INSTRUMENT DEVELOPMENT FOR INVESTIGATING STUDENTS' INTENTION TO PARTICIPATE IN ONLINE DISCUSSION FORUMS: CROSS-CULTURAL AND CONTEXT ADAPTATION USING SEM

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ABSTRACT

There is a need to investigate student intention to participate in online discussion forums in the context of online collaborative learning due to the importance of student participation and the widespread student inactivity reported in some studies. Student participation in online discussion forums could be predicted by the constructs included in the Theory of Planned Behavior (TPB). This paper presents a cross-cultural adaptation (CCA) and validation of a questionnaire based on TPB for analysis using Structural Equation Modelling (SEM). The CCA was conducted to adapt the English items included in the questionnaire for use in an Indonesian context. This is part of our study on factors that affect student intention to participate in online discussion forums. The rationale for conducting a CCA was the need to cater to the different characteristics of the language and the cultural backgrounds of the participants of this study in comparison to the participants involved in the construction of the original measurement items. The adaptation and the validation of the questionnaire involved a literature review, back-translation, an expert review, pretesting, and a statistical validation test to ensure its reliability and validity. The result shows that the adapted instrument is valid and reliable to be used for further SEM analysis (i.e., structural model evaluation). Moreover, this paper demonstrates that expert-reviewed adaptation and the back-translation method could produce valid and reliable measurement items for SEM. Therefore, future studies that utilize SEM with cross-cultural adapted items from relevant prior studies should consider adopting expert-reviewed adaptation and back-translation methods.

Keywords: online collaborative learning, online discussion forum, intention, questionnaire adaptation, back-translation, structural equation modelling.

INTRODUCTION

Nowadays, the notion of online collaborative learning has gained prominence among education practitioners and researchers (Stahl et al., 2006). According to this concept, learners collaboratively construct their personal understanding through exchanging and challenging other learners' ideas in a process of inquiry resembling a scientific

discourse within an online learning environment (Garrison, 2016). To facilitate such collaborative learning activities, an asynchronous online discussion forum is usually utilized as a part of the blended-learning approach in higher education.

The extensive use of elearning due to the growth of the internet made the asynchronous online discussion forum a popular means to facilitate interaction among students and teachers (Hew et al., 2010) and to provide online collaborative learning in higher education. Due to its text-based and asynchronous characteristics, a discussion forum enables students to have time to reflect on their peers' opinions, challenge them, formulate new ideas, and express these in the form of a threaded context (Garrison & Anderson, 2003). Thus, as the discussion progresses, the threads formed in the forum show the process of inquiry among the students.

Whether this process results in successful collaborative learning is ultimately determined by students actively participating in it (Harasim, 2012). Moreover, the students' active participation is an important part of the online learning environment as it determines the learning outcomes (Yukselturk, 2010). However, some studies have reported that student inactivity in online discussion forums poses a significant problem for online collaborative learning (Fung, 2004; Hew et al., 2010). Without active participation, it is impossible to have a meaningful exchange of ideas and construct personal knowledge. Therefore, strategies need to be identified and implemented to foster student participation in online discussion forums by understanding what factors affect students' intention to participate.

To address such problems, student intention to participate in an online discussion forum needs to be investigated because intention is a factor that predicts behavior according to the Theory of Planned Behavior (TPB; Ajzen, 1991). The construct of intention can be quantified and analyzed using the Structural Equation Modelling (SEM) approach to uncover its relationship with other relevant constructs that are the antecedents of intention (i.e., attitude, subjective norms, and perceived behavioral control). This requires the development of a valid and reliable questionnaire.

However, constructing a valid and reliable questionnaire that is adapted from the items of relevant prior studies is challenging due to the different cultural backgrounds of the participants and the different contexts of their behavior. Participants of the study could differently perceive the original items and the adapted items, as shown in a study by Sousa et al. (2016). Thus, a new and distinct method of adapting and translating the items needs to be implemented in order to achieve equivalence with the original items (Beaton et al., 1998). Moreover, a statistical test needs to be conducted to measure the reliability and validity of the measurement items.

Using items developed for a previous study in a new study is common in SEM research. However, some SEM research involves participants who have different cultural backgrounds in comparison to the participants involved in the previous study that developed the SEM items. Furthermore, some SEM research (Adiyasa et al., 2018; Shihab et al., 2017; Wijaya et al., 2015) did not utilize or report the use of Cross-Cultural Adaptation (i.e., the approaches outlined in Beaton et al., [1998]) in adapting the items to fit the intended cultural context. This could lead to participant's misunderstanding SEM measures (i.e., the meaning of some words in the questionnaire), which in turn could be detrimental to the validity and the reliability of the results. Moreover, in the context of developing measurement items for investigating student intention to participate in online discussion forums, it is not sufficient to retrieve and translate relevant items from prior studies that utilize identical segments of studied subjects (i.e., students) and research framework (i.e., including the constructs of TPB) due to the possibility of mistranslating and misunderstanding the terms used in the items. This issue leads to the need to implement a Cross-Cultural Adaptation (CCA) approach in SEM studies.

This study focuses on the development and cross-cultural adaptation of questionnaire items to measure student intention based on the constructs of TPB based on CCA guidelines developed by Beaton et al. (2000) for a cross-cultural adaptation for self-report measures. This is a part of our larger study that implements the SEM approach to investigate the factors that affect student intention to participate in an asynchronous online discussion forum. The following research question is addressed in this study:

Do measurement items that were retrieved

from the relevant literature and adapted using the CCA method have adequate reliability and validity for SEM analysis in the context of student intention to participate in online discussion forums?

LITERATURE REVIEW

There are three concepts that are relevant to this study, namely online collaborative learning, the Theory of Planned Behavior, and the quantitative measures adaptation method. These concepts are presented in the following subsections.

Online Collaborative Learning and Asynchronous Discussion Forums

Online collaborative learning is an approach to online learning in which learners actively engage with each other by exchanging and challenging ideas to construct a personal understanding of a concept (Garrison, 2016). It is rooted in the social constructivist theory of learning, which asserts that learners construct their own knowledge based on their direct experience in their environment, their prior knowledge, and their interaction with other learners in exchanging and challenging ideas (Bransford et al., 2000; Ertmer & Newby, 2013; Garrison, 2016).

An asynchronous text-based means of communication (i.e., an online discussion forum) is usually utilized to facilitate online collaborative learning. An online discussion forum is a favorable environment to support online collaborative learning due to its asynchronous characteristic that enables students to have some time to reflect on their ideas as well as the other students' ideas which could exhibit a higher-order thinking (Garrison, 2016). This study focused on developing a questionnaire to measure student intention to participate in online discussion forums.

Theory of Planned Behavior

The Theory of Planned Behavior (TPB) is a behavioral theory that is commonly utilized in the information system adoption model. This theory was developed by Ajzen (1991), who extended the prior Theory of Reasoned Action proposed by Fishbein and Ajzen (1975). According to the Theory of Reasoned Action, a particular human behavior that is reasoned could be predicted by its subject's intention. The construct of intention has two antecedents, namely the attitude towards the behavior (i.e., positive/negative personal judgement) and the subjective norms (i.e., peer pressure). In the

TPB, the antecedents of the intention also include the construct of perceived behavioral control (i.e., the availability of means to perform the behavior). This study developed an instrument that is based on the TPB (see Figure 1).
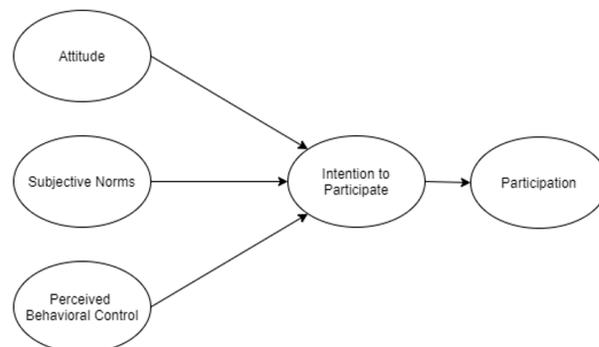

Figure 1. Theory of Planned Behavior (Ajzen, 1991)

This study focused on developing an instrument for investigating the student's intention. Therefore, the constructs addressed in this study consisted of the intention, attitude, subjective norms, and perceived behavioral control of the students on their use of online discussion forums. In the context of this study, attitude refers to the degree of favorable sentiment towards the use of online discussion forums. On the other hand, the subjective norms are related to the social pressure exerted by a student's social environment (i.e., classmates, lecturers, etc.) that encourages the use of online discussion forums. Moreover, the perceived behavioral control refers to the students' ability to use online discussion forums (i.e., skills, access to resource, etc.).

Cross-Cultural Questionnaire Adaptation Method

Adapting a quantitative measurement item retrieved from a prior study conducted using a survey on participants with different cultural backgrounds requires a unique approach in order to achieve equivalence (Beaton et al., 1998). An extensive review by Epstein et al. (2015) provides an overview of state-of-the-art CCA method. In the review, the most common method included in CCA are: (a) a committee review, (b) back-translation, and (c) focus groups. Moreover, it suggests that adaptation and validation are basically two different phases that need to be differentiated in CCA studies. Furthermore, the review concluded that no single method is the best CCA method and the decision to use a particular method is a matter

of resource feasibility (e.g., the time and money available to the researchers).

One guideline that could be adopted is the one proposed by Beaton et al. (2000). Based on this guideline, the adaptation process consists of several phases, namely: (a) translation, (b) synthesis, (c) back-translation, (d) expert committee review, (e) pretesting, and (f) submission and appraisal by a committee. In this study, this guideline was adopted with some adjustments. The details regarding the use of this guideline in this study are presented in the next section.

METHODS

This study employed a CCA method as outlined by Beaton et al. (2000) with several adjustments related to the feasibility of the study. The steps are illustrated in Figure 2, and the details of each step are described in the following subsections.

Literature Review

The first step in developing the questionnaire was a literature review. The review was aimed at retrieving relevant measurement items from relevant studies for each TPB construct. The items were retrieved only from papers that focused on the adoption of elearning and included at least one TPB construct (attitude, subjective norms, or perceived behavioral control). The original items are shown in Table 1.

Adaptation, Forward-Translation, and Initial Expert Review

After the original items in English were retrieved from the literature review, the items were adapted by changing the object of measurement to "online discussion forum." For example, an item that stated, "I will use elearning system on a regular basis in the future" was adapted to state, "I will use online discussion forums on a regular
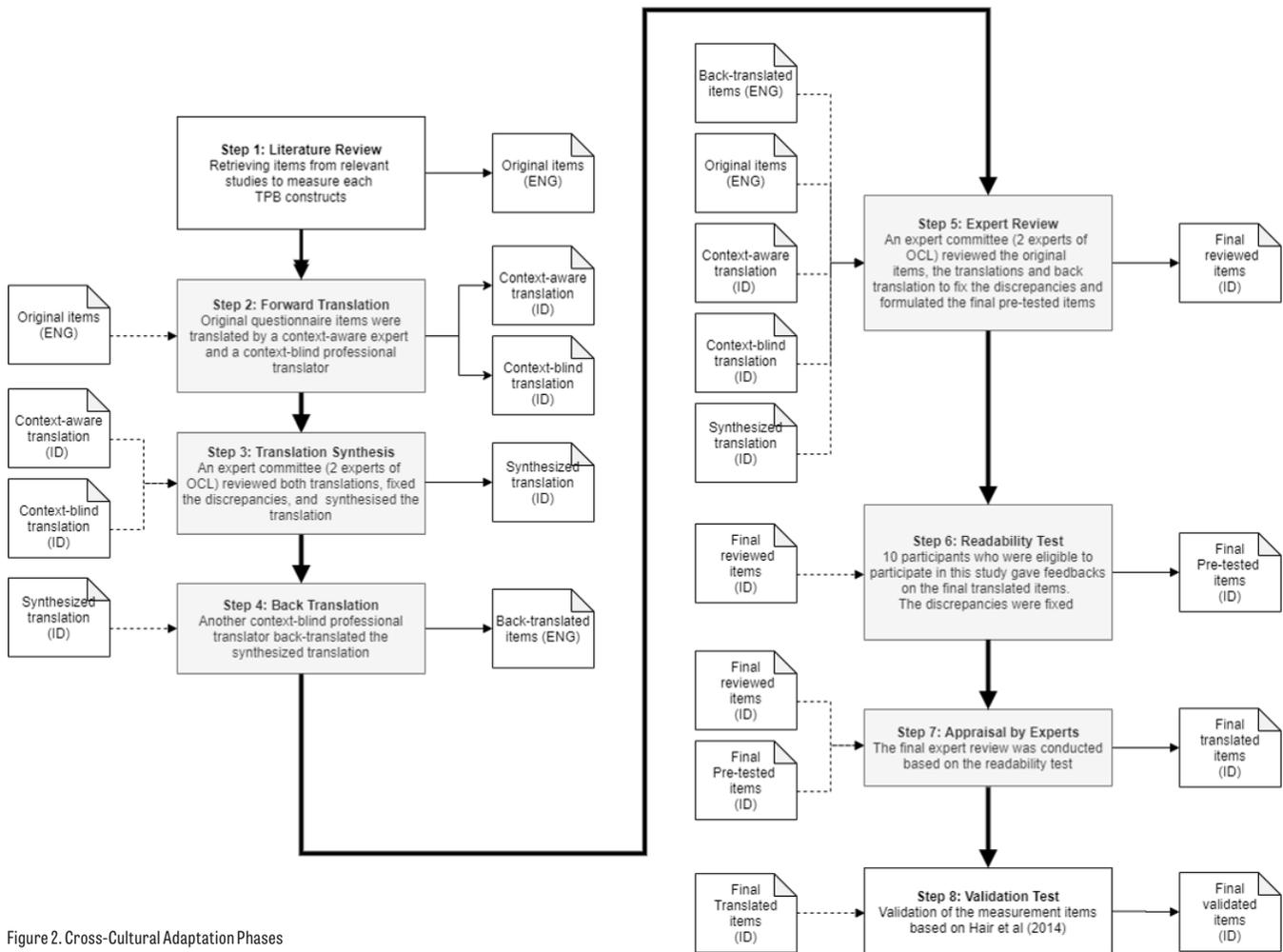

Figure 2. Cross-Cultural Adaptation Phases

Note: The original cross-cultural adaptation method by Beaton et al. (2000) is shown in gray.

basis in the future." The adapted items are shown in Table 1.

Next, the items were forward-translated by two translators, namely a context-aware translator and a context-blind translator. The author (i.e., Kasiyah and Santoso) took the role as the context-aware translator to ensure context relevance of the items. The context-blind translator was a professional translator from an international language institute in Indonesia.

Furthermore, the adapted version and the original items were reviewed by two experts in online collaborative learning. The experts involved in this study have about 15 years experience in online and distance education.

Translation Synthesis

The context-aware and context-blind versions were synthesized by resolving discrepancies. The synthesis was conducted by comparing the versions to the original TPB construct description by Ajzen (1991) and the original items. The experts were also involved in the synthesis to gain more insight and resolve discrepancies.

After the synthesis was conducted on both the context-aware and context-blind versions, the synthesized items were back-translated by a professional translator. The back-translator was different from the translator involved in the previous context-blind translation to prevent subjectivity.

Expert Review

An expert committee consisting of two experts who were involved in the initial expert review reviewed the items produced in the previous steps. The discrepancies were highlighted and resolved by comparing them to the original TPB construct description by Ajzen (1991) and the original items. The review was identical to the one conducted in the previous initial expert review.

Pretesting (Readability Test)

The expert-reviewed items were pretested on 10 participants. The pretest was aimed at identifying readability issues (e.g., participant's understanding of the items). The readability test was conducted online by collecting participants' opinions on each item. They were instructed to report items that were confusing. The participants' opinions were used as the basis for further revision of the questionnaire.

The participants were graduate and undergraduate computer science students from different regions across Indonesia. All participants had prior experience using the online discussion forums in an elearning system provided by the faculty.

Appraisal by Experts

A final expert review was conducted to produce the final revised items based on the readability test. The expert committee consisting of two experts from the initial expert review was involved again in this review. The final expert review was aimed at resolving readability issues in some items by rewording the items while maintaining their meaning equivalence with the original version or adding an explanation below the item (i.e., definition or examples) to aid participants in understanding it.

Final Validation

Finally, after the final translated items were retrieved, the items were validated through a survey and a series of statistical tests. The survey involved 129 graduate and undergraduate students. The method of validation was based on Hair et al. (2014) to ensure the measurement items' validity and reliability for further analysis using the SEM approach. The statistical procedures for the validation included the measurement of: (a) outer loadings, (b) indicator reliability, (c) average variance extracted, (d) composite reliability, (e) Cronbach's Alpha, and (f) HTMT criteria. The results of the measurements are presented in the following.

RESULTS AND DISCUSSION

This section presents the initial construction of the questionnaire (the original measurement items), the pretested items, and the final validated questionnaire. The results are presented in the following subsections.

Original Measurement Items

Through the literature review, the initial questionnaire was developed by retrieving relevant measurement items for each TPB construct from relevant literatures. It consisted of 18 items retrieved from two studies by Lee (2010) and Yu and Yu (2010) in the context of elearning or other educational technology-related adoption. The retrieved items from those studies were developed from prior research in information systems adoption. The original items are presented in Table 1.

The original retrieved items were then adapted to suit the purpose of this study by changing the wording of the measurement items to include the phrase "online discussion forum" as the object of interest. The adapted items are also presented in Table 1. The items were further translated into Indonesian, back-translated into English, and reviewed by experts.

Pretested Items

The translated items were pretested (readability tested) by 10 participants in order to investigate whether the participants had differing perceptions on what were included in the items. Based on the readability test, 26 issue-related comments were collected. The issues and the number of the participants who reported the issues are as follow: (a) confusion due to perceived identical items (n = 6) on ITN1, ITN2, and ITN12, (b) confusing wording of ". . . within my control" on PBC1 (n = 6), (c) confusing wording of "it is likely . . ." on ITN4 (n = 1), (d) confusing wording of "it is desirable . . ." on ATT3 (n = 2), (e) confusing wording of "is a wise idea . . ." on ATT5 (n = 1), (f) confusing use of a comma on a translated item of SN1 (n = 1), and (g) confusion due to perceived identical items (n = 2) on SN2, SN3, and SN4. In summary, the comments explained confusing identical items (n = 2) and confusing wording (n = 2).

The participants reported that 9 out 18 items (50%) had readability issues (i.e., confusing words). These findings revealed that some word usage in the items could lead to different perceptions of the meaning of the items among the participants. Moreover, a questionnaire adaptation study by Ovariyanti and Santoso (2016), who developed an Indonesian version of the Index of Learning Style (ILS), also reported that 25% of their items were confusing according to the participants of the readability test. In another Indonesian CCA by Wardhani et al. (2018), some readability-related problems also existed, such as unfamiliar terms and misinterpretation of items. Similar problems were also identified in a study by Sterie and Bernard (2019).

The persistence of readability issues in several studies confirm that a proper method is crucial in achieving meaning equivalence in adapting a measurement item (Beaton et al., 1998). To achieve such equivalence, some readability-related issues could be identified and resolved through a readability test involving a sample of the participants in a quantitative survey study.

Based on the participants' comments, reviews and appraisals by the previously involved experts were conducted. The items were revised according to the experts' views by changing the words or adding explanations. Furthermore, the revised items were statistically validated in the final validation phase.

Final Validation Results

The final translated and pretested (readability tested) items were validated through a series of statistical procedures for measurement model evaluation that was established by Hair et al. (2014). The procedures included evaluating internal consistency and reliability (Cronbach's alpha & composite reliability), convergent validity (outer loadings, indicator reliability, and average variance extracted), and discriminant validity (confidence interval of the HTMT measures).

The evaluation was conducted by comparing the results with the established cut-off criteria. Two items (SN5 & PBC 1) did not satisfy the criteria and were excluded from the questionnaire to preserve the validity and the consistency of the TPB measurement model for further SEM analysis. Details of the final validation results are presented in Table 2.

By the exclusion of only two items, and no constructs were measured by fewer than two items, the validity and the reliability of the measurement items were successfully achieved. Adequate validity and reliability indicate that only minor readability and comprehension issues were encountered by the participants. Thus, the adapted questionnaire was fit for use in the SEM approach.

The findings show that producing two versions of the translation, i.e., the context-aware and context-blind translations, back translating the items, and conducting several iterations of item revision involving both experts and a sample of participants as proposed by Beaton et al. (2000) could produce adapted measurement items that are fit for the SEM approach. Therefore, future quantitative survey studies that utilize SEM in which the measurement items are retrieved from literature with differing languages should consider adopting this CCA method. Despite a study suggesting that back-translation is not necessary to be conducted (Epstein et al., 2015), it could be

included in the study design to ensure the validity and reliability of the measurement model.

CONCLUSION

Based on the results, the adapted questionnaire is fit for use in a SEM analysis to investigate student intention to participate in online discussion forums. It has adequate reliability and validity to measure student intention, attitude, subjective norms, and perceived behavioral control. Therefore, this study shows that the CCA procedures are beneficial for inclusion in the design study of a quantitative survey research that utilizes the SEM approach and retrieves the measurement items from studies with differing languages and cultures. In the future, further analysis to evaluate the structural model of the TPB should be conducted as part of the ongoing research on student participation in online discussion forums. Future studies could also be directed at utilizing the CCA method in constructing SEM measures in other areas (e.g., health, ecommerce, etc.). Moreover, comparing the outcomes of various CCA validation steps that are conducted in different contexts could give some insights on the effectiveness of the CCA method in producing adapted instruments that have meaning equivalence with the original instruments.

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Table 1. The Original, Adapted, and Final Translated (Readability Tested) Measurement Items Retrieved from the Literature

TPB Construct	Item Code	Original Item	Adapted Item	Final Translated Item
Intention	ITN1	I will use the elearning system on a regular basis in the future (Lee, 2010).	I will use the online discussion forum on a regular basis in the future.	Saya akan menggunakan forum diskusi daring secara rutin di masa yang akan datang.
	ITN2	I will frequently use the elearning system in the future (Lee, 2010).	I will frequently use the online discussion forum in the future.	Saya akan sering menggunakan forum diskusi daring di masa yang akan datang.
	ITN3	I will strongly recommend that others use the elearning system (Lee, 2010).	I will strongly recommend the online discussion forum for the others to use it.	Saya akan sangat menyarankan orang lain menggunakan forum diskusi daring.
	ITN4	It is likely that I will use online learning systems (Yu & Yu, 2010).	It is likely that I will use the online discussion forum.	Kemungkinan besar saya akan menggunakan forum diskusi daring.
	ITN5	Assuming I had access to an online learning system, I would use it (Yu & Yu, 2010).	Assuming I had access to an online discussion forum, I would use it.	Apabila saya memiliki akses ke forum diskusi daring, saya akan menggunakannya.
	ITN6	I intend to continue to use online learning systems (Yu & Yu, 2010).	I intend to continue to use the online discussion forum.	Saya berniat untuk terus menggunakan forum diskusi daring.
Attitude	ATT1	Using elearning is a good idea (Lee, 2010).	Using the online forum discussion is a good idea.	Menggunakan forum diskusi daring adalah ide yang bagus.
	ATT2	I like using elearning (Lee, 2010).	I like using the online discussion forum.	Saya suka menggunakan forum diskusi daring.
	ATT3	It is desirable to use elearning (Lee, 2010).	It is desirable to use the online discussion forum.	Menggunakan forum diskusi daring adalah aktivitas yang saya inginkan.
	ATT4	Using the internet for learning would be/is pleasant (Yu & Yu, 2010).	Using the online discussion forum for learning would be/is pleasant.	Penggunaan forum diskusi daring untuk kegiatan belajar adalah hal yang menyenangkan.
	ATT5	Using the internet for learning would be/is a wise idea (Yu & Yu, 2010).	Using the online discussion forum for learning would be/is a wise idea.	Menggunakan forum diskusi daring untuk pembelajaran adalah ide yang bijak.
Subjective Norms	SN1	People important to me support my use of elearning (Lee, 2010).	People important to me support my use of the online discussion forum.	Orang-orang, yang penting bagi saya, mendukung saya menggunakan forum diskusi daring.
	SN2	People who influence me think that I should use elearning (Lee, 2010).	People who influence me think that I should use the online discussion forum.	Orang-orang, yang berpengaruh bagi saya, berpendapat bahwa sebaiknya saya menggunakan forum diskusi daring.
	SN3	People whose opinions I value prefer that I should use elearning (Lee, 2010).	People whose opinions I value prefer that I should use the online discussion forum.	Orang-orang yang pendapatnya penting bagi saya, lebih senang jika saya menggunakan forum diskusi daring.
	SN4	In general, my classmates support the introduction of online learning systems (Yu & Yu, 2010).	In general, my classmates support the introduction of the online discussion forum.	Secara umum, teman-teman sekelas saya mendukung digunakannya forum diskusi daring.
	SN5	My teacher is very supportive of online learning system use for my learning (Yu & Yu, 2010).	My teacher is very supportive of the online discussion forum use for my learning.	Dosen saya sangat mendukung penggunaan forum diskusi daring untuk pembelajaran.

Perceived Behavioral Control	PBC1	Using elearning system was entirely within my control (Lee, 2010).	Using the online discussion forum was entirely within my control.	Penggunaan forum diskusi daring sepenuhnya berada dalam kendali saya.
	PBC2	I had the resources, knowledge, and ability to use elearning (Lee, 2010).	I had the resources, knowledge, and ability to use the online discussion forum.	Saya mempunyai sumber daya, pengetahuan, dan kemampuan untuk menggunakan forum diskusi daring.
	PBC3	I would be able to use the elearning system well for my learning process (Lee, 2010).	I would be able to use the online discussion forum well for my learning process.	Saya mampu menggunakan forum diskusi daring dengan baik untuk mendukung pembelajaran.

Table 2. Final Validation Results Based on Measurement Model Evaluation for SEM

Item Code	Convergent Validity			Internal Consistency and Reliability		Discriminant Validity
	Outer Loading [>0.70]	Indicator Reliability [>0.50]	AVE [>0.50]	Composite Reliability [0.60–0.90]	Cronbach's Alpha [0.60–0.90]	HTMT [confidence interval does not include 1]
ITN1	0.802	0.643	0.712	0.937	0.919	YES
ITN2	0.839	0.704				
ITN3	0.848	0.719				
ITN4	0.852	0.726				
ITN5	0.826	0.682				
ITN6	0.894	0.799				
ATT1	0.817	0.667	0.731	0.931	0.908	YES
ATT2	0.901	0.812				
ATT3	0.869	0.755				
ATT4	0.872	0.760				
ATT5	0.812	0.659				
SN1	0.838	0.702	0.666	0.889	0.835	YES
SN2	0.849	0.721				
SN3	0.807	0.651				
SN4	0.769	0.591				
SN5*	0.456	0.208				
PBC1*	0.674	0.454	0.818	0.900	0.782	YES
PBC2	0.877	0.769				
PBC3	0.932	0.869				

Note: * SN5 and PBC1 were eliminated due to insufficient outer loading value and indicator reliability. The cut-off values for the SEM analysis according to Hair et al. (2014) are shown inside the square brackets "[ ]."