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A Pilot Study to Test the Reliability and Validity of The Research Instrument

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ABSTRACT

In order to identify the effectiveness of Needham's Five-Phase Constructivism Model on the learning of Economics, an achievement test instrument was developed to fulfill the objectives of the study. There are 20 objective questions and five structural questions in the economic achievement test. A pilot study was conducted before the actual study to test the validity and reliability of the instrument. After the pilot study, it was found that the validity and reliability were at a good level and accepted for use in the actual study.

Contribution/Originality: This study contributes to the effectiveness of Needham"s Five Phase Constructivism Model (NFPCM) on the learning of Economics.

1. Introduction

Tests are tools used to measure a student's ability in teaching and learning conducted by the teacher. According to Mohd Najib (1997), tests are measurement tools or procedures that are organized or systematic in measuring behavioral change. Hence, the procedure for building test items must be systematic. The correct way to construct test items is based on the Test Specification Table (TST), which follows the standard of content and test items (Szafranski and Qing, 2009). Using TST, item builders can plan the topics to be tested with their objective level. Consequently, validity and reliability were tested after constructing the test items based on TST to confirm the applicability. Butler and McMunn (2006) stated that a test has good validity characteristics if it measures what it is supposed to measure and is not included with unrelated matters. Other than that, the reliability of the test is

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considered good when the test can provide consistent achievement to students (Mok, 2003). Because of this, the researcher agrees with the opinion and proposes to choose a test instrument in the study to test the level of student achievement in learning based on the NFPCM method.

2. Literature Review

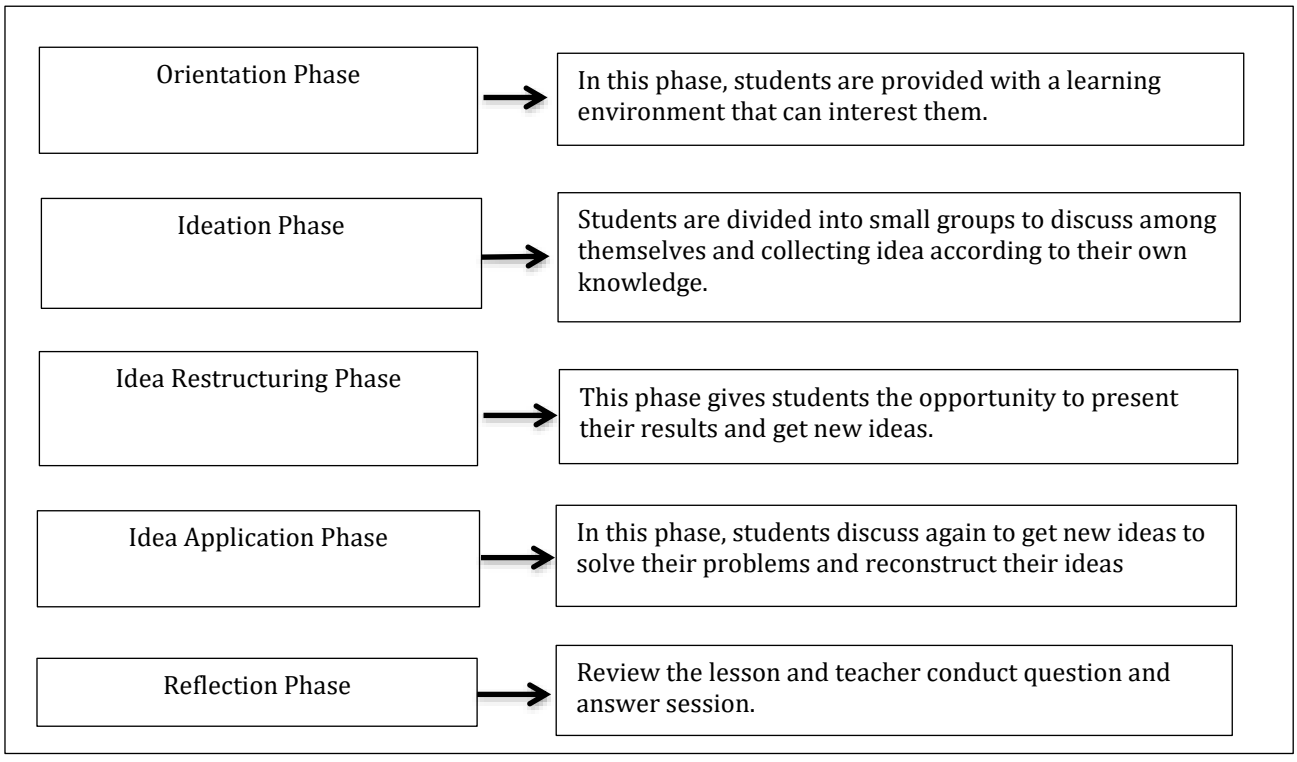
2.1. Pilot Study of Validity and Reliability

According to Altman et al. (2006), a pilot test is a test done on a small scale to test the quality of the instrument used in the actual study. Therefore, validity and reliability are very important to determine the quality and appropriateness of an instrument used. Validity means a measurement that is the extent to which it successfully measures what it wants to measure. Validation is usually done with the help of experts in the field of study to check the validity and accuracy of the instrument. While reliability means testing on a small scale that is as an experiment before the items are used with real samples (Pratt, 1980). Often, reliability is tested by using a sample that has almost the same homogeneity as the real sample so that the test is more accurate. According to Hair et al. (2003), the sample for the pilot test is set at 5 to 30 people only.

2.2. Needham's Five Phase Constructivism Model (NFPCM)

Needham's Five Phase Constructivism Model (NFPCM) is a model that was originally proposed in the 'Children's Learning in Science Project' by Needham (1987). Figure 1 shows the five phases of NFPCM learning.

Figure 1: Needham's Five Phase Constructivism Model (NFPCM)



Source: Adapt from Arihasnida et al. (2020)

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It aims to improve students' understanding of science concepts and activate students in class. This model includes five phases that are structured to learn in more detail. Organized phases allow students to be actively involved in groups to learn a topic or learning. In this learning process, the teacher only acts as a facilitator.

2.3. Theory of Constructivism

Constructivism theory means that students get new experiences with what they understand before (Brooks & Brooks, 1993). Constructivism theory has been emphasized in the new curriculum by various countries. This is because students can have better quality knowledge and can adapt to the current situation (Lee & Hannafin, 2017; International Society of Technology in Education, 2015). In this theory, knowledge cannot be transferred from a teacher to a student because the student must act actively to develop the mind (David Thorbun, 2000).

In addition, when students can actively build knowledge by using existing knowledge then it is an advantage for the student (Zurainu & Abdull Sukor, 2012). Not only that, one of the models used with constructivism theory is Needham's Five Phase Constructivism Model (NFPCM). This model fits the content of the new curriculum which is the Secondary School Standard Curriculum (KSSM). In KSSM, the Ministry has recommended teachers to use student-centered learning strategies (Kementerian Pendidikan Malaysia, 2016). Therefore, the researcher has proposed to apply NFPCM in PdPc. The questionnaire instrument was adapted from Mazdalifa's (2019) study to be used in this study.

3. Methodology

This pilot study aims to test the validity and reliability of the economic achievement test instrument. To test the instrument's validity, the researcher has created Test Specifications Table (TST). It has been reviewed by two expert Economics teachers with more than ten years of experience teaching economic subjects. In addition, they are also knowledgeable in the economics syllabus for the *Sijil Pelajaran Malaysia* (SPM). This panel of expert teachers has reviewed the instrument items according to the content to be tested. Each panel is provided with an evaluation form to review the test items, and the panel provides comments and insights after reviewing the test items. The Table 1 below shows the things that are evaluated.

Table 1: Items Being Evaluated

No	Item
1.	Instructions to answer questions
2.	Use of simple language
3.	Each question item is clearly constructed
4.	There are no spelling mistakes
	Constructed questions measure the content and objectives of teaching
6.	Questions are constructed according to low, medium and high levels and conform to the construct
7.	Appropriate and attractive instrument format
	Each item contains clear information

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4. Result

4.1. Validity Of the Economic Achievement Test Instrument

Evaluation of test items increases the validity of test content based on expert reviews based on the elements of the evaluation form. Experts agreed on 8 points in the evaluation form related to the question. Other than that, experts have also suggested some corrections, such as the instructions for marking answers, the number of pages of the question paper, and the distribution of questions based on the difficulty level. The researcher has corrected the test paper based on the expert's recommendations. The Table 2 below shows the evaluation of experts in the Economic Achievement Test.

Table 2: Evaluation of Experts in Economic Achievement Test

Experts	Comment
Expert 1	Suitable for use with some corrections such as Label out pages on the cover page. Give instructions to answer the questions.
Expert 2	Suitable for use with some corrections such as 1.Determining the level of difficulty of the questions. 2.Items must be create according to DSKP and the current situation.

4.2. Reliability of the Economic Achievement Test Instrument

As for the reliability assessment, as stated in the methodology, the reliability coefficient for this instrument is obtained through successive tests in a test and retest manner. There are actually several methods that can be used to test and analyze the reliability of instruments. Researchers use the Pearson correlation method because they use the test and retest method, which means the same instrument is assessed twice. Cronbach's Alpha is not used in testing the reliability of this test instrument because it is more suitable to be used in testing a questionnaire instrument with a 5 Likert scale (Ghazali Darusalam, 2021). Note that the instrument was administered to the sample twice at different times, and the results were compared by correlation. Through the comparison of pre and post-test scores of students in a pilot study, it was found that the Pearson coefficient obtained was .91. This value is high and acceptable because a measurement tool can be used if its reliability coefficient value is in the range of .65 to .85 (Siti Seri Kartini et al., 2021; Othman, 2001). Table 3 and Table 4 below present the sample scores and Pearson coefficient analysis for both tests conducted in the pilot study.

Table 3: Samples Score

Samples	Score 1 (%)	Score 2 (%)
1	60	65
2	40	43
3	68	68
4	53	63
5	58	63
6	53	55

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7	48	53
8	48	50
9	53	63
10	53	58

Table 4: Pearson Coefficient Analysis

Pearson correlation coefficient (r)	.912
Number of samples	20
Value (p)	< 0.001

5. Discussion

The results of the two experts' validity of the Economic achievement test instrument were found suitable for use in this study by improving some parts. The researcher has corrected the questions according to the comments given by the experts such as retype of pages on the front page, give instructions to answer the questions, arrange the questions according to the level of difficulty and check the questions based on the DSKP. For reliability, this instrument was tested using 10 samples with the test and retest method. According to Cooper and Schindler (2006) the sample size in the pilot study does not need to be determined based on statistics because it is only to test the validity of the test instrument. Pearson coefficient is used in testing the reliability of Economic achievement test instrument because test and retest reliability is used and the students are given the test twice with the same question (Azizi et al., 2021). Subsequently, the sample scores were analyzed using the Pearson coefficient, which demonstrated a high coefficient value of .91. According to Sahabuddin (2022), the Pearson coefficient value of .91 is a high value and can be adopted. Therefore, this result confirms that all the items are valid for the actual study.

6. Conclusion

The validation and reliability of the Economic achievement test instrument applied in the actual study have received support from experts and are suitable for use after analysis. It is a research tool with high validity and reliability (Siti Seri Kartini et al., 2021; Othman, 2001). Next, maybe this reliability test has a shortcoming in terms of a small sample and lack of variation in sample selection. Hence, it is suggested that further research on validity and reliability be conducted using a large number of samples and experts to determine its use.

Ethics Approval and Consent to Participate

The researchers used the research ethics provided by the Research Ethics Committee of Universiti Pendidikan Sultan Idris. All procedures performed in this study involving human participants were conducted in accordance with the ethical standards of the institutional research committee. Permission and consent to participate in the study was also obtained from all the participants, schools, JPN and KPM.

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Conflict of Interest

The authors reported no conflicts of interest for this work and declare that there is no potential conflict of interest with respect to the research, authorship, or publication of this article.

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