Development of Instrument Test Computational Thinking Skills IJHS/JHS Based RME Approach

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Abstract: The increase in the need for critical and analytical thinking among students to boost their confidence in dealing with complex and difficult problems has led to the development of computational skills. Therefore, this study aims to develop an instrument test for computational thinking (CT) skills in the mathematics-based RME (Realistic Mathematics Education) class of the Grade VIII students of JHS/IJHS. This is a Research and Development research carried out using the Plomp model. Data were collected from 30, 27, 22, and 23 Grade VIII students of JHS Negeri 7 Watampone, JHS Negeri 1 Patampanua Pinrang, IJHS Negeri 1 Makassar, and JHS IT Ulul Al-Baab all in South Sulawesi, Indonesia. The data collected were qualitatively analyzed, and the findings showed that more than 50% of the students gave a positive response. Therefore, the students' responses to the questionnaires met the criteria "achieved" without needing instrument improvement. Furthermore, the reliability level of the RME-based computational capability test instrument for multiple-choice issues tested in 4 schools obtained reliability scores of 0.709 and 0.781, which indicated that the developed questions were reliable. Based on data analysis used to measure computational skills in mathematics, out of the 102 test subjects of the assessment instrument, 2 students (1.96%) have a high level of computational skill-based RME approach. Of the remaining 11 (10.78%), 57 (55.8%), 20 (19.6%), and 12 (11.7%) students are in the good, moderate, poor, and very poor categories.

INTRODUCTION

The rapid development of science and technology is marked by the era of industry 4.0, which triggers the need for the renewal of skills and knowledge. According to Hussin (2018) and Lase (2019), this development significantly influences the academic sector. It is also called education 4.0, especially at the formal level, including primary (ES/PS) and secondary educational systems (JHS/IJHS and SHS). This has led to several challenges at the elementary, junior, and senior high schools and the radical conversion of traditional learning practices to modern approaches. In curbing these threats, the government implemented a new orientation involving revising primary and secondary educational curriculum based on literacy and relevant competencies that students need to possess in this era. Some of the skills constitute complex problem solving, creative, innovative, critical thinking skills, communicative and collaborative abilities, emotional intelligence, assessment, and decision making (Mougenot, 2016). These skills are also included in the mathematics curriculum, especially critical thinking and complex problem-solving.

Critical and computational thinking (CT) abilities are related. In recent years, CT has become an emerging global trend in the educational sector (Bustillo & Garaizar, 2014) and is relevant for the future (Adler & Kim, 2018; Maharani, Kholid, Pradana, & Nusantara, 2019; OECD, 2018; Phillips, Yu, Hameed, & Akhdary, 2017). NRC (2011) further stated that its essence is to solve complex problems by breaking them down, making it easier to realize more efficient and automated solutions. Computational thinking improves the ability to solve daily issues (Harangus & Katai, 2020; Kalelioglu, Gulbahar, & Kukul, 2016). Besides, an approach to problem-solving refers to the basic concepts of computing, which is a way to realize abstract concepts into something concrete (Wing, 2008; Romero, Lepage, and Lille,2017). Furthermore, Thinker and NRC (2011) proposed the importance of advancing computational thinking skills in various sciences. However, CT is not only associated with the thinking process (J. Lockwood & Mooney, 2017), problem-solving (Grover & Pea, 2013; Haseski, İlic, & Tuğtekin, 2018; Namukasa, Patel, & Miller, 2017), and determining new questions (Barr & Stephenson, 2011), rather it is also centered on individual abilities, and perspectives as well as cognitive factors (Deschryver & Yadav, 2015). Wing (2016) stated that it is a fundamental skill that needs to be possessed by everyone (Kafai, Burke, & O'Byrne, 2016; Kim, Kwon, & Lee, 2014), and not only computer scientists (Williamson, 2015). Some studies stated that CT (Gadanidis, 2017; Rambally, 2017; Son, 2016) plays an important role in solving mathematical problems, which is a constructive process (Benakli, Kostadinov, Satyanarayana, & Singh, 2016; Junsay, 2016; E. Lockwood, DeJarnette, Asay, & Thomas, 2016). Based on these opinions, CT skills need to be developed, especially in mathematics classes, which means that it is necessary to carry out a new orientation in respect to this subject, such as designing an instrument for assessment, thereby promoting CT development (Alfansuri, Rusilowati, & Ridlo, 2018; Deschryver & Yadav, 2015; Wing, 2006). This is expected to help students develop decision-making and problem-solving skills in mathematics (Bower, Wood, Lai, Howe, & Lister, 2017). Therefore, the computational process is a means to understand natural and social phenomena (Denning, 2019). CT is also developed during solving daily problems associated with computing (Sung, Ahn, & Black, 2017). Meanwhile, students adopt suitable techniques to find solutions through fun activities (Tim Olimpiade Komputer Indonesia, 2017).

Based on the results of observations made in some schools, it was discovered that the process of learning mathematics has not maximally facilitated the development of students' computational thinking skills. Teachers rarely apply content related to daily problems to develop CT abilities. As a result, the students' computational thinking skills during math lessons are still low. In accordance with the data acquired from TIMSS, Indonesia is at a low level. Meanwhile, in 2015, it was ranked 44th out of 49 countries, while the results of the 2018 PISA (Program for International Student Assessment) showed that the nation was categorized under the low-performance quadrant with an average and OECD math score of 379 and 487, respectively (OECD, 2019). The outcome of the PISA in the reading, science, and math categories stated that it was ranked 74th out of 79 countries (KumparanSAINS, 2019). According to Harususilo (2019), math and science scores were below average, with the least and highest mathematics scores of 379 and 591 achieved by Indonesian and Chinese students. Therefore, the students' computational thinking skills in mathematics are still low according to TIMSS and PISA. Another deliberation is centered on the fact that the learning process does not promote the development of children's thinking skills (Sanjaya, 2016). Kemp (1994) stated that the basic knowledge that needs to be possessed in terms of understanding computational algorithms is mathematical reasoning because the subject matter presented is not a routine issue, therefore, the students first need to be equipped. This led to the suspicion that their poor CT ability in mathematics subjects is due to the implementation of minimal learning and assessment activities. It is also commonly found that the test instruments used by teachers are only derived from package books recommended by the school authority (Sutriani, Sukmawati, & Rukli, 2021). Meanwhile, as a facilitator, teachers are expected to optimize all activities during learning until the assessment stage. Assessment is described as collecting and processing information to determine the students' learning outcomes (Hanifah, 2019). It is undeniable that presently, the assessment of mathematics education relies more on tests (Sumaryanta, 2014), although teachers have evaluated students' knowledge (cognitive) and skills through assignments (Irmayati, 2017). However, it simply means something is wrong with the applied scoring system (Sumaryanta, 2014). Therefore, it is necessary to revise the assessment model to hone students' computational thinking skills in mathematics lessons. Teachers are one of the causes of the inadequate development of this attribute in learners, especially during math lessons. Preliminary studies found that apart from incapability to improve computational thinking skills, teachers as facilitators have never developed RME-based test instruments or Realistic Mathematics Education. These are considered relevant to the development of computational thinking skills because their approach emphasizes daily problems or real contexts. This is in line with Anasrudin et al.'s research (2014), stating that the RME approach emphasizes the importance of real contexts and the process of constructing mathematical knowledge by the students. A realistic approach is described as a method that associates the subject matter with practical problems, especially those experienced (activity) daily through horizontal and vertical mathematical processes (Wahyudi, 2016).

The selection of an appropriate assessment model that tends to hone the students' computational thinking skills in mathematics lessons is then essential to be conducted. One solution to renew this developmental process is authentic assessment. According to the 2013 curriculum, this model emphasizes areas that need to be evaluated. Furthermore, both processes consist of various assessment instruments that are adapted to the demands of SK (Competency Standards), KI (Core Competencies), and KD (Basic Competencies) (Kunandar, 2013). In addition, various studies, such as Malik & Wara (2018), Hilda Nurmuslimah (2019), Mufidah (2018), and Fajri & Yurniwati (2019), have been performed on CT to improve and describe its skills and profiles. This means that no research has been carried out on developing the test instruments based on the RME approach. However, it is necessary to pay attention to assessment constructing tools, including integrating computational thinking and subject matter (Tang, Yin, Lin, Hadad, & Zhai, 2020). Therefore, this is related to the development of computational thinking test instruments based on the RME approach.

RESEARCH METHODOLOGY

This Research and Development (R & D) analysis is described as the evaluation of basic and active study (Hasyim, 2016). It adopted the Plomp model, consisting of 4 phases, expressed in the following sections.

Preliminary Investigation Phase

The preliminary investigation phase is the initial stage, carried out to evaluate certain needs to discover the basic challenges required in developing the instrument through an analysis of the curriculum, students, and school materials. Meanwhile, various references related to R & D, research instruments, and computational skills in mathematics were collected. The information obtained was then analyzed based on observation and interviews with mathematics teachers organized in schools where the research was conducted. Furthermore, (a) an analysis of the 2013 curriculum was also performed, based on the acquired data. This aims to improve the students' computational thinking skills. (b) Student analysis, in this phase, those categorized under the 3 abilities, including high, medium, and poor, was further observed in respect to their computational thinking skills based on indicators and (c) material analysis, it was discovered that the 2013 curriculum for junior high school mathematics was used to develop the assessment instrument. This comprises a system of linear equations with 2 variables, circles, and plane shapes.

Design Phase

The design phase is the solution to challenges encountered in the previous stage, besides the resulting instrument is the answer. The developed tools were instrument validation sheet, test blueprint, students', and teachers' responses to the questionnaires. This stage aims to design an instrument for assessing computational thinking skills based on the RME approach identified due to the results obtained from the preliminary investigation phase. It consisted of a blueprint, test questions in essay format, answer sheets, and criteria, including scoring guidelines. The test questions were designed in accordance with the analyzed materials and indicators of computational thinking in mathematics, also known as preliminary design. Meanwhile, 40 questions in the form of multiple-choice and essays were designed. A test blueprint, answer keys, assessment guidelines, and considerations to check the validity of computational thinking skills in mathematics questions were also constructed.

Realization Phase

This is the creation phase of the design comprising instrument validation sheets, test blueprint, students', and teachers' responses to the questionnaires. It is also called prototype I because it is validated at the evaluation phase after designing a prototype from the previously outlined factors. The results were re-examined by referring to 3 characteristics, namely content, construct, and appropriate language tested for validity by experts in accordance with the theoretical rationale and consistency in construction, therefore, all assessment instruments were analyzed.

Evaluation Phase

The evaluation phase consists of 3 parts, the first aspect is the question validation. This is performed by selected validators regarded as experts in the fields of instrument development and mathematics. The second part carries out a limited trial on revised questions validated by experts. Furthermore, the data obtained from this phase were analyzed for reliability, difficulty level, and discriminating power. However, supposing the test criteria is met, then it proceeds to the subsequent stage, and assuming otherwise, it is revised and re-tested, thereby enabling the product to meet the stipulated yardstick. The third part was considered to have met the criteria after carrying out a limited trial analysis and prototype. Furthermore, the research subjects were tested during the case field trials using 30, 27, 22, and 23 grade VIII students at JHS Negeri 7 Watampone, JHS Negeri 1 Patampanua Pinrang, IJHS Negeri 1 Makassar, and JHS IT Ulul Al-Baab. The following is the development flow chart according to the Plomp model.

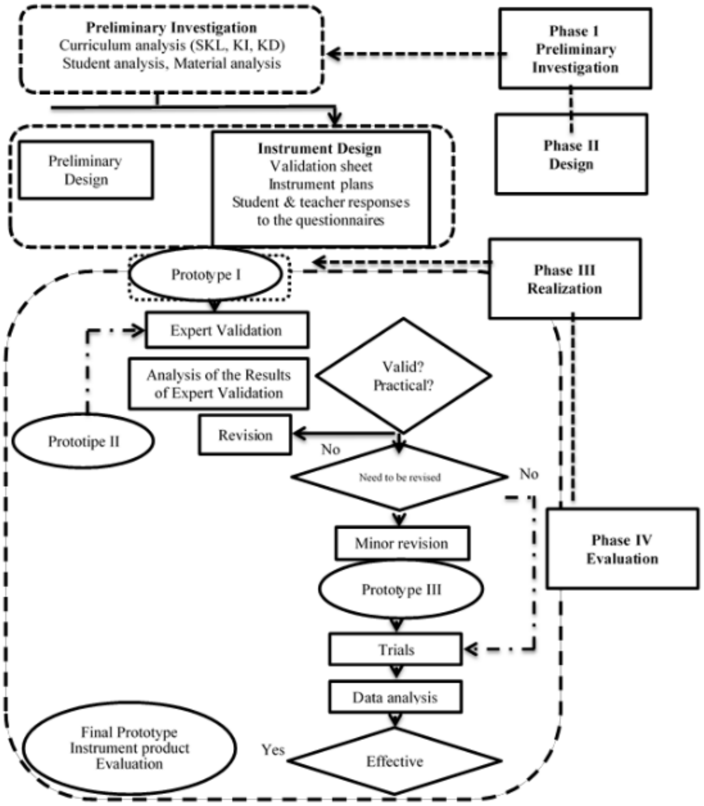


Figure 1: Development Flowchart

Validation activities

Instrument validation was carried out with a test blueprint validation sheet, test questions, and answer criteria, consisting of 2 lecturers and a teacher. In this phase, the validators assessed 10 aspects related to the designed instrument (Prototype I). They stated that the prototype is also used without revision, some or all components of the question need to be revised. The following suggestions were made by the validators, presented in Table 1.

Number	Validator	Instrument	Revision
1	Validator 1	Test blueprint	a. Adjust the indicator items on the blueprint with the questions b. Correction of sentences described in numbers 2, 7, and 9. Provide images and link them with real contexts familiar to students

			c. Complete the time allocation d. Adjust the question with the indicators on the blueprint
		Test question	a. The sentence structure in question no. 3 needs to be revised b. Review the question in no.2 with the blueprint c. Arrange the pictures on the questions to make them appear neater
		Key answer	a. Pay attention to the writing in each sentence b. Answer provided needs to be clear c. Pay attention to the typos
2	Validator 2	Test blueprint	a. Pay attention to the typos b. Show the order of the questions in the blueprint c. Use action verbs to describe the question indicators.
		Test questions	a. Pay attention to the typos b. Pay attention to the use of punctuation c. Questions must be logical and meaningful d. The question must be clear e. For an essay question, provide a place for the answer at the end of each.
		Answer key	a. Pay attention to the typos. b. Adjust the choices and the answer key on the question

Table 1: Suggestions for Revision from Validators

Table 1 describes the suggestions made by the validators regarding the developed instrument, which was further revised to produce a viable product. Some questions led to significant changes after the expert review process, namely numbers 2, 7, and 9, summarized in Table 2.

Questions Number	Before Being Validated	Once Validated
2	**Soal** Sebuah taman mempunyai ukuran panjang 2 kali lebih panjang dari lebarnya. Jika keliling 24 cm, maka luas taman tersebut......	 Lapangan Karebosi memiliki 3 lapangan sepak bola yang sama besarnya. Setiap lapangan sepak bola memiliki rasio antara panjang dan lebar adalah 3: 2. Di tepi lapangan sepak bola ada jalan dengan lebar 3 m di sekitar lapangan sepak bola. Jika perimeter setiap lapangan sepak bola adalah 3 km, luas lapangan karebosi... Source : TribunMakassar
7	**Soal** Di sebuah tempat parkir terdapat 100 kendaran yang terdiri dari mobil beroda 4 dan motor beroda 2. Jumlah keseluruhan roda di parkiran tersebut adalah 300 buah. Biaya parkir sebuah mobil Rp5.000,00 sedangkan motor Rp2.000,00, maka pendapatan uang parkir dari kendaraan tersebut adalah.....	 Di Lapangan parkir Mall Phinisi Point terdapat 300 kendaraan yang terdiri dari mobil beroda 4 dan motor beroda 2. Jumlah keseluruhan roda di parkiran tersebut adalah 1000 buah. Biaya parkir sebuah mobil Rp5.000,- sedangkan motor Rp3.000,-. Maka pendapatan uang parkir kendaraan tersebut adalah… Sumber: TribunMakassar.com
9	**Soal** Di sebuah sekolah terdapat beberapa ruang kelas. Jika jumlah kursi tiap kelas adalah 40, maka tersisa 84 kursi. Jika jumlah kursi di setiap kelas ditambah 6 maka akan kekurangan 12 kursi. Jumlah kelas di sekolah tersebut adalah....	 Di SMA Negeri 2 Makassar terdapat beberapa ruang kelas.. Jika jumlah kursi tiap kelas adalah 40, maka tersisa 40 kursi. Jika jumlah kursi di tambah 2 maka akan kekurangan 18 kursi. Jumlah kelas di SMA Negeri 2 Makassar adalah… Sumber: www.mugniar.com
2.	A Garden is twice as long as its width. If its 24 cm, then the are of the park	Karebosi Field has 3 equally large football fields. Each football field has a ratio between length and width is 3:2. On the edge of the football field there is a road with a width of 3 m around the football field. If the perimeter of each football field is 3 km, the area of the Karebosi field…
7.	In a parking lot there are 100 vehicles consisting of 4-wheeled cars and 2-wheeled motors. The total number of wheels in the parking lot is 300 pieces. The parking fee of a car is Rp5,000.00 while the motorcycle is Rp2,000.00, then the parking money	In the parking lot of Phinisi Point Mall there are 300 vehicles consisting of 4-wheeled cars and 2-wheeled motorcycles. The total number of wheels in the parking lot is 1000 pieces. Parking fee of a cars Rp5,000,- while a motorcycle Rp3,000,-. The vehicle's parking money is…

	income from the vehicle is…	
9.	In a school there are several classrooms. If the number of seats per class is 40, then are 84 seats left. If the number of seats in each class is plus 6 then there will be a shortage of 12 seats. The number of classes at the school is…	In JHS 2 Makassar there are several classrooms. If the number of seats per class is 40, then there are 40 seats left. If the number of seats is added 2 then it will be short of 18 seats. The number of classes at JHS 2 Makassar is…

Table 2: Question Changes After the Expert Review Process

Limited Trial

In this phase, the revised questions were tested on 6 students in 4 JHS/IJHS. They answered 9 of them on the available answer sheets. After the trial process was completed, they were asked to comment on the questions.

Further Trial

The validated and subsequently revised prototype was tested on the research trial subject, namely grade VIII students of JHS/IJHS in South Sulawesi, consisting of 4 schools, JHS 7 Watampone, JHS 1 Patampanua Pinrang, IJHS 1 Makassar, and JHS IT Ulul Al-Baab. The trial was carried out in 1 meeting during class hours. Students were asked to take a computational thinking skill test containing 30 multiple choice and 15 essay questions.

The data collection techniques used were tests, students, teachers, and validators' responses to the questionnaires. The research instrument used consists of test, students' responses to the questionnaires, and a validation sheet. The test instrument is in accordance with multiple choice and essay questions indicator of computational thinking skills, namely decomposition, data representation, pattern recognition, algorithmic reasoning, generalization, and evaluation, based on the RME approach, presented in Table 3.

Indicator	**Item Number**	
	Multiple choice	**Essay**
Decomposition	4, 7, 9, 11, 18, 21, 28	2, 8, 9
Data representation	1, 2, 7, 17, 18, 29, 30	1, 3

Pattern recognition	3, 5, 6, 8, 10, 19, 27, 30	3
Algorithmic reasoning	1, 2, 3, 5, 7, 8, 11, 15, 20, 22, 27	4, 6, 7
Generalization	1, 2, 6, 8, 14, 16, 19, 23, 24, 25, 26	4, 10
Evaluation	4, 11, 12, 13, 20, 21, 25	5

Table 3: Item Number Indicator of Computation Thinking

The data analysis techniques consist of self-evaluation, prototyping, small group, and field research. The test instrument in the form of an essay was analyzed in the previous phase. The instrument step was performed in stages, including 1) evaluation of the test instrument in the form of an essay by obtaining the Content Validity Ratio (CVR). Afterward, a CVI (content validity index) analysis was carried out to determine the average reliability of the accepted questions. The results obtained from the CVR and CVI calculations are a ratio of numbers from 0 to 1.

RESULTS AND DISCUSSION

Results of Development of Computational Thinking Skills Based Assessment Instruments

The validity test was established with the Content Validity Ratio (CVR) to determine the suitability of the item with the material or topic to be measured based on the experts' judgment. The results obtained from CVR and CVI showed that of the 40 items reviewed by 2 validators (experts) these items support the validity of the test, therefore, the prototype was reported to be valid. Apart from the judgment process, some students' responses were based on the completed questionnaire. The responses were given to 3 (one-to-one) and 6 students (small group) outside the test subject. The questionnaires were distributed after students answered the questions concerning the given measuring instrument. The analysis of their opinion on the computational skills-based assessment instrument in the one-to-one and small group trials both obtained an average positive and negative responses of 79.16% and 20.83%, respectively. Therefore, the students' responses to the questionnaires met the criteria of "achieved," and there was no improvement or revision of the developed instrument.

The reliability test was conducted based on the results of a field test involving grade VIII students of JHS 7 Watampone, JHS 1 Patampanua Pinrang, IJHS 1 Makassar, and JHS IT Ulul Al-Baab. Meanwhile, 30 grade VIII students were observed at the JHS 7 Watampone, 27 at JH

S 1 Patampanua Pinrang, 22 at IJHS 1 Makassar, and 23 at JHS IT Ulul Al-Baab. Based on the results of the students' work, the level of test reliability was calculated. The results of the reliability test are shown in Table 4.

Reliability	Cronbach's Alpha	N of Items
Multiple Choices	0.781	30
Essay	0.709	10

Table 4: Data Reliability of Assessment Instruments

Table 4 shows that the assessment instruments are reliable, therefore, based on this analysis, the computational skills-based instrument was not revised. The difficulty level in accordance with the developed instrument was also obtained from the results of students' work in the field test, as shown in Table 5.

Item Number	Level of Difficulty	Category	Item Number	Level of Difficulty	Category
1	0.58	Medium	16	0,21	Difficult
2	0.35	Medium	17	0,5	Medium
3	0.36	Medium	18	0,3	Medium
4	0.28	Difficult	19	0,52	Medium
5	0.6	Medium	20	0,56	Medium
6	0.64	Medium	21	0,8	Easy
7	0.46	Medium	22	0,5	Medium
8	0.63	Medium	23	0,59	Medium
9	0.36	Medium	24	0,47	Medium
10	0.53	Medium	25	0,59	Medium
11	0.49	Medium	26	0,35	Difficult
12	0.34	Difficult	27	0,78	Medium
13	0.59	Medium	28	0,37	Medium
14	0.51	Medium	29	0,63	Medium
15	0.23	Difficult	30	0,69	Medium
Mean		0.493		Medium	

Table 5: Analysis of the Difficulty Level of the Multiple Choice as an Assessment Instrument

Table 5 shows that the categories of the difficulty levels at the trial phase are divided into 3, including questions that are classified as easy with difficulty levels within the range of 0.7 to 1.00, medium with a difficulty level of 0.30 to 0.69, and difficult with a difficulty level of 0.00 to 0.29. For multiple-choice questions, 2 items were categorized as easy, 23 were classified as medium, and 6 as difficult, as shown in Table 6.

Item Number	Level of Difficulty	Category
1	0.402	Medium
2	0.34	Difficult

3	0.14	Difficult
4	0.9	Easy
5	0.4	Medium
6	0.11	Difficult
7	0.16	Difficult
8	0.34	Difficult
9	0.81	Easy
10	0.5	Easy
Mean	0.412	Medium

Table 6: Analysis of the Difficulty Level of Essay Question as an Assessment Instrument

For essay questions, 3, 3, and 5 items were classified as easy, medium, and difficult. The test result used to measure the students' computational skills is based on the final score obtained when working on the instrument. The analysis results of students' computational skills test are shown in Table 7.

Number of Questions	Student Score	Frequency	Percentage (%)	Category
40 questions	$80 < \text{value} \leq 100$	2	1.96	Excellent
	$60 < \text{value} \leq 80$	11	10.78	Good
	$40 < \text{value} \leq 60$	57	55.8	Moderate
	$20 < \text{value} \leq 40$	20	19.6	Fair
	$0 \leq \text{value} \leq 20$	12	11.7	Poor
	Number of Subjects	39	100	
	Average Score	47.35		Moderate

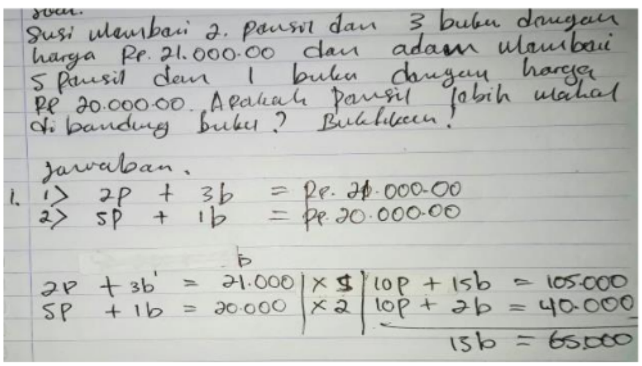
Table 7: Analysis of Computational Skills Test Results at JHS 7 Watampone, JHS 1 Patampanua Pinrang, IJHS 1 Makassar, dan JHS IT Ulul Al-Baab

Based on data analysis to measure the computational skills of students at JHS 7 Watampone, JHS 1 Patampanua Pinrang, IJHS 1 Makassar, and JHS IT Ulul Al-Baab in mathematics, it was discovered that of the 102 test subjects of the assessment instrument, 2 trial students (1 .96%) possessed excellent computing skills, while 11 of them (10.78%) were included in the good category, 57 (55.8%) in the moderate classification, 20 (19.6%) in the fair division, and 12 (11.7%) in the poor group.

After carrying out research on computational thinking in mathematics, it is obvious that this skill is still low in Indonesia. This ability is relevant to the reason mathematical abilities in TIMSS and

PISA are low. Saxena, Lo, Hew, and Wong (2020), stated that this was caused by the students' failure to find solutions at the algorithm stage. The basic knowledge that needs to be possessed in terms of learning computational algorithms is mathematical reasoning. However, because the subject matter presented in the computational algorithm is not a routine issue, the students have to be equipped with creative mathematical reasoning. The results of the 2018 PISA (Program for International Student Assessment) showed that Indonesia was in the poor performance quadrant with an average and OECD math score of 379 and 487, respectively (Kemdikbud, 2019). The results of PISA in the reading, science, and math skills categories stated that Indonesia was still ranked 74th out of 79 countries (KumparanSAINS, 2019).

Meanwhile, based on the research findings, it was obvious that majority of the students were only able to work from the first to third stages. Figure 2 shows one of the incorrect results used by students to determine the answers to the questions.



Susi gave 2 pencils and 3 books at a price of Rp 21,000,000 and Adam gave 5 pencils and 1 book at a price of Rp 20,000,000. Is a pencil more expensive than a book? Prove it!

Figure 2: Students' Work Results for Problem 3

Based on figure 2, it is evident that students are able to solve and represent certain problems related to the pattern recognition stage. This is because they do not completely understand the material explained by their teacher. Based on findings, it was concluded that some of the factors that cause poor mathematical computation were the adopted learning methods and models. These include students' experiences, less challenging statements from the teacher, ability to formulate questions, unequal treatment in each development, and lack of discipline during classes. Subsequently, CT assessments are still lacking in relation to the subject matter (Tang et al., 2020), even though it affects students' computational skills (Djambong & Freiman, 2016).

The poor computing skill is caused by several factors, including the current formal education, which tends to be trapped only in honing aspects of knowledge and understanding perceived as lower-order thinking abilities (Cansu & Cansu, 2019). Moreover, the students are asked to absorb anything the teacher says. Learning activities with the casting system leads to controlling the children's capability, even though everyone is born with amazing potentials. The difficulty in understanding abstract concepts with teacher-centered learning methods is based on the fact that students often succeed in solving certain problems and fail when their context is slightly changed. This is one of the reasons they are not accustomed to high-level thinking, namely understanding, application, and reasoning abilities. In learning, meaningful experiences need to be encountered by the students to develop optimal computational thinking skills (Fajri, Yurniwati, & Utomo, 2017). To determine the students' abilities, evaluations in tests are applied (Ling, Saibin, Naharu, Labadin, & Aziz, 2018). Based on the results of the previous discussion, several weaknesses were obtained during the development of this instrument, namely a) students are less able to solve computational skills questions, b) development of assessment tools are only intended for the grade VIII level, therefore computing abilities of those in other classes are immeasurable, c) students are not used to solving questions on such tools. In addition to the weaknesses of the research, this study also has certain advantages, including a) the developed instrument promotes students to improve their computational skills, b) it is used as an exercise to develop and optimize the computational abilities of those in grade VIII JHS/IJHS in South Sulawesi, c) teachers also use the developed instrument to improve their computing skills.

CONCLUSIONS

The process of developing a computational skill test instrument in mathematics for grade VII JHS/IJHS students in South Sulawesi was determined through 4 stages, namely (a) preliminary investigation, (b) design, (c) realization or construction, and (d) test, evaluation, and revision phases. The results of this study indicate that of the 40 items reviewed by 2 validators, it was reported that these support the validity of the test, meaning that the prototype is valid. Therefore, over 50% of the students gave a positive response. This implies that their responses to the questionnaires met the criteria of "achieved" without revision. The reliability level of the assessment instrument based on computational skill for multiple-choice and essay questions tested in 4 schools was 0.709 and 0.781, which indicates that the formulated problems are reliable. Based on data analysis carried out to measure computational skill in mathematics, it found that of the 102 test subjects, 2 (1.96%), 11 (10.78%), 57 (55.8%), 20 (19.6%), and 12 (11.7%) students are in the excellent, good, moderate, and poor category. Therefore, based on the assessment results, it was discovered that the average category is sufficient, less, and very less large. This proves that there is still no maximum effort to improve these skills because learning activities carried out with the casting system lead to controlling the children's capability, even though everyone is born with amazing potentials. The difficulty encountered in understanding abstract concepts with teacher-centered learning methods is focused on the known fact that students often succeed in solving certain problems and fail when the context is slightly changed. This is one of the reasons they are not accustomed to high-level thinking, namely understanding, application, and reasoning abilities. Therefore, to overcome these problems, the results of this study tend to help teachers in the teaching and learning process, including the use of tests to measure the students' computational thinking skills. This developed product contains details about the scores obtained based on solved problems. The assessment guideline is a useful guide for teachers to assess the results of the students' work in answering test questions, especially those related to computational thinking skills.

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