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Development of the Interactive Whiteboard Acceptance Scale (IWBAS): An Initial Study

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ABSTRACT

The purposes of this study were to develop and to conduct an initial psychometric evaluation of the Interactive Whiteboard Acceptance Scale (IWBAS). The process of item-generation for the IWBAS was carried out through the sequential mixed-method approach. A total of 149 student teachers from a teacher-education institution in Australia participated in the project.The principal component analysis (PCA) yielded a five-factor model comprising 14 items, and its factorial validity was confirmed through the use of confirmatory factor analysis (CFA) using structural equation modelling (SEM). The IWBAS reached the minimum thresholds for an acceptable model fit. In addition to the factorial validities, the convergent validity and discriminant validity of the IWBAS were examined, both showing satisfactory validity and good internal consistency for all five constructs. On this basis, the IWBAS can be considered a valid and reliable instrument designed specifically for assessing IWB acceptance among student teachers.

Keywords

Interactive whiteboard, Student teachers, Educational technology, Technology acceptance

Introduction

The introduction of the interactive whiteboard (IWB) into the multimedia learning environment has ushered in a new era of educational technology. It is a versatile, multi-touch, multi-user interactive learning board that allows groups of learners to work simultaneously. First introduced by SMART Technologies, it found ready acceptance in the United Kingdom for office presentations, and IWBs soon became a mainstay in the British education system (Higgins, Beauchamp, & Miller, 2007). From the research literature it is evident that the use of the boards has led to improved teaching and learning in schools (Hennessy, Deaney, Ruthven, & Winterbottom, 2007; Higgins et al., 2007; Murcia & Sheffield, 2010; Preston & Mowbray, 2008; Wong, Goh, & Osman, 2013). The IWB is a stand-alone interactive display that runs on the teacher's computer or laptop. IWBs can be placed in any suitable position such as mounted on a wall or on a floor stand.

Advocates have noted that one of the most obvious distinctions between IWB technology and other technologies incorporating a data projector and a computer is that users are able to control the computer at the touch of the whiteboard. It also has the advantage that teachers can remain in the front of the class and still be interacting with both the students and the computer applications. As Wong, Goh, & Osman (2013) have noted, this enables teachers to explain topics and teach with more focus. In addition, teachers and students can seamlessly alternate between texts, sound, video and other applications through interacting with the whiteboard whenever required. With the multi-modality and versatile features of the IWB it is not surprising that teaching and learning have become more interesting, fun, and creative. Reports by Becta, an advisory body for educational technologies in British schools, has identified four advantages for students from the use of IWBs; increased enjoyment and motivation, greater opportunities for participation and collaboration, decreased need for note-taking through the capacity to print from the screen, and the potential to cater for different learning styles (Becta, 2004). Evidence reported in recent literature shows that the IWB is no longer a peripheral add-on feature of the computer but is currently considered an integral part of the instructional process (Campbell & Kent, 2010; Northcote, Mildenhall, Marshall, & Swan, 2010; Turel, Serenko, & Bontis, 2011; Wong, Russo, & McDowall, 2013). White (2007) has estimated that, globally, about 750,000 IWBs have been installed in schools across all levels. At the country level, Türel (2011) calculated that about 50 percent of classrooms in Denmark, 47 percent in The Netherlands, and 45 percent in Australia have IWBs installed. In Australia, for example, studies conducted at Abbotsleigh Junior School over the past five years have concluded that IWBs have enhanced teaching and learning as well as facilitating more collaborative and constructive learning (Preston & Mowbray, 2008). Researchers have attributed the success of the IWB for teaching and learning to its alignment with the views of Piaget (1967) and Vygotsky (1978) on “constructivist” teaching. Constructivist learning theory contends that learners create knowledge through personal experiences. Using the board, students are able to compile diagrams and maps based on their prior knowledge and in so doing they initiate active discussions and encourage constructivist learning environments. Furthermore, the IWB has a large-screen display and promotes task authenticity, especially when teachers connect it to online news sites, so bringing the world into the classroom and encouraging further constructive discussions (Wong, Goh, Osman, 2013). Similarly, students can participate actively inlessons in which they explore problems and learn through hands-on and collaborative experiences.

In response to the growing popularity of the IWB, many researchers have begun to assess its affordability and to evaluate its contributions to subject-specific forms of instruction, such as in mathematics (Jewitt, Moss, & Cardini, 2007; Swan & Marshall, 2010), science (Hennessy et al., 2007; Murcia & Sheffield, 2010; Wong, Goh, & Osman, 2013), teaching in elementary schools (Goodwin, 2008); literacy (Shenton&Pagett, 2007); writing (Martin, 2007); early childhood (Wong, Russo, & McDowall, 2013) and special needs (Keay-Bright, Norris & Owen, 2007). The findings of these various studies attest, either directly or indirectly, to the status of IWB as a new-generation classroom tool which has the capability to encourage the engagement of digital learners in teaching and learning in ways that are more effective than other teaching technologies. With its distinctive features, the IWB has been found to be a suitable tool that can seamlessly engage with conventional pedagogy practices (Betcher& Lee, 2009).

The study

To date, despite the credit and adulation given to IWBs for their effectiveness in teaching and learning, there has been a paucity of studies exploring and examining IWB acceptance among student teachers. It is noteworthy that despite the numerous technology-acceptance measurements that have been formulated to understand acceptance of different types technology in different settings (Ajzen & Fishbein, 1980; Davis, Bagozzi, & Warshaw, 1989; Davis, 1989; Venkatesh, Morris, Davis, & Davis, 2003; Wong, Teo & Russo, 2013), none of the measurements has been particularly pertinent to the acceptance of IWB in teaching and learning.

Some recent studies (Türel, 2011; Türel & Johnson, 2012; Şad, 2012) have aimed to empirically develop a valid and reliable IWB measurement to explore IWB use by researching the perceptions of school students or practicing teachers, however, none has focused on student teachers’ perspectives of IWB acceptance. Researchers believe that student teachers have different backgrounds, mindsets and attitudes regarding IWB acceptance. It is noteworthy that school students and student-teachers in teacher education institutions have quite different reasons for using IWBs (Wong, Russo, & McDowall, 2013). Furthermore, the type of technology selected for teaching and learning practice by student teachers is based mainly on the topic and its objectives. In addition, student teachers tend to have freedom to use any teaching tools which they consider best suited to their planned lessons (Teo, Wong, & Chai, 2008). Along the same lines, advocates of IWBs have highlighted that user groups and applications engaged with the technology were significant predictors for technology acceptance in various settings (Im, Kim, & Han, 2008; Marchewka & Kostiwa, 2007; Venkatesh et al., 2003). As a consequence, it was deemed more accurate to measure technology acceptance based on technology type, its applications, and the group involved.

On this basis, having a valid and reliable instrument designed specifically for assessing IWB acceptance by student teachers could provide insights into issues relating to its use. Furthermore, such information would be useful for policymakers and teacher-educators, especially in the design of curricula which could enhance learning experiences for trainee teachers, thus encouraging them to engage in using new technologies in their future teaching and learning activities.

Given the reported effectiveness and versatility of the IWB in education, this researcher’s attention has been drawn to consider the level of acceptance of the IWB by student teachers. This interest is consistent with evidence to suggest that student teachers’ opinions may mirror those of future teachers (Teo, Lee, & Chai, 2008; Wong, Teo, & Russo, 2012). In addition, so far a literature review has not yielded any references to instruments developed to understand student-teacher acceptance of the IWB. It is pertinent to note at this point that over the past three or four decades new technologies have not always been readily adopted by educators and neither have they been used as manufacturers have expected. Consequently, a valid and reliable instrument designed for assessing IWB acceptance among student teachers could provide insights into issues relating to the use of technology in schools and other educational sectors. It is reasonable to believe that a valid IWBAS could enhance the understanding of teacher-educators and related policymakers regarding the factors influencing the acceptance of IWB by student teachers, thus ensuring that trainees engage IWBs in their future teaching and learning activities. Thus, having a specific measurement or scale to evaluate IWB acceptance among student teachers is a worthwhile issue for serious enquiry.

The aim of this study was to develop a valid and reliable Interactive Whiteboard Acceptance Scale (IWBAS) in order to explore and understand factors influencing student-teacher acceptance of the IWB.

Method

Item generation

The process of item generation for the IWBAS was carried out through the sequential exploratory mixed-method, a powerful method for developing and validating a new instrument (Creswell, 2003). In the current study the researchers commenced with a qualitative approach in order to establish the content and validity of the scale, this being followed by quantitative analyses to assess the factor structure and psychometric properties. The exploratory mixed-method has been used in previous studies for developing and validating measurements in educational settings (Teo, 2010; Türel, 2011; Şad, 2012). In the qualitative phase, a review of the literature of similar fields was carried out, with particular emphasis on the items employed in empirical studies (Compeau & Higgins, 1995; Davis, 1989; Gibson & Dembo, 1984; Riggs & Enochs, 1990; Teo, 2009; Thompson, Higgins, & Howell, 1991; Venkatesh et al., 2003).

The literature relating to this area provided a practical framework for constructing the IWBAS (Teo, 2010; Türel, 2011; Şad, 2012; Venkatesh et. al., 2003). This was supplemented by information obtained when the researchers interviewed seven student teachers in order to help build the item pool. The interviews consisted of predetermined questions derived from the literature on similar fields of enquiry. The participating student teachers were recommended by colleagues and through personal contacts. A total of 28 items were created in the first draft. Next, before an examination of the psychometric quality of the IWBAS scale was performed, verification of the content and criterion-related validity was carried out. The researchers consulted several academic several academic researchers experienced in instructional design, three IWB certified trainers, and five teachers experienced in the use of the IWB, their advice being invaluable in determining the items to be used for nomological validity. Next, the items were given to ten student teachers for preliminary examination. The students were randomly selected (being non-participants in the previous interviews) and were asked to explain to researchers the meaning of each item.

Subsequently, a 14-item scaled questionnaire was compiled to assess the acceptance of the IWB. The IWBAS consisted of a four-point Likert scale with responses ranging from “strongly disagree” (1) to “strongly agree” (4). The four-point scale was employed to minimise both a social desirability bias (Garland, 1991; Worcester & Burns, 1975)and respondents’ tendency to choose a midpoint on a five-point format (Matell & Jacoby, 1972). For the quantitative phase, an examination of the psychometric quality of the IWBAS was carried out to ensure the validity and reliability of the items used. For these purposes, a principal component analysis (PCA) and a confirmatory factor analysis (CFA) were implemented.

Participants and data-collection methods

Invitations to participate in this study were extended to student teachers enrolled in science-related courses including the Bachelor of Early Childhood Education, Bachelor of Education (Junior Primary and Primary), and Bachelor of Education (Primary and Middle). A total of 149 agreed to participate; 112 from the first course, 17 from the second, and 20 from the third. Of these participants 146 (98 percent) were female because of the preponderance of female student teachers in the early- and primary-teacher education programmes. Most of them (88.1 percent) had not attended any formal IWB training or workshop, although 74.8 percent reported having had some previous experience with using IWBs for teaching and learning. Participation was voluntary and anonymous and no course credits were given. All participants were briefed on the purpose of the study and informed of their right to withdraw during or after data collection. Participants took approximately 20 minutes to complete the questionnaire.

Results

Psychometric quality of the instrument

In order to develop a valid and reliable IWBAS, close examinations of the factor structure and psychometric properties of the items were conducted. For these purposes, a principal component analysis (PCA) and a confirmatory factor analysis (CFA) were performed.

Principal component analysis (PCA)

A principal component analysis (PCA) was carried out to examine and compute composite scores for the constructs underlying the IWBAS. It is common to assess the factorial validity of the scale used in a research project, and prior to conducting the principal component analysis it is sound practice to appraise the suitability of the dataset. All 14 items were examined for their mean, standard deviation, skewness, and kurtosis. All mean scores were above the midpoint of 2.5, the range being between 2.8 and 3.2. This indicated an overall positive response to the constructs in the study. The standard deviation (SD) values for all constructs were less than one. This indicated that the item scores had a relatively narrow spread around the mean. The univariate normality of the dataset was assessed through inspection of skewness and kurtosis, with values less than 3.0 and 10 respectively, indicative of acceptable normality (Kline, 2010). From the findings, the skewness (performance expectancy = -.94; effort expectancy = .32; social influence = -.29; facilitating conditions = -.97; self-efficacy = .36) and kurtosis (performance expectancy = .19; effort expectancy= .48; social influence = .30; facilitating conditions = .98; self-efficacy = .17) indicated that all constructs were acceptable. In addition to the normality test, the results of the Kaiser-Meyer-Olkin (KMO) test (.685) and Bartlett's test of sphericity (BTS) (χ^2 = 764.008; df = 91; p < .001) indicated the dataset was adequate for factorability analysis.

After the dataset was assessed for its factorability, the 14 items of the IWBAS were subjected to factor analysis. An eigenvalue greater than 1 should be achieved to determine the number of components in the scale (Kaiser, 1960). Based on Kaiser's assumption, the suggested IWBAS had five components with eigenvalues exceeding 1. The results depicted in Table 1 show that the theoretical five-factor structure in the IWBAS explained 70.98 percent of the total variance where the first factor had an eigenvalue of 3.14 and explained 22.44 percent of the total variance while the second factor had an eigenvalue of 2.29 and explained 16.35 percent of the total variance. The third factor had an eigenvalue of 1.78 and explained 12.73 percent of the total variance. The fourth and last factors contributed 19.44 percent to the total variance of the IWBAS. Furthermore, the results indicated that all the factor loadings of the individual items were above .50 and ranged from .68 to .93. None of the items reflected high factor loadings on a second or additional factor. Principal Axis Factoring (PAF) was carried out to cross check the PCA results, and the variances explained from the PAF were similar to the PCA. Consequently, these results confirmed that at least half the variances in all the indicators were explained by their respective latent constructs. Hair, Black, Babin and Anderson (2010) suggested that an item is significant if its factor loading is greater than .50.

Based on the five-factor structure from the PCA, and further examining the theoretical meaningfulness and coherence of the loaded items in each factor, five constructs were identified. They were performance expectancy (PE) (three items), effort expectancy (EF) (three items), social influence (SI) (three items), facilitating conditions (FC) (three items), and self-efficacy (SE) (two items). In the present context, performance expectancy refers to student-teachers' belief that using IWBs would help them to attain benefits for their teaching and learning practices. Effort expectancy refers to the extent to which student teachers believe that the use of IWBs would require little effort and enable them to be free of distractions. Social influence refers to the extent to which student teachers' perception that most people who are important to them think they should or should not use the IWB. Facilitating conditions refer to the degree to which individuals believe that organisational and technical infrastructures exist to support them. On the other hand, self-efficacy refers to student teachers' judgement of their capabilities to teach with the technology (IWB).

Table 1. Results of a principal component analysis of the item scale

Construct	Item		Loading	Eigenvalues	Variances explained (%)
Performance Expectancy (PE)	PE1	I would find using IWBs useful for teaching science.	.77	2.35	16.82
	PE2	Using the IWBs for teaching and learning in the science classroom would enable me to accomplish tasks more quickly.	.92		
	PE3	If I use IWBs for teaching, I will increase my employment opportunities.	.81		
Effort Expectancy (EE)	EE1	It would be easy for me to become skilful at using IWBs.	.88	2.30	16.44
	EE2	I would find it easy to use IWBs for teaching science.	.84		
	EE3	Learning to use the IWBs for teaching would be easy for me.	.66		
Social Influence (SI)	SI1	Educators who influence my behaviour would expect me to use IWBs for teaching science.	.82	2.05	14.71
	SI2	People who are important to me will think that I should use IWBs.	.75		
	SI3	This university has been helpful with learning to use IWBs.	.74		
Facilitating Conditions (FC)	FC1	I have the resources to practice with IWBs.	.82	1.84	13.20
	FC2	I have the knowledge and skills to use IWBs.	.92		
	FC3	When I need help to use the IWBs, someone is there to help me.	.84		
Self-Efficacy (SE)	SE1	I think using IWBs would be very hard for me.	.75	1.37	9.82
	SE2	In the future, if the performance of my students improves, I believe it is usually because of effective teaching with IWBs.	.82		

Note. Extraction method: Principal Component Analysis (PCA)
Rotation method: Varimax with Kaiser Normalization

Confirmatory factor analysis (CFA)

Factorial validity for the five-factor structure of the 14-item scale was confirmed through the use of confirmatory factor analysis (CFA) using structural equation modelling (SEM). A maximum likelihood estimation (MLE), using underlying AMOS software, was carried out for this purpose. Table 2 shows that all parameter estimates were significant at the $p < .05$ level, as indicated by the t – value which was greater than 1.96. All standardised estimated weights were above .50 and ranged from .541 to .968: these values were considered appropriate and acceptable (Hair, et al., 2010). Furthermore, the multiple square correlations (R^2) of all items ranged from .30 to .94, suggesting that these items were explained by their predictors in a range between 30 percent and 94 percent. In this study, indices of composite reliability were reported in recognition of the problems associated with the use of Cronbach's Alpha (Teo& Fan, 2013). These appeared to be above the recommended thresholds for each construct and provided support for the significant indicator-factor relationship of the IWBA scale.

As part of the development of the scale several alternative models should be computed to allow comparisons of different conceptualisations of the factor structure of the proposed scale (Teo, 2010). A series of CFAs was performed to test the models in different factor structures, and the model fit was then assessed. First, a null model (M0) indicated that all the factors were uncorrelated. Second, a one-dimensional structure model (M1) was tested. Finally, a five-structural construct model (M2) was assessed for its fit.

To ensure that the measurement model exhibited a good fit, the following five absolute-fit indices were monitored: Ratio of its degree of freedom (χ^2/df); Goodness of Fit (GFI); Comparative Fit Index (CFI); Tucker-Lewis Index

(TLI); and Standardised Root Mean Square Error of Approximation (RMSEA). Absolute-fit indices measure how well the proposed model reproduces the observed data. According to Hair et al. (2010), the values of GFI and CFI should be more than 0.90 and that of the RMSEA smaller than 0.05 in order to be considered a "good fit." For χ^2/df, a value below 3.0 is considered acceptable. Finally, the TLI value should be greater than 0.90.

Table 2. Results of the measurement model

Construct	Item	SE	t-Value[a]	R^2	Average Variance Extracted[b] (≥.50)*	Composite Reliability[c] (≥.50)*
PE	PE1	.753	-	.568	.70	.851
	PE2	.903	5.61	.815		
	PE3	.553	4.34	.306		
SE	SE1	.706	3.55	.499	.62	.561
	SE2	.552	-	.305		
EE	EE1	.869	-	.755	.64	.738
	EE2	.746	6.67	.556		
	EE3	.522	5.59	.272		
SI	SI1	.791	-	.626	.60	.661
	SI2	.593	4.62	.352		
	SI3	.541	4.51	.292		
FC	FC1	.728	8.79	.529	.74	.836
	FC2	.968	8.87	.938		
	FC3	.702	-	.493		

Note. [a]t-Value (critical ratio) shows whether the parameter is significant at the .05 level.[b]AVE: Average Variance Extracted = $(\sum\lambda^2) / (\sum\lambda^2) + (\sum(1-\lambda^2)$.[c]. Composite Reliability = $(\sum\lambda^2) / (\sum\lambda^2) + (\sum(1-\lambda^2))$.
*Indicates an acceptance level or validity. - This value was fixed at 1.00 for model identification purposes, hence no *t*-value was estimated. SE: Standard Estimate

*Table 3.*Good-of-fit indices and comparison of alternative models

Model	χ^2	*df*	GFI	CFI	TLI	RMSEA	χ^2/df	$\Delta\chi^2(df)$sig	Comparison
Null model									
M0	791.562*	91	.574	.000	.000	.221	8.698		
One-factorial model									
M1	607.225*	77	.647	.243	.106	.209	7.886	(14),182.33**	M1 vs M0
Five-factorial model									
M2	108.063*	66	.910	.940	.917	.064	1.637	(11),499.16**	M2 vs M1

Note. Ratio of the χ^2statistic to its degree of Freedom (χ^2/df); Goodness of Fit (GFI); Comparative Fit Index (CFI); Tucker-Lewis Index (TLI); and Root Mean Square Error of Approximation (RMSEA); $^{**}p < .01$; ns = not significant

From Table 3 it can be seen that the M0 and M1 did not reach the minimum thresholds typically requested for an acceptable fit. However, the M2 showed much better fit statistics and attained the minimum thresholds for an acceptable model fit ($\chi^2 = 108.063^{**}$, $p < 0.00$; $\chi^2/df = 1.637$; GFI = .910; CFI = .940; TLI = .917 and RMSEA = 0.064). However, the χ^2 statistic was found to be too sensitive to sample size differences, especially for studies with large samples. Hair et al. (2010) noted that as the sample size increases there is a great tendency for the χ^2 statistic to indicate significant differences.

Convergent and discriminant validities

In addition to the factorial validities, the convergent validity and discriminant validity of the IWBAS were examined through inspection of the average variance extracted (AVE) and discriminant validity. The AVE for each measure was above .50 which suggested that more than half of the variance observed in the items was accounted for by the hypothesised factors. Table 4 shows the discriminant validity of the measure items. Discriminant validity is present when the variance shared between a construct and any other constructs in the model is less than the variance that constructs share with their indicators (Teo, 2010). If the square roots of the AVEs are greater than the off-diagonal elements in the corresponding rows and columns, it suggests that the given construct is more strongly correlated with its indicators than with the other constructs in the model (Teo, 2009). From Table 4 it can be seen that the values in the matrix diagonals (representing the square roots of the average variance extracted) are greater than the off-diagonal elements in their corresponding rows and columns, suggesting that discriminant validity was present in the five-factor model with 14 items (performance expectancy (PE) (three items), effort expectancy (EF) (three items), social influence (SI) (three items), facilitating conditions (FC) (three items), and self-efficacy (SE) (two items).

Table 4. Discriminant validity for measurement model

	PE	EE	SI	FC	CTE
PE	(.83)				
EE	.065	(.80)			
SI	.162	.046	(.77)		
FC	.078	.215	.105	(.86)	
SE	.362	.177	.174	.118	(.78)

Note. Diagonal in parentheses: square root of average variance extracted from observed variables (items); Off-diagonal: correlations between constructs.

Administering the survey and interpreting scores

It took each participant approximately 20 minutes to complete the IWBAS. The survey consisted of 14 items and participants were requested to select their responses from a four-point scale. In order to determine each participant's level of acceptance of the IWB he/she was requested to select the most appropriate answer from the following options: strongly disagree (1), slightly disagree (2), slight agree (3) to strongly agree (4). The higher the score, the greater the level of IWB acceptance. The 14-item scores ranged from 14 to 56. Participants were informed that no credit would be given, that pseudo-names would be used, and that they had the right to withdraw during or after data collection.

Limitations of the study

Despite the results indicating that the IWBAS is reliable and valid, some primary limitations mirror the need for further investigation. First, self-reporting items were employed to measure the variables for the present study, thus suggesting the possibility of bias in the findings because participants may have given socially desirable responses, especially since one of the researchers was the course coordinator. Second, the population of this study involved only participants from one teacher-education institution and therefore the findings may not adequately reflect the perceptions of the general student-teacher population in regard to IWB acceptance. Associated with this, the use of the same sample for both exploratory and confirmatory factor analyses was not ideal as this gave rise to a potential capitalization on chance in the latter analysis. To ensure validity any future studies should employ a larger sample from different institutions, and from across a broader set of grade levels, including secondary school, to assess the psychometric properties of the IWBAS. Additionally, future studies should also examine the parsimony, interpretability and consistency of the IWBAS by conducting the survey with practising teachers who would be more likely to have experienced new technologies and had considerable autonomy over their teaching tools. Third, as the theoretical five-factor structure in the IWBAS explained only 70.98 percent of the total variance, it is recommended that future research should include other constructs that may determine IWB acceptance and so account for the unexplained variance. It is relevant to note, too, that although findings from the current study achieved good psychometric characteristics and properties overall, the use of the four-point Likert scale should be employed with caution. Future use of a five- or seven-point Likert psychometric scale could be used to enable comparisons with the current study. It could assess and justify any possibility of acquiescence and social desirability bias in the current scale and, if any, provide better linguistic qualifiers for each item.

Conclusions and recommendations

The purposes of this study were to develop and provide an initial psychometric-property evaluation of a scale to assess the level of acceptance of the IWB. This scale provides a better understanding of IWB acceptance among students in teacher-education institutions, and it highlighted student teachers' perspectives regarding technology usefulness, ease of use, social encouragement, individual beliefs, and facilitation of support for the use of IWBs. A total of 28 items were created in the first draft, these being reviewed for content and criterion validity by expert panels. Through elimination of unapproved items, 14 items concerning the IWB acceptance scale were assessed by principal component analysis and confirmatory factor analysis. The exploratory factor analysis indicated that the items in the IWBAS consisted of a five-factor structure comprising performance expectancy, effort expectancy, social influence, facilitating conditions, and self-efficacy. The results showed that the theoretical five-factor structure in the IWBAS explained 70.98 percent of the total variance.

In addition to examining the psychometric properties of the IWBAS the researchers also demonstrated the use of confirmatory factor analysis to provide a more parsimonious list of items to measure student-teacher acceptance of the IWB. A series of confirmatory factor analyses was performed to allow comparisons of different conceptualisations of the factor structure and to obtain the best model fit. Results indicated that the hypothesised five-factor structure had good standardised loadings, and all the absolute-fit indices were above the recommended thresholds for an acceptable model fit. Furthermore, results from convergent validity and discriminant validity of the IWBAS showed satisfactory reliability and validity of all five constructs. On this basis, it is concluded that the five-factor structure of the IWBAS is reliable and valid as a scale to measure IWB acceptance among student teachers. Indeed, the scales developed and validated in this study indicated the importance of performance expectancy, effort expectancy, social influence, facilitating conditions and self-efficacy for IWB acceptance.

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