Factors Impacting Teachers’ Behavioral Intention to Use the Interactive Whiteboard in Hebei, China

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***Abstract*—The present study aimed to investigate factors impacting teachers’ Behavioral Intention (BI) to use the Interactive Whiteboard (IWB) based on the theoretical foundations of Technological Pedagogical Content Knowledge (TPACK) and Technology Acceptance Model (TAM). Specifically, it examined the effect of TPACK on teachers’ BI to use the IWB and mediating effects of Perceived Usefulness (PU) and Perceived Ease of Use (PEU) in the relationship between the teachers’ TPACK and BI to use this educational tool. To achieve these objectives, a quantitative research design was employed. Data were collected using a questionnaire, involving a total of 794 high school teachers who participated in this study. Structural Equation Modeling (SEM) was used for the data analysis, whereby the results revealed that TPACK moderately influenced teachers’ BI to use the IWB. Additionally, PU and PEU were influential mediators in the relationship between TPACK and teachers’ BI to use this tool. Accordingly, the findings provided empirical evidence on the use of IWB and important input for educational authorities and institutions on further improvements with regard to the IWB and its use in schools. Moreover, the findings indicated a need for training to enhance teachers’ skills in using the IWB within the classroom setting. Finally, research limitations and suggestions for future studies were discussed.**

***Keywords*—technological pedagogical content knowledge, perceived usefulness, perceived ease of use, behavioral intention**

I. Introduction

Interactive Whiteboard (IWB) is a touch-sensitive screen that combines a computer and a digital projector. This tool has been widely used in the educational sector due to its multifunctional features, such as recording, highlighting, capturing, and screen sharing [1, 2]. Unlike traditional multimedia, IWB allows teachers to drag or drop objects on the board via their fingers or a pen [3]. Besides, it also enhances teachers’ instruction with various educational techniques, thereby increasing students’ motivation and attention [2]. Moreover, IWB enables teachers to access resources on the Internet, thus making their teaching more engaging, interactive, and interesting for students [4]. Despite the perceived benefits of the IWB as discussed above, numerous previous studies showed that there is a lack of enthusiasm among teachers to use this educational tool. Various issues, such as time constraints, technical issues, and inadequate training, have prevented teachers from using the IWB. Thus, there is still a need to enhance teachers’ ability to use the IWB in the classroom [5, 6].

In China, the government has made substantial investments and implemented many policies, such as “Education Promotion Plan of Action for the 21st Century”, “Networks between Schools Project”, and “National Training Program” to support teachers’ technology integration in schools [7]. However, the implementation of these policies may not entirely effective in ensuring teachers to fully benefit from the use of technology in their teaching and learning, as teachers themselves play an important role in determining the use of technology in their classrooms [8]. A previous study conducted by Zhou *et al.* [9] revealed that although teachers learned using the IWB through the online training program, K-12 teachers, especially those in remote and rural areas of China, were not adequately proficient in integrating IWB into their teaching and learning. In most schools, as the study showed, IWB tools were not being used effectively and had a limited role in the classroom. Similarly, Liu *et al.* [10] suggested that although there were teacher development centers in educational institutions, training in terms of technology integration was very basic and only focused on creating PowerPoint slides or using Word documents. As observed in the study, teachers were still unable to use technology effectively in their classrooms. This statement was supported by Huang *et al.* [11] who similarly suggested that although the China’s government issued policies to support technology integration in schools, teachers’ abilities in terms of technology integration were not satisfactory. Teachers were either reluctant to use IWB tools or only used it for PowerPoint presentations. Few others utilized the IWB to interact with their students. Apparently, this suggests that the use of IWB has not been fully implemented as envisioned in the policy statements. The mentioned issue may lead to significant waste of government investment. Moreover, it may contribute to the failure of efforts towards achieving China’s educational aspirations. Realizing this, it is critical to explore factors impacting the Behavioral Intention (BI) to use the IWB among teachers in Chinese schools and enhance their use of this educational tool in the classroom.

Several previous studies discussed how teachers’ BI to use technology could be enhanced [12, 13]. The findings of these studies primarily suggested that Technological Pedagogical Content Knowledge (TPACK) provided the knowledge required by teachers for technology integration, while positively influenced their BI to use technology [14]. In addition, teachers who perceived that using technology would be free of effort or enhance their job performance were more likely to use it in the classroom. Another study reported that Perceived Usefulness (PU) and Perceived Ease of Use (PEU) significantly influenced teachers’ BI to use technology [15]. Despite this, there is a lack of studies which

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looked into the combination of these variables to investigate their impacts on teachers' BI to use technology. Besides, only a few studies focused on the interactions among these variables to explore the mediating effects of PU and PEU in the relationship between teachers' TPACK and BI to use technology. In order to fill the research gaps mentioned above, the current study looked into the TPACK, PU, and PEU variables to predict teachers' BI to use the IWB by addressing the following research questions.

1) To what extent does teachers' TPACK influence their BI to use the IWB in Hebei, China?
2) To what extent does PU mediate the impact of teachers' TPACK on their BI to use the IWB in Hebei, China?
3) To what extent does PEU mediate the impact of teachers' TPACK on their BI to use the IWB in Hebei, China?

Accordingly, three hypotheses were tested:

H1: TPACK has a significant influence on teachers' BI to use the IWB in Hebei, China.

H2: PU is a significant mediator in the relationship between teachers' TPACK and their BI to use the IWB in Hebei, China.

H3: PEU is a significant mediator in the relationship between teachers' TPACK and their BI to use the IWB in Hebei, China.

II. Literature Review

A. Technological Pedagogical Content Knowledge

TPACK is a framework to identify the knowledge needed by teachers when they adopt technology for teaching and learning [16]. TPACK, which was proposed by Mishra and Koehler, is an extension of Shulman's pedagogical content knowledge model. There are three main components in this framework, namely Content Knowledge (CK), Technological Knowledge (TK), and Pedagogical Knowledge (PK). The interactions among these bodies of knowledge have formed Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK) [17].

Teaching with technology is complex for teachers, as they need to acquire the three main knowledge components, i.e., CK, PK, and TK. TPACK is a valuable framework particularly when there is a significant need to understand how teachers can integrate technology effectively into teaching and learning [18]. In an IWB-based classroom, teachers need to incorporate the IWB with CK and PK. TPACK helps teachers increase their capabilities to create suitable content materials and instructional designs through the use of IWB. In other words, this framework allows teachers to move beyond oversimplified teaching methods and to focus on the interactions among content, pedagogy, and the tool (i.e., IWB). Thus, TPACK assists teachers in maximizing the use of IWB and increases their willingness to use this tool in the classroom [19, 20].

Previous studies reported on the significant influence of TPACK on teachers' BI to use technology [14, 21, 22]. For example, Prasojo *et al.* [14] developed a survey to explore factors impacting teachers' intention to use technology in Indonesian vocational high schools. Involving 640 participants, the study findings revealed that TPACK significantly influenced teachers' intention to use technology. In the context of Chinese schools, Teo *et al.* [22] examined the predictors of pre-service teachers' acceptance of technology in their future teaching role. In their study, data were collected via a questionnaire, involving 464 pre-service teachers as participants. The findings similarly suggested that TPACK had a significant and direct influence on the pre-service teachers' intention to use technology. Meanwhile, Mohammad-Salehi *et al.* [23] investigated factors impacting teachers' adoption of Web 2.0 technologies by utilizing the questionnaire method, involving teachers from private language institutes. The findings revealed a contradicting result whereby TPACK did not influence BI, but significantly influenced PU and PEU. Similarly, as reported by Joo *et al.* [24], while TPACK did not directly influence teachers' BI to use technology, its influence on BI was significant through the mediating variables, such as PU and PEU.

B. Perceived Usefulness and Perceived Ease of Use

The Technology Acceptance Model (TAM), which was first developed by Davis, was adapted from the Theory of Reasoned Action (TRA) model. TAM is frequently employed in technology acceptance studies. The use of this model has been found to be relevant in describing the strategies to promote users' acceptance and utilization of new information systems [25]. In TAM, an individual's BI to use technology is mainly affected by two variables, namely PU and PEU. PU refers to the degree to which users believe that using a particular technology would enhance their job performance, while PEU is the degree to which users believe that using a particular technology would be free of effort [26]. TAM suggests that if a user's PU of a given technology increases, his or her intention to use the technology will also increase. This model also demonstrates that if individuals perceive a certain technology as highly difficult to use, they will be less willing to use it in the future. As for teachers, they are more likely to use a technology if they perceive it as useful in their teaching and learning work. Similarly, if teachers perceive that applying technology is free from effort in the classroom, their BI to use the technology will also increase [27, 28].

Numerous previous studies reported on the significant impacts of PU and PEU on teachers' BI to use technology [28–30]. For example, Moura *et al.* [30] investigated factors influencing teachers' BI to use technology based on TAM. In their study, data were collected through a questionnaire, involving 147 teachers in Brazil. The findings showed that both PU and PEU had a significant and positive effect on teachers' BI to use technology. Similarly, Wijaya *et al.* [28] investigated factors influencing technology usage by mathematics teachers in China. An online questionnaire was used to collect data from a total of 166 mathematics teachers as participants. The study findings revealed that teachers' BI to use technology was positively affected by PU and PEU.

C. Behavioral Intention

BI is defined as an individual's intention to accept and use a particular technology in the future [31]. In the present study, it refers to teachers' intention to accept and use the IWB in the future. In a previous study, it was suggested that teachers with a high level of TPACK were able to effectively deal with the interactions between the knowledge of technology, pedagogy, and content. As a result, they were more likely to use technology in the classroom [14]. Additionally, BI was seen as a form of technology acceptance behavior, which was significantly and positively influenced by PU and PEU [30]. Moreover, PU and PEU reportedly mediated the relationship between teachers' TPACK and their BI to use technology [24]. In line with this, the current study focused on the effect of teachers' TPACK on their BI to use the IWB as well as the mediating effects of PU and PEU in this relationship.

III. Theoretical Framework

The current study used the theories of TPACK and TAM to investigate factors impacting teachers' BI to use the IWB. TPACK can be integrated into TAM and significantly influences PU and PEU [24]. Additionally, TPACK, PU, and PEU were found to be significant factors influencing teachers' BI to use technology [14, 22, 28–30]. TPACK provides relevant supports to understand how teachers effectively integrate the IWB into CK and PK, while PU and PEU offer guidance in understanding teachers' cognitive beliefs when they use this tool in the classroom [14, 28]. Thus, the current study employed the TPACK, PU, and PEU variables to investigate teachers' BI to use the IWB. In this study, BI is the dependent variable, TPACK is the independent variable, while PU and PEU are the mediating variables. A diagrammatic representation of the theoretical framework as shown in Fig. 1 was used to explain the relationships among the dimensions from the underpinning theories of this study.

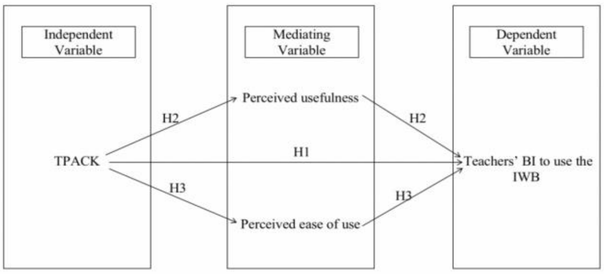

Fig. 1. Theoretical framework.

IV. Methods

A. Research Design, Participants, and Procedures

This study adopted a quantitative research design. A questionnaire link was sent to the teachers' email addresses to investigate factors impacting their BI to use the IWB. A consent form was attached to the email, which clearly stated that teachers' participation in this study were entirely voluntary and their confidentiality and anonymity were upheld. Those who agreed to participate in the study proceeded to complete the questionnaire by clicking on the link given. Initially, the random samples involved 800 teachers from public high schools in Hebei, China. However, six incomplete responses were excluded from the analysis, resulting in a total of 794 responses from teachers who participated in this study. Among these participants, 336 (42.3%) were male and 458 (57.7%) were female. Majority of them were between 36 and 45 years old (34.3%), and had 5 to 10 years of working experience (34.9%).

B. Research Instrument

A questionnaire was constructed based on previous studies to investigate factors influencing teachers' BI to use the IWB. This research instrument was comprised of an introduction section and four dimensions of TPACK, PU, PEU, and BI. TPACK was measured using the scale developed by Schmidt *et al.* [32], while PU and PEU were measured using the scales developed by Davis [26]. Teachers' BI to use the IWB was assessed using the scale developed by Weng *et al*. [33]. Overall, the questionnaire included 23 items, namely TPACK (six items), PU (six items), PEU (six items), and BI (five items). All items were measured based on a five-point Likert scale for agreement, ranging from "strongly disagree-1" to "strongly agree-5" [34].

All of the items adapted from the previous studies were in English. Thus, in order to ensure better understanding by the study participants, it was deemed necessary for the items to be translated from English to Chinese. The English-based questionnaire was translated to the Chinese version by the researcher, utilizing the back-to-back translation method to ensure the accuracy of the translation. Following this, the Chinese version of the questionnaire was forwarded to a professional specializing in English, who then translated the Chinese questionnaire back into the English version. Lastly, the original and back-translation versions were compared to ensure that both versions conveyed the same meanings. In addition, the expert validation method was used to ensure that the questionnaire achieved good content validity. Specifically, the scale items were submitted to five technology integration experts to assess whether the chosen items were sufficient to measure the variables. All items were deemed acceptable based on the suggestions from the experts. Moreover, a pilot study was conducted involving a sample of 291 high school teachers who would not be involved in the main study to measure the questionnaire's construct reliability using Cronbach's alpha. According to the research of Hair *et al.* [35], Cronbach alpha values of 0.7 or higher indicate an acceptable level of reliability. Using the Statistical Package for the Social Sciences (SPSS), the Cronbach's alpha analysis was conducted, with the acceptable alpha set at 0.7 or higher. The reliability results are summarized in Table 1.

Table 1. Reliability statistics

Constructs	No. of items	Cronbach's α
TPACK	6	0.905
PU	6	0.915
PEU	6	0.927
BI	5	0.871

As illustrated in Table 1, the six-item TPACK scale was found to be reliable (α = 0.905). Similarly, both the PU and PEU scales with six items each showed a reliability value (α = 0.915 and α = 0.927, respectively). The five-item BI scale was also found to be reliable (α = 0.871). Therefore, the construct reliability of the questionnaire used in this study was established.

C. Data Analysis

Data were analyzed using Structural Equation Modeling (SEM). For the measurement model, Confirmatory Factor Analysis (CFA) was conducted using AMOS to assess factor loadings, construct reliability, convergent validity, and discriminant validity. In terms of the structural model, model fit indices, including Discrepancy Function by Degrees of Freedom Divided (CMIN/DF), Goodness of Fit Index (GFI), Comparative Fit Index (CFI), Tuker-lewis Index (TLI), Incremental Fit Index (IFI), Standardized Root Mean Square Residual (SRMR), and Root Mean Square Error of Approximation (RMSEA), were used to assess the structural model fit. Path coefficients were estimated to test the relationships between the observed variables, while squared multiple correlations were estimated to assess how well the structural model explained the outcome. Lastly, the bootstrapping technique was employed to determine whether PU and PEU were influential mediators in the relationship between TPACK and BI. The bootstrapped sample was set at 5000, and the mediating effect was assessed based on the 95% confidence interval.

V. Results

A. Data Examination

Missing data was first examined before conducting the data analysis. As mentioned previously, the questionnaire was initially distributed to 800 high school teachers. However, six samples were removed from the dataset due to incomplete responses, resulting in a total of 794 responses for further data analysis. Additionally, multivariate outliers were examined using Cook's distance in SPSS, whereby the results showed that there were no influential outliers for the 794 cases [36].

Then, the absolute values of skewness and kurtosis were calculated using SPSS to assess the data normality. According to the research of Kim [37], for samples greater than 300, if the absolute skewness value is less than 2 and the absolute kurtosis value is less than 7, the data distribution is considered as fairly normal. The results of the normality test in this study are shown in Table 2.

Table 2. Results of the normality test

Variables	Skewness	Kurtosis
TPACK	−0.445	−0.439
PU	−0.568	−0.375
PEU	−0.214	−0.934
BI	−0.421	−0.463

As illustrated in Table 2, the absolute skewness values for all variables ranged from 0.214 to 0.568, thus were less than 2. Meanwhile, the absolute kurtosis values ranged from 0.375 to 0.934, i.e., less than 7. Since all of the calculated values were within their respective common acceptance levels, the data distributions in this study were deemed as fairly normal.

Next, Variance Inflation Factors (VIF) values were tested for multicollinearity. According to the research of Shrestha [38], VIF values less than 5 indicate the absence of significant multicollinearity issue. Table 3 provides the summary of the VIF values in this study.

Table 3. Summary of VIF values

Constructs	VIF
TPACK	1.230
PU	1.204
PEU	1.212

Note: Dependent Variable: BI

As illustrated in Table 3, the VIF values ranged from 1.204 to 1.230, i.e., less than 5. Thus, the multicollinearity issue was not presented in this study.

B. Assessment of the Measurement Model

Factor loadings were first used to assess the measurement model. According to the research of Hair *et al.* [39], loadings can range from –1 to 1, and standardized loadings should ideally be 0.7 or higher. Factor loadings for the measurement model of this study are shown in Fig. 2.

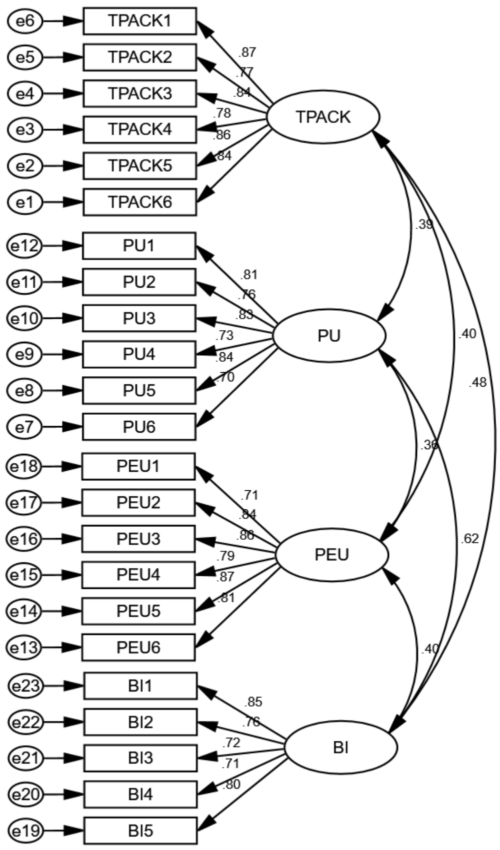

Fig. 2. Factor loadings for the measurement model.

As illustrated in Fig. 2, there were 23 items in total, and factor loadings for all items were greater than 0.7. Thus, the findings indicated that the items used in this study could represent the underlying constructs of TPACK, PU, PEU, and BI.

Then, the construct reliability, convergent validity, and discriminant validity for the measurement model were evaluated. Specifically, the construct reliability was assessed by Composite Reliability (CR), whereby a CR value above 0.7 indicates the model's ability to achieve good construct reliability [39]. The convergent validity was assessed using Average Variance Extracted (AVE), in which this validity will be established if the AVE is greater than 0.5. Next, the discriminant validity was assessed using the Fornell and Lacker Criterion. According to this criterion, discriminant validity is established if the square root of AVE extracted by a construct is greater than the correlation between the construct and any other construct [40]. The summary of the CR, AVE, and square root of AVE values is shown in Table 4.

Table 4. Construct reliability, convergent validity, and discriminant validity

	CR	AVE	TPACK	PU	PEU	BI
TPACK	0.929	0.686	**0.828**			
PU	0.904	0.612	0.391	**0.782**		
PEU	0.921	0.662	0.397	0.357	**0.814**	
BI	0.878	0.591	0.481	0.620	0.395	**0.768**

As shown in Table 4, the CR values ranged from 0.878 to 0.929, i.e., above 0.7. The AVE values ranged from 0.591 to 0.686, which were above 0.5. Moreover, the square root of AVE extracted by each construct was greater than the correlation between the construct and any other constructs. Thus, the construct reliability, convergent validity, and discriminant validity were established in the measurement model of this study.

C. *Assessment of the Structural Model*

The model fit indices, including CMIN/DF, GFI, CFI, TLI, IFI, SRMR, and RMSEA, were used to measure the goodness-of-fit of the structural model. Previous studies recommended that GFI, CFI, TLI, and IFI should be more than 0.9, while SRMR and RMSEA should be less than 0.08. In addition, an acceptable fit is indicated by CMIN/DF of less than 3 [39, 41, 42]. Model fit indices for the structural model in this study are shown in Table 5.

Table 5. Model fit indices for the structural model

CMIN/DF	GFI	CFI	TLI	IFI	SRMR	RMSEA
2.685	0.938	0.969	0.965	0.969	0.0595	0.046

As shown in Table 5, CMIN/DF was below 3, i.e., 2.685. Besides, both the SRMR and RMSEA values were less than 0.08, i.e., 0.0595 and 0.046, respectively. Moreover, GFI, CFI, TLI, and IFI were 0.938, 0.969, 0.965, and 0.969, respectively, indicating that the values were above 0.9. Since all values were within their common acceptance levels, the structural model in this study yielded a good fit.

The standardized coefficients, Critical Radio (CR), and *p*-value were computed using AMOS to analyze the path coefficients of the structural model. The results of path coefficients are summarized in Table 6.

Table 6. Path coefficients for the structural model

Paths	Standardized coefficients	CR	*p*-value
TPACK→BI	0.241	6.316	***
TPACK→PU	0.397	10.027	***
TPACK→PEU	0.403	10.653	***
PU→BI	0.483	11.822	***
PEU→BI	0.140	4.039	***

****p* < 0.001.

As shown in Table 6, the CR values ranged from 4.039 to 11.822, i.e., above 1.96. Thus, the parameter coefficients were statistically significant in the structural model. In addition, all *p*-values in this model were less than 0.001, which indicate the strong relationships between the observed variables. Moreover, the standardized coefficients ranged from 0.140 to 0.483, suggesting positive relationships between the latent variables.

R-squared (R^2) value was used to determine the extent to which the predictors explained the variance in the dependent variable. The calculated values are shown in Fig. 3.

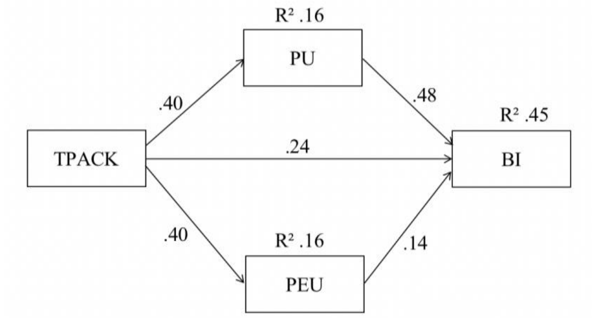

Fig. 3. R-square values for the structural model.

As illustrated in Fig. 3, TPACK explained 16% of the variance in each PU and PEU, respectively. Moreover, 45% of BI was explained by TPACK, PU, and PEU.

D. *Mediation Analysis*

This study assessed the mediating roles of PU and PEU in the relationship between the teachers' TPACK and their BI to use the IWB. The summary of the mediation analysis is presented in Table 7.

Table 7. Mediation analysis summary

	Direct Effect	Indirect Effect	Confidence Interval		*p*-value	Result
			Lower Bound	Upper Bound		
TPACK→PU→BI	0.236 (0.000)	0.188	0.146	0.239	0.000	Partial Mediation
TPACK→PEU→BI		0.055	0.027	0.092	0.001	Partial Mediation

As shown in Table 7, there was a statistically significant weak indirect effect of TPACK on BI through PU (*b* = 0.188, *t* = 8.17, *p* = 0.000), thus supporting H2. In terms of the mediating role of PEU, the analysis similarly revealed a statistically significant weak mediating effect of PEU in the relationship between TPACK and BI (*b* = 0.055, *t* = 3.24, *p* = 0.001), thus supporting H3. Furthermore, the direct effect of TPACK on BI in the presence of the mediators was also moderate (*b* = 0.236, *p* = 0.000), supporting H1. Therefore, both PU and PEU partially mediated the relationship between TPACK and BI.

VI. Discussion

The first objective of this study aimed to explore the impact of teachers' TPACK on their BI to use the IWB. The results indicated that TPACK moderately influenced teachers' BI to use this educational tool. This suggests that teachers with a high level of TPACK were more likely to use the IWB in the classroom. However, the influence was only moderate and other factors were likely involved, as evidenced by the R^2 of BI being only 0.45 and the total direct and indirect effect between TPACK and BI being 0.24 and 0.25, respectively. This finding is in line with the findings obtained in several previous studies [14, 22, 43]. Linking the literature to the findings of this study, it is evident that public high school teachers' TPACK cannot strongly increase their willingness to use the IWB in the classroom. They still need training to improve their ability to incorporate the IWB with content and pedagogy knowledge.

The second and third objectives of this study aimed to examine whether PU and PEU were influential mediators in the relationship between the teachers' TPACK and their BI to use the IWB. The results of this study showed that both PU and PEU were influential mediators in this relationship. However, this influence was weak, as evidenced by the low values of indirect effect of TPACK on BI through PU and PEU, i.e., 0.188 and 0.055, respectively. This finding is not in line with that of previous studies which reported strong mediating effects of PU and PEU in the relationship between TPACK and BI [24, 44, 45]. In the context of the present study, the weak mediating effects of PU and PEU in the relationship between the teachers' TPACK and BI to use the IWB can be explained by two potential reasons. First, the data collection of this study took place during the post-COVID-19 era. In this period, although face-to-face classes were allowed in public high schools in Hebei, China, schools were still closed and only teachers were allowed to enter their schools while students stay at home for online classes in emergencies. In such circumstances, teachers would have to rely on the IWB in the classroom to teach remotely. Therefore, in such situation where teachers have limited alternative teaching options, PU and PEU may become less important mediators in the relationship between TPACK and BI. Second, the majority of teachers in this study have five to ten years of teaching experience. According to the research of Lin [46], PEU affects inexperienced users more than those with higher level of experiences. Similarly, Castañeda *et al.* [47] observed the significantly high impact of PEU on less experienced users compared to the experienced ones. Therefore, this suggests that PEU does not play a crucial role in the decision of experienced public high school teachers to use the IWB in the classroom.

VII. Theoretical and Practical Implications

For theoretical implications, this study extended TAM by incorporating the TPACK variable. Thus, it provides an innovative integration of these two theories. This study also developed a model to understand factors that influenced teachers' BI to use the IWB based on the theoretical foundations of TAM and TPACK. With the proven good validity and reliability, this developed model can be an essential source of information for teachers to fully benefit from the potentials of IWB for teaching and learning in the classroom.

This study provides several practical implications for teachers, educational institutions, and educational authorities. First, teachers should recognize the positive impacts of IWB on their job performance, and at the same time improve their understanding of TPACK. This will help them to easily use various IWB tools as one of their innovative and creative teaching and learning approaches in the classroom. As for educational institutions, it is strongly recommended for them to provide necessary training to support teachers' use of IWB in the classroom. Such training should not only focus on the technical aspects, but also teach the teachers on how to effectively integrate this educational tool into their teaching and learning. In addition, the training can be organized as either online or face-to-face sessions. In these sessions, knowledge sharing among teachers can be facilitated whereby experienced teachers can share about their experiences in using the IWB to improve their job performance and student learning, which will consequently help to increase the willingness of other less or inexperienced teachers in using this tool for teaching and learning. Finally, it is also critically important for educational authorities to consider teachers' TPACK, PU, and PEU when developing and implementing related policies. Specifically, financial, and technical supports can be provided to facilitate teachers' use of IWB in the classroom. Such supports may include the provisions of digital education advisers, online or face-to-face training, and web-based platform with online tutorials on IWB tools.

VIII. Conclusions

This study indicated that TPACK moderately influenced teachers' BI to use the IWB. Additionally, it was identified that PU and PEU were influential mediators in the relationship between TPACK and BI. These findings suggest that teachers are more inclined to use the IWB if they have an in-depth understanding of TPACK and are skillful in using various IWB tools to improve their job performance.

As the scope of this study was limited to one province in China, findings obtained can only be generalized to the specific study area. To address this limitation, future studies are recommended to broaden the sample collection in other provinces in this country in order to obtain more generalized research findings on similar areas of research.

Appendix

Table A. List of questionnaire items

Constructs	Items
Technological pedagogical content knowledge	I know how to use the IWB to enhance the subject I teach.
	I can use the IWB to improve my teaching approaches.
	I can use the IWB to enhance students' learning for a lesson.
	I can use the IWB for different teaching activities.
	I can appropriately combine content knowledge, the IWB and teaching approaches when I teach lessons.
	I can use the IWB in my classroom to enhance students' understanding of the content.
Perceived usefulness	Using the IWB in my job can help me accomplish tasks more quickly.
	Using the IWB can improve my job performance.
	Using the IWB in my job can increase my productivity.
	Using the IWB can enhance my effectiveness on the job.
	Using the IWB can make it easier to do my job.
	I find the IWB useful in my job.
Perceived ease of use	Learning to operate the IWB is easy for me.
	I find it easy to get the IWB to do what I want it to do.
	I clearly understand how to use the IWB.

	I find the IWB to be flexible to interact with.
	It is easy for me to become skillful at using the IWB.
	I find the IWB easy to use.
Behavioral intention	I will use the IWB to interact with my students.
	I will increase the use of the IWB in my future teaching.
	I will use the IWB in my class to enhance students' learning.
	I will use the IWB to assess students' learning.
	I will use the IWB to provide a variety of teaching approaches.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Weihao Zhao conducted the research, analyzed the data, and wrote the paper. Sadiah Baharom and Nordin Abd Razak provided the overall guidance for the research and reviewed the paper. All authors had approved the final version.

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