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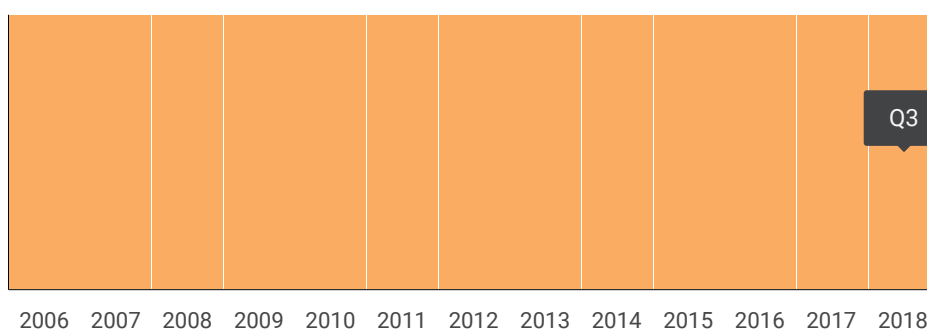How to publish in this journal
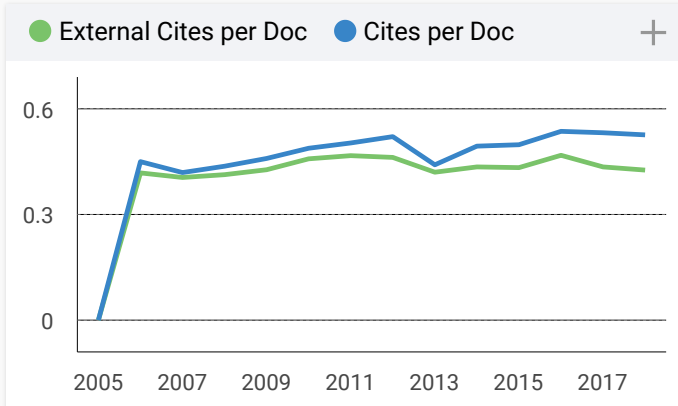
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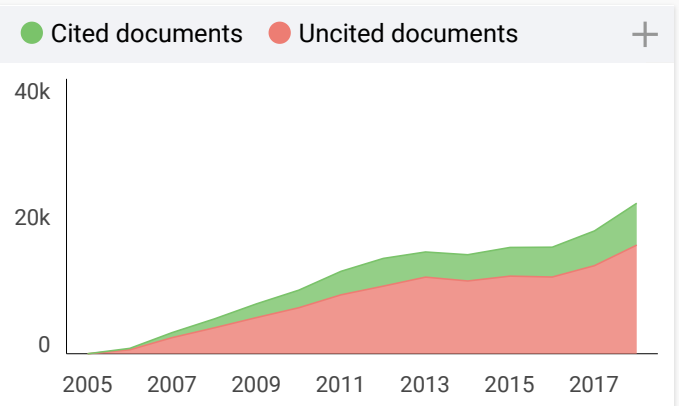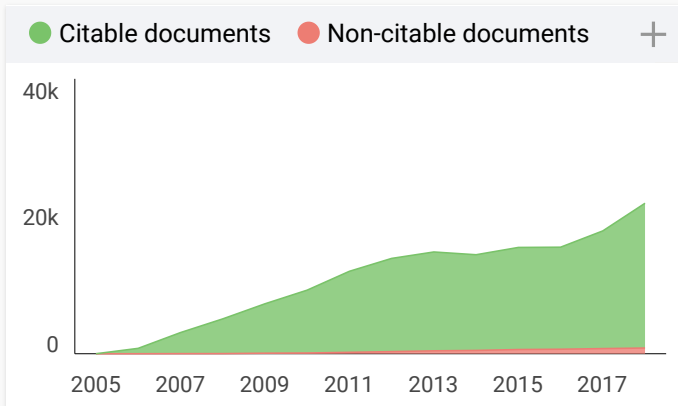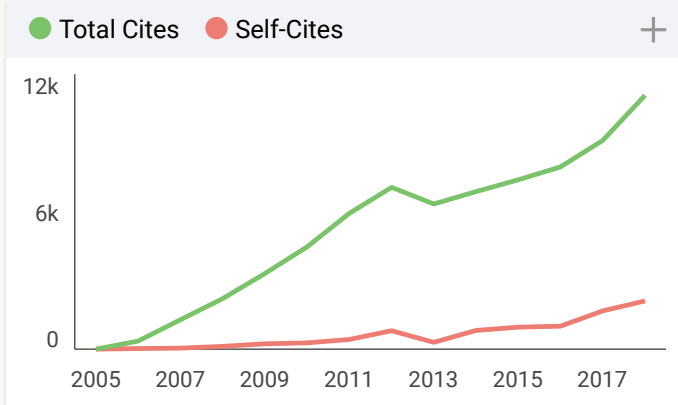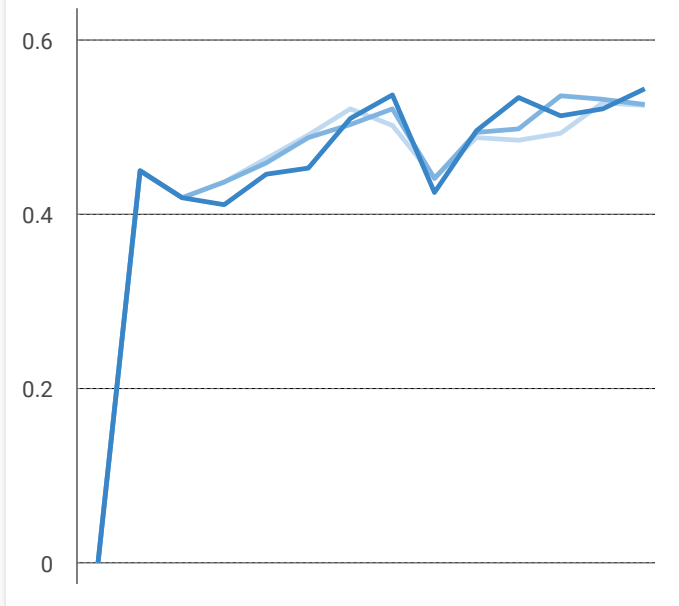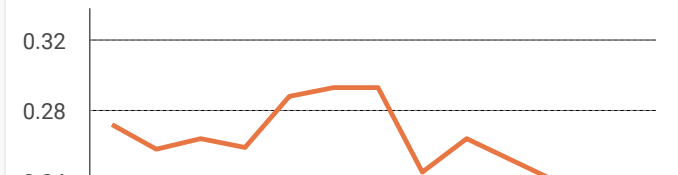
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Preface

We are delighted to introduce the proceedings of the first edition of *International Conference on Computer Science and Enineering* (IC2SE) 2019 with theme "*Industrial Revolution 4.0 Opportunities & Challenges*". The technical program has brought researchers and practitioners around the world to a good forum for discussing, leveraging and developing all scientific and technological aspects that are relevant to digital society. This *IC2SE 2019* acquired 256 full paper with 154 are acceptable with many categories paper with most paper are from Computer Science/Engineering, Information Technology and Education and also authors from almost 13 Countries such as malaysia, New Zaeland, Bangladesh, United Kingdom, Bahrain, Zambia, Nigeria, Saudi Arabia, Uganda, Pakistan, Iraq, and Palestine. This confrence was well-managed for the cooperation of all the committees and co-host from many universities and organisation. We hope that the future *IC2SE* will be as successful and stimulating, as indicated with the contributions presented in this volume.

The Editors
Robbi Rahim
Robby Dharma
Billy Hendrik
Abulwafa Muhammad

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Online Measurement to Assess A Problem Solving Skills Based on Multimedia Instrument

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Abstract. Problem solving ability is a goal that must be achieved in the learning process of all subjects at the elementary school level. Thus, there is a need for identification of problem solving abilities from prospective primary school teachers. The effort to identify this capability was carried out using Google Form as a test tool that facilitated researchers to carry out problem solving ability tests which is multimedia based. This research is a development research, which uses the development of the 4-D approach. The development is carried out on instruments for assessing mathematical problem solving abilities. The test participants consisted of 230 students from the elementary school teacher education program and the Madrasah Ibtida'iyah (Islamic elementary school) Teacher Education Study Program in the Special Region of Yogyakarta. The results indicate that the condition of students' abilities that are quite diverse, with abilities below 0 are still quite high. This indicates that students' problem solving abilities, prospective elementary school / Madrasah Ibtida'iyah teachers, still need to be improved.

1. Introduction

Problem solving ability is one of the abilities that becomes a goal in mathematics learning. Problem solving ability is an effort to achieve the desired goals and not automatically known on how to achieve these goals [1]. This effort shows that to solve problems is not only by applying concepts, which have been obtained in learning, directly. This capability has become the focus of discussion in the National Council Teacher Mathematics (NCTM) which states that students will be able to know the strengths and uses of mathematics through problem solving. This means that to practice problem solving skills, the problems that are not routine are needed. Non-routine problems are problems that have not been known to solve the procedure by students and require high-level skills to solve them [2], [3]. In the Indonesian education curriculum, the ability to solve this problem is a goal that must be achieved by

students from the level of basic education to the level of higher education. This capability should have been built from the level of basic education.

The achievements of Indonesian Elementary School students photographed by TIMSS (Trend in International Mathematics and Science Study) in 2015 showed that the average math score of Indonesian students in class IV was in the order of 45 out of 50 countries, and showed that this position was below the average value international [4]. Therefore, it is necessary to know the level of mastery of problem solving abilities by prospective teachers who are currently still undergoing the learning process at the tertiary level and in the future will assist their students in learning mathematics. In the future, these prospective primary education teachers will facilitate elementary school students in building problem solving skills.

The ability mastered by a person can be measured through scoring. Several studies have been carried out on assessment practices that show results in concerns about school assessment practices that still emphasize evaluating the level of rote skills that use IQ and achievement measures, with little attention given to high-level skills assessment [5], [6], [7]. The school and university systems must strive to expand the scope of cognitive evaluation by incorporating high-level knowledge tests on the assessment process [8]. Assessment of the level of higher education should also emphasize the measurement of high-level abilities of students, one part of which is problem-solving ability.

The current assessment is not only limited to paper and pencil, but online assessment is also available. Online-based assessment is an alternative way to assess students' abilities in certain abilities. The assessment used to measure an ability is expected to provide benefits such as effective and efficient value in its use. At the higher education level, assessment can be sought using an online system with the consideration that at present every student has a laptop or communication device in the form of a mobile phone which is a daily necessity. Taking this into account, researchers used online-based assessments to measure problem-solving abilities of students in Madrasah Ibtida'iyah Teacher Education and Elementary School Teacher Education in Yogyakarta.

There are expert's opinions in defining problems. Chi and Glaser stated "A problem is a situation in which you are trying to reach some goals, and must find a means for getting there" [9]. A problem is a situation that is tried to achieve a certain goal and must find a way to get it. Lester [10] states "a problem is a situation in which an individual or group is called upon to perform a task for which there is no readily accessible algorithm which determines completely the method of solution". In addition, the teacher / lecturer must be prepared to arrange different questions with the training questions given in the learning process, which the question requires reasoning.

The problem is interpreted in a psychological perspective as a situation that contains difficulties for someone, encourages him to find a solution, and the steps to get a solution cannot be known with only one step [11], [12]. The problem is interpreted as a situation that will be resolved by a person or group so that the goals set can be achieved, but the process of resolution cannot only be by memorizing rules or methods that are considered as correct solutions [9], [10], [2].

Problem solving ability is one of the goals to be achieved in mathematics learning. Nitko and Brookhart makes it clear that in achieving a goal or completing a task without a thinking process cannot be said to be a problem solving but it is a no-brainers [1]. Similar opinion also expressed by Haylock, it is called problem solving when the individuals use think mathematical knowledge and reasoning to close the gap between the givens and the goal [13]. To be able to solve a statement categorized as a problem, a thinking process is needed, not just applying one concept, which integrates the knowledge that has been obtained previously.

Through problem solving, student can experience the power and utility of mathematics [14]. Supported by Krulik and Rudnick states that problem solving as the means by which an individual uses previously acquired knowledge, skills, and understanding to satisfy the demands of an unfamiliar situation [15]. Skills and understanding of concepts that have been obtained by students in previous learning will be used integratively in solving problems. Even in mathematics learning problem solving has different interpretations, for example in solving story math problems, non-routine questions, and applying mathematics in everyday life.

The Singapore Ministry of Education states that mathematical problem solving is the central to mathematics learning. It involves the acquisition and application of concepts and skills in a wide range

of situations, including non-routine, open-ended, and real-world problems [16]. The Indonesian government also emphasizes problem-solving skills in every curriculum that is applied both from the basic level of education to higher education. In the 2006 curriculum, problem solving skills became the goal of mathematics learning. Likewise with the 2013 curriculum which currently applies to basic education to secondary education. In this curriculum, the ability to think critically and creatively becomes an ability that students want to achieve after following the learning process.

Online assessment is one alternative that can be used in the learning process by paying attention to effective and efficient values. Online assessment certainly requires an information system that can accommodate data collection, integration and storage. Information systems as a system consisting of several components to achieve a goal that is presenting information [17].

Google has had a major contribution in the development of technology that can support various disciplines, one of which is the world of education. One feature that can be used to facilitate the assessment of cognitive and affective domains is google form. The use of google form in educational assessment provides efficient value including saving paper usage and not spending much time inputting and analyzing data. The assessment process carried out using Google Form is: 1) students are asked to bring hardware such as an internet-connected laptop / handphone, 2) lecturers provide a google form link to students, 3) students fill out the google form according to the instructions given on the form with the test time being 60 minutes, 4) the lecturer takes and processes the response data provided by all students.

2. Research Method

This research is a development research, which uses the development of the 4-D approach [18]. The product of this research is learning materials, which are in the form of a problem solving skill test. The development of test instruments was carried out on problem solving abilities. This problem solving ability is measured using multiple-choice tests.

The multimedia-based online scoring model is validated by expert judgment from the computer-engineering department to validate the multimedia display. The data in this study were responses to responses from 230 students from Elementary School Teacher Education Study Program at the Universitas Sarjanawiyata Tamansiswa, Yogyakarta and the Madrasah Ibtida'iyah Teacher Education Study Program at the Universitas Alma Ata, Yogyakarta. The data obtained were then tested for uni-dimensionality, KMO, and Exploratory Factor Analysis using SPSS 20. Analysis of the Rasch model was carried out using MG 3.0 BILOG and continued with Microsoft Excel to obtain Item Characteristic Curves.

3. Result and Discussion

The development of the mathematical problem solving ability test begins with building a test grid based on a theory of mathematical problem solving abilities. Competence in the test of mathematical problem-solving ability consists of solving problems related to speed, integer operations, nets and volume of building space, and rational numbers. Based on predetermined competencies, these are further described in the indicators that will be tested. The items used in this problem solving ability test are 20 items. Next, the agreed items are inputted into the google form.

The Google form used in this study consists of 3 parts. The first part contains the title and instructions for the tests performed. The second part contains the identity of the test takers. The third part contains 20 items of high-level thinking skills tests. Of the 20 items entered in the Google Form, there are six (6) items using images, and 1 item using video. This is the part that distinguishes between tests using a paper-pencil with a test using a computer, more specifically google form.

Instrument trial data that have been obtained, then used for the assumption test IRT (Item Response Theory) which consists of 3 assumptions, namely dimensions, local independence, and parameter invariance [19]. When the test instrument stated that it has passed the IRT assumption test, then the researcher determines the IRT model that is appropriate for the subsequent analysis. Model 1 PL has more significant number of items than the other models, thus the suitable model used is 1 PL (rasch analysis).

Rasch analysis of the response data test problem solving ability shows the results of the difficulty level of the questions ranged from -2.6 to -0.2. Items that have difficulty levels between -2.6 to -2.0 are items 2, 7, 8, and 11, while items that have difficulty levels between -2.0 to -1.0 are items 5, 6, 9, 10, 12, 13, 14, 15, 16, 17, and 20, then items that have difficulty levels between -1.0 to -0.2 are items 1, 3, 4, 18 and 19. This range indicates that the level problem difficulties are still within a reasonable range, between -3.0 and 3.0. However, if you look back at the spread, the difficulty level of the items in this test is still less diverse, which is only in the half of the range of difficulty levels that are reasonable. The difficulty level of each item can be seen in the Item Characteristic Curve (ICC) graph presented in Figure 2. Because the most suitable IRT analysis model is the PL model, the characteristics seen are only the difficulty level of the item. The difficulty level of this item still collects in the left area of the cartesius coordinate, which indicates that the level of level of difficulty of the problem is still not evenly distributed. There needs to be a revision of the instrument for solving this problem, so that it has a variety of difficulty points.
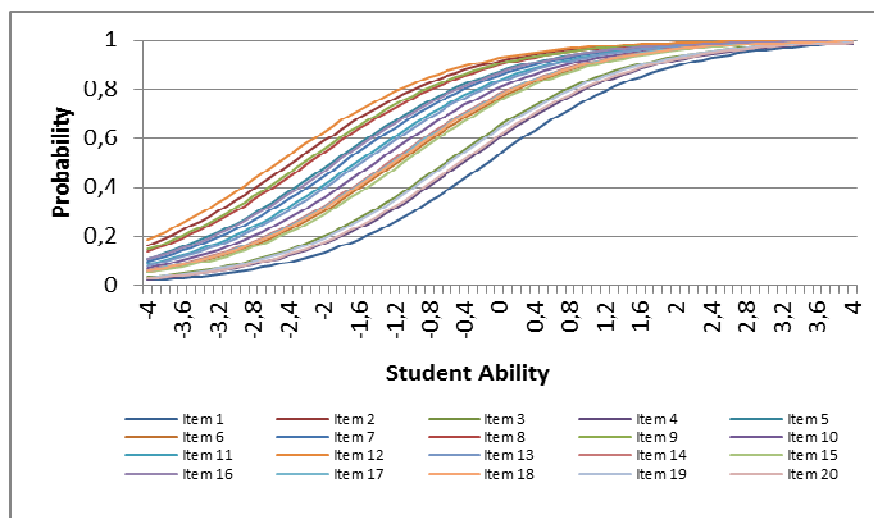
Figure 1. Item Characteristic Curves (ICC)

Items that have a difficulty level of -0.2 mean that at a probability of 0.5 students need an ability of -0.2 to correctly answer the item. The distribution of 230 students who took the test was spread in a range of values between -3,135 to 1,137. The distribution of student abilities shows that 119 students have mathematical problem solving abilities <0, and 111 students have an ability level> 0. If the level of difficulty of the problem is increased, the portrait that will be obtained is the level of students' ability to decrease. To overcome this, special attention needs to be paid to the learning process in the Mathematics course which continuously provides strengthening problem solving skills for students.

The advantage of using multimedia-based mathematical problem-solving ability tests are 1) it can show cases that are shown in the form of videos, 2) save paper usage, 3) the lecturers can immediately ensure students' answers are already completed, and 4) lecturers can immediately obtain data student response. In addition to excellence, this multimedia-based test has disadvantages in its implementation, namely 1) students continue to use paper in carrying out mathematical calculations, 2) if the internet signal is weak it will prevent students from running the test, and 3) require a long time to prepare video (especially videos that must be made by the lecturer).

4. Conclusion

The results obtained from this study that after analysis using 1 PL model (rasch) is the difficulty level of the item in the low category. To overcome this, special attention needs to be paid to the learning process in the Mathematics course which continuously provides in strengthening problem solving skills for students. Based on the development research that collaborated between the tests of mathematical problem solving abilities and multimedia-based assays it was concluded that this online

test tool has several advantages compared to paper-based and pencil tests. These advantages include 1) being able to display cases that are shown in the form of videos, 2) saving paper usage, 3) lecturers can directly ensure the students' answers that have been completed, and 4) lecturers can immediately obtain student response data. In addition to excellence, this multimedia-based test has disadvantages in its implementation, namely 1) students continue to use paper in carrying out mathematical calculations, 2) if the internet signal is weak it will prevent students from running the test, and 3) require a long time to prepare video (especially videos that must be made by the lecturer).

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