a modified TAM.

Figure 1

Technology Acceptance Model



In this study, the external variables consist of parents' attitude, social influence, and parents' awareness as the indicators to investigate the behavioral inclination of parents towards embracing AR as a future-enhancing teaching aid. Attitude toward using and the actual system use have been excluded from this study. The reason is that the parents' attitude toward adopting AR will be examined under the external variable of parents' awareness.

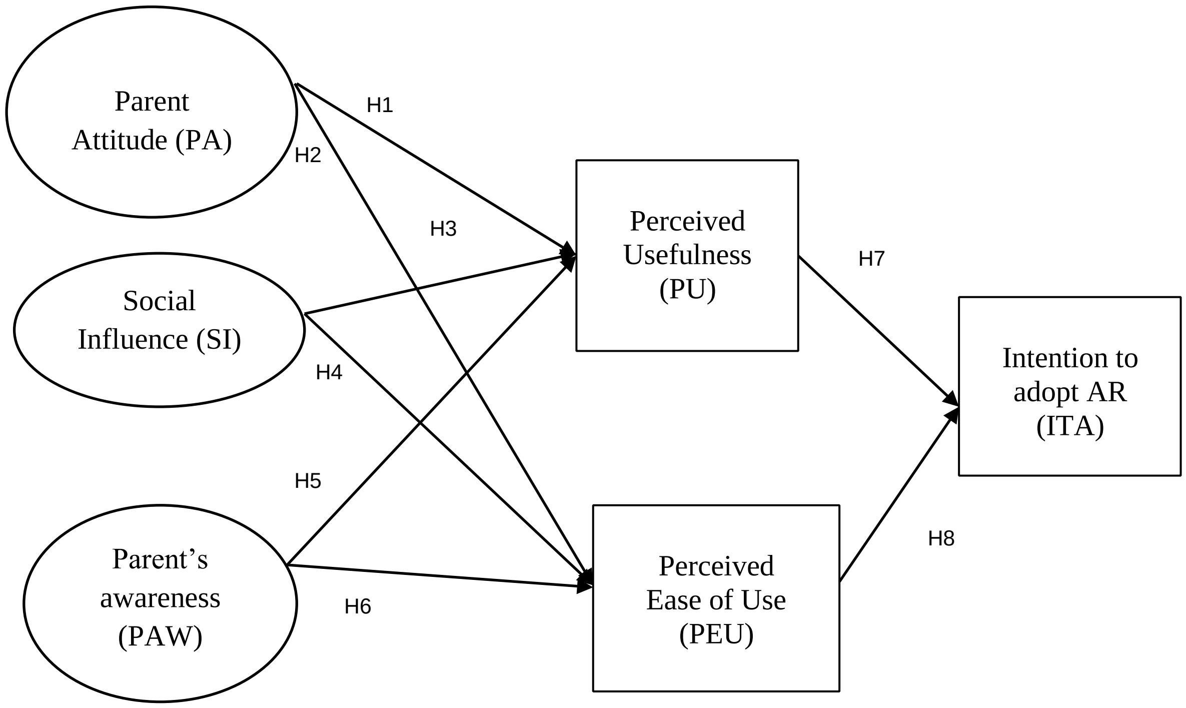
METHODOLOGY

Partial Least Square Structural Equation Modelling (PLS-SEM) will be used to analyze the research hypotheses and estimate the amount of explained variance in latent variables through structural models and inferential analysis. PLS-SEM is particularly relevant in explaining complex cause-effect relationship models between dependent and independent variables.

The participants of this study are parents with dependent children aged 3 to 6 years, as they are potential consumers and users of AR-enhanced learning tools to assist their children's learning. Parents were interviewed, and data were collected through a questionnaire during a Science, Technology, Engineering, and Mathematics education fair held in the Klang Valley. Pilot tests with a sample of 30 respondents were carefully performed to analyze the reliability and validity of the questionnaire instruments. Item modifications to the questionnaire were carried out to meet model-adequacy conditions.

Figure 2

Research framework



During the data collection session, a mini demonstration of AR in science subjects was conducted on-site. As suggested by Wong (2013) and Marcoulides and Saunders (2006), the required sample size is determined by the number of paths pointing towards the latent variables, with a minimum sample size of 84 needed to achieve a statistical power of 80% with a significance level of 5%. According to Anderson and Gerbing (1995), a sample size between 100 and 200 is sufficient for path modeling. A final sample of 210 responses was collected, and their demographic profile is shown in Table 1.

Table 1

Demographic Profile of Respondent

		Frequency	Percent
Gender			
	Female	145	69.0
	Male	65	31.0
Age			
	21 – 30 years old	16	7.6
	31 – 40 years old	94	44.8
	41 – 50 years old	71	33.8
	51 years old and above	29	13.8
Education level			
	primary school or no formal education	26	12.4
	secondary school	28	13.3
	certificate / diploma	24	11.4
	bachelor degree and above	132	62.9
Number of children			
	1	63	30.3
	2	69	33.2
	3	39	18.8
	4 or more	37	17.8
Occupation			
	self - employed	27	12.9
	employed as government servant	104	49.5
	employed as private sector	40	19.1
	housewife	39	18.5

Table 3

Indicator Loadings and Cross-loadings

	Intention to Adopt	Parent Attitude	Parent Awareness	Perceived Ease of Use	Perceived Usefulness	Social Influence
ITA1	**0.934**	0.811	0.776	0.809	0.788	0.470
ITA2	**0.922**	0.768	0.728	0.765	0.760	0.467
ITA3	**0.921**	0.798	0.735	0.806	0.755	0.415
ITA4	**0.952**	0.832	0.783	0.805	0.778	0.437
ITA5	**0.931**	0.798	0.744	0.772	0.758	0.413
PA1	0.771	**0.874**	0.706	0.703	0.705	0.409
PA2	0.765	**0.875**	0.706	0.707	0.696	0.439
PA3	0.741	**0.897**	0.727	0.692	0.721	0.367
PA4	0.795	**0.904**	0.773	0.756	0.752	0.414
PA5	0.689	**0.821**	0.676	0.661	0.701	0.433
PA6	0.769	**0.889**	0.746	0.677	0.772	0.437
PA7	0.749	**0.887**	0.727	0.704	0.726	0.432
PA8	0.716	**0.821**	0.674	0.687	0.692	0.399

PAW1	0.738	0.731	**0.869**	0.697	0.729	0.517
PAW2	0.764	0.773	**0.940**	0.748	0.803	0.482
PAW3	0.763	0.774	**0.935**	0.731	0.780	0.473
PAW4	0.702	0.750	**0.897**	0.694	0.727	0.512
PAW5	0.741	0.757	**0.929**	0.709	0.782	0.487
PAW6	0.739	0.743	**0.929**	0.707	0.789	0.483
PEU1	0.762	0.728	0.702	**0.877**	0.710	0.414
PEU2	0.754	0.730	0.706	**0.926**	0.746	0.474
PEU3	0.732	0.703	0.667	**0.911**	0.719	0.491
PEU4	0.767	0.722	0.732	**0.923**	0.763	0.495
PEU5	0.829	0.764	0.739	**0.927**	0.784	0.483
PEU6	0.806	0.743	0.722	**0.916**	0.767	0.472
PU1	0.801	0.801	0.802	0.770	**0.899**	0.518
PU2	0.720	0.729	0.746	0.717	**0.907**	0.479
PU3	0.755	0.761	0.767	0.747	**0.921**	0.479
PU4	0.736	0.764	0.751	0.731	**0.914**	0.497
PU5	0.746	0.718	0.737	0.719	**0.912**	0.521
PU6	0.715	0.710	0.742	0.727	**0.889**	0.462
PU7	0.737	0.751	0.738	0.761	**0.875**	0.432
PU8	0.708	0.708	0.742	0.721	**0.870**	0.408
SI1	0.418	0.414	0.463	0.499	0.427	**0.724**
SI2	0.400	0.411	0.478	0.429	0.419	**0.760**
SI3	0.352	0.348	0.396	0.389	0.430	**0.867**
SI4	0.377	0.377	0.425	0.398	0.437	**0.894**
SI5	0.391	0.389	0.434	0.422	0.451	**0.883**
SI6	0.425	0.445	0.485	0.442	0.483	**0.889**

Table 4

Fornell and Locker Criterion

	ITA	PA	PAW	PEU	PU	SI
ITA	**0.932**					
PA	0.860	**0.872**				
PAW	0.808	0.823	**0.917**			
PEU	0.850	0.802	0.780	**0.913**		
PU	0.824	0.827	0.839	0.820	**0.899**	
SI	0.473	0.477	0.536	0.516	0.529	**0.839**

Table 5

Heterotrait-Monotrait Ratio of Correlations Criterion

	Intention to Adopt	Parent Attitude	Parent Awareness	Perceived Ease of Use	Perceived Usefulness
Parent Attitude	0.897				
Parent Awareness	**0.840**	0.859			
Perceived Ease of Use	0.883	**0.837**	**0.811**		
Perceived Usefulness	0.854	0.861	0.869	0.851	
Social Influence	**0.502**	**0.509**	**0.571**	**0.549**	**0.561**

Evaluating the Structural Model

The hypotheses and path coefficients have been developed to evaluate the structural equation model using a bootstrapping procedure involving 5000 subsamples with SmartPLS 3.0. Overall, all path coefficients are significant at the 5% level. Based on Table 6, perceived ease of use (PEU) of parents is affected by parents' attitude (0.528), parents' awareness (0.292), and social influence (0.114). Similarly, the perceived usefulness (PU) of parents is affected by parents' attitude (0.429), parents' awareness (0.452), and social influence (0.085).

Table 6

Hypothesis Testing on Path Coefficient

Hypothesis	Path	Path Coefficient	T stat	P-value	Decision
H1	PA -> PEU **	$\beta_1 = 0.528$	6.239	< 0.001	Supported
H2	PAW -> PEU **	$\beta_2 = 0.292$	3.321	0.001	Supported
H3	SI -> PEU *	$\beta_3 = 0.114$	2.402	0.017	Supported
H4	PA -> PU **	$\beta_4 = 0.429$	6.431	< 0.001	Supported
H5	PAW -> PU **	$\beta_5 = 0.452$	6.585	< 0.001	Supported
H6	SI -> PU *	$\beta_6 = 0.085$	2.052	0.041	Supported
H7	PEU -> ITA **	$\beta_7 = 0.567$	8.548	< 0.001	Supported
H8	PU -> ITA **	$\beta_8 = 0.372$	6.111	< 0.001	Supported

Notes. ** significant at 0.01; * significant at 0.05

Predictive Relevance and Effect Size

In general, the model provides a satisfactory level of explanation for the three endogenous variables, with all R^2 values exceeding 70%. From Table 7, 73.8% of the variation in perceived ease of use, 80.8% of the variation in perceived usefulness, and 81.7% of the variation in intention to adopt are explained by the model.

According to Hair et al. (2017), cross-validated redundancy (Q^2) can be used to measure the predictive relevance of the model. As shown in Table 7, the Q^2 value for all endogenous variables is greater than 0.4, confirming the predictive relevance of the model for perceived ease of use, perceived usefulness, and intention to adopt.

Additionally, Table 7 exhibits the effect size (f^2) for each of the exogenous variables. These findings highlight that both parents' attitudes and awareness have medium effects on perceived ease of use and perceived usefulness. On the other hand, social influence has only small effects on parents' perceived ease of use and perceived usefulness. Lastly, parents' perceived ease of use and perceived usefulness have relatively large effects on intention to adopt, indicating that the relationship between these two constructs and the intention to adopt is relatively strong.

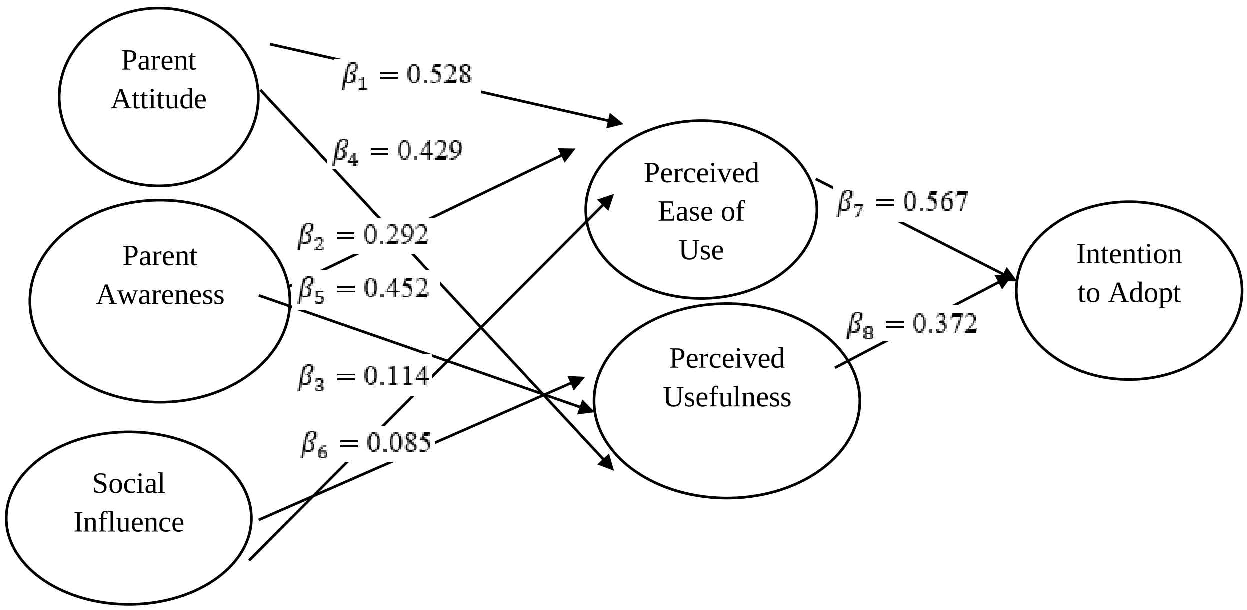
Table 7

Predictive Relevance and Effect Size

Endogenous variables	R - square	Q - square	Exogenous variables	F – square Effect Size
Perceived Ease of Use	0.738	0.404	Parent Attitude	0.247
			Parent Awareness	0.100
			Social Influence	0.030
Perceived Usefulness	0.808	0.747	Parent Attitude	0.237
			Parent Awareness	0.256
			Social Influence	0.025
Intention to Adopt	0.817	0.733	Perceived Ease of Use	0.403
			Perceived Usefulness	0.216

Figure 3

The structural model



Notes. All path coefficients are significant at 1%, except β_6 is significant at 5%

DISCUSSION

Parents' attitudes are found to have a significant effect on both PU and PEU, and these results are consistent with several past studies. Existing evidence suggests that parents who exhibit positive attitudes towards the use of technology are more likely to believe that AR technology is suitable and useful for educational purposes. This finding aligns with several past studies (Chen & Tu, 2018; Deng & Cho, 2021; Eutsler, 2018; Genc, 2014; Papadakis et al., 2019). In most cases, parents' positive attitudes are explained by their belief that the use of AR technology can bring additional benefits to their children during the learning process, as well as the belief that incorporating new technology into daily life is inevitable in the modern era.

Similarly, parents' awareness of AR technology is positively related to their PU and PEU of AR technology in education. The moderately high coefficient (0.452) reveals that parents agree AR is beneficial for their children. Past studies also agree that relatively tech-savvy parents, who are usually younger and better educated than their peers, tend to understand emerging technology better and are more likely to adopt it (Papadakis et al., 2019; Kingston & Paulraj, 2024).

In contrast to parents' attitudes and awareness, social influence is found to have a significant but weak relationship with PU and PEU. This result indicates that parents hold the dominant role in affecting the adoption of AR technology in their children's education compared to the circles of influence of social norms. This result shows because parents are the "first teacher" to children aged 3 to 6. Additionally, parents show more concern about pre-school education as it is the first stage of education that nurtures their children (Cascales et al., 2013; Cheng, 2017; 2019). This finding also suggests that parents' experience and knowledge about the technology are more important in shaping their perception of adopting it.

Regarding the impact of PU and PEU on the intention to adopt AR technology, the results reveal that the effects of parents' PEU and PU are larger, as their path coefficients are higher. These results show that the TAM holds in the context of AR adoption. Also, the significance of PU and PEU is consistent with the empirical evidence of Shen and Eder (2018), except that this study focuses on the perception of the parents of technology users rather than the users' own perception.

However, social influence only affects the intention to adopt through PU. This result is consistent with Tarhini et al. (2017) but not in line with the findings of Chung (2005), Venkatesh and Davis (2000), and Shabbir et al. (2019), who reported a direct correlation between social influence and intention to use technology. Nevertheless, the results support the roles of parents' perceived ease of use and parents' perceived usefulness in adopting AR technology for pre-school education.

CONCLUSION AND IMPLICATIONS

Parents play a critical role in students' informal learning with the aid of technology, especially in the era of the Industrial Revolution 4.0. However, in Malaysia, there is a lack of relevant evidence, particularly concerning parents' opinions on students engaging in learning with cutting-edge technologies such as augmented reality. Consequently, the objective of this study is to examine the perception and behavioral inclination of parents towards the adoption of AR technology for educational purposes for their children. The robust results provide convincing evidence that parents' own attitudes and awareness of AR technology are positively associated with their perception of AR technology, which can subsequently influence their intention to embrace AR technology in informal teaching. Additionally, social factors have a small but significant influence on parents' perspectives on the ease of use and usefulness of AR technology.

The findings of this study offer meaningful insights into parents' viewpoints on AR technology concerning their acceptance of this ubiquitous technology in their children's educational activities. These findings would be useful to stakeholders, including parents, schools, local governments, and the AR industry, in promoting greater integration of AR technology in education, particularly at the pre-school level. Local governments and the AR industry could cooperate to promote greater public awareness of the function and benefits of AR in education. Given the important role of parents' attitudes and awareness of technology in shaping their overall perception, AR developers or marketers might consider promoting AR technology through tech fairs, roadshows, or providing trial usage in collaboration with schools.

Additionally, teachers should be encouraged to employ augmented and mixed reality in the presentation of subject materials, for example in subjects such as general science, history, geography, and arts, to bring a more integrated learning experience to children. Therefore, teachers can assess and expect positive changes in students' performance with the adoption of AR technology in their teaching approach.

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