Mathematical Connection Ability Instruments for Prima-ry School Students

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Abstract: This study is motivated by the importance of mathematical connection ability for elementary school students. To understand the mathematical connection ability of students, it is necessary to develop an instrument that suitable for the indicator for mathematical connection ability. The goal of this research is to develop an appropriate mathematical connection ability instrument for primary school students. This study was applied using the Research and Development. Participants were 34 third-grade elementary school students in Purwakarta through purposive sampling. The instrument is an essay test consisting of six open questions about whole numbers. The indicators developed in the arrangement of test questions are related to the mathematical connection ability, namely connections between topics in mathematics, other subjects, and everyday life. The Questions test were made beforehand in the expert judgment, then tested to see the validity, reliability, difficulty index, and discrimination power index of the questions. The validity test analysis shows that 6 items on the instrument are valid. The reliability of the test instruments is very high. The difficulty level of the questions is classified as difficult and moderate. The discrimination power of questions with good and very good criteria. Thus, the 6 items developed can be used as an instrument to measure mathematical connections in mathematics learning and as an instrument for further research.

Keywords: Test Instruments, Mathematical Connections, Elementary School Students

Abstrak: Penelitian ini dilatarbelakangi pentingnya kemampuan koneksi matematis bagi siswa SD. Untuk memahami kemampuan koneksi matematis siswa perlu dilakukan pengembangan instrumen yang sesuai indikator koneksi matematis. Penelitian bermaksud mengembangkan instrumen kemampuan koneksi matematis yang tepat bagi siswa SD. Penelitian ini diterapkan dengan Research and Development. Partisipan adalah siswa kelas tiga di sebuah sekolah dasar di Kabupaten Purwakarta sebanyak 34 responden melalui purposive sampling. Instrumen berupa tes tertulis yang terdiri 6 item soal terbuka pada topik bilangan cacah. Indikator yang dikembangkan dalam penyusunan soal tes terkait kemampuan koneksi matematis yaitu koneksi antar topik di dalam matematika, mata pelajaran lain, dan kehidupan sehari-hari. Soal tes yang dibuat sebelumnya di *judgement expert*, lalu di uji cobakan untuk melihat validitas, relibilitas, indeks kesukaran dan daya pembeda soal. Analisis uji validitas menunjukan 6 item soal pada instrumen valid. Realibilitas instrumen tes sangat tinggi. Tingkat kesukaran soal tergolong sukar dan sedang. Daya pembeda soal tergolong baik dan sangat baik. Dengan demikian 6 item soal yang dikembangkan dapat dimanfaatkan sebagai instrumen untuk mengukur koneksi matematis dalam pembelajaran matematika dan sebagai instrumen penelitian selanjutnya.

Kata kunci: Instrumen Tes, Koneksi Matematis, Siswa Sekolah Dasar

INTRODUCTION

Mathematics is a subject that cannot be separated from the daily life of students. Mathematics can make it easier to carry out activities and routines every day. For example buying and selling, saving money, setting a daily or monthly schedule, counting many objects, measuring height, etc. The study says math can be useful to solve the larger unit problem and/or to understand the social issue more deeply (Osler, 2007). Teaching mathematics is a subject that can hone students' cognitive (Putri et al., 2021). Mathematics has a very important role in supporting the advancement of science and technology (Yuliyanto et al., 2020). Given how substantial the use of mathematics is in everyday life, mathematics should be taught by emphasizing what students experience in their lives. Besides that, in the field of education, especially education in elementary schools, mathematics is one of the most important subjects to study. Law No. 20 of 2003 states that mathematics is one of the compulsory subjects for students at the primary education level. Mathematics has a strong and clear structure and linkages between concepts, enabling students to think rationally. Given this, it is important to learn mathematics not only to know but also to try to understand and be proficient in applying it to other problems.

One of the objectives of learning mathematics in elementary schools is that students are required to have Higher Order Thinking Skills. This high-level ability aims to hone students' analytical, evaluation, and creative power. Mathematical connection skills are part of higher-order thinking skills that need to be mastered by students (Hendriana et al., 2017; Kementerian Pendididikan dan Kebudayaan RI, 2003; Putri et al., 2018; Sumarmo, 2010).

The ability of mathematical connections can be observed when students link their previous understanding with the problem being solved so that students will solve the problem with its fundamental concepts (Dudung & Oktaviani, 2020), so that, the relationship between mathematical concepts will make students feel better about the concepts and learning process not only based on memorization or relying on formulas obtained from memorization. Mathematical connections are included in the aspect of cognitive in mathematics which have to be developed properly (Kenedi et al., 2018; National Research Council, 2001; Sugiman, 2008; Warih S et al., 2016).

The limited mathematical connection ability of students is shown by the limited percentage of students who provide correct responses, the limited percentage on each indicator of mathematical connections, and misunderstandings produced by students. Wrongdoings made by students explain the difficulties experienced by learners. The challenge that is frequently represented by learners is the difficulty of explaining the problem and the complexity of arranging the equation or theory used to resolve the problem (Wijayanti & Abadi, 2019) and learners with bad mathematical connection ability can't correlate the mathematical concept with real-life (Ariyani et al., 2020). The low ability of elementary students' mathematical connections is because learning activities have not been able to facilitate students to develop their mathematical connection skills. Guru SD jarang memberikan soal-soal yang melatih kemampuan koneksi matematis. The teacher is also not used to making problems related to mathematical connections. There are not many developed mathematical connection ability instruments so it is difficult for teachers to train them for students (Kurnianingtyas & Windayana, 2015; Ulya et al., 2016). Therefore, this study aims to produce suitable mathematical connection instruments for elementary students so that teachers can understand and develop students' mathematical connection skills properly.

One strategy for developing a mathematical connection ability instrument that is suitable for elementary students is to create questions based on mathematical connection ability indicators. The questions that are made are then asked for consideration from the expert (expert judgment) then tested on several samples to see the validity, reliability, difficulty index, and distribution power of the questions. Questions can be given personally either in groups, moreover, usually involve a sequence of objects that reflect the study goals (Ponto, 2015). Questions are tools that can be applied for multiple computations in several types of analysis. The questions must have a specific plan correlated to the research purposes and it must be explicit of the start wherewith the conclusions will be utilized (Roopa & Rani, 2012).

Research says a good instrument test is marked by two conditions, namely validity and reliability (Putri et al., 2020; Setiadi et al., 2020). Furthermore, a good test instrument can be identified by analyzing the validity, reliability, discrimination index, and level of difficulty about using Anates V4 (Sari & Mahendra, 2017), because the main indicators of good quality measurement refer to the feasibility of validity, reliability, discrimination index, and difficulty level (Azwar, 2011; Mohajan, 2017). Researchers must properly analyze the appropriateness of the instruments developed to support an optimal research finding before the implementation of research begins. This is by the opinion of several experts who argue that the essence of the study can be seen as the feasibility regarding the instruments compiled and improved. The tools compiled and developed must be valid, reliable, have good discrimination power with varying levels of problem difficulty (Andrian et al., 2013; Manongko, 2016). An Instrument that generates records with good validity means a tool that can present essential knowledge concerning that which is being

measured. Outwardly indication of validity, the results of an experiment are basically insignificant, and the outcomes based on those decisions could be mortifying (Elliott et al., 2002). Furthermore, a reliable tool provides a constant characteristic measure notwithstanding inconstancies in its background (Putri et al., 2020). The difficulty level is an opportunity to answer the question on the level of certain capabilities that are usually (Patriasih, 2017). The computation of the discrimination index is a determination of the degree to which an object can discriminate between smart learners and those who cannot do some test. The higher the distinguishing coefficient, the more able to distinguish between the two. Items range from a low of -1.00 to a high of +1.00 (Aisyah, 2019). Thus, to measure the instrument properly, one of which is to measure the mathematical connection ability of the instrument must have validity, reliability, level of difficulty, and good discrimination power.

Therefore, researchers are interested in making instruments that can meet the four main indicators of quality measurement. As for the formulation of the problem in this study, how is the arrangement of a test instrument that can accurately estimate the mathematical connection ability of primary school students? Based on the problem, this research aims to produce a test tool that can estimate the mathematical connection ability of primary school students.

METHOD

Research Method

This research is research on the improvement of students' mathematical connection ability instruments, the method used is Research and Development (R&D). Research and development methods in education are the method of producing a research product and ultimately validating the output. R&D is a research method that has a systematic process for developing, improving and assessing educational programs, and materials (Creswell, 2009; Gall et al., 2010).

Participants

The students involved in this study were 34 elementary school students in Purwakarta, Indonesia. Sampling was done by the purposive sampling method. The chosen sample must comply with certain requirements, namely, sampling must be students who have received material about counting operations whole numbers. The representation of samples in this study was more than 20 students, which means that the sample has met the minimum sample limit taken in a study. A large representation of samples will present more intensity to the validation rule (Lima-Rodríguez et al., 2015).

Materials

In this study, the output to be produced and verified in a test instrument that is made by the indicators of mathematical connection ability, including connections between topics in mathematics, among other topics, and among everyday experience and adapted to the chosen mathematical material, namely material about operations count whole numbers for second-grade elementary school students. The test questions that have been tested are then scored by the scoring guidelines set out in **Table 1** below (Putri, 2017):

TABLE 1. Guidelines for Scoring Mathematical Connection Questions

No	Student Responses to Questions	Scors
1	There is no answer/answer is not by the question/there is no correct answer	0
2	Only part of the question was answered correctly	1
3	Almost all aspects of the questions were answered correctly	2
4	All aspects of the question are answered completely/clearly and correctly	3

The instrument developed was an open test related to problem-solving of count operations whole numbers. Indicators that show the success of students' mathematical connection abilities are determined based on three indicators, namely connections with everyday life, connections with disciplines outside mathematics, connections between

mathematical topics. Mathematical connection ability indicators utilized in this investigation are based on research by (Maruliana, 2019; Putri et al., 2016)

Procedures

There are three techniques applied in the implementation of R&D, namely expository, evaluative, and experimental (Sugiyono, 2016). The expository process is practiced to collect the data needed in organizing study tools to estimate the mathematical connections of primary school students. The mathematical connection ability test instrument that is made is a written test item in the form of an essay. Test questions that have been made in advance are consulted with experts in the field of elementary school mathematics for expert judgment. The following phase, namely the evaluative technique applied to review the evaluation results regarding the expert judgment, revises and improves the mathematical connection ability instrument. After the instrument was improved based on the advice of the expert, the test instrument was tested on the research sample. The implementation of test instruments is an activity that is part of the experimental method. The experimental approach was applied to examine the practicability of a study product utilizing analysis techniques for validity, reliability, discrimination, and instrument difficulty index which was measured using ANATES 4.0 software developed by (To, 1996). Products refer to instruments that have obtained developed and operate within an experiment method applying a quasi-experimental design, as the subsequent round the prediction results are interpreted based on certain classifications.

Data Analysis

Measuring the validity of the instrument used the Pearson product-moment correlation coefficient analysis (rxy) and reliability for description instruments by comparing Cronbach's Alpha values, while the problem difficulty level is identified from the difficulty level value (TK) through the percentage between the representation of learners which can answer the questions accurately and the number of all students, Furthermore, the discrimination power is known from the difference in the relationship of learners in the upper group who answered accurately with the relationship of learners in the lower group that responded accurately. A tool was assumed to be valid if the instrument is applied to estimate by the aim to be covered and a valid instrument explains that it can be applied to cover the performance to be measured (Haryeni & Yendra, 2019). The following is the validity value described based on the coefficient distribution by (Guilford, 1956) which is shown in **Table 2** below:

TABLE 2. Guilford's Classification of Validity Coefficients

r-value	Interpretation
$0{,}90 \le r_{xy} \le 1{,}00$	Very High
$0{,}70 \le r_{xy} < 0{,}90$	High
$0{,}40 \le r_{xy} < 0{,}70$	Moderate
$0{,}20 \le r_{xy} < 0{,}40$	Low
$0{,}00 \le r_{xy} < 0{,}20$	Very Low
$r_{xy} < 0{,}00$	Invalid

After that validity test is carried out, the next step is to test the degree of reliability. The instrument was said to have good reliability if the source of measurement errors can be minimized, the reliability of the instrument is the durability of the tool if it is provided to a similar subject even though by several people, at different times, or another place, it will give the equivalent effects or relatively the same (Lestari & Yudhanegara, 2017). The following is the reliability value that is interpreted based on the (Jackson, 2009) n **Table 3** below:

TABLE 3. Guilford's Classification of Reliability Coefficients

Value	Interpretation
$r_{11} < 0,20$	Very Low
$0,20 \leq r_{11} < 0,40$	Low
$0,40 \leq r_{11} < 0,70$	Moderate
$0,70 \leq r_{11} < 0,90$	High
$0,90 \leq r_{11} \leq 1,00$	Very High

After experimenting with the validity and reliability, the next step is to test the discriminating power regarding the questions. Discriminating power is a question item in distinguishing high, moderate, and low-ability students (Lestari & Yudhanegara, 2017). Thus, the computation of discriminating power is an analysis of the degree to which an object can discriminate learners who have understood competencies from students who have not/lacked competence based on several principles. The following is the reliability value interpreted based on the classification of the level of discriminating power by (To, 1996) as stated in **Table 4** below:

TABLE 4. Classification of the Discriminating Power Coefficient of Problem

Classification	Interpretation
< 10%	Very Bad
10% - 19%	Bad
20% - 29 %	Moderate
30% - 49%	Good
> 50%	Very Good

After testing the validity, reliability, and discriminating power of the questions, the next step is testing the difficulty of the questions. The level of difficulty of the item is represented through the difficulty index and this can be defined as a number that states the degree of difficulty of an item (Lestari & Yudhanegara, 2017). The easier the problem is, the larger the index number will be (Arikunto, 2012). **Table 5** below presents the difficulty coefficient of the questions by (Susetyo, 2017):

TABLE 5. Classification of Problem Difficulty Coefficients

Classification	Interpretation
0% - 15%	Very Difficult
16% - 30%	Difficult
31% - 70%	Moderate
71% - 85%	Easy
86% - 100 %	Very Easy

Thus, if the test results from the development of the mathematical connection ability instrument of students have high validity and reliability, various problem difficulty indexes, and good discriminating power, then the instrument is suitable to be applied to measure the mathematical connection ability of second-grade primary school students.

RESULTS

The outcomes of this research area in a specific form of a mathematical connection ability test instrument. The indicator of the mathematical connection ability managed to arrange the test refers to **Table 6** as follows:

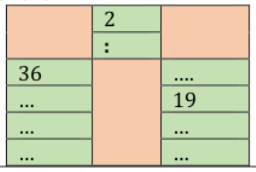
TABLE 6. Mathematical Connection Ability Indicator

Aspects of MCA	Indicators

The Connection between topics in mathematics	1.1 Determine the mathematical concepts used to solve the problem 1.2 Provide examples of simple questions that represent solutions to problems 1.3 Applying mathematical concepts to solve problems
The Connection with other subjects	2.1 Determine the concept of other lessons related to the problem given 2.2 Determine the mathematical concepts required in the given problem 2.3 Applying mathematical concepts and other subjects in solving a given problem
The Connection with Everyday Life	3.1 Determines the mathematical symbol of the given problem 3.2 Determine the mathematical model or sentence of the given problem 3.3 Interpreting math solutions back into real situations

Blueprint of mathematical connection ability test questions developed in this study is material in mathematics learning on the subject of counting count operations whole numbers in the first semester for second-grade elementary school students. The complete set of questions developed can be seen in **Table 7**.

TABLE 7. Blueprint for mathematical connection abilities

MCA Indicators	Learning Indicators	Cognitive Level	Questions	Item
Connection with real situations or everyday life	4.4. Solves a problem that involves the operation of counting whole numbers that are associated with everyday life.	Analyze	Ica is playing guessing math problems from her friend, let's help Ica to win in the game. To become a winner, Ica must fill in all of the math problems correctly. Help Ica to fill in the blanks in the following questions: 	1
Connection with real situations or everyday life	4.4. Solves a problem that involves the operation of counting whole numbers that are associated with everyday life.	Analyze	Rudi has 70 pieces of bread for his birthday party. 40 pieces of bread are red and the rest are brown. Rudi wants to put the brown bread into 6 plates equally, and the red ones into 8 plates equally. How much red and brown bread are on each plate?	2
Connections with disciplines outside mathematics (Connections between whole number mathematics and science)	4.4. Solves a problem that involves the operation of counting whole numbers that are associated with everyday life.	Analyze	Beben got a task from his teacher to observe the growth of 10 sprouts for 1 month. 5 sprouts were planted by the Beben, once a week it grows 2 cm. While others grow 1 cm every week. How tall is each sprout that Beben plants in 1 month? (Note: 1 month = 4 weeks)	3
Connections with disciplines outside mathematics (Connections	4.4. Solves a problem that involves the operation of	Analyze	Yuli is drawing sunflowers in her house, sunflower petals there are 20 petals, but the flower petals fell 4 petals in a day, How many flower	4

LEMBAR PERNYATAAN JUDGEMENT

INSTRUMEN PENELITIAN

Setelah meneliti lebih lanjut mengenai instrumen tes yang digunakan bimbingan skripsi

Nama : Cahya Karisma Pertiwi

NIM : 1702041

Jurusan : S-1 PGSD

Judul : PENGARUH PENDEKATAN *CONCRETE PICTORIAL ABSTRACT* (CPA) BERBANTUAN MULTIMEDIA INTERAKTIF DALAM PEMBELAJARAN DARING TERHADAP PENINGKATAN KEMAMPUAN KONEKSI MATEMATIS SISWA SEKOLAH DASAR

Dengan ini,

Nama : Prof. Turmudi, M. Ed., M. Sc., Ph.D

NIP : 196101121987031003

Menyatakan telah konsultasi dan pengkajian, maka diberikan saran-saran sebagai berikut.

☐ Bisa digunakan ☑ Bisa digunakan dengan perbaikan ☐ Tidak bisa digunakan

1. Lihat bahasan.
2. _____

Selanjutnya instrumen ini dinyatakan valid dan reliabel digunakan untuk mengukur variabel penelitian.

Purwakarta, 15 Februari 2021

Expert,

Prof. Turmudi, M. Ed., M. Sc., Ph.D

NIP. 196101121987031003

Keterangan:

☐ Beri tanda ceklis

between whole number mathematics and Cultural Arts, and Craft)	counting whole numbers that are associated with everyday life.		petals will fall in 4 days? Draw the sunflowers with petals that remain after falling in 4 days!	
The connection between whole math topics and geometric shapes)	4.4. Solves a problem that involves the operation of counting whole numbers that are associated with everyday life.	Analyze	It is known that a wardrobe contains 15 jackets of the same thickness. The wardrobe has 3 racks with different sizes of space. The first rack is larger than the second. The second rack has a size larger than the third rack. How many jackets can be stored on each of these racks? (Note: provide a variety of possible answers)	5
The connection between math topics (addition, multiplication)	4.4. Solves a problem that involves the operation of counting whole numbers that are associated with everyday life.	Analyze	 1 rose is worth 8, a hibiscus flower is worth half the value of a rose. What is the total of roses and hibiscus flowers above?	6

The six questions on the mathematical connection ability test presented in **Table 7** above have proceeded through the expert validation process along with the expert validation results shown in **Figure 1:**

FIGURE 1. Results of the Expert Validation

Based on the outcomes of the expert judgment, it was understood that the question was feasible, valid, and reliable as a test item to estimate the capacity of a mathematical connection. To support the results of the expert's judgment, the researcher tested the questions on a predetermined sample to understand the validity, reliability, difficulty index, and discriminating power of questions. The six questions on the test item items that were tested showed the result that the mean of all items = 5.12; Standard deviation = 4.46; Number subjects = 34. In detail, the results of calculating the validity of the items from each item of the test questions can be observed in **Table 8** below:

TABLE 8. Recapitulation of Mathematical Connection Validity Test Results

Total correlation of all items: 0.68
Number of Subjects: 34
Item Questions: 6

No Item Questions	Correlation	Significance
1	0.795	Very Significant
2	0.630	Significant
3	0.716	Very Significant
4	0.666	Significant
5	0.717	Very Significant
6	0.596	Significant

Based on the information in **Table 8**, it can be viewed that the validity test shows that there are 6 valid items with a category of 0.68. It has been suggested that the following correlation coefficients: If the correlation coefficient is 0.00, it is invalid, 0.00-0.20 (very low), 0.20-0.40 (low), 0.40-0.70 (moderate), 0.70-0.90 (high), 0.90-1.00 (very high). We can also see some information that 6 items are considered valid in items 2, 4, and 5 which are classified as moderate validity, and items 1, 3, and 5 are classified as high. The following is the result of the recapitulation of the reliability test for the achievement of students' mathematical connections, which can be observed in **Table 9**:

TABLE 9. The Summary of Mathematical Connection Reliability Test Results

Standard Deviation: 4.46
Test Reliability: 0.81

No Subject	Subject Initials	Odd Score	Even Score	Total Score
1	AF	0	0	0
2	As	0	0	0
3	Az	0	3	3
4	Rz	0	4	4
5	Ai	0	4	4
6	Ft	0	2	2
7	Gr	0	1	1
8	Dn	0	3	3
9	HI	3	5	8
10	Fk	0	5	5
11	Zr	3	5	8
12	Dl	0	5	5
13	Af	3	5	8
14	Nf	0	5	5
15	Nz	0	5	5
16	Rf	3	5	8
17	Pv	3	4	7
18	Kv	0	2	2
19	Sh	9	9	18
20	Sk	9	9	18
21	Ai	0	6	6

22	Nr	3	5	8
23	Ys	0	3	3
24	Sr	5	6	11
25	Az	0	2	2
26	Rn	0	2	2
27	Ft	0	0	0
28	Hl	0	2	2
29	Kr	3	2	5
30	Pl	0	0	0
31	Ak	6	4	10
32	Afh	9	8	17
33	Hl	3	7	10
34	Fe	0	2	2

Based on the **Table 9**, it is understood that the reliability test results show the reliability of 6 items with a Cronbach's Alpha score of 0.81. It has been argued that the following reliability coefficients are 0.00-0.20 (very low), 0.20-0.40 (low), 0.40-0.70 (moderate), 0.70-0.90 (high), and 0.90- 1.00 is (very high). We can see some information that the 6 items have a high category. Furthermore, the results of the recapitulation of the students' mathematics connection instrument difficulty index test, which can be observed in **Table 10**:

TABLE 10. Recapitulation of Mathematical Connection Difficulty Index Test Results

Item	Level of Difficulty (%)	Interpretation
1	18.52	Difficult
2	44.44	Moderate
3	25.93	Difficult
4	20.37	Difficult
5	37.04	Moderate
6	48.15	Moderate

Based on the **Table 10**, the difficulty index test shows that the six questions are in the moderate and difficult categories. Following, the results of the recapitulation of the discrimination test about the instrument of students' mathematical connections are presented in **Table 11**:

TABLE 11. Recapitulation of Discrimination Power Test Results for Mathematical Connection Problems

Upper/Lower class: 9
Ex: Excellent
SD: Standard Deviation
As: Asor

No	Original Item	Ex Average	As average	Difference	Ex SD	As SD	Combined SD	t	DP (%)
1	1	1.11	0.00	1.11	1.36	0.00	0.45	2.44	37.04
2	2	2.22	0.44	1.78	0.44	0.88	0.33	5.41	59.26
3	3	1.56	0.00	1.56	1.51	0.00	0.50	3.09	51.85
4	4	1.22	0.00	1.22	1.30	0.00	0.43	2.82	40.74
5	5	2.22	0.00	2.22	1.30	0.00	0.43	5.12	74.07
6	6	2.56	0.33	2.22	1.01	0.71	0.41	5.39	74.07

Based on Table 11, it can be understood that for the discriminating power of the six questions, they are in the good and very good categories with the results of item one (37.04), item two (59.26), item three (51.85), four (40.74), item five (74.07) and item six (74.07). As seen from the data obtained, it can be concluded that the items from the trial to see the validity, reliability, difficulty index and discrimination power of the questions

prove that the 6 item items on the instrument are valid with moderate to high categories.The reliability of the test questions is very high. The difficulty level of the questions is in the moderate and difficult categories. The discrimination between the questions is in the good and very good categories. Therefore, the 6 items of the test questions developed can be used as instruments for measuring mathematical connections that can be applied in mathematics learning activities.

DISCUSSION

The process of retrieving data both from the validity, reliability of the difficulty index, and the discrimination in the power of the questions shows that the validity test of the 6 mathematical connection questions given is 34 valid results with a r_{xy} value of 0.68 with a range of 0.59-0.89. If observed based on the validity classification table according to (Guilford, 1956; Lodico et al., 2006), those numbers mean the level of validity which is in the moderate to high criteria. The value of the validity coefficient ranges from 0.00 to 1.00. The coefficient estimation of 1.00 means that the person proceeding with the instrument analysis and the standards test has approximately similar outcomes, whereas if the validity coefficient is 0 it means that there is no correlation between the tool and its standards. The more powerful the validity coefficient value of an instrument, the more accurate the instrument is (Yusup, 2018). Through the validity test of this instrument, it can be understood that the instrument has a good level of accuracy that can be applied to measure the ability of mathematical connections precisely. The study states that a validity test is needed to determine the accuracy of the data submitted (Aliyah, 2015; Shahradesi, 2019; Zahra, 2015).

Moreover, the reliability analysis is a sequence of the validity test, where only valid items are entered into the analysis (Fridayanthie, 2016). From the results of the reliability test using Anates software, the reliability value of the mathematical connection instrument for students was 0.81. When linked through the reliability classification proposed by (Jackson, 2009), so, this score is in the high-reliability category. In conducting any research, not only the right decision of data collection, the instrument is important, but the most important thing is to make sure the instrument selected and used can work accurately (Dikko, 2016). Such high reliability shows high stability (Wang et al., 2010). Consistent instruments can be used to measure variables in similar subjects at different times and present relatively the same responses. In this illustration, the tool can produce accurately if the tool is valid and truthful.

Following, the difficulty index test, this step is a sequence of the validity and reliability analysis, from the results of the difficulty index analysis using the ANATES software, shows that the value of the difficulty index of the student's mathematical connection instrument is moderate and difficult if it is linked within the reliability distribution suggested by (Susetyo, 2017). If the value of the difficulty level is converted into the range 0-1, item 1 becomes 0.18, item 2 becomes 0.44, item 3 becomes 0.25, item 4 becomes 0.20, item 5 becomes 0.37, and item 6 becomes 0.48. Other guidelines reveal that the level of the difficulty level of the analysis items (P) is good in the range of 0.3 to 0.7 as a description of the maximum ability of the test taker (Anderson & Krathwohl, 2001). A good level of difficulty is a moderate level of difficulty (Purwanto, 2014). The difficulty level test is to understand whether the item is too complicated or too simple because a good question is neither too difficult nor too easy (Aseptianova et al., 2019).

Following, the question discrimination power test is a sequence of the problem difficulty index analysis, for the results of the question discrimination power test using the ANATES software. When it is related to the classification of the discrimination in the questions put forward by (To, 1996) shows the value of the discrimination in the value of the students' mathematical connection instrument questions is in the good and very good category with the acquisition of the results of item 1 (37.04), item 2 (59.26), item 3 (51.85), item 4 (40.74), item 5 (74.07) and item 6 (74.07). Good discrimination power can serve to discriminate amid learners who have high abilities and learners that have low

abilities or to discriminate between upper and lower groups (Pangestu et al., 2019; Tanjung & Bakar, 2019). While high-grade discrimination power was presented for the analysis, it was not feasible to connect with other measures to discover imminent validity. It continues an impressive area for further development (Prideaux et al., 2011).

In this case, the validity, reliability, difficulty index, and discrimination power of a tool are essential. An instrument is assumed to be valid if the instrument is applied to estimate by the variable to be measured and a valid instrument determines that it can be applied to measure the performance to be measured (Haryeni & Yendra, 2019). If the data obtained is invalid, it can make incorrect conclusions (Arifin, 2017; Creswell, 2009). he quality of an instrument is assumed to be reliable if the decisions are approximately the same even though it is practiced frequently (Ghofur et al., 2017). As well as the instrument is said to have good reliability if the source of measurement errors can be minimized. Because instruments that have good validity and reliability are considered trustworthy (Maruti, 2016).

Besides, the validity and reliability of the difficulty level and the discrimination power of the questions, it is also related to consistency in the measurement in line with the study which states that the difficulty level of the items can be expressed through a number that states the degree of difficulty of an item, besides that the discrimination power is also a certain aspect that is measured in research where the ability of the items in discriminating high, moderate, and low-ability students. So that, the computation of discriminating power is an estimation of the degree to which an object can discriminate learners who have understood competencies from learners who have no /lacked competence based on certain criteria (Lestari & Yudhanegara, 2017).

Therefore, to obtain optimal research findings in measuring mathematical abilities, before implementing mathematics learning, researchers should have properly investigated the suitability of the instruments that have been produced where these premises can be determined empirically and logically, the instruments produced in research have validity, reliability, difficulty index, and good

CONCLUSION

Based on the outcomes of this study, it can be decided that 6 items are feasible to be applied as an instrument of mathematical connection ability of second-grade primary school learners in counting operations whole numbers. These questions have been comprehensively studied based on the revised results of the expert judgment and the results of empirically and logically tested instruments. The results showed that the mathematical connection ability instrument developed in this study had fairly good validity, high reliability, various difficulty indexes, and good discriminating power. The test questions resulting from the development of the instrument in this study can be used as an alternative question for teachers in schools and can be used in the development of further research by other researchers to develop the mathematical connection skills of second-grade elementary school students. Of course, this research has limitations which only produce instruments to measure the ability of mathematical connections, and there are many other higher-order thinking skills that researchers can develop in more depth by referring to this research.

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PROFILE

Mathematical Connection Ability Instruments for Prima-ry School Students

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