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# Multimedia constructivism instrument: Validity and reliability analysis

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**ABSTRACT**

This study aimed to investigate the use of the translated version of constructivism multimedia instrument through validity and reliability tests. The instrument contained five constructs of which each construct contained five items which made 25 items in total. The translation process has been implemented through the back-translation by researchers and expert translators. The validation process was performed by nine panel experts who are lecturers in the field of Language and curriculum. The results of validity analysis through intraclass correlation coefficient (ICC) found that the reliability value between evaluators was .957 based on 95% confidence interval between .904 to .989 ($F(8,192)=23.469$, $p<.05$). Meanwhile, the process of obtaining the reliability value was conducted on 70 students and obtained a high overall reliability value of the instrument which was .853. In addition, the reliability values for each construct of the multimedia constructivism learning instrument were .753 (negotiation), .780 (inquiry learning), .691 (reflective thinking), .683 (authenticity) and .803 (complexity). Overall, the high values of validity and reliability of the instrument proved that this translation study has been successfully implemented.



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## 1. INTRODUCTION

The constructivist approach is a learning approach where the teacher is responsible for creating an environment and the students can go through their own learning experiences and not just memorizing concepts [1]. This environment allows students to collaborate and support each other as they use a variety of tools and information resources in achieving learning objectives and completing problem-solving activities [2]. Thus, knowledge experience and social environment can be constructed by students independently and meaningfully [1]. Meanwhile, multimedia constructivism learning can be defined as learning that is assisted by electronic tools which provide text, graphics, video, animation and voice in an integrated manner in a student-centered active learning process for the purpose of achieving learning goals [2].

According to previous study [3], constructivist theory originated from Piaget [4], stated that the learning process needs to go through stages of modification, adaptation, compilation and organization of the information received, followed by the process of assimilation which then occurs based on the new information received by the student. As such, the learning process focuses on students rather than teachers. This means that teachers only act as moderators, facilitators and designers of teaching materials that can provide opportunities for students to form new knowledge. Thus, this kind of learning is about more thinking, more understanding, more remembering, more confidence, more social skills and more fun [5].

Based on the theory of cognitive constructivism by Piaget [4], the human mind goes through a process that can reorganize cognitively. In the learning process, students are autonomously responsible for receiving stimuli to organize the conceptual or cognitive frameworks. Furthermore, in the learning theory of social constructivism, Vygotsky explains that the mind is a social management that exists as a result of cultural differences in community practice [6], [7]. Students learn to reflect on problems that arise from environments that are more complex than the world of reality they face. The fact-only lecture learning process results in students always feeling bored [8]. This is because the lecture method delivered by the teacher does not involve their own feelings and does not apply the real world, synthesis and discussion in the teaching and learning process [9]. This in turn has an impact on the acquisition of knowledge through the learning process. It can even lead to a decline in student academic performance [10]–[14].

Previous researchers [10], [11], [15] associated the decline in performance achievement with outdated and boring conventional learning strategies. According to Kalyani and Murugan [16], conventional method means a method or strategy of learning that is passive, teacher-centered and without the use of technology applications. Thus, active learning strategies, student-centered as well as the use of technology is one of the strategies proposed to help improve performance in school subjects. Aside from going through the learning process to acquire new knowledge and skills, students also need to identify their level of effectiveness in learning performance. Therefore, this constructivist learning instrument is an important measuring tool to provide opportunities to the relevant parties such as counselors, school administrators and students themselves in preparing themselves towards an effective learning process and subsequently able to influence performance.

According to Maor [17], the multimedia constructivism instrument is a constructivism theory-based questionnaire that focuses on the construction of students' knowledge through social interaction in the classroom. There are five learning elements of multimedia constructivism that are articulated [17]: i) Student consultation; ii) Reflective thinking; iii) Inquiry learning; iv) Authentic multimedia programs; and v) The complexity of multimedia program display. Maor [17] emphasized that these five elements can influence the effectiveness of students' learning process. Therefore, translating and testing the multimedia constructivism learning instrument by [17] was important so as to know the students' level of multimedia constructivism skills, which was then followed by conducting interventions to overcome the problems of poor performance among students. Thus, the objectives of this study were to: i) Translate the multimedia constructivism learning instruments; ii) Study the face and content validity of the multimedia constructivism learning instruments; and iii) Study the reliability value of the multimedia constructivism learning instruments.

## 2. THEORETICAL BASIS OF MULTIMEDIA CONSTRUCTIVISM INSTRUMENT

The construction of multimedia constructivism learning instrument was based on the Constructivist Multimedia Learning Environment Survey (CMLES) instrument [17]. This test was used to measure students' perceptions of learning awareness in a multimedia constructivism environment. This instrument contained 25 items and involved five score scales, namely never (1) to always (5) for items 1 to item 15. Meanwhile, items 16 to 25 involved a score scale (1) strongly disagree until (5) strongly agree. Of the 25 items, the instrument was divided into five constructs namely: i) Negotiation (items 1 to 5); ii) Inquiry learning (items 6 to 10); iii) Reflective thinking (items 11 to 15); iv) Authenticity (items 16 to 20); and v) Complexity (items 21 to 25). The details of the multimedia constructivism learning constructs are shown in Table 1 [17].

Table 1. Details of the multimedia constructivism learning construct

| Construct | Description | Item no. |
|---|---|---|
| Negotiation | Students' perceptions of the opportunity to share learning ideas, give and receive opinions, discuss the content of learning either among students or teachers during the learning process. | 1-5 |
| Inquiry learning | Inquiry learning means that students' perceptions of the level of stimuli received in the learning environment are to be more involved in the process of continuous investigation of research questions. | 6-10 |
| Reflective thinking | A general term that refers to a cognitive activity in which individuals use the knowledge and experience they have gained to draw final conclusions to the situation at hand and solve problems more thoroughly. | 11-15 |
| Authenticity | Students' perceptions of the suitability of multimedia-based learning materials in terms of teaching and learning and the extent of their success in describing real life situations. | 16-20 |
| Complexity | According to Maor, it is the individuals' perception of the extent of difficulty in the use of multimedia resources provided in the program | 21-25 |

## 3. RESEARCH METHOD

The research used a quantitative approach by analyzing the validity and reliability data of the instrument that have been translated. This section describes the research process through three main phases. The phases are: i) Translation of the multimedia constructivism learning instruments; ii) Expert assessment on the validity of the instrument; and iii) Instrument reliability assessment.

### 3.1. Phase 1: Translation of the multimedia constructivism learning instrument

The original constructivism learning instrument was constructed by [17] in the English language. To make the instrument suitable for use, amendments have been carried out based on local values and culture. Therefore, the translation process from the original English version to English was made. This was to facilitate samples' understanding of the instrument. Based on previous study [18], among the advantages of reusing existing instruments are: i) Existing instruments have undergone validity and reliability tests; and ii) A comparison of the findings of the current study and previous studies can be done.

The translation process has been implemented through the use of back-translation method as suggested by [19]. Back-translation is the process of translating the original instrument into the local language and comparing the translation with the original instrument in terms of the similarity of the meaning of the item. The original translated document can be compared by expert and trained independent translators to obtain the reliability and validity of the translation [19]. Thus, this process was implemented by the researcher together with a trained translator expert to obtain items that are in line with the meaning of the original item.

### 3.2. Phase 2: Expert assessment of instrument validity

The next process was an expert evaluation of the translated item. Nine expert assessors of which six were lecturers in the field of language while the other three were lecturers in the field of curriculum from Universiti Utara Malaysia were selected. The number of evaluators is based on Yusoff [20] who states that five to ten evaluators are sufficient in making an evaluation of the study items and constructs. All appointed lecturers have evaluated the translation in terms of language accuracy, sentence structure and terminology as well as item accuracy based on constructs.

The selection of expert assessors was based on their respective expertise in curriculum areas, instrument construction and in-depth experience as academics. For this process, the researchers have provided a full copy of the instrument validity sheet which contains items-based learning projects and items constructivism learning multimedia which was translated into the Malay language and annex containing a summary of the introductory study and user manual for evaluation forms and confirmation to obtain expert assessments and recommendations. The panel experts were asked to provide a score based on a choice scale of one (1) to ten (10) on each item in the section provided on the evaluation form. A score of 1 (very weak) to 10 (very good) was the level of expert agreement on the translation of the items that has been made. Comments and views were provided for a score of less than six for the purpose of item improvement by the researchers. Table 2 shows a partial display of the expert evaluation form.

Table 2. Expert evaluation form

| No. | Item | Expert assessment rubric scale. Circle score from 1 (very weak item) up to 10 (excellent items) |
|---|---|---|
| 1 | **Original version**<br>I get the chance to talk to each other.<br><br>**Translated version**<br>*Saya berpeluang bercakap sesama sendiri.* | 1 2 3 4 5 6 7 8 9 10<br>Very weak ⟷ Excellent<br>Comments for improvement are required if the score is 6 and below |
| 2 | **Original version**<br>I discuss with each other how to conduct investigations.<br><br>**Translated version**<br>*Saya berbincang sesama sendiri cara untuk mengendalikan penyelidikan* | 1 2 3 4 5 6 7 8 9 10<br>Very weak ⟷ Excellent<br>Comments for improvement are required if the score is 6 and below |

### 3.3. Phase 3: Instrument reliability assessment

Reliability refers to the consistency or stability of feedback provided by respondents across items, questions or constructs [21]. This means that an individual will get the same score from an instrument if the individual's abilities are consistent or the trait to be measured does not change even if measured many times with the same instrument. Therefore, researchers used the method of internal consistency to determine the coefficient of reliability that is to find the alpha coefficient or known as Cronbach Alpha of the multimedia constructivism learning instrument through Statistical Package for Social Science (SPSS) software.

To obtain the reliability value of multimedia constructivism learning instrument, a study was conducted on 70 form two students in a school in the district of Baling Kedah, Malaysia. The number of samples in this pilot study is adequate because according to Cooper and Schindler [22], the appropriate number of samples in the pilot study ranged from 25 to 100 people. While, other research [23] suggested that the minimum number is 30 people.

## 4. RESULTS AND DISCUSSION

This section discusses the findings of the translation analysis, validity and reliability of the instrument. It will describe the findings of the study through four phases. The phases are: i) Instrument translation analysis; ii) Instrument validity analysis; iii) Instrument qualitative analysis; and iv) Instrument reliability analysis.

### 4.1. Phase 1: Instrument translation analysis

In the translation process carried out by the researchers together with translation experts. All 25 items of the multimedia constructivism learning instrument have been successfully translated according to the values and culture of the local community. In addition to the translation, refinement of each item was also implemented to produce a sentence structure that was simple, concise and accurate but still retained the same meaning as the original item.

### 4.2. Phase 2: Instrument validity analysis

Once the expert evaluation forms were collected, an analysis of the scores given by the nine appointed experts was carried out. Based on the scores, further analysis was performed to obtain the reliability values of nine expert evaluators or inter-rater reliability through the Two-Way Mixed Intraclass Correlation Coefficient (ICC). This method is recommended and adopted by previous studies [24], [25]. ICC is useful for estimating inter-rater reliability of quantitative data because it is very flexible compared to Pearson Correlation which is a valid estimator for inter-rater reliability between two evaluators only [26]. Findings from this inter-rater reliability data analysis were used to assess or measure the level of agreement between evaluators. Table 2 presents the validity value through inter-rater reliability for multimedia constructivism learning instrument through intraclass correlation coefficient (ICC) analysis.

Table 2. Instrument validity analysis through ICC

| | Intraclass correlation[b] | 95% Confidence interval | | F Test with true value 0 | | | |
|---|---|---|---|---|---|---|---|
| | | Lower bound | Upper bound | Value | df1 | df2 | Sig |
| Single measures | .473[a] | .273 | .775 | 23.469 | 8 | 192 | .000 |
| Average measures | .957[c] | .904 | .989 | 23.469 | 8 | 192 | .000 |

Two-way mixed effects model where people effects are random and measures effects are fixed.
a. The estimator is the same, whether the interaction effect is present or not.
b. Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance.

Based on Table 2, the result of the validity analysis on inter-rater reliability was .957 based on a 95% confidence interval between .904 and .989 ($F(8, 192)=23.469$, $p<05$). This data indicated that multimedia constructivism learning instrument has a high and acceptable validity value. Meanwhile, Table 3 shows the overall validity values of the multimedia constructivism learning instrument and the five constructs in detail based on the minimum and maximum values and the average measures. Expert evaluations for multimedia constructivism learning constructs obtained minimum values from .664 to .904, while the maximum value was from .967 to .985. This indicated that the minimum and maximum values of the four constructs were above .60. Based on the average score, the researchers found that the validity coefficient for the overall multimedia constructivism learning instrument was .904 (minimum) and .989 (maximum). The average measures of validity for each construct obtained a value between .872 and .943, namely inquiry learning constructs and complexity were .872, reflective thinking .919, negotiation .921 and authenticity .943. Meanwhile the multimedia constructivism learning instrument as a whole obtained a validity value of .957. Thus, the constructivism learning instrument as a whole was valid for use as research instruments because according to [27], [28], validity values of .60 to .80 are considered acceptable.

Table 3. Overall validity value and instrument constructs based on expert evaluation (n=9)

| Instruments and constructs | No. of items | Minimum value | Maximum value | Validity value/ average measures (α) |
|---|---|---|---|---|
| Negotiation | 5 | .794 | .980 | .921 |
| Inquiry learning | 5 | .665 | .967 | .872 |
| Reflective thinking | 5 | .788 | .979 | .919 |
| Authencity | 5 | .850 | .985 | .943 |
| Complexity | 5 | .664 | .967 | .872 |
| Multimedia constructivism learning | 25 | .904 | .989 | .957 |

### 4.3. Phase 3: Instrument qualitative analysis

Qualitative data analysis involved analysis of expert comments and views on each item of the instrument. The comments and views of these experts were very important for researchers to make improvements and refinements of each item found in the multimedia constructivism learning instrument before distributing it to students for use in the study. Table 4 shows a summary of the comments and views of each expert evaluator on the multimedia constructivism learning instrument. Based on expert comments and views, overall, the translation of items did not involve significant changes as expert comments and views mostly focused on term modification, term replacement, retention of original words and sentence structure changes. Thus, the researchers have made improvements to all the proposed items to make it a better instrument and easier to be understood by the study sample.

Table 4. Expert suggestions for improvement to the instrument

| Expert | Suggestions for improvement |
|---|---|
| 1 | Use specific terms consistently for all items. |
| 2 | Retain original terms, for example 'idea' and 'focus' because they give a more precise meaning than other translated words. In addition, the word has been generally accepted and understood. |
| 3 | Restructure the sentence so that it is shorter, concise, accurate and understandable. |
| 4 | Use terms that can be understood by the study sample. |
| 5 | All the items are well translated. |
| 6 | The translation does not need to be direct instead it can be modified but still retains the same meaning. |
| 7 | There are no major mistakes in the translation, just a change of certain terms to make the sentences better and not too long. |
| 8 | All translation items are good and in line with the instrument construct. |
| 9 | Sentence improvement on specific items so that sentences become shorter, more concise and accurate. |

### 4.4. Phase 4: Instrument reliability analysis

The multimedia constructivism learning instrument that had undergone a process of improvement and refinement was then given to 70 form two students who were the study sample. The data were analyzed using SPSS software to obtain Cronbach Alpha reliability values. The analysis result in Table 5 shows that the overall multimedia constructivism learning instrument obtained a high reliability value of .853, while the reliability value for each construct of the multimedia constructivism learning instrument was as follows; .753 for negotiation, .780 for inquiry learning, .691 for reflective thinking, .683 for authenticity and .803 for complexity.

Table 5. Overall reliability analysis of instrument and constructs

| Instrument and constructs | No. of items (N) | Cronbach Alpha value |
|---|---|---|
| Multimedia construstivism learning | 25 | .853 |
| 1 Negotiation | 5 | .753 |
| 2 Inquiry learning | 5 | .780 |
| 3 Reflective thinking | 5 | .691 |
| 4 Authenticity | 5 | .683 |
| 5 Complexity | 5 | .803 |

The Cronbach Alpha reliability values obtained as in Table 5 indicated that the entire instrument and the five constructs have obtained a good and acceptable level of instrument reliability. The reliability value of this instrument was considered satisfactory based on previous studies [29], [30], stating that the reliability index in a test is satisfactory if it is worth 0.7 and above. Meanwhile, according to previous research [27], [28], the reliability value is considered acceptable when it reaches a value of .60 to .80. Thus, based on the results of reliability values analysis, this instrument was suitable for use in the study to measure the learning variables of multimedia constructivism.

The translation of multimedia constructivism learning instrument from the original version to the Malay language version is a major contribution to the development of psychology and the education system in Malaysia. This is because the instrument constructed by [17] has not yet been translated for use in any research in Malaysia. Furthermore, this instrument is based on constructivist theory which emphasizes on active learning process, use of multimedia technology materials, acquisition of knowledge through own experience, process of exploration and sharing of ideas [1], [2], [5]. These elements can encourage students to master and improve knowledge and skills in the learning process. In addition, students are also able to improve their ability to compete in real-life environments. Thus, this balance can further meet the new policy requirements under the Malaysian Education Development Plan (PPPM) [31]. In addition, the demands of the National Philosophy of Education to produce balanced and harmonious students intellectually, spiritually, physically and emotionally can also be realized.

## 5. CONCLUSION

This study proved that the multimedia constructivism learning instrument has been successfully translated, through the process of analysis of validity and reliability and suitable for use with the values and culture of local people. This translation study is hoped to make a significant contribution in the process of improving students' learning performance in subjects whether at primary, secondary or university levels. In addition, this instrument can also be used as an additional instrument in research studies involving related issues. A systematic translation process that has been guided by the methods proposed by previous researchers, making it a better, quality and valid instrument to use.

Furthermore, this instrument can be used as a measuring tool to identify the students' level of constructivism learning skills from the aspects of negotiation, reflective thinking, inquiry learning, as well as multimedia skills in building and improving learning performance. In addition, counselors and school administrators can use it as a guide to build interventions to improve all elements in the learning of multimedia constructivism. This is an important element to ensure that the development of students is balanced in terms of the knowledge, skills and values required in today's world environment.

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