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Examining the Reliability and Validity of Measuring Scales related to Informatization Instructional Leadership Using PLS-SEM Approach

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ABSTRACT
During the COVID-19, university teachers' informatization instructional leadership (TIIL) was adopted in many countries. This attracted widespread attention. This research derived six factors from the unified theory of acceptance and use of technology (UTAUT) including performance expectancy (PE), effort expectancy (EE), social influence (SI), facilitating conditions (FC) and behavioral intention (BI), added two new internal elements related to the individual teacher which are computer self-efficacy (CSE) and blended teaching competence (BTC). Before using the Partial Least Squares Structural Equation Modeling (PLS-SEM) to explore the contributing factors to TIIL by assessing interrelation between constructs within extended UTAUT model in this study. This pilot study aimed to examine the reliability and validity of modified scales incorporating Use Expectancy (UE) Scale including (PE Scale and EE Scale) used to measure use expectancy, SI Scale to measure social influence, FC Scale to measure facilitating conditions, CSE Scale to measure computer self-efficacy, BTC Scale to measure blended teaching competence, BI Scale to measure behavioral intention to adopt TIIL, and the TIIL Scale to measure teachers' informatization instructional leadership. A total of 60 teachers from the large multi-disciplinary private undergraduate universities in Xi'an city of Shaanxi province in China participated in this research. The data was collected in November-December 2022 during the middle stages of COVID-19 pandemic. The PLS-SEM approach was used to evaluate the reliability and validity of the adapted scales. The internal consistency reliability was determined by composite reliability (CR) and Cronbach's alpha. Convergent validity was assessed by outer loading and average variance extracted (AVE). Assessment of discriminant validity was measured by Fornell-Larcker criterion, Cross-loadings and Heterotrait-Monotrait Ratio (HTMT). Results showed after deleting nine items with lower than .40, Cronbach's alpha values were all higher than .70. CR values were at a satisfactory level. All item values fulfilled the criteria of AVE, Fornell-Larcker criterion, cross-loadings, and HTMT. Research results revealed all adapted scales were valid and reliable to be used in future research. This study explored the influencing factors of TIIL in Chinese context, enriched the theory of TIIL, and provided practical support for the future development of TIIL.

Keywords: Behavioral intention, blended teaching competence, computer self-efficacy, partial least squares structural equation modeling (PLS-SEM), reliability; teachers' informatization instructional leadership; validity

INTRODUCTION

The present teaching management environment is complex with blended teaching and learning environment. Blended teaching was defined by [14] as models "that combined face-to-face instruction with computer mediated instruction". The COVID-19 has caused blended teaching as common-state teaching modality across worldwide universities [31], bringing the greater challenge to university teachers to learn computer technology to lead or manage blended teaching. Thus, the conventional face-to-face way of leading and managing university class was broken, presenting a mode of adoption of university

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teachers' informatization instructional leadership (TIIL). TIIL needs to lead and manage blended teaching through computer technology/devices/teaching management platform.

Furthermore, Chinese Education Informatization 2.0 Action Plan pushed university teachers to integrate computer technology into leading and managing blended teaching. From the perspective of leadership process, it has been suggested that university teachers need continuously to adapt themselves and enhance their competence of informatization instructional leadership to respond to the changes of blended teaching and learning environment. What factors influence TIIL is concerned by many educational researchers during the COVID-19?

Teachers' informatization instructional leadership is a kind of comprehensive competence that teachers lead and manage blended teaching with the help of internet tools/devices. [44] proposed factors affecting TIIL in the perspective of extrinsic factors, intrinsic factors and individual ability factors i.e. blended teaching competence. UTAUT model by [39] is increasingly used in educational domain to explore influencing factors to behavioral intention to use a system or technology, and investigate individual use behaviors.

Previous researches on instructional leadership and the affecting factors to it has focused on the relationships between elements using the first-generation technique such as correlation analysis and regression analysis and the use of AMOS structural equation modeling. But the re-validation of research instruments adopting the second-generation such as PLS-SEM is not be sufficient. In addition, the discussion about the adoption of teachers' informatization instructional leadership will have its unique significance in the special period of COVID-19, therefore, this study used PLS-SEM approach to explore the factors to TIIL among university teachers during COVID-19, and examine the reliability and validity of adapted scales to measure the factors affecting TIIL.

Definition of teachers' informatization instructional leadership

The term "informatization" originated in Japan. Wu (2008) defines it as "the process of penetration of information and communication technology into all levels and fields of human production, exchange and social interaction". 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. 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[37]. From the perspective of leadership process, the connotation of teachers' informatization instructional leadership includes Informatization Teaching Environment Construction (ITEC), Informatization Extracurricular Learning Leading (IELL) and Informatization Classroom Teaching Management (ICTM) [44].

In the context of current research, teachers' informatization instructional leadership refers to a process of information technology integrated with instructional management and leadership. Additionally, it also refers to the comprehensive competence that teachers utilize information technology to manage and lead blended teaching process. TIIL is not only limited to the face-to-face 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 [44] to measure TIIL from three dimensions:ITEC, IELL and ICTM.

Factors affecting the teachers' informatization instructional leadership

The research perspective of the instructional leadership is multidimensional. [44] discussed TIIL in terms of connotation, influencing factors and improving path, using the first-generation data analysis methods (i.e., the 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 of rationally controlling network autonomous learning time and informatization teaching evaluation ability.

The acceptance and use of information technology in the teachers' instructional leadership and management process is a behavior which can be explained by Unified Theory of Acceptance and Use of Technology (UTAUT) by [39] in current research. Originally UTAUT was created to understand the factors that affected employee information technology acceptance and use. Nevertheless, with the trending of technology integration into education area, increasing studies have applied it to an educational context [5] [1][4][27][29]. Researchers often use the UTAUT model because it examines more factors in the technology use decision. Increasing researches have suggested that UTAUT model by [39] can be used to predict teachers' behavioral intention in the classroom to use technology and use behavior [6] [22] [24] [29] [42], stipulating the effect of performance expectancy (PE), effort expectancy (EE), social influence (SC) and facilitating conditions (FC) on the behavioral intention (BI) to adopt innovative technology in the classroom.

In current research, performance expectancy is adapted to suggest that university teachers will find computer technology useful in instructional leadership. Adapting effort expectancy to this study indicates if university teachers find computer technology easy to apply while leading and administering instructional process, they will have stronger intention to conduct instructional leadership. Social influence adapted to current study to indicate that someone's behavior is influenced by how they believe others will view them due to using technology. The construct of facilitating conditions concerns the view that someone's behavior is influenced by an organizational and technical infrastructure to support the use of a technology.

Beyond that, in proposed structural model based on UTAUT model in current research, computer self-efficacy (CSE) and blended teaching competence (BTC) were attempted to become two additional direct determinants of university teachers' behavioral intention and informatization instructional leadership behavior. This is grounded in Theory of Planned Behavior (TPB) by [3] that blended teaching competence is one of technology skills, and computer self-efficacy is one of self-efficacy beliefs. Moreover, the research by [11] from information system research area has found that individual computer-related behaviors and attitudes are rooted in all or part of social cognitive theory (SCT). [23] found that computer self-efficacy positively affects individual cognition and behaviors. Other than this, it can be inferred from theory of planned behavior that blended teaching competence which is a kind of control belief and perceived facilitation believed

necessary can be used to measure teachers' informatization instructional leadership behavior. This argument was identified by [44] that teachers' blended teaching competency is one of the important influencing factors in predicting teachers' informatization instructional leadership (TIIL).

[41] and [33] considered Smart PLS as one of the second-generation prominent software applications for Partial Least Squares Structural Equation Modeling (PLS-SEM), still treated by many as an emerging multivariate data analysis method. However, data analysis in related research of informatization instructional leadership still mainly adopts the first-generation techniques such as correlation analysis and regression analysis [44]. [43] used AMOS-SEM to explore the impact of teacher information technology leadership on teaching efficacy in Chinese education context. However, there have been relatively few attempts to validate the instruments using PLS-SEM.

Based on the above review, prior to examining the interrelation between performance expectancy (PE), effort expectancy (EE), social influence (SC), facilitating conditions (FC), behavioral intention (BI), computer self-efficacy (CSE), blended teaching competence (BTC) and teachers' informatization instructional leadership (TIIL) among university teachers to explore which construct-factors affect Chinese university teachers' behavioral intention and employing informatization instructional leadership, this pilot study mainly attempted to examine the reliability and validity of the adapted, modified and translated scales by using PLS-SEM approach. SmartPLS was performed to examine the reliability and validity of scales in terms of three criteria: internal consistency reliability depending on composite reliability (CR) and Cronbach's alpha, convergent validity involving outer loading and average variance extracted (AVE), and discriminant validity including Fornell-Larcker criterion, cross-loadings and Heterotrait-Monotrait Ratio (HTMT).

MATERIALS AND MOTHODS

Participants

Sample participants in current research were randomly selected based on cluster sampling technique from a population of nine private undergraduate universities in Xi'an city of Shaanxi Province of China. According to the comprehensive ranking of private undergraduate universities from Chinese Ministry of Education, Chinese private universities are divided into four clusters. In this research, four private undergraduate universities were elected from four clusters because they have carried on blended teaching that is a necessary condition for adopting teachers' informatization instructional leadership. The purposive sampling technique was used to exclude those private undergraduate universities which did not employ blended teaching. And then a random cluster sampling technique was used to select in-service teachers from different clusters of universities, which is to say, different cluster universities had the same probability of being chosen during the sampling process. A total of 60 in-service teachers were finally selected randomly for this study with 15 in-service teachers representing each of the four cluster universities. They are A representing Chinese top private universities, B representing Chinese first-class private university, C representing regional first-class private university and D representing regional well-known private university.

Instrument

Table 1 shows the code and all items used in this research instruments. Use Expectancy (UE) instrument referred to the measurement scale from [8], which was initially formulated to measure pre-service teachers' intention to use learning management system. Beyond that, 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 'Effort Expectancy' (EE) dimension. SI Scale to measure social influence and FC Scale to measure facilitating conditions were referred to and modified from a six point Likert scale [8] and a five-point Likert scale [40].

The CSE scale was adapted from [11]. [11] 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. Based on the above scale, this study adapted the computer self-efficacy scale under the background of informatization teaching leadership in the blended teaching mode, including 5 questions, which is used to measure the level of university teachers' computer self-efficacy.

Blended Teaching Competence (BTC) Scale was developed by [15], referring to [28] which was originally to measure pre-service and in-service teachers' blended teaching competence. BTC Scale by [15] 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 environment. In this research, the Blended Teaching Competence Scale was modified and consisted of eight dimensions with a total of 32 items in terms of the pedagogy, management, assessment, and technology. The following eight dimensions were respectively measured 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), 'Managing the Blended Learning Environment (MBLE).

Behavioral Intention (BI) is the mediating variable in this research model. BI Scale also referred to the scale to measure pre-service teachers' intention to use learning management system [8] and a 5-point Likert scale [40].

The TIIL Scale was adapted from [44] that involved three dimensions with four items for each dimension and in current research modified it 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 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 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 all adapted, modified, and translated original scales into 11-point semantic differential scales starting from 0 (strongly disagree) to 10 (strongly agree) to fulfil the requirement of employing PLS-SEM approach to conduct data analysis in this research context.

Procedures

The procedure of carrying out the research was firstly permitted by university teachers' development center from 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 administrated during teacher routine meeting weekly in Wednesday afternoon. The survey questionnaires made via 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 via social media (i.e., QQ, We-chat) with the help of peer teachers. None of the respondents was forced to answer the questionnaire but voluntarily and anonymously

responded to questions. The respondents were also given adequate time 20 min to answer the questionnaire.

Data Analysis

Prior to using PLS-SEM to analyze data, it is crucial to screen the collected data to delete errors from missing value, suspicious response patterns, and outliers. It is essential to review and evaluate the statistical analysis in terms of the relation among items in the measurement model. In current research, the assessment of reliability and validity of the survey questionnaire is based on three important criteria (Table 2): internal consistency reliability, convergent validity, and discriminant validity [33]. Internal consistency reliability for each subscale was measured from two criteria: Cronbach's alpha coefficient and composite reliability. The convergent validity of the instrument depends on Outer Loading (OL) and Average Variance Extracted (AVE) to be evaluated. Forenell Larcker Criterion, Cross-loading and Heterotrait-Monotrait ratio (HTMT) were assessed to evaluate the discriminant validity for each construct in seven scales.

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	*[33]*
	Cronbach's alpha (CA)	0.6-1 accepted	
Convergent Validity	Outer Loading (OL)	• > 0.70 accepted •0.4-0.7 (Acceptable with certain condition) • < 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	

RESULTS AND DISCUSSION

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

Data Distribution

For the Kolmogorov-Smirnov normality test shown in Table 3, the significant level is reported to be .200 ($p > .05$) for total UE, .008 ($p < .05$) for total SI, .032 ($p < .05$) for total FC, .024 ($p < .05$) for total CSE, .028 ($p < .05$) for total BTC, .034 ($p < .05$) for total BI, and .200 ($p > .05$) for total TIIL. Results show that the data is normally distributed for latent constructs use expectancy and teachers' informatization instructional leadership. whereas it is non-normal for the latent constructs social influence, facilitating conditions, computer self-efficacy, blended teaching competence, and behavioral intention. Nevertheless, non-normal distribution is still suitable for using PLS-SEM to analyze data because PLS-SEM is a soft second-generation data analysis technique and modeling approach with less stringent criterion as compared to CB-SEM. It has no assumption towards the data distribution. However, CB-SEM requires the data to be normally distributed [33];.[41].

Table 3. Kolmogorov-Smirnov Normality Test

construct	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
UE	0.058	60	.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	.200*

*This is a lower bound of the true significance ($p < .05$).

Examination of Reliability and Validity

[33] posited that three crucial criteria were used to assess reliability and validity of the survey questionnaire: internal consistency reliability, convergent validity, and discriminant validity.

Internal Consistency Reliability

Internal consistency reliability is the first criterion for evaluation of how all factors on the test relate to all other factors. In this research, the reflective measurement model for the instruments was being evaluated to measure the internal consistency reliability. Cronbach's Alpha is the most conventional method used to show degree of internal consistency reliability measure in the first-generation statistical techniques. Cronbach's Alpha follows a principle that all factors intend to measure the same variable, then they are highly related and the value of alpha must be high. On the contrary, they are not related and the value of alpha must be low. Cronbach's Alpha tends to underestimate the internal consistency reliability. It assumes all items have equal outer loading on the constructs. While composite reliability makes up the Cronbach's Alpha's limitations. It tends to overestimate the internal consistency reliability. In addition, composite reliability takes into account the different outer loading of all items.

The matrix tab in Table 4 shows the composite reliability value showed as .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 that fall threshold range of.60 to 1. The specific Cronbach's alpha reported to be .819 for UE_PE, .829 for UE_EE, .920 for SI, .945 for FC, .804 for CSE, .818 for BTC_ER, .767 for BTC_FSSI, .826 for BTC_FTSI, .829 for BTC_MBLE, .806 for BTC_PBAS, .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.

From the results of the composite reliability and Cronbach's alpha, it shows that all adapted scales are reliable survey tools which are able to measure all the complex constructs in this research and have achieved high degree of internal consistency reliability.

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

Matrix	Cronbach's alpha	Composite Reliability	Average Variance Extracted (AVE)
UE_PE	.819	.880	.648
UE_EE	.829	.885	.659
SI	.920	.941	.799
FC	.945	.959	.855
CSE	.804	.864	.614
BTC_ER	.818	.879	.681
BTC_FSSI	.767	.865	.647
BTC_FTSI	.826	879	.647
BTC_MBLE	.829	.884	.656
BTC_PBAS	.806	.874	.656
BTC_PBA	.876	.924	.802
BTC_PI	.877	.890	.673
BTC_TL	.796	.866	.617
BI	.831	.734	.552
TIIL_ICTM	.870	.899	.642
TIIL_IELL	.914	.928	.721
TIIL_ITEC	.856	.893	.677

Convergent Validity

Convergent validity is used to measure the extent to which a measure correlates positively with alternative measure of the same construct. Outer loading is also referred as item/indicator reliability. Item loadings reflect the correlation between an item and its corresponding latent variable. Based on [33], Average Variance Extracted (AVE) indicates the degree in which the constructs explain its items/indicators.

Table 5 shows specific outer loading that failed load. Nine items were deleted due to outer loadings that was lower than .40 in which 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), UE_PE_4 (.290). After items deletion, the calculation process is conducted again until the AVE values reach the acceptance level of .50.

Table 5. Research items of 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 items with OL < 0.4	
UE_EE	5	4 items with OL > 0.7	UE_EE_3
		1 items with OL < 0.4	
SI	5	4 items with OL > 0.7	SI_5
		1 items with OL < 0.4	
FC	5	4 items with OL > 0.7	FC_4
		1 items with OL < 0.4	
CSE	5	4 items with OL > 0.7	CSE_2
		1 items with OL < 0.4	
BTC_TL	4	4 items with OL > 0.7	-
		0 items with OL < 0.4	
BTC_PBA	4	3 items with OL > 0.7	BTC_PBA_2
		1 items with OL < 0.4	
BTC_PBAS	4	4 items with OL > 0.7	-
		0 items with OL < 0.7	
BTC_PI	4	4 items with OL > 0.7	-
		0 items 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 items 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 items with OL < 0.7	
BI	5	4 items with OL > 0.7	BI_4
		1 items with OL < 0.4	
TIIL_ITEC	5	4 items with OL > 0.7	TIIL_ITEC_3
		1 items 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 items with OL < 0.7	

Table 4 shows after item deletion, the specific Average Variance Extracted (AVE) value of UE_PE (.648) is beyond the required lowest threshold value of .50. This is also applicable to UE_EE (.659), SI (.799), FC (.855), CSE (.614), BTC_ER (.681), BTC_FSSI (.647), BTC_FTSI (.647), BTC_MBLE (.656), BTC_PBAS (.656), BTC_PBA (.802), BTC_PI (.673), BTC_TL (.617), BI (.552), TIIL_ICTM (.642), TIIL_IELL (.721), and TIIL_ITEC (.677). Based on above data analysis, outer loading and AVE all met the threshold criteria. It indicated that convergent validity has been established in this study.

Discriminant Validity

Discriminant validity measures the uniqueness of each construct to ensure it is distinct from other constructs in the structural model [33]. Cross Loading indicates that the

indicator's outer loading on the associated construct should be greater than any of its cross-loadings on other constructs. Fornell-Larcker Criterion compares the square root of AVE value with the latent variable correlations. The construct is considered valid and distinct from other construct when the square root of each construct's AVE is greater than its highest correlation with any other construct [33]. According to [34], HTMT approach is the mean value of all correlations 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-heteromethod correlations). The threshold value for HTMT is .90. Any HTMT value that is higher than .90 is considered as lack of discriminant validity.

Table 6 shows the results of the Fornell-Larcker criterion assessment with the reflective construct BI has a value of .743 for the square root of its AVE. This value is higher than 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). As for the other reflective construct, they also have the highest values for the square root of their AVE values which are respectively greater than values in the same row and column. Thus, it can be concluded that based on research findings shown in Table 6 the discriminant validity has been established for all seven constructs.

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

	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**

Table 7 shows the cross-loadings for each item reflected on latent construct BI, UE, CSE, FC and SI. Items BI_1, BI_2, BI_3, and BI_5 load high on its corresponding construct BI and much higher on 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 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 its corresponding construct CSE but much higher on other constructs 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 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 each item of BI, BTC, FC, CSE, UE and TIIL.

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

	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 shows the cross-loadings for each item reflected on latent construct BTC. Items BTC_ER, BTC_FSSI, BTC_FTSI, BTC_MBLE, BTC_PBA, BTC_PBAS, BTC_PI, BTC_TL load high on its corresponding construct BTC and also much higher on other constructs each item of BI, CSE, FC, SI, TIIL and UE.

Table 8. Cross loadings for the construct BTC

	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
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 displays the cross-loadings for each item reflected on latent construct TIIL. The each item of TIIL also load higher than other constructs' each item of BI, BTC, SI, CSE, UE and FC.

Table 9. Cross loadings for the construct TIIL

	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

According to Fornell-Larcker criterion and cross-loadings criterion, it can be concluded from the research findings shown from Table 6 to Table 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 exceeded the cross-loadings. Thus, this indicates the discriminant validity has been established for all seven constructs.

The Heterotrait-Monotrait Ratio (HTMT) shown in Table 10 was the last criterion used to measure the discriminant validity. All the constructs fall under the maximum threshold value of .85. It illustrates 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 indicated the discriminant validity has been established.

Table 10. Heterotrait-Monotrait Ratio (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	

Comparison of Structural Equation Modeling

Figure 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. Mean-while, the number shown in the circular shape is the composite reliability for each construct. Nine items' outer loadings were indicated to be lower than .40, hence must be removed to meet the criterion of outer loading. Although composite reliability values for all items reach the acceptance minimum threshold of .60 in both figures, after item deletion, all composite reliability values reach a satisfying level.

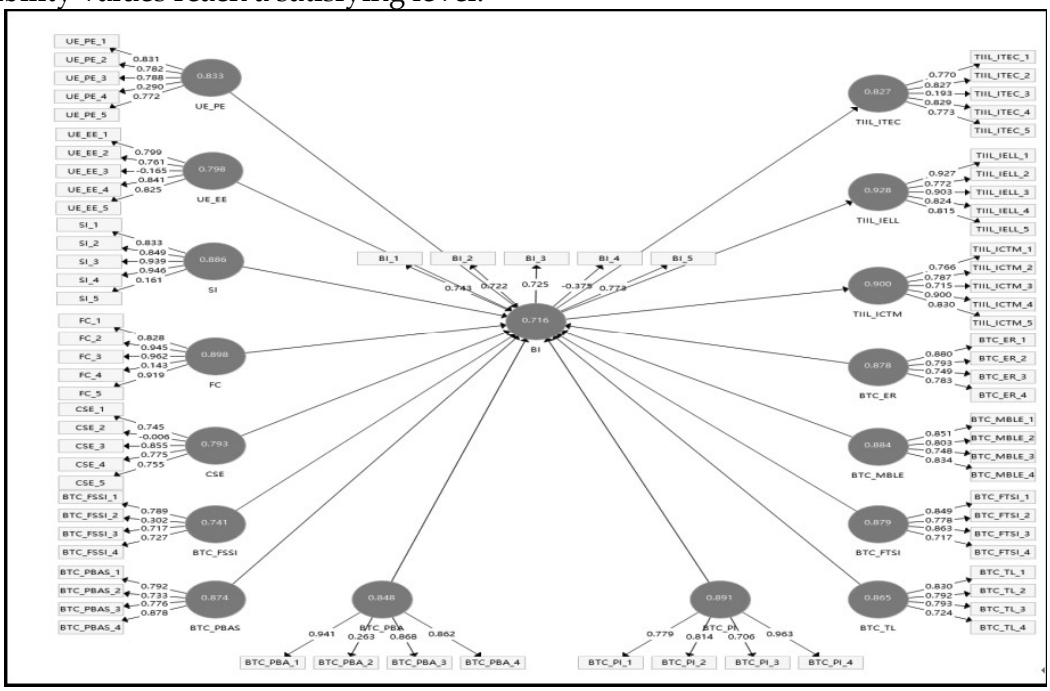

Figure 1. Composite Reliability and Outer Loading before item deletion

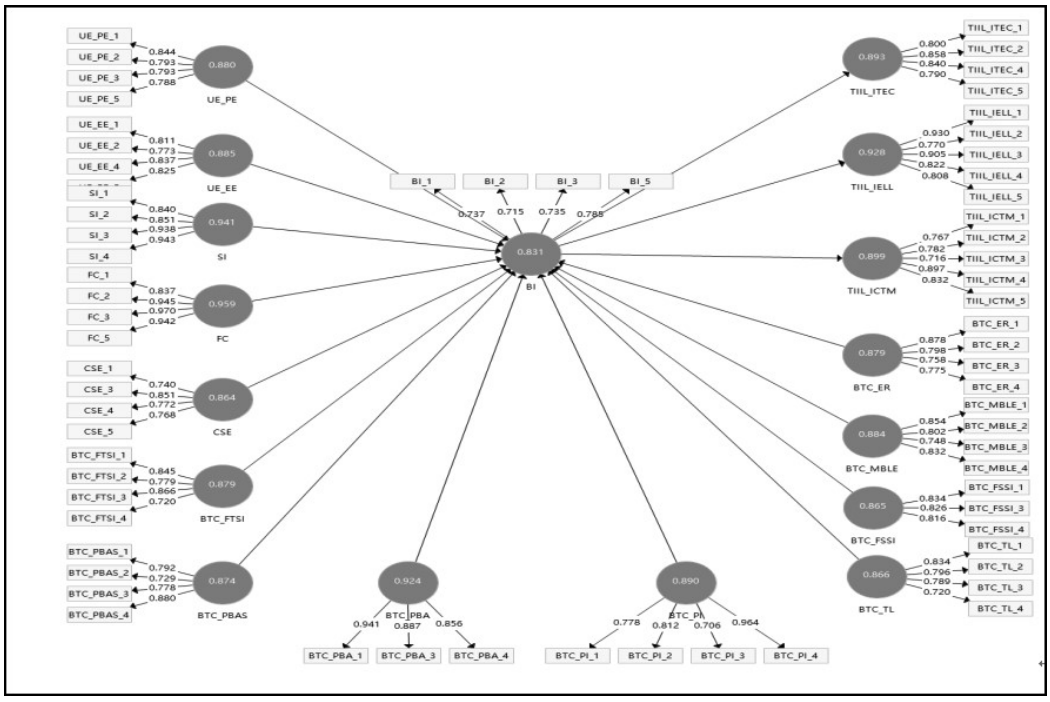

Figure 2. Composite Reliability and Outer Loading after item deletion

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. After assessment, there were a total of nine items eliminated from the original 77 items in the questionnaire. 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.

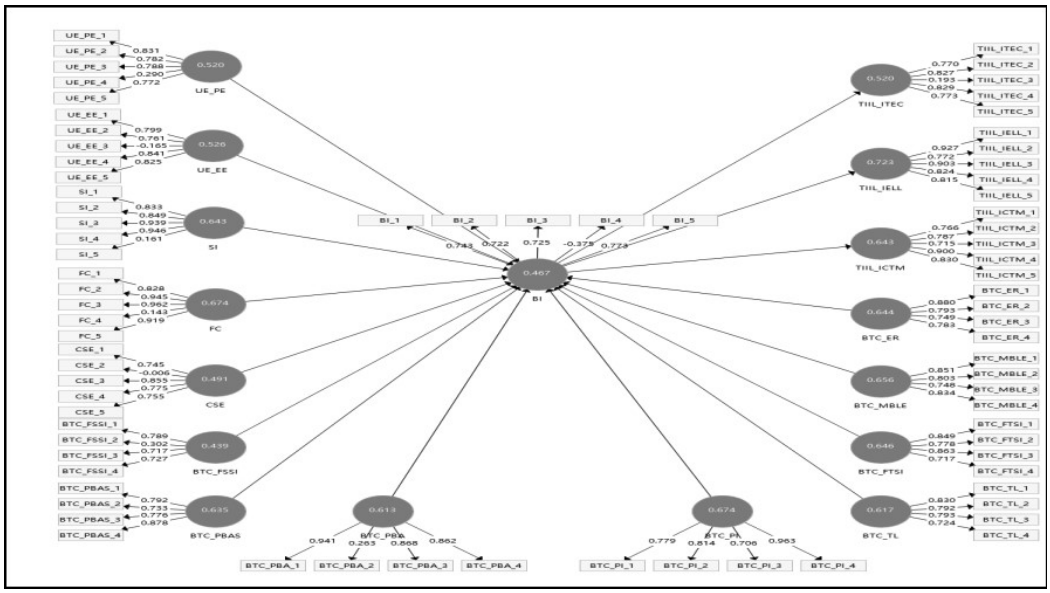

Figure 3. AVE and Outer Loading before item deletion

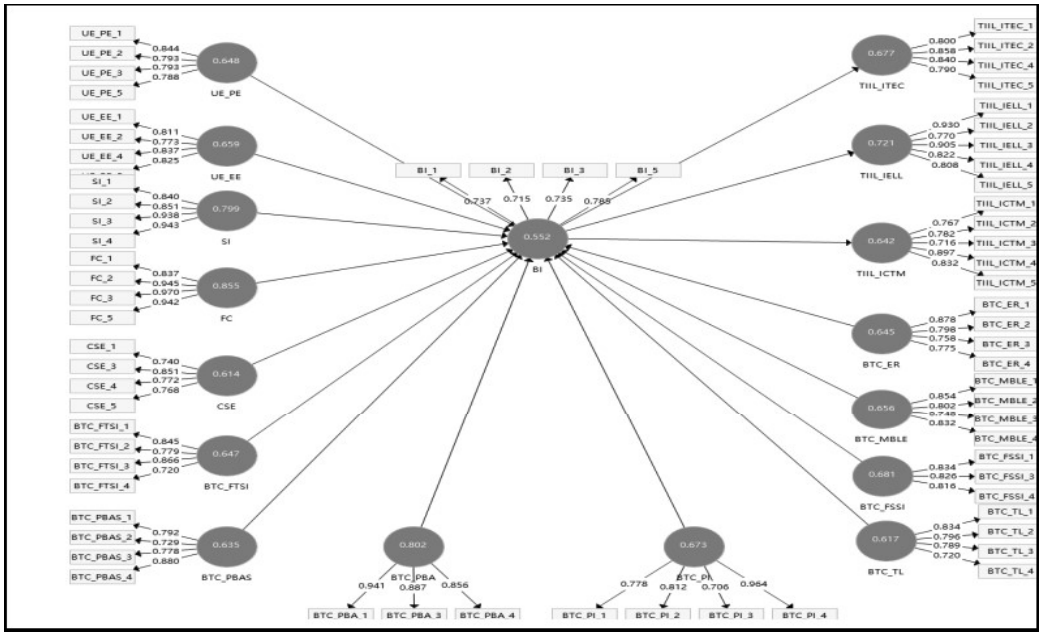

Figure 4. AVE and Outer Loading after item deletion

Discussion

The current research obtained the five influencing factors to TIIL which are UE, SI, FC, CSE, BTC and BI based on the UTAUT model. Before achieving the result of the interrelation of the constructs in extended UTAUT model to explore contributing factors to TIIL, this pilot study examined above all the reliability and validity of research instruments by using the PLS-SEM approach. There is a scarcity of research adopting Smart PLS to validate instruments from multidimensional in spite of questionnaires developed in previous literature. Additionally, when the previous researches 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 lack of the instrument validation in multidimensional and easy to produce measurement error. Thus, this research adopts PLS-SEM statistical analysis approach to evaluate the validation of the instruments in terms of internal consistency reliability, convergent validity, and discriminant validity for each individual item of the instruments to reduce measurement error. Using PLS-SEM approach focuses on composite reliability with making up the deficiency of main emphasis on the Cronbach's alpha value when measuring internal consistency reliability of instruments by employing the first-generation statistical analysis approach. Hence, using more sophisticated second-generation approach to re-validate instruments tends to enhance the instrument precision in measuring specific constructs as the various perspectives of validation contributes to increase the accuracy of evaluating the instrument by using several indicators.

Reliability

In the studies by [8] and [40], the reliability analysis for 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, which is to say, extended UTAUT model can be applied into the field of teachers' informatization instructional leadership.

This research combined CSE and BTC instruments development from the literature review by [11], by [15] with the Chinese university context. Through re-validating the CSE and BTC scales and deleting outer loadings with lower than .40, the composite reliability value and Cronbach's alpha value all met criteria. Thus, this proved distinct internal consistency reliability has already been established in the field of TIIL.

As for TIIL scale, the TIIL Scale was developed according to Chinese literature review by [44] , but after re-validating the adapted TIIL Scale, one item's outer loading was found to fail loading so was deleted. This indicated it is essential for researchers to re-validate an adapted, modified TIIL scale although TIIL scale by[44] and adapted TIIL scale both used in the same research field of teachers' informatization instructional leadership. The rationale behind it is because this research adopted PLS-SEM technique and [44] used AMOS-SEM technique. In other words, PLS-SEM and AMOS-SEM are both the second-generation approach, but they require different data assumption that PLS-SEM has no assumption towards the data distribution. In contrast, AMOS-SEM assumes the data to be normally distributed. This is a similarity to [41].

Validity

Outer loading and Average Variance Extracted (AVE) are two important criteria to assess the convergent validity of seven adapted scales. Compared before items deletion with after items deletion for outer loading and AVE in this research, It was evident from the findings

that the assessment of convergent validity is very necessary for examining the correlation between an item and its corresponding latent variable, and for examining the degree in which .the constructs explain its items/indicators. Beyond that, based on results from Cross Loading, Fornell-Larcker Criterion, and HTMT, it proved that each of seven constructs had its uniqueness and it is distinct from other constructs in the structural model by deleting unloaded items to lead to an increase in Cross Loading, Fornell-Larcker Criterion, and HTMT. This is in line with [33] who mentioned in his study that all items deleted in HTMT were the same as the items deleted in cross-loading assessment, Fornell-Larcker Criterion, Cronbach's Alpha, composite reliability, and AVE analysis, thus there was no contradiction issue emerged for the reliability and validity assessments. This from the above proved that validity assessment of seven adapted scales in PLS-SEM model was essential for this research.

Taken together, it also revealed after re-validating the developed UE Scale, SI Scale, FC Scale, and CSE Scale, BI Scale and TIIL Scale, they are reliable and validate to be used in the following investigation of interrelation between constructs to explore the contributing factors to TIIL.

CONCLUSION

This research explored status of Chinese university teachers carrying on informatization instructional leadership during COVID-19 from both theoretical and empirical perspectives, and extended UTAUT model by adding two new variables from the perspective of teachers' informatization instructional leadership process. In terms of practice, this study suggests that CSE and BTC are also two important affecting factors to TIIL so they should be focused in the process of adopting TIIL. Most importantly, this research adopted PLS-SEM approach to re-validate seven modified scales which are used to respectively measure seven influencing factors. This enriched methodological the theory. This 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 conduct TIIL goals.

Due to the influence of CONVID-19, the research respondents are limited to in-service teachers from private undergraduate universities of the same province of China. The discussions in the article are limited to a study of representative states of China. Thus, the future study should extend the research population to the state-funded universities from the different provinces of China, and should discuss the representative states worldwide. On the other hand, whether the six influential factors i.e., UE, SI, FC, CSE, BTC and BI derived from UTAUT model are positively or significantly related to TIIL has not been verified, whether five influential factors (i.e., UE, SI, FC, CSE, BTC) have positive and significant effect on BI has not been confirmed, and whether mediating variable i.e., BI can mediate the relationship between five influential factors (i.e., UE, SI, FC, CSE, BTC) and TIIL also need to be verified, for this reason, the researcher attempts to use PLS-SEM to

further explore the interrelation between constructs in future studies to explore how different factors affect teachers' informatization instructional leadership.

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