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Examining the reliability and validity of measuring scales related to informatization and instructional leadership using the PLS-SEM approach

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ABSTRACT

This study focuses on six variables that impact teachers' use of technology in their instructional leadership: usage expectancy (UE), social influence (SI), enabling circumstances (FC), behavioural intention (BI), computer self-efficacy (CSE) and blended teaching competency. This study aimed to examine the reliability and validity of modified scales incorporating UE scales including the PE scale, EE scale, SI scale, FC scale, CSE scale, BTC scale, BI scale and TIIL scale. A total of 60 in-service university teachers participated in this research. The PLS-SEM approach was employed to examine the reliability and validity of all scales. Composite reliability (CR) and Cronbach's alpha determine internal consistency and reliability. Convergent validity was assessed by the outer loading and the average variance extracted (AVE). Assessment of discriminant validity was conducted by the Fornell-Larcker criterion, cross-loadings and Heterotrait-Monotrait Ratio (HTMT). After deleting nine items that were lower than .40, Cronbach's alpha and CR values were all higher than .70. All scales' item values fulfilled the criteria of AVE (>.50), Fornell-Larcker criterion, cross-loading and HTMT(<.90). Assessment results indicate that all modified scales have established validity and reliability for in-depth research. This research contributed to the PLS-SEM research technique, examined TIIL's influencing elements in the Chinese environment, enhanced the theoretical model of TIIL and provided useful assistance for the field's advancement.

Contribution/Originality: This study offers original insights into teachers' informatization instructional leadership in China. It extends theoretical knowledge by additionally highlighting two intrinsic individual elements based on UTAUT using PLS-SEM to examine the validity and reliability of scales for further research.

1. INTRODUCTION

The present teaching and learning environment is complex with blended teaching and learning. Blended teaching was defined by Graham (2006) as a models that "combines face-to-face instruction with computer mediated instruction". The COVID-19 has made blended learning a standard teaching modality at universities worldwide (Ritimoni, Prasenjit, & Kandarpa, 2021). This presents an additional obstacle for university teachers who need to acquire computer technology in order to monitor or manage blended learning. Thus, the traditional face-to-face methods of teaching and monitoring university classes have been impacted resulting in a method for implementing university teachers' digitalization. TIIL needs to lead and manage blended teaching through computer technology, devices and a teaching management platform.

Furthermore, the Chinese Education Informatization 2.0 action plan (Lei, 2018) pushed university teachers to integrate computer technology into leading and managing blended teaching. According to concepts in the leadership process, university teachers must constantly modify themselves and improve their proficiency in information-based instructional leadership in order to adapt to the evolving blended teaching and learning environment. What factors influence TIIL? It is a concerned for many educational researchers during COVID-19.

Teachers' informatization instructional leadership is a kind of comprehensive competence that teachers use to lead and manage blended teaching with the help of internet tools and devices. Zhao and Zhang (2019) proposed factors affecting TIIL from the perspective of extrinsic factors, intrinsic factors and individual ability factors i.e. blended teaching competence. The UTAUT model by Venkatesh, Morris, Davis, and Davis (2003) is increasingly applied in the educational domain for exploring influencing factors in behavioral intention to use a system or technology and investigating individual use behaviors.

Previous research mainly adopted the first-generation analytical technique to conduct correlation analysis or regression analysis to explore factors influencing teachers' instructional leadership (Zhao & Zhang, 2019). There is a lack of effectiveness in the field of instructional leadership when using second-generation techniques. Further investigation tools that use second-generation techniques such as PLS-SEM are still lacking. The goal of this study is to close the gap by evaluating the validity and reliability of an instrument that has been modified to look at the contributing elements that impact TIIL.

2. LITERATURE REVIEW

2.1. Definition of Teachers' Informatization Instructional Leadership

The term "informatization" originated in the Japanese translation of "johoka". Robert and Lavina (2012) defined educational informatization as a process pertaining to education and nurturing subsystems based on a task-oriented, that integrates methods, theories, technology and optimal use of ICT tools into the education domain to attempt to protect health and gain human education and development goals. Informatization leadership was one of the concepts that described and explained the leadership role shift which bridged two fields of leadership and technology. Informatization leadership is the ability to integrate information technology and management to facilitate the rapid absorption and use of information technology (Duan, 2020). Teachers' informatization instructional leadership (TIIL) is a product of the combination of information technology and teachers' instructional leadership in the context of the information age (Sun & Liu, 2015). Informatization Teaching Environment Construction (ITEC), Informatization Extracurricular Learning Leading (IELL) and Informatization Classroom Teaching Management (ICTM) are concepts that refer to teachers' informatization instructional leadership from the perspective of the leadership process (Zhao & Zhang, 2019).

The term "teachers' informatization instructional leadership" in the context of current research refers to an information technology integration process with instructional management and leadership. Additionally, it also refers to the comprehensive competence with which teachers use information technology to manage and lead the blended teaching process. TIIL is not only related to the conventional e classroom but also extends beyond the classroom and their roles are diversified before, during, and after the classroom. This research will use survey questionnaires referring to Zhao and Zhang's (2019) measure of TIIL in three dimensions: ITEC, IELL and ICTM.

2.2. Factors Affecting Teachers' Informatization and Instructional Leadership

Instructional leadership involves a multidimensional research perspective. Zhao and Zhang (2019) discussed TIIL in terms of connotation, influencing factors and improving paths using first-generation data analysis methods (i.e., correlation analysis and regression analysis) and disclosed the correlated relationship between TIIL and its affecting factors such as the availability and accessibility of equipment and network conditions, the accessibility and value of extracurricular online learning resources, blended teaching competence, the ability to rationally control network autonomous learning time and informatization teaching evaluation ability.

The Unified Theory of Acceptance and Use of Technology (UTAUT) originally measured the factors influencing employees who accept and employ information technology. These days UTAUT is increasingly applied to technology acceptance and use in educational contexts (Agudo-Peregrina, Hernández-García, & Pascual-Miguel, 2014; Attuquayefio & Addo, 2014; Bervell & Arkorful, 2020; Mukred, Yusof, Alotaibi, Mokhtar, & Fauzi, 2019; Arumugam Raman & Don, 2013). Dwivedi, Rana, Jeyaraj, Clement, and Williams (2019) asserted that the UTAUT model could measure many factors influencing the decision to use technology because it incorporated previous theories pertaining to the theory of reasoned action (TRA) by Fishbein and Ajzen (1975) the theory of planned behavior (TPB) by Venkatesh et al. (2003) and the Technology Acceptance Model (TAM) by Chuttur (2009). The UTAUT model by Venkatesh et al. (2003) was indicated to predict teachers' behavioral intention in the classroom to use technology and use behavior in terms of PE, EE, SC and FC (Bian, Tian, & Meng, 2016; Li & Zhao, 2021; Malczyk, 2018; Raman & Thannimalai, 2021; Yeop, Yaakob, Wong, Don, & Zain, 2019).

This study employed UTAUT to explain the TIIL behavior. Performance expectancy is adapted to suggest that university teachers will find computer technology useful in instructional leadership. According to this study's adaptation of effort expectations, university teachers will be more inclined to engage in instructional leadership if they find it simple to use computer technology for managing and directing the learning process. Social impact has been modified to show that in-service teachers using TIIL behaviour are influenced by their peers' views about their technology use. Facilitating conditions are adapted to consider if teachers' adoption of TIIL is affected by the support from the technical and policy of a university.

Furthermore, computer self-efficacy (CSE) and blended teaching competence (BTC) were attempted to become two additional direct determinants of university teachers' behavioural intention and informatization instructional leadership behaviour in a proposed structural model based on the UTAUT model in current research. This is grounded in the Theory of Planned Behavior (TPB) that blended teaching competence is one of technology skills and computer self-efficacy is one of self-efficacy beliefs. Moreover, the research by Compeau, Higgins, and Huff (1999) in the information system research area has found that individual computer-related behaviors and attitudes are rooted in all or part of social cognitive theory (SCT) by Bandura (1997). Liaw, Chang, Hung, and Huang (2006) found that computer self-efficacy positively affects individual cognition and behaviors. The theory of planned behavior proved that blended teaching competence is a kind of control belief and perceived facilitation which is used to measure teachers' informatization instructional leadership behavior. This argument was identified by Zhao and Zhang (2019) that teachers' blended teaching competency is one of the important influencing factors in predicting teachers' informatization instructional leadership (TIIL).

Wong (2013) and Hair, Hult, Ringle, and Sarstedt (2017) evaluated SmartPLS as one of the second-generation leading software utilization for PLS-SEM considered it a powerful tool for analyzing multivariate data. However, data analysis in related research on informatization instructional leadership still mainly adopts correlation analysis and regression analysis (Li, 2020; Zhao & Zhang, 2019). Yu and Zhang (2020) used AMOS-SEM to assess the predicted correlation between teacher information technology leadership and teaching efficacy based on the Chinese education context. Nevertheless, the employment of PLS-SEM to validate the instruments is still scarce.

In relation to the above review, prior to examining the interrelation between PE, EE, SC, FC, BI, CSE, BTC and teachers' informatization instructional leadership (TIIL) among university teachers explore contributing construct-factors to TIIL. This pilot study mainly assesses the reliability and validity of instruments using SmartPLS in terms of three criteria: internal consistency and reliability depending on composite reliability (CR) and Cronbach's alpha, convergent validity leaning against outer loading and average variance extracted (AVE), and discriminant validity relying on the Fornell-Larcker criterion, cross-loadings and Heterotrait-Monotrait Ratio (HTMT).

3. MATERIALS AND METHODS

3.1. Participants

Sample participants were randomly selected through purposive sampling techniques and random cluster sampling techniques with the recruitment of 60 in-service teachers from a total population of nine private undergraduate universities in Xi'an city Shaanxi Province China. According to the comprehensive ranking of private undergraduate universities from the Chinese Ministry of Education, Chinese private universities are divided into four clusters. The elected four private undergraduate universities respectively represent four different clusters of private undergraduate universities because they have carried on blended teaching which is a necessary condition for adopting teachers' informatization instructional leadership. The goal of the purposive sample strategy is to eliminate private undergraduate institutions that have not used blended learning.

The next step was using a random cluster selection approach to choose in-service teachers who represented various university clusters. In other words, each university cluster had an equal chance of being selected throughout the sampling process. A total of 60 in-service teachers were finally selected randomly from five left universities with 15 in-service teachers representing each of the four cluster universities. They represent top private universities in China (A), first-class private universities in China (B), first-class private universities in the area (C) and well-known private universities in the region (D).

3.2. Instrument

Table 1 shows the code and all the items used in this research instrument. Buabeng-Andoh and Baah's (2020) evaluation scale known as the Use Expectancy (UE) instrument was first developed to assess pre-service teachers' intention to adopt learning management systems. It also referred to a five-point Likert scale (Wang, 2018). It consists of 5 items measuring the 'Performance Expectancy' (PE) dimension and 5 items adapted to measure the 'Effort Expectancy' (EE) dimension. A six-point Likert scale has been developed and adapted for use with the SI scale which measures social impact and the FC scale which measures enabling circumstances (Buabeng-Andoh & Baah, 2020) and a five-point Likert scale (Wang, 2018).

The CSE scale was adapted from Compeau et al. (1999). Compeau et al. (1999) initially devised three questions for measuring self-efficacy: I feel comfortable using this system. I can easily operate any device on this system if I want to. I can use the devices in the system even if no one is around to tell me how to use them. The present study modified the computer self-efficacy scale, comprising five items to assess the computer self-efficacy of university teachers in the context of blended learning and information leadership. The original scale was based on this model. The Blended Teaching Competence (BTC) scale was developed by Graham, Borup, Pulham, and Larsen (2019) referring to Pulham and Graham (2018) which was originally to measure pre-service and in-service teachers' blended teaching competence. The BTC scale by Graham et al. (2019) consisted of four global themes which were pedagogy, management, assessment and technology to measure 6 dimensions respectively which are technical literary, planning, personalizing instruction, facilitating interactions, evaluating and reflecting and managing blended learning environments. In this research, the blended teaching competence scale was modified and consisted of eight dimensions with a total of 32 items in terms of pedagogy, management, assessment and technology. The following eight dimensions were respectively measured as four items: Technical Literacy (TL), Planning Blended Activities (PBA), Planning Blended Assessments (PBAS), Personalizing Instruction(PI) Facilitating Student-Student Interaction (FSSI), Facilitating Teacher-Student Interaction (FTSI), Evaluating and Reflecting (ER) and Managing the Blended Learning Environment (MBLE).

Behavioral Intention (BI) is the mediating variable in this research model. The BI scale also refers to the scale to measure pre-service teachers' intention to use a learning management system (Buabeng-Andoh & Baah, 2020) and a 5-point Likert scale (Wang, 2018). The TIIL scale was adapted from Zhao and Zhang (2019) which involved three dimensions with four items for each dimension and in current research, it has been modified into three dimensions with five items for each dimension. They were respectively Informatization Instructional Environment Construction (IIEC) with 5 items, Informatization Extracurricular Learning Leading (IELL) with 5 items and Informatization Classroom Instructional Management (ICIM) with 5 items.

Table 1. Number of items in the survey questionnaire.

Section	Items	Total items
A	Use expectancy (UE)	
	Dimension 1: Performance expectancy	5 items
	Dimension 2: Effort expectancy	5 items
B	Social influence (SI)	5 items
C	Facilitating conditions (FC)	5 items
D	Computer self-efficacy (CSE)	5 items
E	Blended teaching competency (BTC)	
	Dimension 1: Technical literary	4 items
	Dimension 2: Planning blended activities	4 items
	Dimension 3: Planning blended assessments	4 items
	Dimension 4: Personalizing instruction	4 items
	Dimension 5: Facilitating student-student interaction	4 items
	Dimension 6: Facilitating student-teacher interaction	4 items
	Dimension 7: Evaluating and reflecting	4 items
	Dimension 8: Managing a blended learning environment	4 items
F	Behavioral intention (BI)	5 items
G	Teachers' informatization instructional leadership (TIIL)	
	Dimension 1: Informatization teaching environment construction (ITEC)	5 items
	Dimension 2: Informatization extracurricular learning leading (IELL)	5 items
	Dimension 3: Informatization classroom teaching management (ICTM)	5 items
Total items		77 items

The above seven scales were all adapted, modified and translated from original scales into 11-point semantic differential scales starting from 0 (strongly disagree) to 10 (strongly agree) to fulfil the requirement of employing the PLS-SEM approach to conduct data analysis in this research context.

3.3. Procedures

The procedure for carrying out the research was first permitted by the university teachers' development center at four universities (A, B, C and D). The process of data collection was carried out in four sampled universities from November to December 2022. The questionnaires were administered during teacher routine meetings weekly on Wednesday afternoon. The survey questionnaires made through the Chinese questionnaire-star platform were distributed online to 15 in-service teachers from each of four private undergraduate universities (A, B, C and D) in Xi'an city of Shaanxi Province of China by survey questionnaire through social media (i.e., QQ, We-chat) with the help of peer teachers. None of the respondents were forced to answer the questionnaire but voluntarily and anonymously responded to the questions. The respondents were also given adequate time (20 minutes) to answer the questionnaire.

3.4. Data Analysis

It is essential to evaluate the data collected to resolve missing values, questionable response patterns and outliers before using PLS-SEM for data analysis. The assessment of reliability and validity of the survey questionnaire relies on three important criteria (see Table 2): internal consistency reliability, convergent validity and discriminant validity (Hair et al., 2017).

Table 2. Criteria for reliability and validity in PLS-SEM.

Assessment	Criteria	Threshold value	Reference
Internal consistency reliability	Composite reliability (CR)	• 0.7-0.9 satisfied • 0.6 – 0.7 accepted • < 0.60 rejected	Hair et al. (2017)
	Cronbach's alpha (CA)	0.6-1 accepted	
Convergent validity	Outer loading (OL)	• 0.70 accepted • 0.4-0.7 (Acceptable with certain conditions) • < 0.40 rejected	
	Average variance extracted (AVE)	• > 0.50	
Discriminant validity	Cross loading	• The indicator's outer loading on the associated construct should be greater than any of its cross-loadings on other constructs.	
	Fornell-Larcker criterion	• The square root of each construct's AVE should be greater than its highest correlation with any other construct.	
	Heterotrait-Monotrait ratio (HTMT)	• HTMT < 0.90 accepted • HTMT > 0.90 lack of discriminant validity	

4. RESULTS

This study examined the reliability and validity of seven adapted scales based on the survey questionnaires and the results of the findings are as follows:

4.1. Data Distribution

Table 3 shows the results of the Kolmogorov-Smirnov normality test. The significant level is as follows: UE (.200, p > .05), SI (.008, p< .05), FC (.032 , p < .05), CSE (024, p < .05), BTC (028, p < .05), BI (.034, p < .05), and TIIL (.200, p > .05). Results indicate that UE and TIIL constructs show a normal data distribution. In contrast, it is not a normal distribution for the constructs of social influence, facilitating conditions, computer self-efficacy, blended teaching competence and behavioral intention. The PLS-SEM approach is still appropriate for non-normal data distribution since it is a non-parameter data analysis and modelling approach with less severe criteria than CB-SEM, which needs normal data distribution (Hair et al., 2017; Wong, 2013).

Table 3. Kolmogorov-Smirnov normality test.

Construct	Kolmogorov-Smirnov		
	Statistic	Df	Sig.
UE	0.058	60	0.200*
SI	0.136	60	0.008
FC	0.12	60	0.032
CSE	0.123	60	0.024
BTC	0.121	60	0.028
BI	0.119	60	0.034
TIIL	0.099	60	0.200*

Note: *p <0.05.

4.2. Examination of Reliability and Validity

Hair et al. (2017) posited that three crucial criteria were used to assess the reliability and validity of the survey questionnaire: internal consistency reliability, convergent validity and discriminant validity.

4.2.1. Internal Consistency Reliability

Internal consistency reliability is the first criterion for evaluating how all factors on the test relate to all other factors. Cronbach's alpha, as a first-generation statistical technique is the most conventional method used to show the degree of internal consistency reliability. Cronbach's alpha follows the principle that if all factors intend to measure the same variable, then they are highly related and the value of alpha must be high; otherwise, they are not related and the value of alpha must be low. In addition, Cronbach's alpha tends to underestimate internal consistency reliability. It assumes all items have equal outer loading on the constructs. Conversely, composite reliability fills up the Cronbach's alpha limitations. It tends to overestimate the internal consistency reliability taking the different outer loadings of all items into account.

Table 4's composite reliability value indicated that it was.880 for UE_PE, .885 for UE_EE, .941 for SI, .959 for FC, .864 for CSE, .866 for BTC_TL, .924 for BTC_PBA, .874 for BTC_PBAS, .890 for BTC_PI, .865 for BTC_FSSI, .879 for BTC_FTSI, .879 for BTC_ER, .884 for BTC_MBLE, .831 for BI, .893 for TIIL_ITEC, .928 for TIIL_IELL, and .899 for TIIL_ICTM.

Additionally, all Cronbach's alpha values shown in Table 4 exceed .70 which falls within the threshold range of.60 to 1. The specific Cronbach's alpha showed UE_PE (.819), UE_EE (829), SI (.920), FC (.945), CSE (.804), BTC_ER (.818), BTC_FSSI (.767), BTC_FTSI (.826), BTC_MBLE (.829), BTC_PBAS (.806), .876 for BTC_PBA, .877 for BTC_PI, .796 for BTC_TL, .831 for BI, .870 for TIIL_ICTM, .914 for TIIL_IELL, .856 for TIIL_ITEC. The results of the composite reliability and Cronbach's alpha estimates show that all of the modified scales have attained a high level of internal consistency reliability and are reliable for evaluating each of the complex ideas included in this study.

Table 4. The internal consistency reliability of scales based on constructs UE, SI, FC, CSE, BTC, BI and TIIL after item deletion.

Matrix	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
UE_PE	0.819	0.880	0.648
UE_EE	0.829	0.885	0.659
SI	0.920	0.941	0.799
FC	0.945	0.959	0.855
CSE	0.804	0.864	0.614
BTC_ER	0.818	0.879	0.681
BTC_FSSI	0.767	0.865	0.647
BTC_FTSI	0.826	0.879	0.647
BTC_MBLE	0.829	0.884	0.656
BTC_PBAS	0.806	0.874	0.656
BTC_PBA	0.876	0.924	0.802
BTC_PI	0.877	0.890	0.673
BTC_TL	0.796	0.866	0.617
BI	0.831	0.734	0.552
TIIL_ICTM	0.870	0.899	0.642
TIIL_IELL	0.914	0.928	0.721
TIIL_ITEC	0.856	0.893	0.677

4.2.2. Convergent Validity

Convergent validity is used to measure the extent to which a measure correlates positively with an alternative measure of the same construct. Outer loading is also referred to as item and indicator reliability. Item loadings reflect the relationship between an item and its corresponding latent variable. According to Hair et al. (2017), Average Variance Extracted (AVE) describes the way the constructs explain the items or indicators. Table 5 shows specific outer loads that failed. Nine items were deleted due to outer loadings that was lower than .40 including outer loading values for BI_4 (-.375), BTC_FSSI_2 (.302), CSE_2 (.006), BTC_PBA_2 (.263), FC_4 (.143), SI_5 (.161), TIIL_ITEC_3 (.193), UE_EE_3 (.165) and UE_PE_4 (.290). After item deletion, the calculation process is conducted again until the AVE values reach the acceptance level of .50. The Average Variance Extracted (AVE) values of the items in Table 4 exceed the necessary threshold value of.50 following item elimination. The specific AVE values are UE_PE (0.648), UE_EE (0.659), SI (0.799), FC (0.855), CSE (0.614), BTC_ER (0.681), BTC_FSSI (0.647), BTC_FTSI (0.647), BTC_MBLE (0.656), BTC_PBAS (0.656), BTC_PBA (0.802), BTC_PI (0.673), BTC_TL (0.617), BI (0.552), TIIL_ICTM (0.642), TIIL_IELL (0.721), and TIIL_ITEC (0.677). The data analysis presented above indicates that AVE and outer loading both satisfied the threshold requirements. It is said that this study has proven convergent validity.

Table 5. Research items for outer loading assessment.

Constructs	No. of items	Outer loading (OL)	Item deletion
UE_PE	5	4 items with OL > 0.7	UE_PE_4
		1 item with OL < 0.4	
UE_EE	5	4 items with OL > 0.7	UE_EE_3
		1 item with OL < 0.4	
SI	5	4 items with OL > 0.7	SI_5
		1 item with OL < 0.4	
FC	5	4 items with OL > 0.7	FC_4
		1 item with OL < 0.4	
CSE	5	4 items with OL > 0.7	CSE_2
		1 item with OL < 0.4	
BTC_TL	4	4 items with OL > 0.7	-
		0 item with OL < 0.4	
BTC_PBA	4	3 items with OL > 0.7	BTC_PBA_2
		1 item with OL < 0.4	
BTC_PBAS	4	4 items with OL > 0.7	-
		0 item with OL < 0.7	
BTC_PI	4	4 items with OL > 0.7	-
		0 item with OL < 0.7	
BTC_FSSI	4	3 items with OL > 0.7	BTC_FSSI_2
		1 items with OL < 0.4	
BTC_FTSI	4	4 items with OL > 0.7	-
		0 item with OL < 0.7	
BTC_ER	4	4 items with OL > 0.7	-
		0 items with OL < 0.7	
BTC_MBLE	4	4 items with OL > 0.7	-
		0 item with OL < 0.7	
BI	5	4 items with OL > 0.7	BI_4
		1 item with OL < 0.4	
TIIL_ITEC	5	4 items with OL > 0.7	TIIL_ITEC_3
		1 item with OL < 0.4	
TIIL_IELL	5	5 items with OL > 0.7	-
		0 items with OL < 0.7	
TIIL_ICTM	5	5 items with OL > 0.7	-
		0 item with OL < 0.7	

Table 6. Fornell-Larcker criterion for the constructs UE, SI, FC, CSE, BTC, BI and TIIL.

Fornell-Larcker criterion	BI	BTC_ER	BTC_ FSSI	BTC_ FTSI	BTC_ MBLE	BTC_ PBA	BTC_ PBAS	BTC_ PI	BTC_ TL	CSE	FC	SI	TIIL_ ICTM	TIIL_ IELL	TIIL_ ITEC	UE_ EE	UE_ PE
BI	0.743																
BTC_ER	0.362	0.803															
BTC_FSSI	0.310	0.624	0.825														
BTC_FTSI	0.308	0.614	0.387	0.804													
BTC_MBLE	0.439	0.680	0.366	0.650	0.810												
BTC_PBA	0.470	0.545	0.361	0.519	0.583	0.896											
BTC_PBAS	0.469	0.628	0.403	0.562	0.606	0.639	0.797										
BTC_PI	0.193	0.160	0.012	0.427	0.291	0.272	0.209	0.820									
BTC_TL	0.466	0.360	0.242	0.402	0.388	0.577	0.663	0.129	0.786								
CSE	0.252	0.329	0.383	0.311	0.366	0.328	0.408	0.072	0.557	0.784							
FC	0.243	-0.013	0.013	0.203	0.107	0.252	0.282	0.078	0.423	0.160	0.925						
SI	0.230	0.363	0.076	0.186	0.233	0.179	0.395	0.127	0.207	0.201	-0.009	0.894					
TIIL_ICTM	0.236	0.283	0.152	0.276	0.234	0.202	0.373	0.140	0.353	0.278	0.159	0.293	0.801				
TIIL_IELL	0.282	0.302	0.332	0.265	0.253	0.283	0.318	0.112	0.282	0.263	0.101	0.161	0.528	0.849			
TIIL_ITEC	0.275	0.367	0.393	0.323	0.393	0.320	0.389	0.164	0.278	0.470	0.096	0.239	0.589	0.642	0.823		
UE_EE	0.442	0.318	0.343	0.373	0.354	0.440	0.276	0.257	0.269	0.347	0.092	0.206	0.012	0.164	0.209	0.812	
UE_PE	0.459	0.393	0.455	0.215	0.408	0.570	0.495	0.094	0.434	0.378	0.225	0.142	0.092	0.271	0.309	0.738	0.805

4.2.3. Discriminant Validity

Discriminant validity assesses the uniqueness of each construct which is distinct from other constructs in the structural model (Hair et al., 2017). Henseler, Ringle, and Sarstedt (2015) assert that the HTMT approach is the mean value of all relationships of items across constructs measuring different constructs (i.e., the heterotrait-heteromethod correlations) relative to the mean of the average correlations of items measuring the same construct (i.e., the monotrait-heteromethods correlations). The threshold value for HTMT is .90. The term "lack of discriminant validity" refers to any HTMT score greater than .90.

Table 6 displays the Fornell-Larcker criterion results with the square root of the AVE value for the BI construct (.743). It exceeds the BTC_ER (.362), BTC_FSSI (.310), BTC_FTSI (.308), BTC_MBLE (.439), BTC_PBA (.470), BTC_PBAS (.469), BTC_PI (.193), BTC_TL (.466), CSE (.252), FC (.243), SI (.230), TIIL_ICTM (.236), TIIL_IELL (.282), and TIIL_ITEC (.275), UE_PE (.459), UE_EE (.442). They also have the highest values for the square root of their AVE values which are higher than the values in the same row and column for the other reflective constructs. Thus, Table 6 indicates that discriminant validity was proven for all seven constructs.

Table 7 shows the cross-loadings for each item reflected on the latent constructs BI, UE, CSE, FC and SI. Items of BI_1, BI_2, BI_3, and BI_5 have high loading on their corresponding construct BI and far exceed other constructs BTC_ER, BTC_FSSI, BTC_FTSI, BTC_MBLE, BTC_PBA, BTC_PBAS, BTC_PI, BTC_TL, CSE, FC, SI, TIIL_ICTM, TIIL_IELL, TIIL_ITEC, UE_EE and UE_PE. Similarly, items UE_PE and UE_EE also load higher than other constructs for each item of BI, BTC, SI, CSE, FC and TIIL.

Similarly, items CSE_1, CSE_3, CSE_4, and CSE_5 also appeared to load high on their corresponding construct CSE but much higher on other constructs for each item of BI, BTC, FC, SI, UE and TIIL. Items FC_1, FC_2, FC_3, and FC_5 load high and also much higher on other constructs for each item of BI, BTC, SI, CSE, UE and TIIL. Items SI_1, SI_2, SI_3, and SI_4 also load higher than other constructs for each item of BI, BTC, FC, CSE, UE and TIIL.

Table 8 displays the cross-loadings for items of the latent construct BTC. Items BTC_ER, BTC_FSSI, BTC_FTSI, BTC_MBLE, BTC_PBA, BTC_PBAS, BTC_PI, BTC_TL all have high loading on their corresponding construct BTC and also far exceed each item of other constructs BI, CSE, FC, SI, TIIL and UE.

Table 7. Cross loadings for the constructs BI, UE, CSE, FC and SI.

Cross loadings	BI	BTC_ER	BTC_FSSI	BTC_FTSI	BTC_MBLE	BTC_PBA	BTC_PBAS	BTC_PI	BTC_TL	CSE	FC	SI	TIIL_ICTM	TIIL_IELL	TIIL_ITEC	UE_EE	UE_PE
BI_1	0.737	0.260	0.158	0.241	0.391	0.357	0.420	0.173	0.293	0.156	0.244	0.201	0.174	0.164	0.169	0.182	0.311
BI_2	0.715	0.203	0.275	0.228	0.268	0.384	0.261	0.066	0.419	0.232	0.125	0.061	0.143	0.216	0.248	0.349	0.295
BI_3	0.735	0.258	0.184	0.188	0.283	0.295	0.319	0.082	0.260	0.144	0.040	0.293	0.122	0.161	0.151	0.254	0.327
BI_5	0.785	0.339	0.275	0.250	0.359	0.354	0.394	0.225	0.381	0.200	0.270	0.167	0.237	0.267	0.230	0.463	0.414
UE_EE_1	0.406	0.231	0.457	0.302	0.248	0.347	0.208	0.194	0.371	0.370	0.115	0.126	-0.008	0.187	0.099	0.811	0.605
UE_EE_2	0.273	0.168	0.253	0.155	0.164	0.302	0.145	0.086	0.110	0.142	0.077	0.048	-0.027	0.017	0.191	0.773	0.629
UE_EE_4	0.347	0.188	0.141	0.303	0.329	0.346	0.234	0.333	0.093	0.275	0.071	0.274	-0.066	0.015	0.219	0.837	0.589
UE_EE_5	0.383	0.418	0.236	0.410	0.380	0.419	0.292	0.199	0.250	0.296	0.036	0.201	0.124	0.268	0.187	0.825	0.586
UE_PE_1	0.446	0.205	0.304	0.145	0.327	0.482	0.312	0.130	0.272	0.292	0.151	0.111	-0.037	0.160	0.248	0.686	0.844
UE_PE_2	0.328	0.198	0.280	0.111	0.319	0.492	0.407	0.127	0.316	0.340	0.187	-0.014	0.027	0.132	0.231	0.562	0.793
UE_PE_3	0.351	0.454	0.462	0.142	0.249	0.378	0.385	-0.012	0.386	0.201	0.174	0.144	0.129	0.350	0.160	0.518	0.793
UE_PE_5	0.334	0.440	0.439	0.307	0.428	0.485	0.526	0.046	0.450	0.399	0.224	0.213	0.211	0.245	0.364	0.589	0.788
CSE_1	0.083	0.188	0.189	0.155	0.294	0.252	0.338	-0.002	0.451	0.740	-0.041	0.109	0.200	0.182	0.294	0.203	0.214
CSE_3	0.270	0.368	0.434	0.359	0.412	0.338	0.383	0.105	0.389	0.851	0.088	0.115	0.291	0.252	0.528	0.309	0.340
CSE_4	0.185	0.236	0.313	0.263	0.240	0.169	0.320	0.119	0.490	0.772	0.190	0.214	0.253	0.250	0.389	0.262	0.293
CSE_5	0.163	0.154	0.142	0.094	0.150	0.247	0.230	-0.060	0.481	0.768	0.209	0.199	0.083	0.108	0.143	0.277	0.293
FC_1	0.100	0.068	0.026	0.245	0.130	0.190	0.271	-0.009	0.281	0.057	0.837	0.074	0.183	0.039	0.028	0.108	0.237
FC_2	0.274	-0.023	0.002	0.197	0.111	0.220	0.284	0.038	0.409	0.162	0.945	-0.009	0.162	0.138	0.157	0.036	0.196
FC_3	0.222	-0.016	0.035	0.197	0.069	0.225	0.244	0.068	0.406	0.160	0.970	0.000	0.157	0.107	0.112	0.072	0.163
FC_5	0.236	-0.031	-0.005	0.155	0.105	0.284	0.258	0.154	0.423	0.165	0.942	-0.052	0.112	0.057	0.017	0.150	0.260
SI_1	0.163	0.184	-0.047	0.037	0.072	0.139	0.228	0.065	0.166	0.063	0.005	0.840	0.058	-0.030	0.140	0.221	0.147
SI_2	0.087	0.271	0.095	0.218	0.183	0.113	0.382	0.128	0.084	0.247	-0.036	0.851	0.213	0.103	0.234	0.090	0.040
SI_3	0.208	0.365	0.107	0.177	0.243	0.186	0.385	0.138	0.158	0.234	-0.041	0.938	0.283	0.161	0.271	0.221	0.166
SI_4	0.274	0.406	0.102	0.225	0.280	0.174	0.408	0.124	0.256	0.193	0.017	0.943	0.395	0.253	0.217	0.172	0.117

Table 8. Cross loadings for the construct BTC.

Cross loadings	BI	BTC_ER	BTC_FSSI	BTC_FTSI	BTC_MBLE	BTC_PBA	BTC_PBAS	BTC_PI	BTC_TL	CSE	FC	SI	TIIL_ICTM	TIIL_IELL	TIIL_ITEC	UE_EE	UE_PE
BTC_ER_1	0.363	0.878	0.579	0.570	0.584	0.537	0.625	0.252	0.326	0.295	-0.087	0.297	0.212	0.239	0.265	0.281	0.354
BTC_ER_2	0.281	0.798	0.530	0.445	0.507	0.494	0.615	-0.031	0.393	0.303	0.133	0.382	0.237	0.236	0.447	0.211	0.366
BTC_ER_3	0.214	0.758	0.406	0.560	0.518	0.333	0.402	0.183	0.343	0.322	0.057	0.271	0.233	0.174	0.233	0.387	0.334
BTC_ER_4	0.275	0.775	0.460	0.408	0.578	0.346	0.330	0.089	0.105	0.148	-0.110	0.217	0.241	0.317	0.236	0.172	0.211
BTC_FSSI_1	0.284	0.578	0.834	0.289	0.347	0.401	0.360	-0.021	0.193	0.286	-0.114	-0.001	-0.025	0.229	0.284	0.362	0.466
BTC_FSSI_3	0.241	0.427	0.826	0.370	0.207	0.163	0.285	-0.016	0.090	0.180	0.086	-0.008	0.172	0.367	0.353	0.241	0.308
BTC_FSSI_4	0.238	0.530	0.816	0.305	0.346	0.312	0.349	0.074	0.318	0.489	0.082	0.211	0.259	0.233	0.344	0.233	0.338
BTC_FTSI_1	0.310	0.515	0.325	0.845	0.532	0.365	0.523	0.331	0.386	0.261	0.216	0.120	0.287	0.208	0.242	0.286	0.180
BTC_FTSI_2	0.198	0.451	0.269	0.779	0.471	0.440	0.333	0.339	0.245	0.251	-0.056	0.098	0.186	0.260	0.287	0.391	0.161
BTC_FTSI_3	0.284	0.555	0.371	0.866	0.575	0.513	0.509	0.365	0.362	0.265	0.300	0.250	0.249	0.162	0.297	0.274	0.191

Cross loadings	BI	BTC_ER	BTC_FSSI	BTC_FTSI	BTC_MBLE	BTC_PBA	BTC_PBAS	BTC_PI	BTC_TL	CSE	FC	SI	TIIL_ICTM	TIIL_IELL	TIIL_ITEC	UE_EE	UE_PE
BTC_FTSI_4	0.123	0.443	0.253	0.720	0.544	0.349	0.396	0.383	0.249	0.223	0.095	0.098	0.084	0.300	0.214	0.292	0.159
BTC_MBLE_1	0.336	0.678	0.371	0.558	0.854	0.613	0.536	0.305	0.354	0.314	0.000	0.282	0.284	0.229	0.319	0.284	0.307
BTC_MBLE_2	0.405	0.546	0.319	0.541	0.802	0.448	0.467	0.084	0.350	0.321	0.130	0.151	0.155	0.236	0.383	0.214	0.234
BTC_MBLE_3	0.213	0.494	0.186	0.448	0.748	0.254	0.413	0.229	0.228	0.201	0.189	0.250	0.125	0.071	0.194	0.151	0.229
BTC_MBLE_4	0.405	0.492	0.278	0.540	0.832	0.504	0.530	0.338	0.298	0.314	0.063	0.120	0.185	0.229	0.326	0.438	0.507
BTC_PBAS_1	0.363	0.527	0.329	0.385	0.501	0.415	0.792	0.020	0.551	0.354	0.243	0.208	0.171	0.251	0.231	0.155	0.426
BTC_PBAS_2	0.390	0.446	0.231	0.373	0.438	0.472	0.729	0.176	0.477	0.276	0.215	0.368	0.222	0.279	0.363	0.253	0.385
BTC_PBAS_3	0.343	0.493	0.383	0.539	0.559	0.581	0.778	0.361	0.540	0.329	0.145	0.252	0.344	0.128	0.347	0.236	0.372
BTC_PBAS_4	0.394	0.534	0.347	0.497	0.443	0.567	0.880	0.123	0.544	0.342	0.285	0.413	0.446	0.340	0.298	0.233	0.393
BTC_PBA_1	0.446	0.646	0.465	0.535	0.551	0.941	0.622	0.266	0.546	0.347	0.180	0.197	0.201	0.227	0.306	0.376	0.491
BTC_PBA_3	0.428	0.371	0.224	0.510	0.468	0.887	0.535	0.414	0.522	0.222	0.277	0.225	0.275	0.251	0.232	0.485	0.492
BTC_PBA_4	0.386	0.437	0.272	0.335	0.551	0.856	0.560	0.029	0.478	0.314	0.222	0.047	0.053	0.288	0.328	0.315	0.555
BTC_PI_1	0.067	0.323	0.200	0.489	0.406	0.350	0.334	0.778	0.134	0.194	0.057	0.170	0.152	0.130	0.184	0.274	0.183
BTC_PI_2	0.080	0.074	0.039	0.314	0.207	0.087	0.105	0.812	-0.006	0.072	0.000	0.099	0.103	0.040	0.093	0.230	0.070
BTC_PI_3	-0.006	0.145	0.110	0.358	0.238	0.192	0.208	0.706	0.032	0.066	0.043	0.146	0.082	0.286	0.224	0.214	0.049
BTC_PI_4	0.233	0.116	-0.050	0.379	0.239	0.268	0.176	0.964	0.151	0.026	0.098	0.105	0.126	0.118	0.158	0.219	0.060
BTC_TL_1	0.384	0.359	0.160	0.347	0.342	0.440	0.530	0.063	0.834	0.469	0.331	0.132	0.313	0.180	0.189	0.057	0.188
BTC_TL_2	0.323	0.272	0.160	0.322	0.279	0.429	0.510	0.040	0.796	0.373	0.435	0.099	0.221	0.228	0.188	-0.001	0.229
BTC_TL_3	0.449	0.282	0.238	0.314	0.325	0.542	0.556	0.144	0.789	0.452	0.258	0.288	0.317	0.223	0.250	0.493	0.548
BTC_TL_4	0.258	0.195	0.195	0.275	0.256	0.363	0.474	0.164	0.720	0.459	0.346	0.075	0.236	0.279	0.251	0.224	0.356

Table 9. Cross loadings for the construct TIIL.

Cross loadings	BI	BTC_ER	BTC_FSSI	BTC_FTSI	BTC_MBLE	BTC_PBA	BTC_PBAS	BTC_PI	BTC_TL	CSE	FC	SI	TIIL_ICTM	TIIL_IELL	TIIL_ITEC	UE_EE	UE_PE
TIIL_ICTM_1	0.120	0.197	0.160	0.309	0.153	0.218	0.368	0.185	0.361	0.119	0.264	0.045	0.767	0.515	0.479	0.030	0.140
TIIL_ICTM_2	0.050	0.080	0.003	0.055	0.095	0.035	0.140	0.106	0.056	0.159	0.006	0.205	0.782	0.380	0.444	-0.219	-0.072
TIIL_ICTM_3	0.143	0.265	0.194	0.253	0.160	0.002	0.278	0.022	0.107	0.102	-0.005	0.380	0.716	0.465	0.434	-0.013	0.028
TIIL_ICTM_4	0.218	0.195	0.122	0.209	0.204	0.135	0.320	0.105	0.321	0.228	0.287	0.152	0.897	0.527	0.537	-0.029	0.109
TIIL_ICTM_5	0.259	0.287	0.095	0.218	0.235	0.280	0.308	0.142	0.373	0.359	0.033	0.332	0.832	0.301	0.467	0.090	0.070
TIIL_IELL_1	0.324	0.345	0.371	0.305	0.272	0.363	0.378	0.130	0.353	0.297	0.100	0.197	0.585	0.930	0.645	0.259	0.307
TIIL_IELL_2	0.115	0.208	0.195	0.162	0.249	0.123	0.204	0.039	0.150	0.132	0.029	0.191	0.375	0.770	0.495	0.061	0.174
TIIL_IELL_3	0.300	0.229	0.312	0.231	0.145	0.251	0.266	0.105	0.246	0.227	0.093	0.083	0.416	0.905	0.529	0.147	0.260
TIIL_IELL_4	0.056	0.231	0.234	0.290	0.269	0.226	0.234	0.152	0.122	0.172	0.085	0.150	0.400	0.822	0.587	0.175	0.188
TIIL_IELL_5	0.146	0.220	0.169	0.108	0.230	0.096	0.162	0.038	0.139	0.193	0.104	0.095	0.384	0.808	0.496	-0.064	0.107
TIIL_ITEC_1	0.160	0.134	0.275	0.129	0.152	0.146	0.222	0.043	0.163	0.414	0.028	0.147	0.459	0.555	0.800	0.042	0.188
TIIL_ITEC_2	0.329	0.409	0.390	0.394	0.396	0.338	0.416	0.177	0.335	0.347	0.126	0.199	0.549	0.482	0.858	0.277	0.280
TIIL_ITEC_4	0.180	0.309	0.366	0.208	0.420	0.313	0.284	0.082	0.150	0.420	0.064	0.151	0.471	0.555	0.840	0.151	0.336
TIIL_ITEC_5	0.122	0.241	0.168	0.202	0.232	0.163	0.269	0.227	0.160	0.436	0.048	0.339	0.400	0.618	0.790	0.103	0.170

Table 10. Heterotrait-Monotrait Ratio (HTMT).

HTMT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.BI																	
2.BTC_ER	0.443																
3.BTC_FSSI	0.396	0.769															
4.BTC_FTSI	0.359	0.739	0.471														
5.BTC_MBLE	0.531	0.825	0.443	0.776													
6.BTC_PBA	0.581	0.624	0.427	0.600	0.659												
7.BTC_PBAS	0.606	0.756	0.513	0.669	0.737	0.762											
8.BTC_PI	0.182	0.267	0.190	0.551	0.372	0.323	0.299										
9.BTC_TL	0.574	0.439	0.307	0.469	0.458	0.673	0.822	0.157									
10.CSE	0.286	0.375	0.461	0.334	0.410	0.378	0.499	0.161	0.713								
11.FC	0.254	0.138	0.142	0.245	0.155	0.273	0.324	0.075	0.485	0.184							
12.SI	0.277	0.393	0.156	0.222	0.273	0.191	0.448	0.172	0.215	0.249	0.058						
13.TIIL_ICTM	0.239	0.304	0.297	0.287	0.246	0.211	0.415	0.160	0.361	0.281	0.187	0.308					
14.TIIL_IELL	0.266	0.330	0.358	0.325	0.295	0.281	0.336	0.203	0.286	0.261	0.098	0.180	0.575				
15.TIIL_ITEC	0.292	0.393	0.446	0.335	0.409	0.335	0.429	0.223	0.296	0.537	0.101	0.283	0.650	0.749			
16.UE_EE	0.527	0.386	0.411	0.448	0.393	0.509	0.329	0.308	0.371	0.389	0.119	0.234	0.160	0.186	0.217		
17.UE_PE	0.573	0.492	0.573	0.261	0.481	0.677	0.623	0.135	0.530	0.450	0.268	0.175	0.184	0.286	0.350	0.891	

Table 9 displays the cross-loadings for all items of the latent construct TIIL. Each TIIL item loads more quickly than each BI, BTC, SI, CSE, UE, and FC item in other constructs.

According to the Fornell-Larcker criterion and the cross-loadings criterion, it can be concluded from the research findings shown in Tables 6 to 9 that all reflective constructs have the highest values for the square root of their AVE values which are respectively greater than values in the same row and column and that all loadings of items are greater than the corresponding cross-loadings. Thus, this indicates all constructs have established discriminant validity.

The Heterotrait-Monotrait Ratio (HTMT) shown in Table 10 was the last criterion used to measure the discriminant validity. The HTMT of all constructs is below the threshold value of .85. It illustrates that the HTMT for BTC_ER à BI is .443, BTC_FSSI à BTC_ER is .769, BTC_FTSI à BTC_FSSI is .471, BTC_MBLE à BTC_FTSI is .776, BTC_PBA à BTC_MBLE is .659, BTC_PBAS à BTC_PBA is .762. BTC_PI à BTC_PBAS is .299, BTC_TL à BTC_PI is .157, CSE à BTC_TL is .713, FC à CSE is .184, SI à FC is .058, TIIL_ICTM à SI is .308, TIIL_IELL à TIIL_ICTM is .575, TIIL_ITEC à TIIL_IELL is .749, UE_EE à TIIL_ITEC is .217, and UE_PE à UE_EE is .891. The above data analysis clearly indicates that discriminant validity has been established.

4.3. Comparison of Structural Equation Modeling

Figures 1 and 2 display a comparison of the structural equation model for composite reliability and outer loading values for all constructs before and after item deletion. The outer loading values for each item were displayed by the arrow respectively. Meanwhile, the number shown in the circular shape is the composite reliability for each construct. The outer loadings of nine items were found to be less than.40; hence, they must be eliminated in order to satisfy the outer loading criterion.

All composite reliability values reach a satisfactory level following item elimination despite the fact that they all exceed the acceptance minimum requirement of.60 in both figures.

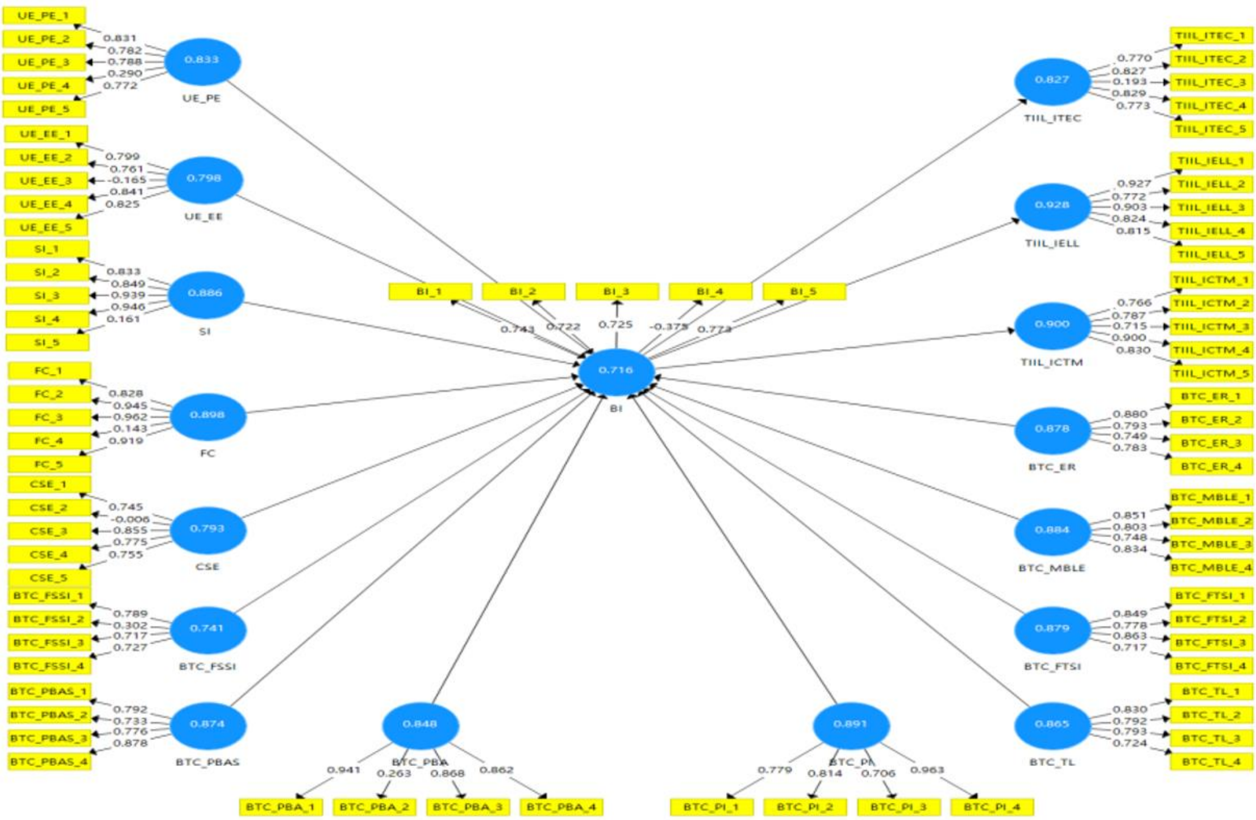

Figure 1. Composite reliability and outer loading before item deletion.

Figure 2. Composite reliability and outer loading after item deletion.

Figures 3 and 4 display a comparison of the structural equation model for AVE and outer loading values for all constructs before and after item deletion. The outer loading values for each item were displayed by the arrow respectively. All indicators of the first-order construct BTC_TL, BTC_PBAS, BTC_PI, BTC_FTSI, BTC_ER, BTC_MBLE, TIIL_IECLL, and TIIL_ICTM have outer loadings higher than the threshold value of 0.70. Nonetheless, few constructs (i.e., UE_PE_4, UE_EE_3, SI_5, FC_4, CSE_2, BTC_PBA_2, BTC_FSSI_2, BI_4, and TIIL_ITEC_3) consisted of items with outer loading values less than .70. Nine items out of the 77 original items in the questionnaire were removed after examination.

Thus, the total percentage of items deleted from the research instruments is reported as 11.7%. The item deletion has led to an increase in AVE values.

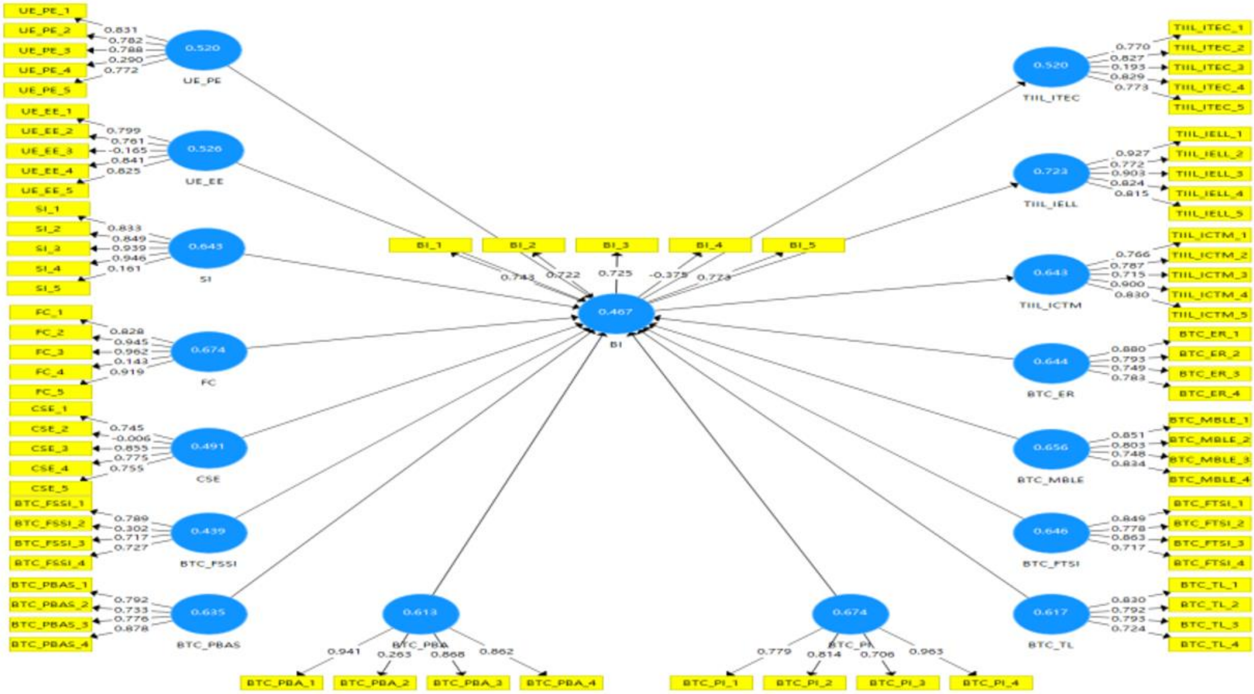

Figure 3. AVE and outer loading before item deletion.

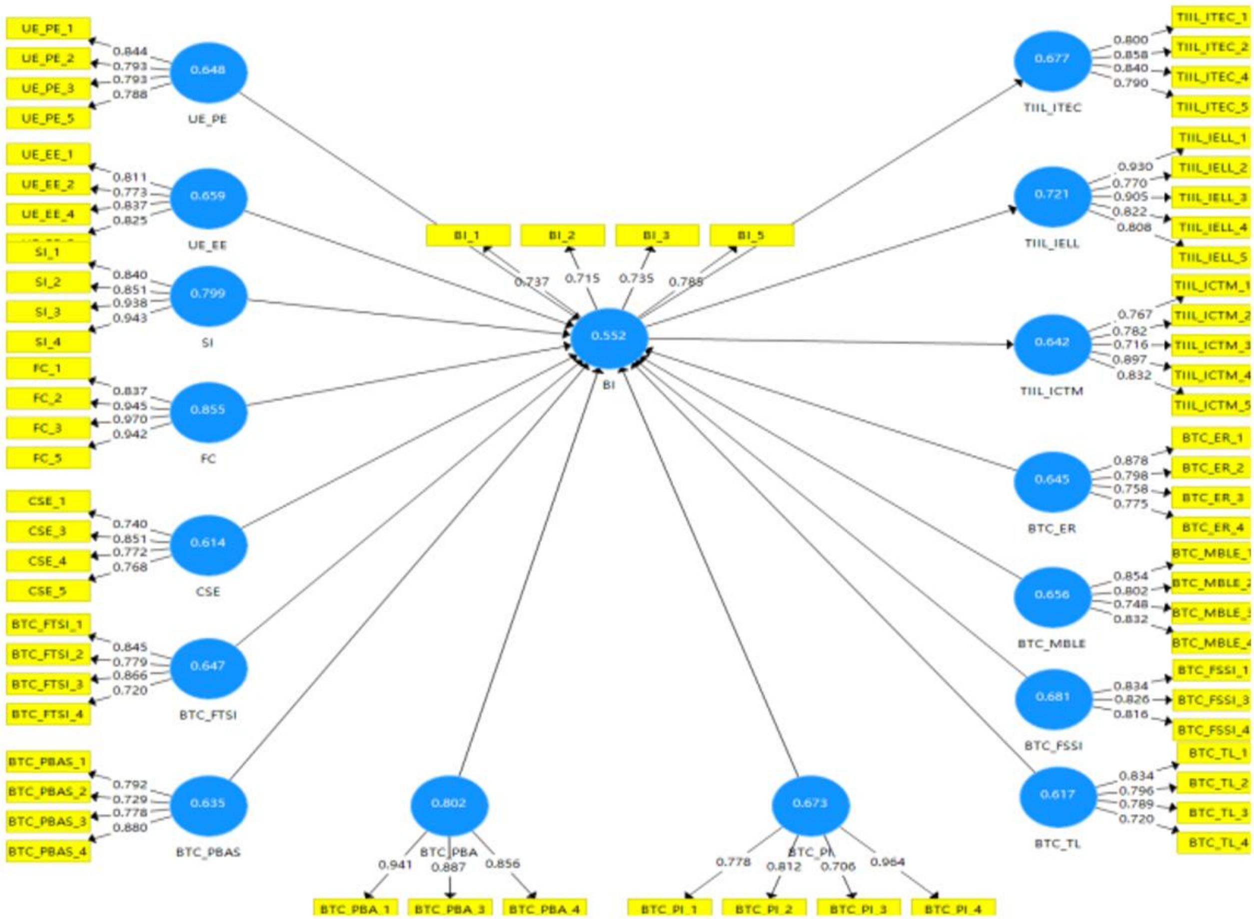

Figure 4. AVE and outer loading after item deletion.

5. DISCUSSION

The UTAUT model was used in the current study to determine the five components that influence TIIL, UE, SI, FC, CSE, BTC and BI. This pilot study used the PLS-SEM analytical approach to assess the validity and reliability of scales prior to obtaining the results of the interrelationship of the components in the expanded UTAUT model to explore contributing variables to TIIL. There is a scarcity of research adopting Smart PLS to validate multidimensional instruments in spite of questionnaires developed in previous literature. Additionally, when previous research used the first-generation technique to validate research instruments (i.e., performance expectancy scale , effort expectancy scale, social influence scale, facilitating conditions scale, behavioral intention scale and teachers' informatization instructional leadership scale), they mainly focused on the Cronbach's alpha value (other than composite reliability value) and CFA values instead of EFA values. The limitation of using the first generation statistical analysis approach is the lack of instrument validation in multidimensional data and the easy production of measurement errors. Thus, this research adopts the PLS-SEM statistical analysis approach to evaluate the validation of the instruments in terms of internal consistency reliability, convergent validity and discriminant validity for all items of instruments to reduce measurement error. When testing the internal consistency reliability of instruments using the first-generation statistical analysis technique, the PLS-SEM approach emphasises composite reliability while compensating for the lack of primary focus on the Cronbach's alpha value.

Hence, re-validating instruments using more advanced second-generation approaches tends to improve the instrument's precision in measuring certain constructs since the several validation perspectives boost the accuracy of evaluating the instrument using many indications.

5.1. Reliability

According to Buabeng-Andoh and Baah (2020) and Wang (2018) the reliability analysis for the developed PE scale, EE scale , SI scale , FC scale and BI scale only used one criteria which is Cronbach's alpha value, whereas current research used two criteria which are composite reliability and Cronbach's alpha value to analyze the reliability of scales. Research results showed that five modified scales (i.e., PE scale, EE scale, SI scale, FC scale and BI scale) established the internal consistency reliability extended UTAUT model that can be applied to the field of teachers' informatization and instructional leadership.

This research combined CSE and BTC instrument development from the literature review by Compeau et al. (1999), Graham et al. (2019) and Pulham and Graham (2018) with the Chinese university context. The results of composite reliability and Cronbach's alpha all fulfilled requirements after the CSE and BTC scales were revalidated and outside loadings with a coefficient of less than.40 were eliminated. Thus, distinct internal consistency reliability has already been established in the field of TIIL.

As for the TIIL scale, it was developed according to a Chinese literature review by Zhao and Zhang (2019) but after re-validating the adapted the TIIL scale , one item's outer loading was found to fail loading so it was deleted. This indicated that it is essential for researchers to re-validate an adapted modified TIIL scale although the TIIL scale and the adapted TIIL scale are both used in the same research field of teachers' informatization and instructional leadership. The rationale behind it is that this research adopted the PLS-SEM technique and Zhao and Zhang (2019) used the AMOS-SEM technique. In other words, PLS-SEM and AMOS-SEM are both second-generation approaches but they require different data assumptions. PLS-SEM has no assumptions about the data distribution. In contrast, AMOS-SEM assumes the data to be normally distributed. This is similar to Wong (2013).

5.2. Validity

Outer loading and Average Variance Extracted (AVE) are two important criteria to assess the convergent validity of seven adapted scales. The results of this study clearly showed that convergent validity assessment is crucial for analyzing the extent to which the constructs explain the items or indicators and for assessing the correlation between an item and its corresponding latent variable for outer loading and AVE before and after item deletion. Furthermore, it demonstrated that every construct had a unique quality that set it apart from the other constructs in the structural model by increasing cross loading, the Fornell-Larcker criterion and HTMT in response to the deletion of unloaded items. This is consistent with the findings of Hair et al. (2017) who stated in their study that there was no contradiction issue that emerged for the reliability and validity assessments because all of the items deleted in the HTMT were the same as the items deleted in the cross-loading assessment, Fornell-Larcker criterion, Cronbach's alpha, composite reliability and AVE analysis.

The aforementioned discussion demonstrated that it was crucial for this study to evaluate the validity of the seven modified scales in the PLS-SEM model. When the constructed UE, SI, FC, CSE, BI, and TIIL scales were revalidated, the results added up to show that these instruments are valid and reliable for use in the subsequent examination of the relationships between the constructs to determine the components that contribute to TIIL.

6. CONCLUSION

This study added two new variables to the UTAUT model from the perspective of teachers' informatization instructional leadership process and examined the status of Chinese university teachers participating in informatization instructional leadership during COVID-19 from both theoretical and empirical perspectives. In terms of practice, this study suggests that CSE and BTC are also two important factors affecting to TIIL so they should be focused on in the process of adopting TIIL. The PLS-SEM technique was most crucially employed in this study to re-validate seven updated scales that evaluate different influencing elements. This enriched methodological theory will help to increase Chinese teachers' computer self-efficacy to use technology in their future instructional leadership, i.e., to gradually shift from passive obedience to conduct TIIL to an intrinsic confidence to integrate computer technology into instructional leadership. In addition, this empirical research expressed the concern that Chinese private university teachers need to improve their blended teaching competence in order to design and use technology well to achieve TIIL goals.

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