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Content Validity of Digital Knowledge using CVI Method

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Abstract:
This study aims to examine the content validity of Digital Knowledge for TESL pre-service teachers using Content Validity Index (CVI). Seven experts were selected via purposive sampling evaluated the content. Four professional university experts in multimedia learning, digital, and psychometrics, and three subject matter experts from Institute of Teacher Education Malaysia (ITEM) were consulted. The instruments involved 73 items with three main constructs. The result showed that the instrument has good content validity and suggests that Digital Knowledge has a great potential to be promoted as good instrument to measure TESL pre-service teachers' perception of writing essay.

Keywords: Content Validity Index; Instrumentation; Digital Knowledge.

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1.0 Introduction

Developing an instrument to measure video use among Malaysian TESL pre-service teachers is crucial due to the need to understand how this technology is integrated into their teaching practices, particularly about perceived writing ability (Aris, 2020). This specialized tool aims to uncover video use's frequency, methods, and effectiveness in this context (Gönen, 2019). This focus is driven by the increasing use of technology like video in language teaching and its potential to enhance learning experiences, coupled with concerns about the low uptake of ICT in Malaysian ESL classrooms, especially for writing skills (Yunus et al., 2013).

Recognizing the growing importance of technology in language instruction, this study examines the integration of video materials in TESL pre-service teacher education in Malaysia (Thulasi et al., 2015). It investigates video use's extent, methods, and perceived impact on writing ability development (Wah and Hashim, 2021). This focus is grounded in research highlighting the potential of video and other ICT tools to enhance ESL instruction, particularly in areas like writing skills and collaborative learning (Campbell, 2016; Tan and Annabel Chen, 2020).

Besides, the tool is designed to evaluate the teaching methods TESL pre-service teachers adopt when incorporating videos into their teaching. By examining the use of videos in lessons focused on writing, researchers can pinpoint effective approaches that have the potential to positively influence how writing ability is perceived. The utilization of videos in the classroom has been increasingly recognized for its potential to enhance student engagement and learning outcomes (Brame, 2016). By assessing the frequency and variety of videos integrated into writing instruction, researchers can gain valuable insights into how these multimedia resources contribute to cultivating interest among pre-service teachers (Baepler and Reynolds, 2014).

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The primary aim of this study is to investigate the impact of video integration on the perceived writing ability and motivation of pre-service TESL teachers (Silvani, 2020). Existing research indicates that multimedia tools, such as animated movies and short videos, can positively influence students' writing skills and attitudes toward writing (Silvani, 2020). Furthermore, the integration of video-based assignments has been shown to enhance student engagement, confidence, and interest in the writing process (Baepler and Reynolds, 2014).

As more than just a result, the rationale for developing this instrument is that it is more focused on the intended participants. Any findings can help elucidate what educators and learners can do to address issues related to the perception of writing essays among TESL pre-service teachers and improve motivation to write problems among TESL pre-service teachers (Baepler and Reynolds, 2014).

One crucial aspect of instrument development is the measurement of the instrument's content validity. Content validity ensures that the instrument is measuring what it wants to measure. Even if the instrument is reported as having good items, poor content validity will jeopardize the instrument's psychometric utility (DeVellis, 2017). Furthermore, the content validation process will guarantee the instrument has justifiable, rigorous, applicable, meaningful, and beneficial properties (Furr, 2020). Thus, the validation process should be rigorous in developing one valid instrument.

Content validation, apart from construct and criterion validation, is the first step in instrument validation (DeVellis, 2017). It refers to the evaluation of each item so that the item is suitable for the instrument's development purpose. Two elements focused on the content validation process are the item's representativeness and suitability in measuring what the researcher intends to measure. This study emphasized one of the important steps in instrument development: assessing content validity using the Content Validity Index (CVI).

The main objective of this article is to test the content validity of Digital Knowledge

2.0. Literature Review

Digital Knowledge applies CVI as the approach to measure content validation. CVI is a quantitative method of proving that items and instruments meet the specifications of content validity. In addition, CVI's role is to measure mutual agreements among experts regarding how essential a particular item is. Compared to other alternative methods in quantifying content validity, such as Cohen's kappa, Tinsley–Weiss T index, and James, Demaree, and Wolf's index, the CVI method provides more lucidity and representativeness (Knebel et al., 2022; Rico-Sapena et al., 2022). It also provides a table for determining the critical cut-off value (citation). These factors have led to the adoption of CVI by local and foreign researchers as the initial step in the instrument development process (Olapade et al., 2023). Using the Content Validity Index (I - CVI) for Items, the items of the Digital Knowledge were assessed for clarity and representativeness. The I-CVI was determined by dividing the total number of experts by the sum of the "1" or "0" ratings for each item (Knebel et al., 2022). This caused the rating scale to be dichotomous (1: item fit, 0: item not fit). The number of experts who choose "essential" is calculated for each item. A formula is then used to calculate the CVI.

$$\boldsymbol{CVI = \frac{N_e}{N}}$$

CVI = Content Validity Index, N_e + Number of panels indicating “essential”, and N = total number of experts. The benchmark set for either accepting or removing an item is based on the Table 1 below.

Table 1:Number of Experts Endorsing Item as Content Valid

Number of Experts	NUMBER OF EXPERTS ENDORSING ITEM OR INSTRUMENT AS CONTENT VALIDITY								
	2	3	4	5	6	7	8	9	10
2	1.00								
3	.67	1.00							
4	.50	.75	1.00						
5	.40	.60	.80	1.00					
6	.33	.50	.67	.83	1.00				
7	.29	.43	.57	.71	.86	1.00			
8	.25	.38	.50	.63	.75	.88	1.00		
9	.22	.33	.44	.56	.67	.78	.89	1.00	
10	.20	.30	.40	.50	.60	.70	.80	.90	1.00

CVI is also able to determine the instrument (S – CVI), the proportion of items on an instrument that achieved a rating of 1 by all content experts. To average the I -CVIs is by summing them up and divide by the number of items.

$$S - CVI = \frac{I - CVI}{Number\ of\ items}$$

S – CVI of .80 or higher is acceptable (Polit and Beck, 2006).

The minimal CVI critical value for each item is .86 based on Table 1, with a total of 7 experts, thus if an item receives less than the critical value, it needs to be revised or may be eliminated from the instrument.

3.0. Methodology

3.1. Instrumentation

As researchers initially proposed (DeVellis, 2017), various models of instrument development can be used to produce new instruments. Even though all of these models have the same objective of developing an instrument, each development process is distinctive and has its advantages.

3.2. Rationale for Developing the Instrument

This study addresses the need for a nuanced understanding of video technology integration among Malaysian TESL pre-service teachers. While video use in education is increasing, existing research lacks the depth to fully capture its application and impact within this context. This purpose-built instrument investigates the frequency, methods, and perceived effectiveness of video use by these future educators, aiming to inform the development of targeted training and interventions to optimize technology integration in TESL classrooms. This instrument will evaluate the extent, pedagogical strategies, and perceived impact of video use on language skills development, ultimately enhancing language instruction by aligning it with evolving technological landscapes and the needs of TESL pre-service teachers in Malaysia. Furthermore, the tool examines specific teaching methods these teachers employ when incorporating videos, particularly in writing lessons, to identify effective approaches that positively influence perceived writing ability.

This instrument examines how video use in TESL pre-service teacher training can impact perceived writing ability. By analyzing the frequency and types of videos used in writing instruction, the tool reveals how these resources contribute to engagement and potentially influence perceptions of writing ability. This focus on pre-service teachers is crucial as findings can guide educators and learners in addressing challenges related to essay writing perception and improving perceived writing ability among TESL pre-service teachers (Al-Shehab, 2020). Additionally, this research addresses the need for a deeper understanding of video technology integration in TESL pre-service teacher education. Existing research lacks the detail to fully capture its application and impact, particularly among pre-service teachers. This purpose-built instrument investigates the frequency, methods, and perceived effectiveness of video use, aiming to inform the development of targeted training and interventions to optimize technology integration in TESL classrooms.

This instrument systematically evaluates the use of video materials in TESL pre-service teacher education in Malaysia, examining the extent, pedagogical strategies, and perceived impact on language skills development. The goal is to inform educational practices and enhance language instruction by aligning it with evolving technology and the specific needs of these future educators.

Besides, the tool is designed to evaluate the teaching methods TESL pre-service teachers adopt when incorporating videos into their teaching. By examining the use of videos in lessons focused on writing, researchers can pinpoint effective approaches that have the potential to positively influence how writing ability is perceived.

3.3. Instrument Preparation

A draft of the instrument is prepared, and the items are accumulated based on their subscale. This draft of the Digital Knowledge instrument is developed and presented to a panel of experts, which consists of seven members. As they were in different places, a draft of the instrument was sent to each of them, and they answered and commented on each of the listed items. The draft, which initially contained different subscales for different variables, is then mixed into a 10-point Likert scale as it offers more significant variability (variance) compared to 1 to 5 or 1 to 7 Likert scales (Simms et al., 2019). It requires a smaller sample size to have the same degree of precision as a scale with fewer points. As a result, the 10-point format places more reliance on the respondent providing a numerical response, the precise meaning of which has not been defined. This disadvantage is compensated by the fact that many people are familiar with rating 'out of 10' (Dawes, 2008).

Furthermore, the 10-point Likert scale is more sensitive to measuring differences than scales with fewer points. Researchers have found that a multiple regression performed on the same data yielded more predictive effects in the 10-point scale data than the same data collected with a 5-point scale. This scale offers greater statistical reliability and validity, with reliability being the extent to which the measurements of a test remain consistent over repeated tests (Hair et al., 2017). These advantages of the 10-point Likert scale reassure us of its effectiveness in our research instrument.

According to Konting (2005), using questionnaires is very practical for a large population to get a more comprehensive overview of the sample on the research question, especially for a large number of samples and distances from each other, and requires a high cost. The questionnaire is the most appropriate measuring tool for such a study. The advantage of using a questionnaire is that it is easy to administer, process, and analyze, and information can be collected directly from respondents quickly (Rea and Parker, 2014). A draft of the instrument is prepared, and the items are accumulated based on their subscale.

Then, it is more sensitive at measuring differences than scales with fewer points; researchers also found that a multiple regression performed on the same data yielded more predictive effects in the 10-point scale data than the same data collected with a 5-point scale. It has greater statistical reliability and validity. Reliability is the extent to which the measurements of a test remain consistent over repeated tests (Hair et al., 2017).

3.2. Item Development

3.2.1 Phase 1: Development Phase

The item development for this research is adopted from the STEMTIP Instrument Development Process (Ramli et al., 2018), which consists of ten steps. Then, it is adapted (10 steps to 8 steps) to suit the needs of this research. These eight steps were divided into two phases, namely, the development phase and the validation phase. Figure 1 shows the eight steps of the research process. The item

development for this research is adopted from the STEMTIP Instrument Development Process (Nur Farhana Ramli, 2019), which consists of ten steps. Then, it is adapted (10 steps to 8 steps) to suit the needs of this research. These eight steps were divided into two phases, namely, the development phase and the validation phase. Figure 1 shows the eight steps of the research process.

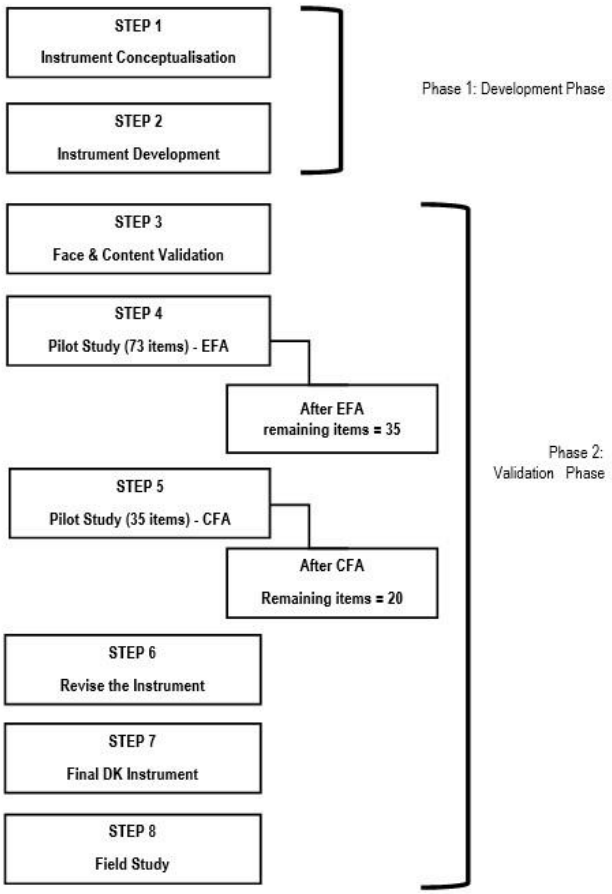

Figure 1: Item Development

3.2.1.1 Instrument Conceptualization

This preliminary step defined and specified the purpose of the study, testing universe, target audience, and test format.

Identifying the purpose of the instrument's development.

This instrument aims to assess the impact of streaming video and digital knowledge on essay writing among TESL pre-service teachers in Malaysia.

The purpose of the study, testing universe, target audience, and test format were all defined and specified in this preliminary step.

Identifying the purpose of the instrument's development.

The purpose of this instrument is to assess the impact of streaming video and digital knowledge on essay writing among TESL pre-service teachers in Malaysia.

Testing universe

The working definition of the constructs must be established in the testing universe to specify what will be tested in the instrument. The constructs built using the Cognitive Theory of Multimedia Learning (CTML) and other relevant supporting documents will determine the influence of video usage and digital knowledge on perceived writing ability.

Target audience

The proposed instrument in this study was aimed at the TESL pre-service teachers in Malaysia who undergo training in twenty-three ITEs.

Test format

This instrument employed objective test format to enable the TESL pre-service teachers to provide responses based on their experiences in writing essay for coursework and examination.

3.2.1.2 Instrument Development

There are several approaches in constructing the instrument items. This research used deductive approach as it involves the generation of items based on the literature review. After conducting critical readings in relation to the issues in the impact of streaming video and

digital knowledge on essay writing among TESL pre-service teachers in Malaysia, the items were generated based on the predetermined operational definitions.

3.2.2 Phase 2: Validation Phase

3.2.2.1 Content Validity

The process of measuring variables to determine whether the full domain of the conceptual variable has been adequately covered is known as content validity (Stangor, 2015). This step of validity will employ experts to evaluate whether the items on the instrument cover the necessary content (Clark and Creswell, 2015). The review of a panel of experts will provide constructive feedback on the quality of the newly developed items. It can provide information on each item's representativeness and clarity.

Content Validation Index (CVI), suggested by (Lynn, 1986) and (C. T. B. D. F. Polit, 2006), is one of several methods for verifying item content. Other examples of validity content measurements include Cohen's kappa (Cohen, 1960), Tinsley-Weiss T index (Tinsley and Weiss, 1975), rWG and rWG (J) indexes (James, Demaree, and Wolfs, 1993), and r*WG(J) (Lindell and Brandt, 1999). Therefore, the validation above tests is very complex to compute as their determination tables are not readily available.

This study employed the Content Validation Index (CVI) to validate the content. This step of validity used seven experts to assess whether the items on the instrument had covered the appropriate content (Clark and Creswell, 2015). The chosen experts are professionals in their respective fields, with a number of publications and years of experience. These experts were also willing to participate in this content validation process.

Experts with specialized competence and talents play a crucial role in content validation by evaluating and refining proposed suggestions (Ramli, 2019). They can be categorized as either professional experts, those with established experience and publications in the field, or lay experts, individuals possessing specialized skills within a specific domain (Rubio et al., 2003; Zamanzadeh et al., 2015). Key criteria for expert selection include a strong portfolio in the research area, relevant work experience, the ability to provide diverse perspectives, and up-to-date knowledge (Catherine, 2003; Rubio et al., 2003).

This research selected seven professionals from public universities and the Institute of Teacher Education Malaysia based on the abovementioned criteria. They are still active in research and publication and are subject matter experts in Malaysia's education system. Table 2 summarizes the information of the professional experts.

In this research, seven professionals from public universities and the Institute of Teacher Education Malaysia were selected based on the abovementioned criteria. They are still active in research and publications, besides being the subject matter experts in Malaysia's education system. Table 2 summarizes the professional experts' information.

Table 2:Professional Experts Information

No	Expert	Area of Expertise	Years of Experience	Affiliation
1	Assoc. Prof Dr H	• Quantitative Research • Technology in Mathematics Education • Statistics in Mathematics Education	10 years	University of Malaya (UM)
2	Dr N	• Instrument development • Special Education Pedagogy	14 years	SDH, Universiti Kebangsaan Malaysia (UKM)
3	Ts Dr H	• Digital and Multimedia • Educational Technology • Computer Security and IT Forensics	26 years	Universiti Teknologi Malaysia (UTM)
4	Dr N	• Cognitive Theory of Multimedia Learning (CTML) • Module Development	16 years	Universiti Institut Teknologi MARA (UiTM)
5	Dr A	• Instrument development • Structural Equation Modelling (SEM) • Subject Matter Expert	24 years	Institut Pendidikan Guru Malaysia (IPGM)
6	Dr S	• Instrument development • Subject Matter Expert	30 years	Institut Pendidikan Guru Malaysia (IPGM)

7	Mr M	• Applied Linguistic • Pedagogy • Subject Matter Expert	28 years	Institut Pendidikan Guru Malaysia (IPGM)

4.0. Findings

Seventy-three items were validated based on the seven experts' judgments using CVI. Four experts are male (66.7%) and three are female (33.3%). One expert (14%) has ten years of experience in the field, followed by two experts with 11 to 20 years of teaching experience (29%). The panel was dominated by experts who have more than 20 years in their respective fields (57%). All experts were chosen from three public universities: three from the Institute of Teacher Education Malaysia (ITEM) and one from Sekolah Dalam Hospital, Pusat Perubatan Hospital Universiti Kebangsaan Malaysia (SDHPPUKM).

In conclusion, the results show that only two items from 73 newly developed items were under the CVI critical value of .86. Based on the expert's advice, the researcher refined these two items to clarify their meanings by referring to the instrument conceptualization (Table 4).

Table 3:The CVI Critical Item

Item Number	Item	The CVI Category Expert Panel		Item Status
		Professional (N = 7)	Total (N = 7)	
		CVIcrit = .86	CVIcrit = .86	
24	I am satisfied with my essay writing when I use the ideas from streaming videos.	.71	.71	Refined
25	I am satisfied with my essay writing when I use the information from streaming videos.	.71	.71	Refined

Items 24 and 25 (Table 4) are under the perceived satisfaction construct, which measures the TESL pre-service teachers' satisfaction with using videos to write essays. This construct is proposed to measure the TESL pre-service teachers' satisfaction when they used videos as sources to write essays.

The refinement and improvement process is not only for the two items. Comments from the experts on each item will be considered to ensure the quality of the items. The improved items will then be prepared for a pilot test among TESL pre-service teachers.

The next step is to average the I–CVIs by summing them up and divide by the number of items. S – CVI of .80 or higher is acceptable (Polit and Beck, 2005). Figure 1 illustrates the calculation.

1+1+1+1+1+1+1+1+.86+1+1+1+1+1+1+1+1+1+1+1+1+1+.71+.71+
.86+1+1+1+1+1+1+1+.86+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1
+1/73 = .98

Figure 2:I - CVI

5.0. Discussion

The "perceived satisfaction" construct, comprising refined items 24 and 25, measures TESL pre-service teachers' satisfaction using videos for essay writing. Expert review (71% deemed content valid) suggests these items are well-written and aligned with the construct definition. However, further testing (e.g., CFA) is needed to establish the construct's internal consistency, reliability, and factor structure. This process contributes to validating the "Digital Knowledge" construct.

While items 24 and 25 demonstrate individual content validity, it's crucial to establish the reliability and validity of the entire "perceived satisfaction" construct. Content validity alone doesn't guarantee a reliable and valid construct. Items may appear relevant individually but might not function effectively as a collective measure due to assessing slightly different aspects or potential redundancies. A lack of internal consistency among items can compromise the reliability of the overall score, making it difficult to draw meaningful conclusions about perceived satisfaction and potentially impacting the validity of the research findings.

Applying Cognitive Load Theory to this research on TESL pre-service teachers' video use for essay writing can strengthen the study's findings. Demonstrating a link between perceived satisfaction (liking videos) and lower cognitive load (ease of learning) can support the use of videos as effective sources (Sweller, 2020). The study can investigate if teachers who enjoy using videos for essay

writing also find them less mentally taxing. If this connection is found, it would strongly suggest that videos can be a very effective source for these teachers.

6.0. Conclusion and Recommendations

Researchers should refine the remaining 71 items to meet the CVI critical value to ensure the instrument's content validity, construct validity, and reliability. Pilot testing with a larger sample will further assess clarity, relevance, and comprehensibility. Factor analysis will examine construct validity and factor structure, while Cronbach's alpha will assess internal consistency reliability. Including more diverse experts can further strengthen content validity. Finally, publishing the validated instrument will allow for wider use and validation by other researchers and practitioners.

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Paper Contribution to Related Field of Study

The validation of 73 items using the Content Validity Index (CVI) by a panel of 7 experts from various universities and teaching experience levels contributes to the related field by establishing content validity, refining measurement instruments based on expert feedback, providing a template for instrument validation, and advancing research through the use of a validated instrument, ultimately enhancing the overall quality and generalizability of the study's findings.

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