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Numeracy Literacy Worksheet: Identifying High School Students' Needs In Mathematics Learning

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***Abstract*:**
This study aims to analyze the need for numeracy literacy worksheets by identifying students' needs in mathematics learning. This study uses a descriptive qualitative approach. The data in this study were obtained from the results of interviews with students and teachers. Test the validity of the data in this study using source triangulation and member checking. Data analysis techniques use interactive analysis techniques (data collection, data reduction, data presentation, and conclusions). The results of this study indicate that: 1) high and medium category high school students tend to have a need for numeracy literacy worksheets designed in the form of 3D games; 2) low category high school students tend not to want numeracy literacy worksheets but need ordinary mathematical worksheets designed in the form of 3D games. 3) High category students tend to need challenging and innovative worksheets, 4) Medium category students tend to need worksheets that emphasize the need for clear instructions, a variety of questions, and not too many numbers, while 5) Low category students tend to need worksheets with simple, clear, and easy-to-understand questions without long contexts.

Keywords: Gamification, Numeracy Literacy, Mathematics, High School Students, Worksheets,

Introduction

Numeracy literacy is one of the basic skills (Grawe, 2024) that every student needs to have (Laamena et al., 2024). This is because numeracy literacy affects cognitive development (Moruk & Sulisworo, 2024), especially for critical thinking skills (Laamena et al., 2024). Someone who has critical thinking skills can make better decisions (Nugroho et al., 2020). This shows that numeracy literacy also helps someone in making better decisions (Retamero et al., 2019) in every aspect of life (Basri et al., 2021). The importance of numeracy literacy skills causes every student to have good numeracy literacy skills to become adaptive individuals in living life (Hikamudin et al., 2023). The study indicates that numeracy literacy needs to be prioritised and achieved in learning (Pratiwi et al., 2024), especially mathematics learning. However, it is unfortunate that most students do not have good numeracy literacy skills (Grawe, 2024; Pancawardani et al., 2024; Fitrianingrum & Murtiyasa, 2023; Rakhmawati & Mustadi, 2022; Retamero et al., 2019; Ningrum et al., 2025; Setiawan et al., 2024; Rediani, 2024). This is in accordance with the results of interviews with 8 (eight) high

school mathematics teachers in North Lampung who stated that almost all students have poor numeracy literacy. This finding is reinforced by the results of a simulation conducted by high school students at five schools in North Lampung via the website https://pusmendik.kemdikbud.go.id/an/simulasi_akm. The simulation results showed that most students answered incorrectly and ran out of time to complete all the numeracy literacy questions.

The poor performance of students' numeracy and literacy skills indicates the need for serious efforts to strengthen them. One way to strengthen numeracy literacy is by designing worksheets that integrate numeracy literacy skills (Putriana et al., 2024). Worksheets are one of the teaching materials/learning media considered capable of helping to strengthen students' numeracy and literacy skills (Adiningsih et al., 2023; Oktaviana et al., 2024). Some worksheets that have been developed are considered quite satisfactory by some researchers for improving numeracy literacy skills (Adiningsih et al., 2023; Oktaviana et al., 2024), but in fact, they are still not optimal. One factor in the suboptimal improvement of numeracy literacy skills is because the existing worksheets are considered uninteresting to work on. This is based on an interview with a mathematics teacher who stated, "Schools have actually begun providing worksheets orientated toward strengthening numeracy and literacy skills, as outlined in training and available online. However, many students remain uninterested in completing them, resulting in low numerical literacy skills. Students struggle to understand texts and visualise geometric objects (Nugroho et al., 2024). The perception of text overload and the inadequacy of available geometric illustrations to comprehensively represent real objects cause this difficulty. One solution to overcome the difficulty in visualising geometric objects is to design worksheets that include interactive three-dimensional (3D) object simulations. This solution aligns with student expectations, as outlined in the survey results that served as the background for this research.

The survey used multiple-choice questions with open-ended options, allowing students to express their desires. Figure 1 shows the results of a survey conducted with 68 high school students from five different schools.

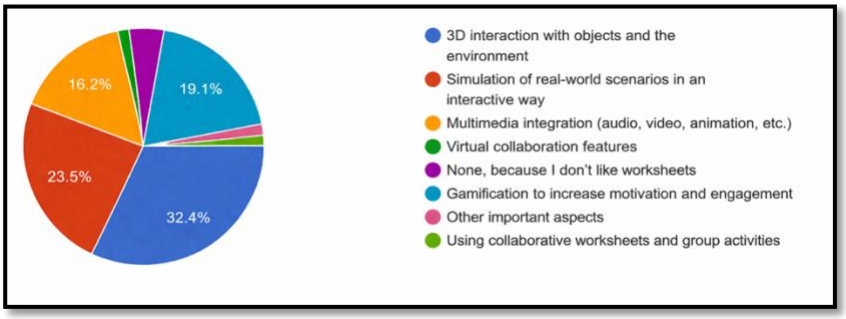

Figure 1. Worksheet expected by students

Figure 1 shows that there are 4 things about the worksheet that students want, namely 1) the existence of 3D interaction of objects and the environment; 2) the existence of interactive real-world scenario simulations; 3) gamification and 4) multimedia integration (audio, visual and animation). From the students' expectations, it is urgent to develop a mathematical worksheet that meets the 4 things that students want. Before developing the worksheet that students expect based on the results of the survey via Google Form, it is necessary to analyse more deeply the students' needs regarding worksheets to strengthen their numeracy literacy not only from the survey results but also from several other more detailed methods. Based on this, this article aims to analyse the need for numeracy literacy worksheets by identifying students' needs in mathematics learning. In this study, numeracy literacy worksheets are defined as worksheets designed to help students use mathematical concepts and skills in understanding, analysing, and solving problems related to real situations. The difference between numeracy literacy worksheets and regular math worksheets is the primary focus on problem-solving skills. Regular maths worksheets focus on practising calculations and applying formulas, while numeracy literacy worksheets focus on the ability to use mathematics to understand and solve real-life problems.

Research Methods

This study employed a descriptive qualitative research approach. Qualitative descriptive research is used because it aims to understand the phenomena of a subject holistically. Data were collected through both spoken and written words from the subjects (Husna et al., 2024). The subject selection technique used purposive sampling. The subjects consisted of eight mathematics teachers and 30 students from five schools: SMAN 1 Kotabumi, SMAN 3 Kotabumi, SMKN 1 Kotabumi, SMKN 3 Kotabumi, and SMAS Kemala Bhayangkari. From each school, six students were selected as research subjects, categorised as having high, medium, and low learning outcomes, with two students in each category. Student classification was based on summative mathematics assessment scores obtained from their mathematics teachers. High-score students were those with scores above 80, medium-score students were those with scores between 60 and 80, and low-score students were those with scores below 60. Table 1 provides additional information about the research subjects.

Table 1. Research Subject

School	Number of Students in Mathematics Learning Outcomes Category		
	High	Moderate	Low
SMAN 1 Kotabumi	2	2	2
SMAN 3 Kotabumi	2	2	2
SMKN 1 Kotabumi	2	2	2
SMKN 3 Kotabumi	2	2	2

School	Number of Students in Mathematics Learning Outcomes Category		
	High	Moderate	Low
SMAS Kemala Bhayangkari Kotabumi	2	2	2

Other criteria for research subjects included willingness to be interviewed and ability to communicate effectively. To facilitate the writing of this study, the subjects were coded as follows: Subject (S), High School (A), Vocational School (K), State (N), Private (S), High School (T), Medium (S), and Low (R), with the order of subjects in each category being 1 and 2. For example, the first subject was SMAN 1 Kotabumi in the High Category (SAN1T1); the second subject was SMAS Kemala Bhayangkari in the Low Category (SASR2); and the first subject was SMKN 3 Kotabumi in the Low Category (SKN3R2).

The data in this study were obtained from interviews with students and teachers. Interviews were conducted using semi-structured interview guidelines related to students' needs for numeracy literacy worksheets in mathematics learning. The validity of the data in this study was tested using source triangulation. Source triangulation was carried out by comparing data from student interviews with each other according to school and mathematics learning outcome category so that 2 students were selected for each category and school. (e.g., interview results for SAN1T1 compared with SAN1T2). In addition to source triangulation from one student to another, source triangulation was also carried out by comparing data from student interviews with interview results with teachers.

The data analysis technique for this research uses interactive data analysis techniques. The following is a chart explaining interactive data analysis techniques (Muinah et al., 2021).

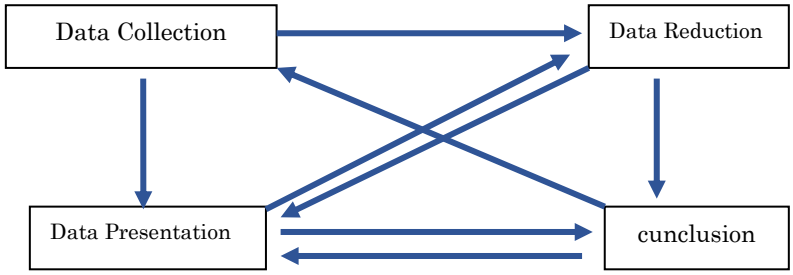

Figure 2. Interactive Data Analysis Model

Results and Discussions

The information presented must be arranged in sequence and accordance with the hierarchy of the theory. If you want to emphasise the results obtained, they should be presented in the form of other numbers; for example, percentages or differences. If you want to show the number in question, just refer to the table that contains it.

Discussions need to be written in clear language, and do not use sentences that are too long.

Based on the data obtained, the results obtained can be seen in tables 2 and 3 below.

Table 2. Worksheet Needs of Every School

School	Student Category		
	High	**Moderate**	**Low**
SMAN 1 Kotabumi	**Requirements for Display Structure and Learning Experience:** 1. Designed like a competitive game. 2. Present math problems in a real-world context.	**Requirements for Display Structure and Learning Experience:** 1. Designed like an ML game 2. Allow students to discuss and solve problems together. **Requirements for Cognitive Accessibility:** 1. Provide instructions and guidance in solving problems	**Display Structure Requirements** 1. Designed like ML and FF games **Cognitive Access Requirements:** 1. Contains to-the-point questions without lengthy and confusing introductions 2. Dislikes worksheets that contain story-based questions
SMAN 3 Kotabumi	**Requirements for Display Structure and Learning Experience:** 1. Designed like a game with a school setting. **Requirements for Cognitive Accessibility:** 1. Worksheets must be concise.	**Requirements for Display Structure and Learning Experience:** 1. Provide instructions and guidance in solving existing problems 2. Allow students to discuss and solve problems	**The Need for a Proportional Workload** 1. The time given to complete the worksheet is not too little.
SMAS Kemala Bhayangkari	**Requirements for Display Structure and Learning Experience:** 1. Designed like a school-themed game **The Need for Proportional Workload** 1. Worksheets with a wide variety of questions so you can practice without having to search for questions online	**Requirements for Display Structure and Learning Experience:** 1. Not monotonous on a sheet of paper **The Need for a Proportional Workload** 1. Only contain 3–5 questions 2. To be completed at school only and not as homework.	**The Need for a Proportional Workload** 1. Only include questions ranging from 1 to 5 items.

School	Student Category		
	High	Moderate	Low
SMKN 1 Kotabumi	**Display Structure and Learning Experience Requirements:** 1. Designed like a game that requires competition to collect points. 2. Math problems presented in a real-life context and with an adventure theme.	**Requirements for Display Structure and Learning Experience:** 1. Designed like a game like ML or Roblox **The Need for a Proportional Workload** 1. Only contain questions ranging from 1 to 5 items2. 2. To be completed at school only, not as homework.	**Requirements for Display Structure and Learning Experience:** 1. Designed like a game like Roblox
SMKN 3 Kotabumi	**Requirements for Display Structure and Learning Experience:** 1. Designed like a competitive game with a variety of attractive colors. 2. Math problems presented in a real-life context and with an adventure theme. **The Need for a Proportional Workload** 1. Math problems with a total of approximately 10-20.	**Display Structure and Learning Experience Requirements:** 1. Designed like a beach-themed adventure game and requiring competition to collect points.	**The Need for a Proportional Workload** 1. Contains only a few questions 2. To be done at home

Table 3. Worksheet Needs Based on Student Category.

Student Category	Worksheet Requirements	Interview Results Quotes
High	**Display Structure and Learning Experience Requirements:** 1. Designed like an adventure game. 2. Designed like a school-themed game with a variety of attractive colors. 3. Encourage competition in collecting points. 4. Present math problems in a real-world context. **Requirements for Ease of Cognitive Access:** 1. Challenging but not too long-winded.	"I want real-life or adventure-based problems like in Free Fire or Mobile Legends games." "I want colorful, school-themed ones to make it more interesting because I'm bored with black and white (blackboards or books)." "I want game-like math problems with points."

Student Category	Worksheet Requirements	Interview Results Quotes
	The Need for a Proportional Workload 1. Contain a large number of questions (10–20) and a variety of questions.	"I like story problems that require thinking, but I don't like long-winded ones." "I want lots of problems, 10 to 20, for practice at home."
	Display Structure and Learning Experience Requirements: 1. Designed like a beach-themed adventure game and requiring competition to collect points. 2. Designed like ML or Roblox. 3. Designed like a beach-themed game.	"I just like ML because you can level up, so it's challenging." "I'd like it to be like that game, like ML or Roblox." "I'd like a beach-themed game."
Moderate	**Requirements for Ease of Cognitive Access:** 1. Provide instructions and guidance in solving the problems.	"I'd like a worksheet with clear instructions."
	The Needs for a Proportional Workload. 1. Not contain many questions (only 1–5 questions). 2. To be completed at school and not as homework.	"I don't want too many questions, so it's not overwhelming. Just around 1 to 5." "It's better if the assignments can be done in class with teacher guidance."
	Display Structure and Learning Experience Requirements: 1. Designed like ML, FF, or Roblox games.	"I like it when questions are turned into games, like ML, if possible." "I like games like Roblox or FF."
	Requirements for Ease of Cognitive Access: 1. Contain to-the-point questions without lengthy and confusing introductions. 2. Dislike worksheets with story-based questions.	"I don't like long, straightforward questions. "I don't like confusing story questions."
Low	**The Needs for a Proportional Workload.** 1. Contain only a few questions (1 to 5). 2. To be completed at home.	"If there's a worksheet, keep the questions short, between 1 and 5." "I'd rather do them at home so I have more time."

Based on the results of tables 1 and 2, an overview is obtained regarding the worksheet needs of students in the high, medium and low categories.

1. Students in the High-Ability category

Students in the high-ability category prefer worksheets designed in the form of 3D games, such as Mobile Legends (ML) or similar games, as recommended by Lagmay et al. (2024). Lagmay et al. (2024) found that students prefer learning that integrates games, which can enhance their performance. High-ability students tend to prefer challenging and innovative questions, especially those related to numeracy literacy. They do not mind a relatively large number of questions (10–20), as long as they are clear, varied, and engaging. Most high-ability students also prefer math problems designed like games, scoring points after completion, and presenting abstract concepts in a concrete form.

These findings indicate that high-ability students are more prepared to accept challenges and require stimulation in the form of varied formats and presentations of learning media.

2. Students in the Moderate Category

Students in the moderate category also prefer worksheets designed in the form of 3D games, such as Mobile Legends (ML) or similar games, as recommended by Lagmay et al. (2024). Lagmay et al. (2024) stated that learning that integrates games is preferred by students and can improve student performance. However, students in this category prefer a small number of questions (3–5 questions). They do not show resistance to numeracy literacy but tend to still require assistance in understanding the material, such as clear instructions on the worksheet. Furthermore, students in the moderate category prefer varied, non-monotonous questions that they can work on in class.

Thus, the needs of students in the moderate category focus on questions that are simple, clear, and accompanied by guidance.

3. Students in the Low-Ability Category

Students in the low-ability category mostly prefer worksheets designed in the form of 3D games, such as Mobile Legends (ML) or similar games, although some do not include any math problems. Students in this category tend to prefer simple, few-question questions (1–5 questions). This supports Park's (2023) statement that low-ability students prefer structured and simple tasks. They tend to focus on completing tasks, often with minimal interaction, and avoid tasks that require creativity or deep thinking. They show resistance to lengthy numeracy or contextual literacy problems, as they perceive them confusing. Furthermore, they prefer worksheets that are colourful, attractive, and not monotonous. Therefore, low-ability students need simple, visual, and motivating worksheets.

Based on the description of the worksheet needs of students in the high, medium, and low categories, it is clear that all three categories generally prefer math worksheets designed in the form of games, such as Mobile Legends (ML) or similar games. Reyssier et al. (2022) stated that the use of game elements is favoured by students and

can increase positive attitudes toward mathematics. Comparing the categories, this study found a general pattern:

a) High students tend to seek challenges and desire innovation (game-based worksheets, points, and missions).
b) Medium students: Emphasise clear instructions, a variety of questions, and a moderate number of questions.
c) Low students require simple, clear, colourful, and straightforward-to-understand questions without lengthy context.

The differences in worksheet needs across categories indicate that learning media in the form of worksheets can be tailored to their needs, resulting in better results. Students in the low category can be given worksheets with easier questions. This practice is usually done by a teacher to overcome differences in categories (achievement) as stated by Schlag & Glock (2025), who stated that usually students with low achievement (minority) are given easier material so that they can understand.

Conclusions and Suggestions

This study concludes that: 1) High- and medium-level high school students need numeracy literacy worksheets designed in the form of 3D games; 2) low-level high school students do not want numeracy literacy worksheets but require regular maths worksheets designed in the form of 3D games. High-level students tend to need challenging and innovative worksheets; medium-level students need worksheets that emphasise clear instructions, a variety of questions, and a moderate number of questions. Low-level students need worksheets with simple, clear, and easy-to-understand questions without lengthy context.

Based on these findings, it is recommended that a math worksheet be developed with a differentiated 3D game design to suit student needs. Game-based worksheets with gradual levels of difficulty can be a solution based on needs. High-level students receive more challenges, medium-level students receive guidance in completing the work, and low-level students benefit from simple questions and attractive visual displays.

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