Parent's Perception towards Robot Tutor in Egyptian Schools

Lamiaa Mostafa

Assistant Professor
Business Information Systems Department
Arab Academy for Science and Technology and Maritime Transport
Alexandria, Egypt

Abstract:

This study aims to understand the perspective of Egyptian parents to use robots tutor for their children in the primary education stages. Many factors affect user decisions to use new technology including the perceived ease of use, perceived usefulness, social influence, security, and Trust. This study is a quantitative research examines intention to use Robot Tutor in Education using Structured Equation Modeling (SEM). An online survey was designed to collect the desired data where the sample size is 1239 survey. The proposed research model was developed based on conducted analysis. The proposed model would help educational institutions to understand the factors that affect using Artificial Intelligence in the education process. The study results showed a significant impact of perceived usefulness, social influence, security and trust and perceived ease of use is not significant.

Keywords: Artificial Intelligent; Robot; Tutor; primary education; Intention to use; Structured Equation Modeling; Egypt.

رؤيا اولياء الامور عند استخدام الروبوت كمدرس في المدارس المصرية

المستخلص:

تهدف هذه الدراسة إلى فهم وجهة نظر أولياء الأمور المصريين بشأن استخدام الروبوتات لتعليم أطفالهم في المرحلة الابتدائية. تؤثر العديد من العوامل على قرارات أولياء الأموربخصوص استخدام التكنولوجيا من عدة نواحي بما في ذلك سهولة الاستخدام المتصورة والفائدة المتصورة والتأثير الاجتماعي والأمن والثقة. هذه دراسة كمية تدرس نية استخدام الروبوتات في التعليم.صُمم استطلاع ونُشر عبر الإنترنت لجمع البيانات المطلوبة وجُمعت اراء من ١٢٣٩ ولي أمر. طُور نموذج البحث المقترح بناءً على التحليل نمذجة المعادلة الهيكلية. سيساعد النموذج المقترح المؤسسات التعليمية على فهم العوامل التي تؤثر على استخدام الذكاء الاصطناعي في عملية التعليم. تثبت نتائج الدراسة أن هناك تأثير كبير على الفائدة المتصورة والتأثير الاجتماعي والأمن والثقة.

الكلمات المفتاحية: الذكاء الاصطناعي. إنسان آلي؛ تدريس؛ تعليم ابتدائي؛ نية للاستخدام؛ نمذجة المعادلة الهيكلية؛ مصر.

1. Introduction

During Covid-19 isolation, all the human activities were digitalized including Education. New application and technologies were introduced to help the teaching and the learning process such as Artificial Intelligence (AI). Robotic teachers have been tested in China and students were happy with the experiment (Robertson, 2021). The use of digital technology including machines and robots has been increasing (Rotman, 2020).

Human beings are interacting via the screen more than the physical communication in which machines became mediators of human connection (Robertson, 2021).

Fields of machine learning and natural language processing (NLP), information systems (IS) are becoming more capable of communicating with humans in natural language (Brendel et al., 2020; Schanke et al., 2021). Applications like chatbot, Facebook Messenger, Apple's Siri and Amazon's Alexa are designed to assist humans on different tasks (Wambsganss et al., 2021), many researchers point out the barriers to communication with Robots and share knowledge (Sukhwal,et al., 2023; Matthews, 2020). To enhance Robots gesture and expression inputs, additional computer vision techniques would be created (Feldhus et al., 2022; Sukhwal,et al., 2023).

Educational robots are used in different fields including education. The most important challenge of this new trend will be to match their.

Social behavior, style, appearance and interaction with the educational demands and the actual users' needs. Neumann (2020), believes that children inter-actions with social robots will enhance student language and communication skills.

In another context, Augmented Reality (AR) and Virtual Reality (VR) technologies can enhance the interaction between participation of the stakeholders and their students while providing a competitive advantage to use such a new technology (Jalowski,et al., 2019).

The paper examines the user intention to use robots in the tutor process. Factors are extracted from previous researchers examined using structured equation modeling. A research model created based on the variables selected from previous research, the model would help educational institutions to be able to adapt the artificial intelligence in the education process and managing the acceptance level of the primary education students and their parents.

This paper contains five major sections. Section one: provides an introduction about the research. Section two: briefly describes the literature review that includes Education, new technologies and factors affecting the intention to use robot tutor. In section three, description of the proposed research model and research hypotheses are the focus, the research methodology including data collection and sample size and survey. Section four is the statistical analysis consists of descriptive analysis, reliability test, Exploratory Factor Analysis and confirmatory factor analysis. Section five represents discussion of the results. Lastly, conclusion, implications of this research, limitation and future work are presented in section six.

2. Literature Review

Education concept is moving around three main perspective: student, content and teacher according to (Friesen, and Osguthorpe, 2018) also known as Pedagogical Triangle. Student satisfaction and learning progress is the main success reason for the education process. Teacher must work on their

relationship with the students to enhance the student learning level. Teacher must have passion to change the student's relation to content effectively also he/she must have the ability to define the important learning parts an emphasis it.

Covid-19 pandemic affected the behavior of the people all over the world. They started to digitalize all the daily activities including work, education, bank, shopping and health activities. People accepted new application and technologies to assist them do daily activities more easily and with less cost.

Asimov (1995) defined robots as industrial product built by engineers for a specific purpose. A robot is a machine that can judge without human input. Robots are used as a teaching and learning tool, they are used to support the learning process in various learning content (Sonderegger, 2022 ;Belpaeme& Tanaka 2021).

Mostafa (2022) aimed to identify the factors affecting Egyptian users of new technologies such as Metaverse. 661 Facebook users answered questionnaire. The results demonstrate that Social Influence, Security, Technology Availability and Trust have a positive significant effect on User Intention to Use such technology. On the other hand, Perceived usefulness and Perceived ease of use have a minor impact on User intention.

Pérez,et al. (2020)highlighted the advantage of physical presence over screen-based or computer-based technologies which enhance learning outcomes and motivation (Belpaeme& Tanaka 2021), however other researchers (Guggemos et al.,

2020; Schulze et al.,2021) pointed out the barriers of using robots tutor such as: low ability to meet the high expectations,high level of technical requirements; not mature enough in terms of a natural interactive conversation.

Guggemos et al. (2020) created a survey for university students in university to understand their acceptance level of social robots for learning purposes. Results had shown that the intention to use them could be predicted and thus increased by determinants (factors) such as improved perceived adaptiveness or social presence of the robot. Sonderegger et al. (2022) designed an interview study to understand perceptive of university students towards robot tutor and concluded that their uses are limited to robots interaction level. In the same context, Sonderegger (2022) aimed to understand how interactive learning with social robots for educational purposes could be enhanced based on literature review. He concluded that there is a research gap to address the process of knowledge transfer between human and Robots. Three factors that engineers can enhance in a robot to be able to teach close to the human is Appearance, Intelligence, Emotional Expression.

Amanatiadis, et al. (2017) tested response inhibition, cognitive flexibility and children's' joint attention when education using interactive social robots. In the same context, Rao and Jalil (2021) tested the teacher's technological acceptance and readiness to implement robotic technology in the teaching and learning process in

Malaysia, they concluded that teachers do not accept the usage of robots due to the high cost and the low interaction level.

Davis et al. (1989) proposed the Technology Acceptance Model (TAM) to predict the acceptance of innovative technologies. The model contains two variables which are perceived ease of use and perceived usefulness. An Extended Technology Acceptance Model (ETAM) was proposed to solve TAM problems including social influence. Venkatesh and Bala (2008) proposed TAM 3that includes trust and security.

This study investigates the factors affecting parent's perspective towards using robot tutor to teach their children in the primary education in Egypt. Different variables are used, including Perceived Ease of Use and Perceived Usefulness (TAM), Social Influence from (ETAM) and Trust, Security (TAM3).

3. Research Methodology

Research Framework and Hypothesis

The following subsections will define each variable and the suggested hypothesis based on the previous work.

The paper aims to understand the behavior intention of the student to accept the Robot tutor. The researcher used Perceived usefulness, Perceived ease of use, Social Influence, Security, and Trust selected from the literature, as shown in Figure 1.Each variable will be described on the following subsections:

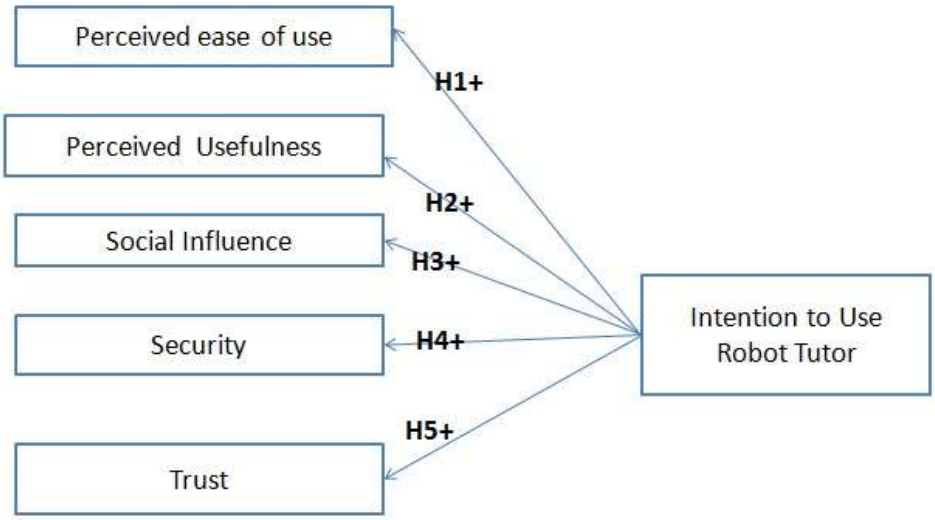

Figure 1. Proposed Research Model

Perceived Ease of Use

Perceived ease of use defined as the level of user's attitude towards a new technology and how much the user perceives that said technology is easy to use (Rao and Jalil, 2021;Casey, et al., 2021).

H1. Perceived Ease of Use has a significant effect on user Intention to use Robot Tutor

Perceived Usefulness

Perceived usefulness is acceptance of the user that the technology may improve their performance (Henningsson et al., 2020 ; Fussell and Truong,2022; Rao and Jalil, 2021).

H2. Perceived Usefulness has a significant effect on Intention to use Robot Tutor

Social Influence

Social influence is the opinion of the people around a person (Photiadis and Papa ,2022; Alsharhan et al., 2022; Rao and Jalil, 2021).

H3. Social influence has a significant effect on Intention to use Robot Tutor

Security

Users may face problems like risk, bugs and hackers while using technology. Security concerns may appear when people are interacting with robots, whichcannot expect their feedback or interaction (Alsharhan et al., 2022). For this reason, Asimov, (1995) created three laws for robots to follow in order to secure human .Asimov's three laws are: Law 1: A robot may not harm a human being, or through inaction, allow a human being to come to harm. Law 2: A robot must obey the orders given to it by human beings except where such orders would conflict with the first law. Law 3: A robot must protect its own existence, as long as such protection does not conflict with the first two laws. Security standards and rules allow users to perform their operations and adopt technologies safely.

H4. Security has a significant effect on Intention to use Robot Tutor.

Trust

Due to Covid-19 pandemic, most people turned into digitalization all their activities and accepting new technology, however Organizations make a great effort to gain their customers trust and loyalty (Velentza,et al., 2021 ;Alsharhan et al., 2022).

H5.Trust has a significant effect on user Intention to use Robot Tutor

User Intention to use Robot Tutor

Applications owners are interested the factors that affect a users decision to use a given application or technology (Rao and Jalil, 2021;Velentza,et al., 2021;Henningsson et al., 2020).

Sample Size

This research sample type is stratified sampling which is one of the sampling methods to be used in social media data collection (Chaudhuri and Stenger , 2005). Stratified sample is the participants who are accessible to the author. As noticed the sample is parents of students in a primary stage of education. Sample was 1239 that represents parents who accept to participate and fill in the questionnaire.

Survey Development

The paper aims to understand the perception of parents about Robot tutor in primary schools in Egypt. A survey strategy

was employed using an online questionnaire. A survey was developed in English using Google Forms.1250 participants were sent by email and Facebook to participate in this survey without knowing their identity (anonyms). The Data collection period lasted for 30 days. Of the1250 Egyptian parent of children in primary schools,1239 responses were valid.

The questionnaire involves all study variables and four demographic information. Twenty-five questions are placed in the questionnaire, and the Likert-type five level scales are employed. The options for each question using points 1 to 5 to represent extremely disagree, disagree, neutral, agree, and extremely agree, respectively. Appendix A represents the questionnaire questions.

Statistical Analysis

The research type is quantitative and the proposed model was constructed based on literature review. The data collection is a survey that was employed using an online Google form. The target population was expressed as parents who have children in a primary stage. Two statistical software, SPSS 25.0and AMOS23.0,were used to measure the proposed model variables relationships. The following tests are described descriptive analysis, reliability test, Exploratory Factor Analysis and the confirmatory factor analysis were conducted.

4. Statistical Analysis and Results

This section describes the four analysis developed to understand the factors effect on user intention to use robot tutor including the following: descriptive analysis, reliability test , Exploratory Factor Analysis and confirmatory factor analysis.

Descriptive Statistics

Considered valid for further analysis after verifying incomplete questionnaire and data. Detailed descriptive statistics of respondents 'characteristics are shown in Table 1.

Table1:Respondents'Profile

Attribute	Category	Frequency	Percent
Age	1	300	24.2%
	2-3	482	38.9%
	More	457	36.8%
Gender	Male	521	42.0%
	Female	718	57.9%
Work	Working	1026	82.8%
	Household	213	17.19%
Salary	Less than 10000	261	21.0%
	10,000-25,000	782	63.1%
	More than 25,000	196	15.8%
Total	**Total**	**1239**	

Exploratory Factor Analysis (EFA)

Reliability of the survey was tested using Cronbach's alpha coefficient. Based on Kannan and Tan (2015) : Cronbach's alpha coefficient showed be at least 70%. Three assumptions were used to examine Exploratory factor(Marsh andHocevar,1985): Kaisers–

Mayesolk in measure greater than 0.5; the minimum value for each factor; considering the sample size, factor loading of 0.50 . After examining the pattern matrix of EFA, it was found that all the items had factor loadings greater than 0.50 as shown on Table 2.

Table2:EFA

Latent Variable	Item	Factor Loading	Composite Reliability CR	Cronbach's alpha	Average Variance Extracted AVE
Perceived Ease of use	PE1	0.775	0.784	0.755	0.765
	PE2	0.718			
	PE3	0.732			
	PE4	0.719			
	PE5	0.771			
Perceived Usefulness	PU1	0.781	0.769	0.801	0.755
	PU2	0.748			
	PU3	0.711			
	PU4	0.792			
Social Influence	SI1	0.961	0.912	0.932	0.914
	SI2	0.989			
Security	S1	0.854	0.876	0.873	0.877
	S2	0.812			
	S3	0.883			
	S4	0.849			
	S5	0.861			
Trust	T1	0.832	0.866	0.878	0.816
	T2	0.847			
	T3	0.812			
Intention to Use Robot Tutor	IU1	0.817	0.861	0.911	0.932
	IU2	0.824			

Conformity Factor Analysis(CFA)

Confirmatory factor analysis (CFA) is a statistical technique that defines the factor structure of the observed variables. The relative Chi-Square for this model was 4.802 that is smaller than 5.0 as recommended by(MarshandHocevar,1985).The comparative fit index (CFI) is 0.953 that greater than threshold recommended by

(Bentler, 1990). The root mean residual (RMR) value was found to be0.033, which is less than 0.08 defined by(Hu andBentler,1998).

Goodness of fit index (GFI) of the model is 0.958, which is more than the recommended value of 0.90 suggested by(Joreskog andSorbom,1993). The adjusted goodness of fit index (AGFI) was found to be 0.879 which matches the threshold recommended by(Anderson and Gerbing, 1984). The root mean square error of approximation (RMSEA) is 0.072 which is also less than the suggested fit of (BrowneandCudeck,1993).Finally, the standardized means square residual (SRMR) is 0.051which is less than 0.035 recommend by (BrowneandCudeck,1993).Table 3 defines the confirmatory factor analysis model fit.

Table3:Confirmatory Factor Analysis Model Fit

Model Fitting Index	Value	Level of Acceptance
C*h*i-square/df	4.802	<5.0
Comparative fit index(CFI)	0.952	>0.90
Root mean residual(RMR)	0.033	<0.08
Goodness of fit index(GFI)	0.958	>0.90
Adjusted goodness of fit index(AGFI)	0.879	>0.85
Root mean square error of approximation(RMSEA)	0.072	<0.08
Standardized means square residual (SRMR)	0.035	<0.08

Structural equation modeling was utilized to identify the significant relationships intention to use Robots tutor. After validating the measures of the model, the testing of the research

hypotheses was conducted using the bootstrapping approach using the PLS-SEM. The findings indicate that perceived ease of use has an insignificant impact on intention to use Robots tutor(β=0.117,t=10.817,p=0.370),thus H1 is rejected. On the other hands, the findings show that Perceived usefulness significantly influences intention to use robot tutor (β=0.214,t=11.12,p=0.000), indicating the acceptance of H2. The findings showed that Social influence (β=0.382,t=1.582,p=0.001),thus H 3 was accepted. On the other hand, the results showed that Security significant positive impact on intention to use Robot tutor (β=0.272,t=0.258,p=0.000),thus H4 supported. Moreover, the results indicated Trust have significant impact (β=0.083, t=10.811, p=0.006).Table 4 represents path coefficient and significance.

Table4:Path Coefficient and significance

Path	Hypothesis	Path Coefficient B	t-value	Significance Value(p)	Results
UI←PE	H1	0.117	0.817	0.398	x
UI←PU	H2	0.214	11.12	0.000	√
UI←SI	H3	0.382	1.582	0.001	√
UI←S	H4	0.272	0.258	0.000	√
UI←T	H5	0.083	10.811	0.006	√

5. Discussion of Results

The paper examines the perspective of parents to user robot tutor for the process of primary education. The results of the research are important for the following reasons. Firstly, the

paper contributes theoretically to the Robot usage in education since it tests the effect of robot on the education process. Mainly, it focuses on perceived usefulness, perceived ease of use, social influence, security and trust. The research can emphasis researches in Egypt that focuses on artificial intelligence, new technologies in education and learning process.

Different previous researchers focused on understanding the advantages and barriers of using robots in education (Amanatiadis, et al., 2017;Sonderegger et al.,2022; Belpaeme& Tanaka 2021; Guggemos et al., 2020; Schulze et al.,2021; Perez et al., 2020; Rao and Jalil, 2021). Results of the analysis show that perceived usefulness, social influence, security and trust affects significantly intention to use robot tutor, this results agreed with Guggemos et al., 2020; Perez et al., 2020; Rao and Jalil, 2021).

Guggemos et al. (2020) results were different since the focus on the university student and their perceptive with the great difference between the study content of the university level and the primary level, in the same context Sonderegger et al.(2022) who interviewed university students to understand their perspective when using robot tutor.

Finally, the findings showed that security and trust are important variables in which parents do not know the interaction between robots and children and they are afraid of feedback of robots when dealing with children in the primary level, however they accept the robot tutor but with the existence of human mentor.

6. Conclusion

Academic Implication

The research provide an important implication in which it focuses on factors affecting the usage of robot tutor in the primary education level and the parents attitude to leave their children with a robot teacher in the class with the mentor of a human teacher. Academic researchers working in education and technology sectors can benefit from the results of this research. This research investigates the user intention to use robot tutor in the primary education level.

Limited researchers focus on the robot tutor in Egypt. The new technology of education is still face resistance from the family and the student. Parents are not able to understand how robot can be a part of the Egyptian citizen life. By exploring the literature review it was noticed that most researches focuses on the teacher perspective to use robot as a helping technological tool however this research has the primary aim to understand parents perspective toward robot tutor in the primary education.

The recommendation of this research is listed as following. First , the research recommends that robots can enhance the education system.

Parents accepted the robot tutor to assist their children in the primary education level.

Human teacher should monitor the attitude of Robot Tutor during the class.

Practical Implication

This research provides vital insights into education sector. Research model is created from factors that are extracted from previous research such as perceived usefulness, perceived ease of use, social influence, security and trust. Based on a sample of 1239 respondents, the findings revealed that using robot tutor is accepted from the parents' side. Perceived usefulness, social influence, security and trust affects significantly on intention to use robot tutor.

Robots are a powerful technological tool for the education process. Robots with some enhancements can assist human teachers in the education process.

Limitation and Future work

Research limitation are summarized as follows. First, this research sample is limited to 1239 which needs expansion to understand more parent opinions and use intention factors, and a comparative study should provide very interesting results such as testing the variables on European countries.

Future research can examine parents' intention to use robot tutor in different countries like Gulf countries with a big experience in ordering online. Quantitative approach in the research is limited to the number of collecting data through an online questionnaire, future research can adopt qualitative research such as interviews to provide

more understanding of the intention to use of robot tutor and the factors that can effect this decision.

Selected factors from the literature review were focusing on Perceived usefulness, perceived ease of use, social influence, security and trust. It is recommended that further studies may be conducted to involve other variables such as Appearance, Intelligence, and Emotional Expression.

Finally, the research did not examine how the demographic and culture dimensions affect parents' opinion suchasage,gender, education and income.

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Appendix A

Factor	Encoding	Statements
Perceived Ease of use (PE)	PE1	Learning by Robot Tutor is easy
	PE2	Using Robot tutor in learning is clear and understandable
	PE3	I consider that learning by Robot tutor is too technical to be use everyday
	PE4	It is easy to become skillful when learning with Robot Tutor
Perceived usefulness (PU)	PU1	Robot tutor can make learning productive
	PU2	Learning by robot tutor can make thing easier
	PU3	I consider that robot tutor will allow new abilities in Learning
	PU4	I know learning by robot tutor is the future applications
Social Influence (SI)	SI1	People who influence my behavior would think that I should learning using Robot Tutor
	SI2	People who are important to me would think that I should learn using Robot tutor
Security	S1	I consider that using learning by Robot Tutor is not secure
	S2	I am worried that information transferred by Robot Tutor is not right
	S3	I consider that using Robot Tutor is not secure
	S4	I consider that Robot Tutor can be secured
Trust	T1	Robot Tutor in learning is trusted
	T2	Robot Tutor in learning is trustworthy
	T3	Robot Tutor behavior is Trusted
Intention to use robot tutor	IURT1	I have the intention to use Robot Tutor in learning
	IURT2	I want to learn using Robot Tutor in the future