Lecture Notes in Networks and Systems 573

Mohammed A. Al-Sharafi
Mostafa Al-Emran
Mohammed Naji Al-Kabi
Khaled Shaalan *Editors*

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Editors
Mohammed A. Al-Sharafi
Department of Business Analytics
Sunway University
Subang Jaya, Selangor, Malaysia

Mohammed Naji Al-Kabi
Al Buraimi University College
Al Buraimi, Oman

Mostafa Al-Emran
The British University in Dubai
Dubai, United Arab Emirates

Khaled Shaalan
The British University in Dubai
Dubai, United Arab Emirates

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Preface

Over the past ten years, no one has disputed the contribution that intelligent systems and emerging technologies have made to developing digital societies and transforming the knowledge-based economy. The high number of practical new technologies is causing a rapid increase in experimental and theoretical outcomes. These technologies have played a crucial part in many industries, such as healthcare, education, tourism, and marketing. The main aim of the 2nd International Conference on Emerging Technologies and Intelligent Systems (ICETIS 2022) is to provide a forum for academics, researchers, and developers from both academia and industry to share and exchange their latest research contributions and identify practical implications of emerging technologies to advance the wheel of these solutions for global impact. In line with the fourth industrial revolution goals and its impact on sustainable development, ICETIS 2022 is devoted to increase the understanding and impact of emerging technologies on individuals, organizations, and societies, and how intelligent systems have recently reshaped these entities. ICETIS 2022 focuses on the recent innovations in Artificial Intelligence (AI) and Data Science, Advances in Information Security and Networking, Intelligent Health Informatics, Management Information Systems, Educational Technologies, and recent trends in Software Engineering.

The ICETIS 2022 was able to attract 200 submissions from 33 different countries across the globe. From the 200 submissions, we accepted 117 submissions, which represents an acceptance rate of 58.5%. Out of the 117 accepted submissions, 61 were selected to be published in this volume. The accepted papers in this volume were categorized into four main themes: *Artificial Intelligence and Data Science*, *Software Engineering*, *Emerging Technologies in Education*, and *Intelligent Health Informatics*. Each submission is reviewed by at least two reviewers, who are considered experts in the related submitted paper. The evaluation criteria include several issues, such as correctness, originality, technical strength, significance, quality of presentation, interest, and relevance to the conference scope. The conference proceedings are published in *Lecture Notes in Networks and Systems Series* by Springer, which has a high SJR impact.

We acknowledge all those who contributed to the success of ICETIS 2022. We would also like to express our gratitude to the reviewers for their valuable feedback

and suggestions. Without them, it was impossible to maintain the high quality and success of ICETIS 2022. As gratitude for their efforts, ICETIS 2022 is partnered with Publons to recognize the reviewers' contribution to peer review officially. This partnership means that reviewers can opt-in to have their reviews added to their Publons profile.

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Contents

Exploring the Accuracy of Mathematics Students on the Final Semester Assessment Based on Racsh Model Analysis in Timor-Leste

Jerito Pereira[1,2(✉)], Jianlan Tang[1], Bento Soares[2], Rafiantika Megahnia Prihandini[3], and Tommy Tanu Wijaya[4]

[1] Department of Mathematics and Statistic, Guangxi Normal University, Guilin 541004, China
jeritopereira@gmail.com, tjlwxt@mailbox.gxnu.edu.cn
[2] Departmento de Ensino de Matematica, Universidade Nacional Timor-Lorosa'e, Timor-Leste, Dili, Timor-Leste
[3] Mathematics Education Department, University of Jember, Jember, Indonesia
[4] School of Mathematical Sciences, Beijing Normal University, Beijing, China
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Abstract. Mathematics is a difficult subject and often bored students with it always low student learning outcomes, in addition to student understanding is still low due to student accuracy is still low. The purpose of this study was to determine whether student accuracy can affect learning achievement. This research was conducted in the country of Timor Leste at Escola Secundaria Catolica St. Madalena de Canossa in 2021/2022 school year. The researcher used a saturated sampling method, so that the entire class XI students were taken as the main sample with a total of 72 students. The instrument used was a multiple-choice test instrument with a total of 25 questions and data analysis using Winstep Rasch model software. The results of the study can be summarized that, in the wright person item, we can see that there are 68% of the question positions in the understanding, applying and analyzing stages, while most students around 77% are in that position, so the actual 77% of the students get the correct results but the results of the students' answers are mostly wrong. Thus, by using the Rasch model, we can see that most students do not have accuracy in solving problems.

Keywords: Students accuracy · Students assessment · Mathematics result · Rasch model analysis

1 Introduction

Mathematics is a very important science and can be implemented in various fields. Every aspect of everyday life always involves mathematics and is adapted to the needs

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of each user (Pereira et al. 2021). The development of science and technology cannot be separated from the role of mathematics (Khalid Abdullah Bingimlas 2003). This is supported by the National Education Strategy Plan of the Ministry of Education and National Culture as stated in Article 3 Part 1 of the 11-year Priority Program (2011–2030). In the regulation, it is stated that mathematics is a universal science that underlies the development of modern technology, has an important role in various disciplines and advances the power of human thought. Based on this description, it can be concluded that mathematics is a very important science to learn but most people still think that mathematics is difficult to teach, learn and difficult to solve (Chadli et al. 2019).

Mathematical problem solving is a process carried out by students to solve a given problem by using their knowledge and understanding (Star et al. 2013). Important mathematical problem-solving abilities possessed by a student are as follows: (1) problem solving ability is a general goal of teaching mathematics, even as the heart of mathematics, (2) problem solving includes methods, procedures and strategies is a core and main process in the mathematics curriculum, and (3) completion of mathematics is a basic ability in learning mathematics. Problem solving ability is very important in learning mathematics, because almost every competency standard contains aspects of problem-solving ability. Students must be trained in the problem-solving process so that students can get used to making decisions in solving the problems they face (Sumule et al. 2018).

This cannot be separated from the role of an educator as a facilitator in the learning process. Educators are required to be able to direct students to solve mathematical problems using the right method. Educators are also expected to be able to understand the importance of student understanding which includes three main things, namely the ability to recognize, the ability to explain, and the ability to draw conclusions. Understanding the concept becomes an important capital in solving problems, because in determining problem solving strategies, mastery of the concepts that underlie these problems is required (Branca 1980).

In this regard, Naila explained that the low learning outcomes of students in mathematics are not only due to the low understanding of students but also due to the low accuracy of students. In line with the research of Lutvaidah and Hidayat (2019), there is an effect of reading accuracy in solving arithmetic problems. The results of Amir's research (2015) say that students' critical thinking processes in mathematics are different because of the students' accuracy in the re-examination process. This shows that students' accuracy in the learning process is very important to be mastered by students because it will affect the final results of students' answers. Muhammad (2017) explains that one of the important skills to be improved is a conscientious attitude. Accuracy is needed by students as their main foundation in a more optimal learning process and draws the right conclusions. Therefore, teachers have an important role to increase students' accuracy in solving math problems.

Students' thoroughness skills are urgent in the world of education because they can improve the quality of education. If students are able to work on the questions more carefully, there will be more correct answers than wrong ones. If one student is able to be more thorough in doing the questions, then thousands and even millions of students in Indonesia can contribute to improving the quality of education in our country. One of

the models that can explore students' accuracy in the mathematics learning process is the Rasch model. This model is effective because Rasch modeling converts raw score data into data with equal intervals so as to produce a linear, precise and unitary measurement scale (Febrian and Fera 2019). According to Febrianno et al. (2021) said that the basic principle of analysis of the Rasch model, namely probabilistic interpreted as students who have a higher level of ability than other students should have a greater opportunity to answer the correct questions.

Previously, to explore students' accuracy, classical theory was used, but in the process of applying this theory, it still has many weaknesses. Therefore, in this study, researchers focus on explore the accuracy of grade 10 mathematics students based on final semester assessments using modern theory Rasch model. By conducting this research, researcher hoped that using modern theory can provide an overview of the identification of students' level of accuracy in the process of solving mathematical problems and become a reference for educators and researchers in developing and improving students' accuracy in learning and solving mathematical problems.

2 Student Accuracy

Accuracy is the main accuracy or thoroughness of a person in doing something. Accuracy allows one's work and results to be more thorough, neat and accurate (Sheneamer 2021). Based on this definition, we can say that accuracy is the most important that must be owned by students, because this fundamental is used by students in studying a lesson, describing material concepts and working on questions during exams. Students who have low ability but have high accuracy, then the results of these students will be more than students who have high ability but low accuracy.

Accuracy students have a very important role that students must have, thus some previous researchers used various learning models to increase students' accuracy. Such as, the application of problem-based learning, cooperative script model, discovery learning, problem solving model, group investigation and others. Where the application of the discovery learning model can increase students' accuracy in doing exam questions and build reading skills (Setyaningsih and Utami 2021). Student learning outcomes based on the classical mastery cycle, where the increase in the percentage of student learning outcomes from the first cycle to the second cycle increased by 18.2%. Thus the application of the problem based learning model can increase the accuracy and student learning outcomes (Ashari et al. 2018; Nasution et al. 2018; Yoon et al. n.d.).

3 Methodology

This study uses a quantitative approach. The researcher carried out the learning process for twelve meetings based on the subject schedule and ended with the final semester exam. Furthermore, data collection from the intervention was carried out and carried out measurements.

3.1 Research Subject

The main sample in the study was students aged 16–18 years with a total of 72 students consisting of 18 male and 54 female in a private high school in Timor Leste which is located in the Capital of Timor Leste, Dili. A school founded by Religious Canossa with very good quality in Timor Leste. In the process of implementing the exam, the student's sitting position is arranged alphabetically by the name of the student with each code from 1–6 with different sequences alternately in different rooms.

3.2 Learning Implementation and Instrument

The learning model applied in learning is the conventional model and discussion. Educators fully facilitate the learning process. Process learning is more focused on mastering content and practice in problem solving. At each stage of problem solving the teacher invites students to discuss. Educators also provide practice questions after discussing sample questions. This is done with the aim of sharpening students' memory and understanding of the subject or sub-topic that has been conveyed.

In the exam researcher prepared 25 multiple choice test items with three diagnostic levels to measure students' mathematical understanding. This research focuses on students majoring in science and technology. The exam will take place on March 6, 2022, 25 multiple-choice questions that are done for 60 min during the exam.

3.3 Research Framework

The type of research used in this research is quantitative research using descriptive quantitative research type (Davies 2011; Reale 2013). More specifically, the descriptive quantitative method used in this research is case study method. The type of data used in this research is quantitative data that can be used. Measured or calculated directly, in the form of information or explanations expressed in numbers or figures. While the source of data in this study is primary data. Thus, quantitative data in the form of primary data needed in this study is the data on student results for the final semester assessment exam for the 2021/2022 school year.

3.4 Data Analysis Techniques

The technique of analyzing quantitative data obtained from the results of the end semester assessment exam in mathematics subjects is using the Rasch Model through the Winstep v5.4.2 software (Sumintono 2018). The Rasch model uses the principle of probability for each available choice which in classical test theory is prioritized on the total score of the results of the exam or questionnaire (Chao et al. 2018; Ibrahim et al. 2012). The result is a new unit called logit (log odd unit) which shows the students ability and difficulty of item, so that later from the logit value obtained, it can be concluded that the level of success of students in solving on the question really depend on the level of ability and level of difficult or the question or problem. For the data i the form of a dichotomy, Rasch modeling combines an algorithm that expresses the results of probabilistic expectations of item and respondent which is mathematically expressed

through the following outputs tables Table 1.0 Variable (Wright) maps, Table 17.0 person measure, Table 22.0 scalograms, which is mathematically expressed as:

$$P_{ni}\left(x_{ni} = \frac{1}{\beta_n}, {}^{\delta_i}\right) = \frac{e^{\beta^n - \delta^n}}{1 + e^{\beta^n - \delta^n}}$$

P is the probability of respondent in item to produce a correct answer () with the respondent's ability, and difficulty level of item.

4 Result and Finding

4.1 Wright Map (Person-Item)

Bloom's taxonomy which was initiated by Benjamin Bloom can be interpreted as a hierarchical structure that identifies skills from the lowest level to the highest level. This theory has had a lot of influence on the education sector from century to century until now and has undergone various revisions. Bloom views that items or questions such as asking or memorizing are still included in the category of the lowest cognitive level. Because the cognitive level starts from memorizing, understanding, applying, analyzing, evaluating and synthesizing. The levels of the cognitive domain can assist teachers in giving questions and evaluating students so that teachers can find out how far the cognitive level of students is.

Analysis of students' cognitive level can be done by using Winstep Table 1.0 software. Item person map (or Wright Map) is a tool for measuring the Rasch model. This software presents a map that describes the student's ability and level of difficulty using a logit ruler that provides information about test results. On the left side shows the distribution of students' abilities in solving math problems at the end of the semester from lower to higher ability students while on the right side shows the distribution of questions from the easiest to the most difficult questions (Iramaneerat, Smith, and Smith, 2008). The results of Winstep Table 1.0 are presented in Fig. 1. On the left side of the wright person, it is shown that there are four students with code 1DBF 2VEF 3CLF 5DRM which are students who have a high level of thinking ability while code 6EGF are students who have a very low level of thinking ability. On the right side of the Wright item, we can describe that the most difficult question is question number 11 and the easiest question is question number 3.

Based on Bloom's taxonomy theory, there are 6 cognitive stages of students, in the wright person item (Fig. 1) we can see that there are 68% of the question positions in the understanding, applying and analyzing stages while most students around 77% who are in that position are actually 77% of these students get the correct results but the results of the students' answers are mostly wrong. Thus, by using the Rasch model, we can see that most students do not have accuracy in solving problems. The results of students' inaccuracy can be seen clearly in the following scalogram (Fig. 1).

4.2 Scalogram

Students with codes 2DSF, 4GDM, 2UAM, 2EAF have the same ability as four students who have a high level of thinking ability. However, the four students were less careful in

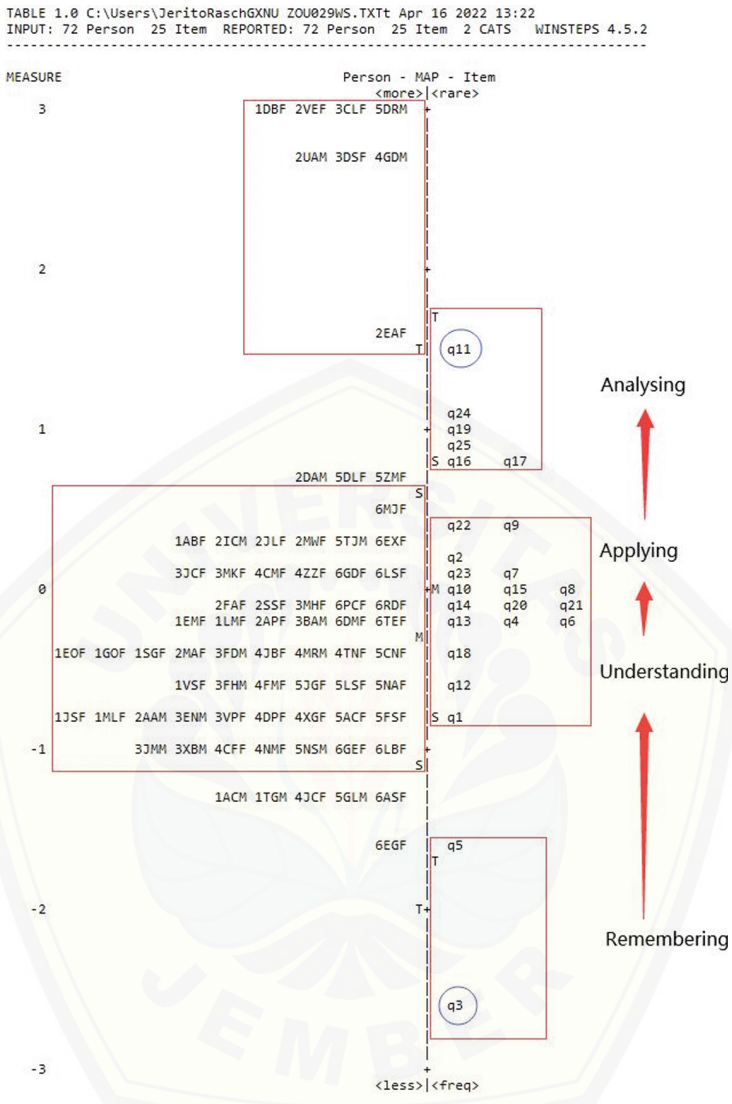

Fig. 1. Scalogram for students accuracy

solving the questions. Therefore, these students still make many mistakes in answering the easiest questions from the hardest, as well as several other students such as student codes 2DAM, 5DSLF, 5ZMF. 6MJF…..1TGM AND 6EGF. Thus, by using the Rasch model, it can be seen that there are 51 female students out of 54 female students with a percentage of 71% who are not careful in solving math problems during the exam while there are 17 male students out of a total of 18 male students who not thorough in solving math problems during the exam as well as in Fig. 2.

Fig. 2. Output of Winstep Table 22.1 Scalogram

Likewise, in Table 22.1 of the scalogram, we can see that students who have the lowest abilities are not students who are in the last position with a student code of 6EGF. From some of these students who were only able to answer 5–9 questions out of 25 questions correctly, they could be categorized as low-ability students. The students with low thinking ability can be described as follows: students with code 5GLM, 4JCF, 6ASF, 1ACM, 4CFF, 3XBM, 1JSF, 1MLF, 1VSF. Figure 1 shows that the easiest question is question number 3 because it was only answered incorrectly by 7 students or about 97.2% of students who answered correctly. While the most difficult question is question number 11 because there are only 16 students who answered correctly or about 78% of all students answered incorrectly.

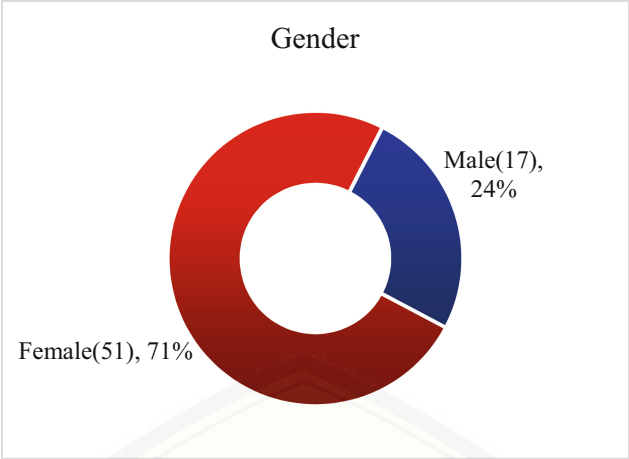

Fig. 3. Gender accuracy

5 Conclusion

Based on the objectives of this study, it is expected to provide an overview of the identification of the level of accuracy of students in the process of solving mathematical problems and become a reference for educators and researchers in developing and improving students' accuracy in learning and solving mathematical problems. In the wright person and item, we can conclude that there are 68% of the question positions at the understanding, applying and analyzing stage, while most students around 77% are in that position, so actually 77% of the students got the correct results but most of the students' answers were wrong. Wrong. Thus, by using the Rasch model, we can see that most students do not have accuracy in solving problems. On a scalogram that shows a systematic response pattern between test takers (sorted from high ability to low vertically, top to bottom) and items (ordered from easy to difficult horizontally, from left to right). The results of the research above, it can be observed that with the use of the Rasch model, it can be concluded that there are 51 female students out of 54 female students with a percentage of 71% who are not careful in solving math problems at the end of the semester while there are 17 male students out of the total. a total of 18 male students who were not thorough in solving the questions. Thus, the use of the Winstep Rasch analysis model can find out students who are smart by solving problems with full accuracy, students who are smart but not careful in working on questions, students whose results are correct at random, students who copy each other, answers that don't make sense.

Based on the results of the analysis and conclusions above, it can be suggested to pre-service teachers, teachers and lecturers to validate the constructs before the exam by using the Rasch model analysis because the Rasch modeling application in the student formative exam with Rasch has many advantages because it utilizes measurement accuracy. This can be used for detecting students' accuracy in solving problems, quality of questions, as well as detection of individual abilities and so on.

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