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A New Decade for Social Changes
Students' Numeracy Literacy Ability through the Implementation of Problem-Based Learning and STEM Approach

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Abstract. This research describes the numeracy literacy abilities of students from the Mathematics Department, Faculty of Mathematics and Natural Sciences, Gorontalo State University in solving problems in the MNA and Boundary Conditions courses. The results of the research show that the numeracy skills of students from the Mathematics Department at Gorontalo State University who program the MNA and Boundary Conditions courses in solving mathematical problems are sufficient in using various kinds of numbers or symbols to solve daily life problems and analyzing information displayed in various forms such as graphs, tables, charts, diagrams and so on. In general, the results of this analysis cannot be used by students to predict and make appropriate decisions. This is shown in the results that only 11.84% of students were able to use various kinds of numbers and symbols in the first question, 21.05% of students were able to analyze information displayed in various forms and only 9.21% had the ability to interpret all question analyzes to take the right decision.

Keywords. Numeracy Literacy, Problem Based-Learning, STEM Approach

INTRODUCTION
Mathematics learning is currently facing global challenges in preparing students' needs in the 21st century. One of them is numeracy literacy. Numeracy literacy skills are core skills that are very important in the concept of 21st century education (Gun and Smith, 2011), and are important for every individual to succeed in various aspects of their life. Education in the 21st century must be able to guarantee that students have learning and innovation skills, skills in using and utilizing technology and information media, can work and survive using life skills, the ability to identify relevant information or the problems they face, analyzing, prioritizing the most relevant information or the most appropriate alternative solutions (literacy) and the ability to reason using concepts, procedures, facts and mathematical tools to solve problems related to oneself, the immediate environment, the surrounding community and global society (numeracy) (Naibaho, Simangunsong, Sihombing, 2022).

However, in reality, numeracy literacy is still the main challenge in basic mathematics education and is the main issue and trend in mathematics education research (Murtiyasa, 2016). Various surveys at national and international levels show that there has not been a significant increase and in fact tends to decrease. This is shown in one way by the PISA results which have
been followed since 2000 with the results always being in the top 10 from the bottom. The 2018 PISA results, for example, in the reading ability category, Indonesia is ranked 6th from the bottom (74th) with an average score of 371, down from 64th in 2015. In the mathematics category, Indonesia is ranked 7th from the bottom (73) with an average score of 379, down from 63rd in 2015. Meanwhile in the science performance category, Indonesia is ranked 9th from the bottom (71), namely with an average score of 396, down from 62nd in 2015. (Schleicher, 2019: 5). It is possible that the low literacy of 15 year old students in Indonesia is the impact of less effective learning at school (Firdaus, Wahyudin, & Herman, 2017: 213). This fact highlights the need for improvements in the Indonesian education system in terms of mathematics learning. Although there have been several efforts to improve the curriculum and mathematics learning methods in Indonesia, there is still room for making further improvements and developing learning innovations.

One of the innovations in mathematics learning is through the development of Problem Based Learning (PBL) and the STEM Approach. Some of the reasons underlying the development of PBL and STEM Approach are as follows:

1. Improves critical thinking skills: PBL emphasizes problem solving which encourages students to think critically, analyze information, and develop solutions. This helps students develop deep thinking skills, which are especially important in the STEM Approach, where complex problem solving is common.

2. Relevance of content: PBL ensures that learning has direct relevance to the real world. Students face problems that are often related to everyday life or real problems and are related to science, technology and engineering.

3. Collaboration and social skills: PBL encourages teamwork, communication, and other skills. In the STEM Approach, collaboration between various disciplines is often required to solve problems, this social skill is very valuable.

4. Active learning: in PBL students are actively involved in the learning process. They identify problems, search for information, and develop solutions, which is a much deeper process than passively receiving knowledge. This can help students understand and remember the material better.

**Theoretical Review**

2.1 Problem Based-Learning

Problem Based Learning is a student-centered learning method that aims to develop problem solving skills through independent learning as a lifelong habit and teamwork skills (Ali, 2019). The Curriculum and Learning Team of the Directorate General of Higher Education also provides the following definition of Problem Based Learning (PBL). PBL is learning by utilizing problems and students must search/excavate information (inquiry) to be able to solve the problem. In general, there are four steps that students need to take in PBL, namely: (a) Receiving problems that are relevant to one/several of the competencies required by the course, from the lecturer; (b) Search for relevant data and information to solve problems; (c) Organize data and relate data to problems; and (d) Analyzing PBL problem solving strategies is learning by utilizing problems and students must search/excavate information (inquiry) to be able to solve the problem.

According to Arends (1997: 156), the problem-based learning model is used in developing higher levels of thinking in problem-oriented situations, including learning how to learn. This learning model refers to other learning such as project based learning (Project Based...
Instruction), learning based on experience (Experienced Based Instruction), authentic learning (Authentic Instruction) and learning rooted in real life (Anchored Instruction).

Problem-based learning according to Ibrahim (2005: 5-6) is defined as a learning model that uses problems as a starting point for acquiring new knowledge. Students learn to use certain authentic problems to learn lesson content and vice versa students also learn specific skills to solve problems using lesson content tools.

Furthermore, Arends (1997: 288) stated that the problem-based learning model is a learning model with a student learning approach to authentic problems so that students can construct their own knowledge, develop higher skills and inquiry, make students independent, and increase their own self-confidence. This refers to Piaget's theory. Piaget explained that young children have an innate curiosity and are constantly understanding the world around them. According to Piaget, this curiosity motivates them to actively build their understanding of the environment they live in. On the basis of Piaget's theory, a problem-based learning model was developed.

This model functions to stimulate higher level thinking in problem-oriented situations, including how to learn. In this learning model, the teacher plays a role in presenting problems, asking questions, and facilitating investigations and dialogue. More importantly, teachers carry out scaffolding (as a process in which a student is helped to solve certain problems beyond their developmental capacity from teachers or other people who have more abilities), a support framework that enriches inquiry and intellectual growth (Ibrahim and Nur, 2000: 22).

From the opinion above, the author concludes that the problem-based learning model is a learning model that uses authentic problems to construct one's own knowledge, develop higher skills and inquiry, make students independent, and increase self-confidence.

2.2 STEM Approach

The STEM approach initially emerged as a response to the need for skilled workers in the fields of science and technology. In the 1990s to early 2000s there was increasing awareness of the importance of preparing students for careers in science and technology. Initially, the idea of a STEM approach emerged at the university level and several schools that focused on science and technology. Organizations and educational institutions then began to realize the need to integrate STEm to improve students' skills. Several countries, especially the United States, have begun to encourage STEM approaches at the national level as part of efforts to increase economic competitiveness. These national programs and initiatives introduced STEM learning in schools. STEM is starting to gain international recognition as a learning model that can improve students' skills and prepare them for the demands of the world of work. The STEM approach continues to evolve over time with various research, initiatives and educational policy changes aimed at improving quality and preparing students for future challenges.

STEM is an integration between four pillars of scientific disciplines, namely knowledge, technology, engineering and mathematics in an interdisciplinary approach and is applied based on real-world contexts and problem-based learning. In STEM learning, skills and knowledge are learned simultaneously by students. The STEM approach in the field of education aims to prepare students to be competitive and ready to work in their field of expertise. The four aspects of STEM have benefits for training students' character:

1. Science, children gain knowledge about applicable natural laws and concepts. This is very good for increasing scientific insight.
2. Technology, children learn to organize, socialize, and use creativity in designing. Students become creative, more socially minded and have noble character.
3. Engineering, children learn how to solve problems regularly. Students become competent and responsible.
4. Mathematics, children will be trained in many things and skills. Starting from solving problems, being thorough, patient, honest, disciplined, critical thinking and so on.

   The STEM approach is a learning method that integrates the four scientific disciplines together. The goal of the STEM approach is to develop critical thinking, creativity and problem-solving skills in students, so that they can face real-world challenges.

   The following are some basic concepts in the theory of the STEM Approach:

1. Integration of Scientific Disciplines. The STEM approach integrates science, technology, engineering, and mathematics into a coherent and integrated curriculum. Combining concepts from these four disciplines helps students see connections between fields and apply their knowledge in practical contexts.
2. Project Based Learning: Learning in STEM often occurs through real-world projects that require the application of scientific and mathematical concepts. Students are given the opportunity to work together, identify problems, and design solutions using STEM skills.
3. Problem Solving Oriented: The STEM approach emphasizes the development of problem-solving skills. Students are invited to identify problems, formulate questions, and develop solutions through critical and creative thinking.
4. Active Student Involvement: Students are involved in the learning process by conducting experiments, observations, and applying theoretical concepts to real-world situations. Learning involves the hands, minds, and overall involvement of students.
5. Use of Technology: Technology is used as a tool in the STEM approach to support learning and provide students with practical experience in using modern technology.
6. Soft Skills Development: In addition to technical skills, the STEM approach also emphasizes the development of soft skills such as teamwork, communication, and leadership.

The STEM approach aims to create a learning environment that is relevant to the real world, prepares students to face global demands, and encourages their interest in STEM careers. This approach provides opportunities for students to develop a deep understanding of scientific and mathematical concepts as well as skills that can be applied in everyday life and in future careers.

2.3 Numeracy Literacy
PISA defines three categories of processes in mathematical literacy: formulating situations mathematically; use mathematical concepts, facts, procedures and reasoning; and interpreting, applying and evaluating mathematical results. They describe what students do to connect the problem context to the mathematics involved and thereby solve the problem. These three processes each refer to seven basic mathematical abilities, namely communicating; mathematization; representation; reasoning and argumentation; designing strategies to solve problems; use symbolic, formal and technical language and operations; and using mathematical tools. All of these abilities utilize students’ detailed mathematical knowledge.

The Program for International Student Assessment (PISA) also has digital competency standards set to measure students’ abilities in mathematical literacy. PISA is an international assessment program organized by the Organization for Economic Co-operation and Development (OECD) and carried out on students aged 15 years. The following are several aspects of competency measured in PISA:
1. Numbers This content covers the representation, sequence properties, and operations of various types of numbers (whole, whole, fractional, decimal).

2. Geometry and Measurement, this content covers getting to know flat shapes and using volume and surface area in everyday life. Apart from that, this content also assesses students' understanding of measuring length, weight, time, volume and discharge, as well as area units using standard units.

3. Data and Uncertainty, this content includes understanding, interpreting and presenting data and opportunities

PISA also determines the level of students' mathematical literacy abilities (OECD, 2015; OECD, 2016), namely:

- **Level 1**: Students are able to answer questions with a general context and all relevant information is clearly provided. Able to identify information and receive all instructions based on clear instructions in the existing situation. Able to demonstrate an action according to the given simulation.
- **Level 2**: Students are able to interpret and recognize situations with contexts that require direct conclusions. Able to sort relevant information from a single source and use a single presentation method. Able to work on basic algorithms, use formulas, carry out procedures or agreements in solving problems. Able to draw conclusions accurately from the results of the solution.
- **Level 3**: Students are able to carry out procedures clearly, including procedures that require sequential decisions. Able to choose and apply simple problem solving strategies. Able to interpret and use representations based on different information. Able to explain based on the results of their interpretation and reasons.
- **Level 4**: is able to use certain methods effectively in complex but concrete situations that may involve obstacles or making assumptions. Able to select and use different representations including symbols. Able to use skills and knowledge in a clear context. Able to explain their opinions based on their understanding, reasons and formulations.
- **Level 5**: able to develop and work with models for complex situations, identify problems and establish assumptions. Able to select, compare and evaluate strategies to solve complex problems related to models. Able to use thinking and reasoning and correctly relate symbolic representations to the situation at hand. Able to describe and formulate the results of his work.
- **Level 6**: able to conceptualize, generalize and use information based on research and modeling in complex situations. Able to connect and translate different information sources flexibly. Able to apply their understanding by mastering symbols and mathematical operations, developing new strategies and approaches in dealing with new situations. Able to formulate the results of his work correctly by considering his findings, interpretations, opinions and accuracy in real situations.

**Research Methods**

This research is research that uses qualitative descriptive methods that describe students' abilities in solving mathematical problems. This research was carried out in the Mathematics Education study program, Department of Mathematics, Faculty of Mathematics and Natural Sciences, Gorontalo State University, Academic Year 2022/2023 using two instruments, namely tests and interviews. The test was carried out on 23 students who were programming the MNA and Boundary Requirements courses and the researchers also conducted interviews with the lecturers implementing the courses.
The test developed in this research is a numeracy literacy ability test which consists of 4 objects, namely Geometry, Data and Uncertainty, Algebra and Numbers where each object is developed in 1 question. Thus, the total number of questions is 4 essay questions. This initial test was carried out on November 10, 2023 with a total of 23 students participating in the Mathematics Department, Mathematics Education Study Program, who program MNA courses and Boundary Requirements.

Question 1 Numbers: Cantrang is a fishing tool that is operated at the bottom of the water. In its use the cantrang is towed by a ship. In 2021, the government officially issued a new regulation regarding the prohibition of fishing gear that does not support the ecology of the Republic of Indonesia's seas, one of which is the cantrang. According to the Ministry of Maritime Affairs and Water Affairs (KKP), cantrang catches are increasingly dominated by small fish that are not yet suitable for catching, thereby destroying the marine ecosystem.

The following is a series of developments in cantrang operations:

<table>
<thead>
<tr>
<th></th>
<th>Before 1990</th>
<th>1990-2010</th>
<th>After 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large cantrang tugboat</td>
<td>5 GT, cantrang pulled by pulley</td>
<td>4 times more than before, ships began to be equipped with engines</td>
<td>More than 30 GT, equipped with fish cooling machines</td>
</tr>
<tr>
<td>Number of ships cantrang in Indonesian waters</td>
<td>1,360 ships</td>
<td>5,100 ships</td>
<td>2.6 times more than before</td>
</tr>
</tbody>
</table>

Note: GT (Gross Tonnage) is a unit of measurement that shows the volume of a ship, 1 GT = 2.83 m³

Another reason for issuing the ban on cantrang is that the cantrang rope has been modified to become longer. This causes the netted sea area to become wider.

<table>
<thead>
<tr>
<th>Cantrang rope size (in meters)</th>
<th>Length of the area covered (in meters)</th>
<th>Area covered (in hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000</td>
<td>320</td>
<td>8</td>
</tr>
<tr>
<td>1,500</td>
<td>480</td>
<td>24</td>
</tr>
<tr>
<td>3,000</td>
<td>960</td>
<td>72</td>
</tr>
<tr>
<td>6,000</td>
<td>1,920</td>
<td>198</td>
</tr>
</tbody>
</table>

Note: 1 hectare = 10⁴ square meters

Based on the data provided, determine the size of the cantrang rope with the area that can be netted with the rope if the fisherman uses a rope 10³ meters long.

Question 2 Algebra

During the Independence Day celebration, a food bazaar was held in the sub-district office parking lot. One of the stands participating in the bazaar was the Creative Youth stand which sold dumplings, cuankie meatballs, batagor, and several kinds of fresh drinks. These various foods and drinks are sold in several types of packages. The following is the price of each food and drink package sold.

| Meal package price list | Package A | 1 serving of dumplings | 1 serving of Batagor | Rp. 30,000.00 |
From the price list for the food packages provided, determine the price per portion of food and the biggest profit from the three food packages.

<table>
<thead>
<tr>
<th>Package B</th>
<th>1 serving of dumplings</th>
<th>1 portion of Meatballs</th>
<th>Rp. 32,000.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package C</td>
<td>1 serving of dumplings</td>
<td>1 serving batagor</td>
<td>1 portion of meatballs</td>
</tr>
</tbody>
</table>

Question 3 Geometry:
It is known that there are 2 types of water pumps that will be used to consider filling a pond.

<table>
<thead>
<tr>
<th>Product Specifications</th>
<th>Pump A</th>
<th>Pump B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical power</td>
<td>125 W</td>
<td>125 W</td>
</tr>
<tr>
<td>Suction power</td>
<td>9 meters (max)</td>
<td>9 meters (max)</td>
</tr>
<tr>
<td>Thrust</td>
<td>31 meters (max)</td>
<td>18 meters (max)</td>
</tr>
<tr>
<td>Water discharge</td>
<td>36 liters/minute</td>
<td>30 liters/minute</td>
</tr>
</tbody>
</table>

Determine the volume of water that enters the pool in 1.m hour.

Problem 4 data and uncertainty:
Badminton is a sport that is contested in competitions. Competition levels range from local to international.
In a badminton competition, there are 8 remaining participants from various countries in the quarterfinals. There are several rules for participants to advance to the semi-finals and finals, namely: Participants who get a bigger set of wins will win and enter the semi-finals. Group I and Group II participants who win in the semi-finals will compete in the final.

The following is data on the number of sets won in the quarterfinals:

<table>
<thead>
<tr>
<th>Group</th>
<th>Participant</th>
<th>Number of winning sets</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>A</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>0</td>
</tr>
<tr>
<td>II</td>
<td>E</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>2</td>
</tr>
</tbody>
</table>

what is the probability that participant A meets participant F in the final.

These four questions were given to 23 students who were research subjects. They were given 60 minutes to answer the questions. Student answers were analyzed based on the following numeracy indicators.
Table 1: Numeracy Ability Assessment

<table>
<thead>
<tr>
<th>No</th>
<th>Numeracy Literacy</th>
<th>10</th>
<th>20</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Capable use various kinds of numbers or symbols associated with basic mathematic in completing life problems daily.</td>
<td>Students not yet Able to use various kinds of numbers or symbols Which related to mathematics base in completing life problems everyday and answers wrong ending.</td>
<td>Enough students Able to use various kinds of numbers or symbols associated with basic mathematic in completing life problems everyday with final answer is correct.</td>
<td>Students can use various numbers or symbol in completing problem everyday life with the final answer Correct.</td>
</tr>
<tr>
<td>2</td>
<td>Capable analyze information that shown in various shapes (graphs, tables, charts, diagrams and others etc).</td>
<td>Students not yet Able to analyze information that shown in various forms (graphics, tables, charts, diagrams and others)</td>
<td>Enough students Able to analyze information that shown in various shapes (graphs, tables, charts, diagrams and others etc).</td>
<td>Students are capable analyze information is displayed in various forms (graphs, tables, charts, diagrams and others etc).</td>
</tr>
<tr>
<td>3</td>
<td>Interpret the results the analysis to predict and take decision</td>
<td>Has not been able to interpret the results the analysis to predict and make decisions appropriately .</td>
<td>Able to interpret Some analysis results to predict and make decisions appropriately.</td>
<td>Able to interpret all analysis results the to predict and make a decision appropriately</td>
</tr>
</tbody>
</table>

Results And Discussion

Ability to convey ideas effectively, analyze, give reasons, formulate, solving, and interpreting mathematical problems in various forms and situations is a numeracy ability. This means that numeracy ability is the ability to use number concepts and skills in arithmetic operations in everyday life (for example, in household life, work, society or in the country) and the ability to interpret quantitative information that exists around us. This can be proven by the individual's comfort with numbers and ability to use mathematical skills practically in everyday life. This ability can also be seen in the individual's level of appreciation and understanding of information presented mathematically (in the form of graphs, tables, charts and others).

The following are the results of the analysis of the numeracy abilities of students from the Mathematics Education Study Program in solving mathematical problems based on a summary of the results of problem solving on 4 questions using numeracy indicators:
Based on Figure 4.1, in the field of Geometry there were 5 students who got a score of 10, 6 people got a score of 20 and 12 people got a score of 30. In the field of Algebra there was 1 person who got a score of 0, 8 people got a score of 10, 12 people got a score of 20, and 2 people got a score of 20, people got a score of 30. In the field of Numbers there were 7 people who got a score of 10, 12 people got a score of 20, and 4 people got a score of 30. In the field of data and uncertainty there were 4 people who got a score of 10, 11 people got a score of 20 and 8 people got a score 30.

Apart from tests, this observation also included tracking of learning carried out by lecturers who gave courses

Question 1: What are the MK MNA Learning Objectives and Boundary Conditions

Answer:
The course "Initial Value Problems and Boundary Conditions" usually aims to provide students with an in-depth understanding of basic concepts in calculus, especially those related to initial values and boundary conditions. Some learning objectives generally associated with this course involve: Understanding the Concept of Initial Value: Understanding the concept of initial value in the context of ordinary differential equations. Students are taught how to determine the solution to a differential equation using initial conditions given at a point. Understanding the Concept of Boundary Conditions (Boundary Value): Understand how to solve partial differential equations using boundary conditions. This involves applying concepts such as boundary solutions and boundary conditions to independent variables. Solving Differential Equations: Know the techniques for solving differential equations, both ordinary differentials and partial differentials. Able to apply numerical methods to find solutions to differential equations, especially in complex initial conditions and boundary conditions. Use of Software and Tools: Able to use mathematical software or numerical computing tools to solve initial value and boundary condition problems. Know the advantages and limitations of the various numerical methods used. Application of Concepts to Real Problem Contexts: Able to apply the concepts of initial values and boundary conditions to modeling physics problems or other real world problems. Develop the ability to formulate problems in the form of differential equations and solve them using appropriate methods. Stability and Convergence Analysis: Understand...
the concept of solution stability and convergence of numerical methods used in the context of initial value and boundary condition problems. Understanding basic theory: Understand the basic theory behind the methods used in solving differential equations. This course often forms the basis for a deeper understanding of mathematical analysis and its applications in various fields of science and technology.

Question 2: What strategies are used for MNA and Boundary Conditions lectures

Answer:

Effective strategies for lectures on Initial Value Problems and Boundary Conditions can include a variety of approaches to help students understand these concepts better. Here are some strategies to use:

- Conceptual Approach: Start by providing a strong conceptual understanding of what Initial Value Problems and Boundary Conditions are. Discuss the definition, purpose, and practical application of these concepts.
- Real Cases and Examples: Illustrate concepts with real case examples and applications in various disciplines. This can help students see the relevance and practical utility of Initial Value Problems and Boundary Conditions.
- Emphasis on Theory and Solution Methods: Explain the theory behind Initial Value Problems and Boundary Conditions in detail. Discuss the solution method and provide examples of its application in solving real problems.
- Problem Based Learning: A problem-based learning approach is also used by giving students real assignments or cases. This can help them apply the concepts they have learned in the context of real situations, but the implementation is not yet optimal.
- Visualization: Utilize visual tools such as diagrams, graphs, and animations to help students visualize complex concepts. The use of visualization can improve understanding and retention of information.
- Group Discussions: Facilitate group discussions in class to discuss complex issues. Group discussions can stimulate the exchange of ideas and better understanding between students.
- Use of Technology: Utilizes technology such as simulations and interactive software to provide students with hands-on experiences. This can help them engage in virtual experimentation and problem solving.
- Practice Questions: Provides varied practice questions and gradual levels of difficulty. This is expected to help students strengthen their understanding and improve problem-solving skills.
- Constructive Feedback: Provide constructive feedback on student work. This will hopefully help them understand their mistakes and improve their understanding of certain concepts.
- Projects or Case Studies: Provide projects or case studies that involve solving real problems related to Initial Value Problems and Boundary Conditions. This can improve problem-solving skills and application of concepts in a wider context.

Question 3: What obstacles are faced in MNA lectures and boundary conditions?

Answer:

The following are some obstacles that students may face:

- Difficulty Understanding Material: Students have difficulty understanding lecture material or certain concepts. This can be caused by the complexity of the material, the lecturer's teaching style, or a lack of basic understanding.
- Time and Task Management: High workloads and tight deadlines can be an obstacle. Students find it difficult to manage their time well to complete academic assignments and exams.
- Mental and Physical Health Issues: Poor mental and physical health can impact academic performance. Stress, anxiety, or physical health problems can be serious obstacles.
Resource Limitations: Some students face financial, technological, or access barriers to academic resources. This can affect their ability to attend lectures and complete assignments. Initial Grade and Cut-off Requirements Issues: If a student has problems with initial grades or does not meet the cut-off requirements to take a particular course, this can be a major obstacle. Maybe you need to do remedial work or find a solution so you can take the desired course. Technology Challenges: With the increasing use of technology in education, some students may experience technical difficulties, such as internet connection problems or an inability to use online learning platforms.

Question 4: How to measure individual student progress in numeracy literacy skills in lectures. Initial Grade Problems and Cutoff Conditions
Answer:
Measuring individual student progress in numeracy literacy skills, especially in the context of lectures on Initial Grade Problems and Limit Conditions, can be done through several evaluation methods. Here are some methods that can be used:
Written Exam: Give a written exam that covers various types of numeracy questions, including initial value problems and cut-off conditions. Exams may include multiple choice questions, open-ended questions, and problem solving.
Individual or Project Assignments: Provide individual assignments that require solving numerical problems, including application of initial value problem concepts and boundary conditions. The project may involve analyzing real cases or solving relevant mathematical problems.
Participation in Class Discussions: involves students in class discussions related to initial value issues and boundary conditions. Open questions and discussion are expected to help gauge their understanding of these concepts.
Oral Exam: In addition to the written exam, give an oral exam where students are asked to explain solving numerical problems and the concept of initial value problems and boundary conditions.
Homework or Practice Questions: Provide additional homework or practice questions that involve the application of the concept of initial value problems and boundary conditions. This is expected to help students practice independently.
Portfolio: Ask students to create a portfolio that includes their work related to initial value issues and boundary conditions. This portfolio may include assignments, projects, and problem solving that they completed during the course period.
Formative Exams: During the semester, formative exams or short quizzes are given to measure their understanding periodically. This can help detect difficulties or additional needs in learning.

Question 5: How do you ensure that the course Preliminary Value Problems and Boundary Conditions not only teaches numeracy skills but also promotes critical thinking and problem solving
Answer:
To ensure that learning the MNA and Boundary Conditions courses not only teaches numeracy skills but also promotes critical thinking and problem solving, lecturers integrate the following teaching methods and strategies:
Case Studies and Applications in Real Contexts: Insert case studies or real-world applications to demonstrate the relevance of MNA concepts and boundary conditions in everyday situations or specific fields. Encourage students to identify and analyze problems related to real life using the concepts learned.

Group Discussions: Facilitate group discussions to allow students to share their understanding of concepts and discuss various approaches to solving problems. Challenge students to think critically by asking questions that stimulate deep thinking.

Collaborative Projects: Provide collaborative projects in which students must apply the concepts of initial value problems and boundary conditions to solve real problems. Projects may include mathematical modeling, data analysis, or simulations that encourage critical thinking and problem solving. However, in implementation, there are still several obstacles.

Open Questions: Use open, complex questions to stimulate critical thinking. These questions should encourage students to relate the concepts they are learning to broader situations. Encourage students to develop mathematical arguments and provide logical reasons for their approaches.

Problem Solving by Steps: Teach students how to break down complex problems into smaller steps. Focus on understanding basic concepts first before engaging in more complex steps.

Critical Evaluation: Train students to evaluate their mathematical solutions critically, identifying weaknesses and thinking about ways to improve them. Teach them to consider the implications of mathematical solutions in a broader context.

Use of Technology: Utilize software or mathematical tools that can help students model, simulate, or solve problems visually. Encourage the use of technology as an aid, not a substitute for understanding concepts.

Conclusion
It is section where the conclusion reached through findings is presented and referring to similar studies about the same topic and discussions in literature. Cambria, 11 font, single line spacing, and first line indented 1cm, no space between paragraphs. It is section where the conclusion reached through findings is presented and referring to similar studies about the same topic and discussions in literature. Cambria, 11 font, single line spacing, and first line indented 1cm, no space between paragraphs.

After analyzing the results of students' answers to solving the third problem given questions, it can be concluded that in the first question the results were as high as 43.42% of students are less able to use various kinds of numbers or symbols to solve problems in the context of everyday life. This can be seen in errors in the use of symbols in solve the given problem. The answer to the first question also describes 44.74% quite capable of using numbers or symbols related to mathematics and only 11.84% were able to use numbers or symbols and can answer the end correctly. Wrong placement in the use of symbols often occurs due to several factors among others, as stated by (Widodo, 2016) that errors occur in several stages namely the first stage is errors of fact, errors due to habit, and errors in language interpretation; then the second stage is errors in concepts and facts, and the third stage is errors in principles and
procedure. If we look at the results of students' answers, students generally make interpretation errors symbol language. This is due to a history of mathematics learning experience and students have not been able to interpret the symbol as a whole as proven by (Matitaputy, 2018) in similar research.

Another contributing factor in the inability to use various kinds of numbers or symbols to solve problems in the context of everyday life, namely errors in principles and procedures solving mathematical problems that result in wrong answers. As research (Sarlina, 2015) revealed that the common causes of misconceptions come from students, teachers, books text, context and how to teach. So, student factors can come from various things, such as early conceptions, skills, developmental stages, interests, thinking patterns and friends. Teachers can cause misconceptions due to incompetence or poor relationships with students.

The results of the analysis on the second question, 34.21% of students were not able to carry out information analysis which are displayed in various graphs, tables, charts, diagrams and so on, while 44.74% is sufficient able to analyze information displayed in various graphs, tables, charts, diagrams and others etc. Only 21.5% of students have the ability to analyze various types of information graphs, tables, charts, diagrams and more. Information in image form is easier to analyze students rather than written or word forms. Because the visualization of mathematics in pictures is more makes it easier to solve mathematical problems. This is what is called a mathematical representation that representation is a configuration of something that can be expressed in several ways, such as: pictures, graphs, charts, symbols, and written text to help students communicate their thinking (Putri, Munandar and Zulkarnaen, 2021). There are 3 indicators of mathematical representation ability according to (NCTM, 2020), including: 1. Create and use representations (visuals, mathematical equations, words written) to communicate mathematical ideas. 2. Select, apply, and translate mathematical representations (visuals, mathematical equations, written words) to solve problems. 3. Using representations (visuals, mathematical equations, written words) to model and interpret physical, social, and mathematical phenomena.

In interpreting the results of the analysis on the third question, it shows that 56.58% of students have not Have the ability to interpret analysis results to predict and make decisions correct, and 34.21% of students already have the ability to interpret some of the results of the analysis to predict and make decisions correctly and only 9.21% of students have the ability to interpret all analysis results to predict and make informed decisions appropriate.

Based on these results, it can be concluded that the numeracy abilities of Mathematics department Gorontalo state University students are good in solving mathematics problems is sufficient the ability to use numbers or symbols related to mathematics to solve problems everyday life. Apart from that, PGMI students have quite the ability to carry out analysis information displayed in various forms of graphs, tables, charts, diagrams and others. However, in terms of In general, students do not have the ability to interpret the results of the analysis to make predictions and make the right decisions. This is in accordance with previous research by (Sri Hartatik, 2020) regarding the Numeracy Ability of PPG Elementary School Students in completing mathematics that most of them PPG elementary school students make many mistakes in writing numbers and symbols in solving math problems even though the meaning they want to convey is correct so it will cause misconceptions for those who read the results of solving their problems. This is confirmed by (Siagian, 2021) that confidence in learning teaching mathematics from prospective elementary school teachers, is more likely believe mathematics is static knowledge. So a formulation is needed to carry out construction towards the dynamics of mathematics learning. Because it only uses limited research instruments and
subjects, this research is still possible developed with other variables to explore the numeracy abilities of prospective teacher students madrasah ibtidaiyah in solving mathematical problems.

References


