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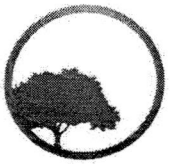

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The User Characteristics Effects to Smart Board Usage on Technology Acceptance Model Variables: The Sample of Bartin Highschool Teachers[i]

Yaşar Akça

Assistant Professor Dr., Economics and Administrative Faculty, Bartın University, Bartın, Turkiye.

Gökhan Özer

Professor Dr., Management Faculty, Gebze Technical University, Gebze/Kocaeli, Turkiye.

Ayşe Derya Işık

Assistant Professor Dr., Education Faculty, Bartın University, Bartın, Turkiye.

Ercan Çelik

Head master, MBA, Bartın Highschool, Bartın, Turkiye,

Abstract

A new technology's acceptance also gets shaped according to users' features, expectations and perceptions. Technology Acceptance Model (TAM) that developed by Davis (1989), defends that there are perceived usefulness and perceived ease of use variables to determinants of a new technology's usage by user. These perceptions predict the user's behavior and explain it. The smart board that has common usage in modern classrooms provides effectiveness at education and learning activities. Teachers who use smart boards can present more effectively. This situation increases the teacher's productivity and student's learning success and improvement the class's education quality. Existence of the smart board in the classroom motivates all by self. Thanks to this technological device, it is easy to access internet based study materials. This study's purpose is testing the user features explanation power effects to usage of smart board, which is a new education tool, based on TAM variables. For performing of the research, surveys have actualized with 24 teachers at Bartin High School with smart boards. Survey data have been interpreted based on correlation, factor and regression analyses in WarpPLS 5.0. Results have been concluded from analyse strongly supports research model.

Key words: *User Characteristics, Technology Acceptance Model, FATIH Project, Smart Board.*

JEL classification: *A22, I28, O33*

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Introduction

Today, there has been an intense competition in every part of life, especially in every sector of economy. So, the factor that determines the superiority in competition is technological innovations. The use of new technologies resulting from that intense competitive environment affects human life by changing the process and method of work. While the cost of reaching and having these innovations decreases, it becomes very significant to use them correctly.

The most prominent new technological practice in education sector is the use of smart boards. The first smart board technology was developed at the beginning of 1990 (Gursul and Tozmaz, 2010: 5731). They have become very common and have been accepted as indispensible education instruments in schools in time. The use of these instruments isn't only a popular trend. Many governments around the world realized the significance of this kind of teaching process and these instruments became significant parts in many education policies. Ministry of Education in Australia, U.S.A. and England invested big amount of money in order to buy and implement these equipments in schools (Hall and Higgins, 2005: 102; Şad, 2012: 900; Wood and Ashfield, 2008: 85).

In parallel with these developments in the world, Turkey started the process of using these instruments in education through the project called FATİH (in Turkish mean ***F**ırsatları **A**rtırma ve **T**eknolojiyi **İ**yileştirme **H**areketi, in English mean The Movement of Increasing Chances and Developing Technology*). **FATİH** project is based on increasing technological facilities in education and using them effectively. The goal of this project is to give students the best chance to have education, reach qualified content and enable equality of opportunities in education. Through this project, equality of chances will occur and technology in schools will be developed. In this way, information technologies instruments will be used more effectively as more sense organs will be involved in learning process (http://fatihprojesi.meb.gov.tr/proje-hakkinda/). Teachers will be able to share lesson materials with students and evaluate their in-class learning levels. The goal of **FATİH** project is to enable smart board and internet connection in each class.

In this study, perceptions of teachers about the use of smart board technology in classes are researched. The variables of user satisfaction and user resistance represent the user characteristics of teachers that use smart board. The effects of these two variables on perceived ease of use and perceived usefulness, which constitute TAM (Technology Acceptance Model) variables, are analyzed and evaluated in this study. This article, which aims at analyzing the effect of user characteristics on the use of smart board through TAM variables, is made of six sections. The first section is introduction. The second section focuses on user characteristics. Smart board technology is explained in the third section. General information about TAM is presented in the fourth section. Research model is explained and the process of making scales of variables, hypothesis tests are presented in the fifth section. Findings are interpreted and suggestions for the future studies are made in the last section.

User Characteristics

An individual who uses technology in his/her work is called user (Kreie, Cronan, Pendley and Renwick, 2000: 145). When user features are taken into consideration, the use of new technologies increases and while the resistance force decreases. User is the basic key factor in the process of developing new technologies. A new technology is not meaningful without user acceptance. Perceptions about using a new technology represents success of use (Zhang, Lee, Zhang and Banerjee, 2002: 6). Users are basically and mainly interested in the effects of a new technology on their work. So, technological innovations that meet the demands of users are successful. It is necessary to determine the variables that affect user attitudes in order to understand the use of new technologies. Attitudes of users towards a technological innovation are either in the form of 'satisfaction' or 'resistance' (Kim and Kankanhalli, 2009: 568). There is information about this point in the related literature (Yoon, Guimaraes and O'Neal, 1995: 85).

User Satisfaction

User satisfaction has a significant place in the acceptance of a new technology. User satisfaction is defined as the level of an innovation in terms of meeting the demands of a user (Zviran and Erlich, 2003: 83). General feelings of a user when he/she is affected by a new technology is another definition of user

satisfaction (Chung, Park, Koh and Lee, 2016: 533). Through this, users make general evaluations about the continuous use of a new technology. When user is willing to use a new technology, he/she uses it, operational costs decrease and productivity increases. Through the new technology, boredom resulting from routine activities decreases and user satisfaction increases (Yaverbaum, 1988: 76). For instance, one of the reasons why some projects are unsuccessful is that support of users is missing and they don't want to take responsibility (Au, Ngai and Cheng, 2008: 44).

User Resistance

This concept is defined as the counter reaction of users against the change resulting from the use of something new (Kim and Kankanhalli, 2009: 568). It is significant to understand and manage user resistance. When people meet a new technology, they may have some strong negative attitudes and feel anxious (Yoon, Guimaraes and O'Neal, 1995: 88). So, the act of resistance is a threat as it is an individual reaction. Users either use the technology or they ruin it. A new technological system may be very useful, but it is a complete waste if not used.

The act of resistance is a part of a wide spectrum. For instance, when a user have a passive resistance, he/she doesn't attend educations about the new technology. He/she feels distanced from change. He/her interest decreases to work and he/she only does what is told. On the other hand, active resistance means slowing down the process of work. He/she intentionally acts incorrectly. He/she doesn't come to work or sabotages the innovation physically (Lapointe and Rivard, 2005: 464).

Smart Board Technology

One of the new technological practices in education is smart board technology. As there is not a specific and correct terminological explanation of the concept, this technology has different names such as smart board, electronic white board, interactive electronic board etc. The technology was firstly produced in 1991, but it is started to be used in schools after the end of 1990s (Şad, 2012: 900). Smart board technology is also strengthened with internet connection. The use of this technology has been increasing all over the world. One of the reasons of this increase is that set up cost has decreased in time and features of the system have increased (Demirli and Türel, 2012: 199). Smart board, which is an effective education technology in classes, is made of a projector, a computer and a touchpad electronic board combination (Al-Qirim, 2011: 827). Image on the computer screen is reflected on touchpad screen through a projector. A special pen can be used or teacher can touch the screen. Writings on the screen or images reflected on the screen can be recorded and they can be printed out (Gursul and Tozmaz, 2010: 5731). This technology increases visuality, thus increases the interest of students. It eases lessons, creates an amusing classroom environment and to be an interactive learning environment. This technology also contributes to the academic success (Korkmaz and Çakıl, 2013: 595). It has an important role in turning classroom education into fruitful and innovative processes. Teachers and students think that the use of smart boards in education is interesting, it increases motivation and it is fun (Şad, 2012: 900). Besides all these positive features, smart board technology is completely user-friendly and can be easily learned.

Technology Acceptance Model

Attitudes of individuals towards using a new technology can be positive or negative. So, attitudes affect the performance of new technologies. This is why, it is necessary to analyze the factors that determine the use of a new technology. Technology Acceptance Model developed by Davis (1989), explains the factors that determine the individual use of new technologies. TAM has a high explanatory power in determining the reasons that affect users' behaviors towards new technologies (Dasgupta, Granger and McGarry, 2002: 87; King and He, 2006: 740; Lu, Yu, Liu and Yao, 2003: 207). The model, defends that acceptance of a new technology depends on the variables of perceived usefulness and perceived ease of use. According to the model, adaptation of a new technology doesn't only depend on technical and managerial features. It is shaped according to the personal aspects, expectations and perceptions of users. In other words, user perception affects the success of the adaptation of innovation. New technology usage behavior includes a four stages process (Figure 1). In the first stage, there are external variables. The second stage is made of

beliefs about the perceived ease of use and perceived usefulness. The third stage is attitude towards use. The fourth and last stage is behavioral intention. Thus, actual system usage is realized.

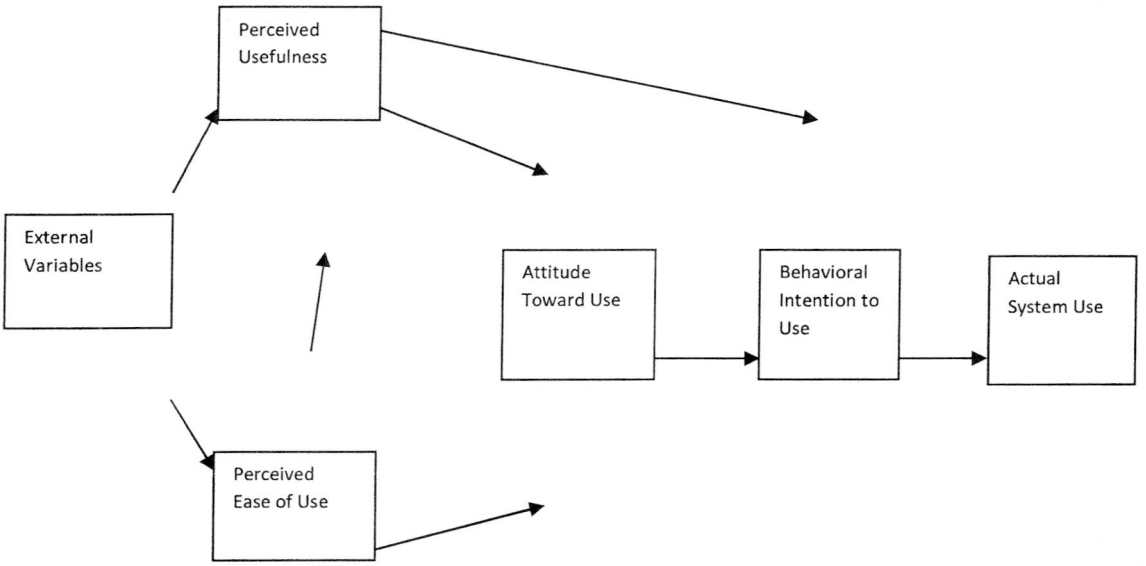

Figure 1. Original Technology Acceptance Model

Resource: *Davis, F.D., Bagozzi, R.P. and Warshaw, P.R. (1989). User acceptance of computer technology: A comparison of two theoretical models, Management Science, 35(8), p. 985.*

External variables are demographic features and environment of individuals, definition of profession, technical aspects of system, education level, personal abilities, skills and work experience (Kim and Chang, 2007: 792; Legris, Ingham and Collerette, 2003: 196). The real determinants of the use of information technology are perceived ease of use and perceived usefulness.

Perceived ease of use means the level of an individual in terms of understanding that doesn't need a specific physical and mental effort while using a technology (Davis, 1989: 320). Perceived ease of use affects perceived usefulness and attitude towards use. Individuals will be more willing to use the system when they perceive that it is easy to use a new technology (Saade and Bahli, 2005: 318). The concept of perceived usefulness implies an individual's belief in that when he/she uses a system, it will increase work performance (Gyampah & Salam, 2004: 733). When a system can be learned easily, it can be used more efficiently and willingly (Venkatesh and Davis, 2000: 187). Perceived usefulness directly affects attitude towards use and behavioral intent. Perceived usefulness and perceived ease of use put pressure on the attitude toward use. Actual system use is affected by behavioral intention. The behavioral intention to use is the possibility of displaying a specific behavior (Al-Gahtani and King, 1999: 278). It shows that the willingness of an individual about the use of the system. Behavioral intent about the use determines the up-to-date system use (Jones and Hubona, 2006: 706). Using a system is a behavior (Downing, 1999: 204).

Research Method

The universe of the research is made of Bartın High School teachers using smart board technology in classes. Bartın High School was established in 1964. It has 23 classrooms, 36 teachers and 550 students. There is a smart board in every classroom. The teachers participated in the survey know how to use these smart boards.

Research Model and Hypothesis

User characteristics are affect the acceptance and use of a new technology. Users should be carefully analyzed and their reactions should be taken into consideration in order to prevent any problem.

Technology that meets the demands of users will produce trust and user satisfaction will increase. At the same time, new system brings some uncertainties with it. Change, work anxiety, developing new abilities and high performance demand are some of these uncertain factors. The use of technology increases with the precautions that are taken in order to prevent user resistance. TAM takes the factors of usefulness and perceived ease of use into consideration as they are most important determinants of new technology use (Dasgupta, Granger and McGarry, 2002: 89; Lu, Yu, Liu and Yao, 2003: 207; Yang and Yoo, 2004: 26-27). So, there are various articles that explain new technology usage behavior by using these two perceptions (Chau and Hu, 2001: 702; Ma and Liu, 2004: 61). This is why, these two variables of TAM are added into the theoretical research model (see figure 2).

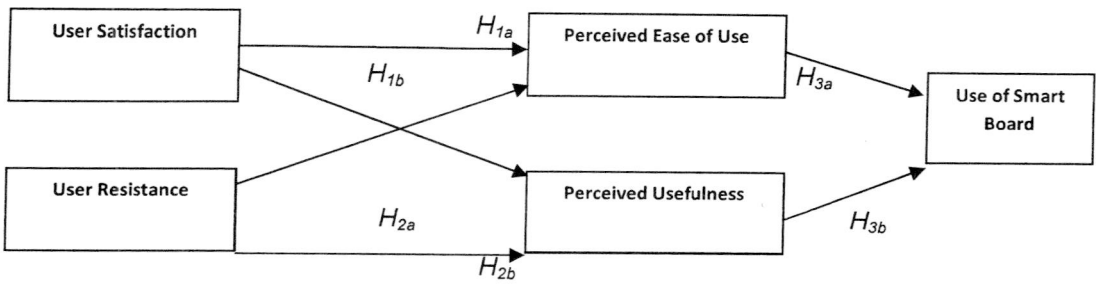

Figure 2: Theoretical Research Model

Hypothesis to be tested in the research are:

H_{1a}: User satisfaction has a positive effect on perceived ease of use.

H_{1b}: User satisfaction has a positive effect on perceived usefulness.

H_{2a}: User resistance has a negative effect on perceived ease of use.

H_{2b}: User resistance has a negative effect on perceived usefulness.

H_{3a}: Perceived ease of use has a positive effect on smart board use.

H_{3b}: Perceived usefulness has a positive effect on smart board use.

Scales of variables

Validity and reliability of questions that will reveal the interaction among variables are evaluated through different tests. Survey questions are evaluated with five point likert scale. They range from 1 (I definitely don't agree) to 5 (I definitely agree).

Questions that measure user satisfaction are taken from Bradford and Florin (2003: 223). Questions measuring user resistance are adapted from Jiang, Muhanna and Klein (2000: 27), Hong and Kim (2002: 38). Questions in the perceived ease of use and perceived usefulness surveys are taken from Gyampah and Salam (2004: 737). Studies by Demirli and Türel (2012: 204-207), Korkmaz and Çakıl (2013: 597-598), Şad (2012: 906-907) are analyzed in order to develop the survey questions measuring benefits obtained from the use of smart boards.

Data Collection

Necessary arrangements were made and Bartın Provincial Directorate for National Education approved the survey. The goal of the survey was explained in the teachers' room. There were 24 teachers who were willing to participate in the practice. The completed survey forms were loaded to WarpPLS5.0 statistics program. Features of survey participators are summarized in table 1.

Table 1: Features of Survey Participators

Variables	Valid Range	Frequency	Percentage (%)
Age	20-30	3	%13
	31-40	7	%29
	41-50	12	%50
	51+	2	% 8
		Total 24	**%100**
Years of service	1- 5	3	%13
	6-10	-	-
	11-15	3	%13
	16+	18	%74
		Total 24	**%100**
Branch	Maths.	6	%25
	Foreign language	5	%21
	Literature	3	%14
	History	2	% 8
	Physical ed.	2	% 8
	Geography	2	% 8
	Religion	1	% 4
	Chemistry	1	% 4
	Physics	1	% 4
	Counseling	1	% 4
		Total 24	**%100**

Analysis

In order to analyze the relations suggested by the research, structural equation modeling method was used. WarpPLS5.0 software was used in this process. The advantage of WarpPLS software is that, it takes non-linear relations among hidden variables (Kock, 2015: 33). In order to evaluate coherence of the model and quality indicators, WarpPLS 5's coherence and quality indicators were calculated (see Table 2). According to the obtained results, coherence and quality indicators show that there is 'ideal coherence' (Kock, 2015: 51).

Table 2: Model Coherence and Quality Indicators

Average path coefficient (APC)=0.401, P=0.006
Average R-squared (ARS)=0.472, P=0.002
Average adjusted R-squared (AARS)=0.422, P=0.004
Average block VIF (AVIF)=1.347, acceptable if<= 5, ideally<= 3.3
Average full collinearity VIF (AFVIF)=2.151, acceptable if<= 5, ideally<= 3.3
TenenhausGoF (GoF)=0.546, small>= 0.1, medium>= 0.25, large>= 0.36
Sympson's paradox ratio (SPR)=0.833, acceptable if>= 0.7, ideally = 1
R-squared contribution ratio (RSCR)=0.971, acceptable if>= 0.9, ideally = 1
Statistical suppression ratio (SSR)=1.000, acceptable if>= 0.7
Nonlinear bivariate causality direction ratio (NLBCDR)=0.833, acceptable if>= 0.7

Cronbach's alpha was used in order to determine if the survey participators understood the questions (Kock, 2012: 69) and if surveys of variables have a sufficient correlation with the others. In order to mention a reliability based on Cronbach's alpha, the calculated value should be higher than 0.6 (Cronbach, 2004: 28). As can be seen in the table 3, all of Cronbach's alpha values are higher than 0.6 (see Table 3).

Table 3: Reliability Coefficients and Correlation Values

	User satisfaction	User resistance	Perceived ease of use	Perceived usefulness	Use of Smart Board
Cronbach's alpha	0.775	0.812	0.841	0.876	0.887
Arithmetical average	4,0083	2,8472	3,5278	3,8611	3,8214
Standart variation	,56408	,64628	,39827	,59317	,46578
User satisfaction	1.00				
User resistance	-,147	1.00			
Perceived ease of use	,315	,003	1.00		
Perceived usefulness	,502*	,012	,482	1.00	
Use of Smart Board	,384	,033	,742**	,749**	1.00

*. Correlation is significant at 5% level.

**. Correlation is significant at 1% level.

Structural Equation Model that is carried out in order to reveal the relations among the model's variables are presented in table 4 and table 5.

Table 4. Structural Equation Analysis Results

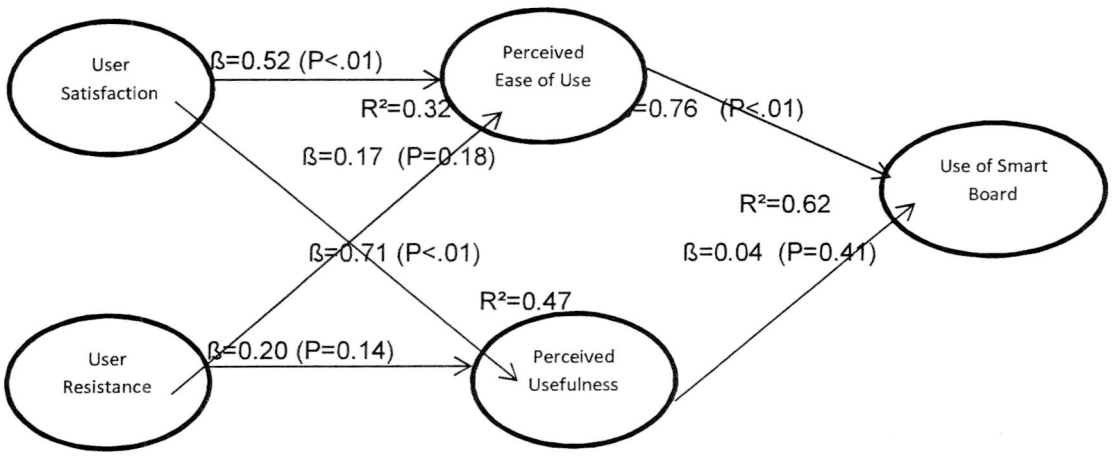

Table 5: Path Coefficients and P Values

Hypothesis	Path	Path coefficient	P values	Support
H_{1a}	User satisfaction → perceived ease of use	0.52	<0.001	supported
H_{1b}	User satisf. → perceived usefulness	0.71	<0.001	supported
H_{2a}	User resist. → perceived ease of use	0.17	<0.181	Not supported
H_{2b}	User resistance → perceived usefulness	0.20	<0.141	Not supported
H_{3a}	Perceived ease of use → use of smart board	0.76	<0.001	supported
H_{3b}	Perceived usefulness → use of smart board	0,04	<0,410	Not supported

According to the analysis results, there is a statistically important and positive relation between user satisfaction and ease of use (ß=0.52, P<0.01). This result shows that H_{1a} hypothesis is supported. Namely, user satisfaction has a positive effect on perceived ease of use. In the second hypothesis, which is about

the question if user satisfaction has a positive effect on perceived usefulness, the obtained findings (β=0.71, P<0.01) show that H_{1b} hypothesis should be accepted. User satisfaction affect perceived usefulness in a statistically significant and positive way.

Analyses that are made in order to determine the hypothesis on the question if user resistance has negative effect on the ease of use and perceived usefulness show that the hypotheses aren't supported (H_{2a} and H_{2b}). Signs of path hypotheses aren't negative and parameters aren't meaningful (see Table 4 and Table 5).

Analyses of H_{3a} hypothesis, which is claiming that perceived ease of use has a positive effect on smart board use, support the hypothesis. There is a statistically meaningful and positive relation between perceived ease of use and smart board use (β=0.76, P<0.01). On the other hand, although there is a positive relation between perceived ease of use and smart board use, it isn't statistically meaningful. This is why, H_{3b} hypothesis isn't supported.

Conclusion

In this article, smart board, which is an example of smart technology, is analyzed. The effect of user characteristics, which should be taken into consideration in smart board use, is analyzed through TAM variables. The main contributions of the study on science are that it identifies user features that affect smart board use and explains TAM variables' effects on smart board use. User satisfaction and user resistance are user characteristics.

21th century is the age of information. So, the existence of smart board in schools isn't surprising. FATİH project, started by the Ministry of National Education, brought the power of new computer technologies into classes. Internet, integrated with smart boards is completely essential in this age.

According to the results of analyses, user satisfaction has a statistically meaningful and positive effect on perceived ease of use, which is the first of TAM variables. It is determined that user satisfaction has a positive effect on perceived usefulness which is the second variable of TAM and the relation between them is statistically meaningful.

User is the most significant factor in the successful use of new technologies (Martinsons and Chong, 1999: 124). At the correlation analyses, it is determined that user resistance, which is accepted to be the basic reason of failure in the use of new technology, isn't a significant factor in terms of teachers who use smart boards. Obtaining the main benefits of using smart board technology depends on teachers. It is mentioned in the literature that smart board motivates students in terms of being active in classes and it easier learning (Korkmaz and Çakıl, 2013: 595); these facts are also accepted by the teachers participated in the survey of this research.

According to the survey results, teachers think that smart board use is beneficial. Teachers have a positive attitude towards this technology. But in order to follow the benefits of this process, the level of teachers' satisfaction should be regularly measured. Especially insufficiencies of teachers in using this technology prevent the realization of benefits that can be obtained from the use of this smart technology. This may cause wasting significant amount of investment and disappointments. Shortly, Ministry of National Education has to expedite the presentation of quality classroom materials that can be used in this process. Practices throughout the world can be reviewed in this process.

Suggestion that can be used in the new studies about smart board use can be summarized under these headings: Firstly, effects of different variables can be analyzed in terms of their effects on smart board use. On the other hand, effects of physical situation that shapes environmental features can be researched. In this respect, student perception and school management can be analyzed. Number of samples used in the analyses can be increased.

Writers, hope that this article will encourage the research of similar issues and contribute to the development of smart board technology.

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