Development of Numeracy Problems with the Context of Bee Cultivation Activity for Junior High School Students

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Abstract. The minimum competency assessment evaluates the numeracy skills of Indonesian students, aiming to facilitate the development of personal skills for self-improvement and contribute positively to society. The low numeracy skills among students are the lack of familiarity and infrequent practice in solving numeracy problems. This study aimed to determine the characteristics of numeracy problems with a context of biodiversity conservation using the Research and Development (R&D) method by Tessmer. This model includes preliminary, self-evaluation, expert review, one-to-one, small group, and field tests. The subjects of this study were Year 7 students from one junior high school in Banda Aceh, Indonesia. This study developed 20 problems. The validity data result of the questions is 0.88 with valid criteria, and the practicality data result of the questions is 89.7% with highly practical criteria. Furthermore, the potential effect is obtained from the average student score (75.39), indicating good criteria. It can be stated that numeracy questions with a context of bee cultivation activity met the valid and practical criteria, and have a potential effect. Therefore, teachers can use these questions as instruments to improve students’ numeracy skills.

Keywords: biodiversity conservation, numeracy, sustainable development goals (SDGs)


Introduction

Education in the 21st century necessitates individuals to possess life skills, enabling them to adapt and confront life’s challenges (Gravemeijer, Stephan, Julie, Lin, & Ohtani, 2017; Hesse, Care, Buder, Sassenberg, & Griffin, 2015; Kay & Greenhill, 2011). A critical approach to cultivating these 21st-century life skills involves enhancing understanding, abilities, and competencies across various aspects of life (Rosa & Orey, 2015). To improve the quality of education, the government has introduced a new policy, as indicated in the circular letter of the Minister of Education and Culture No. 4 of 2020, which transitions from the National Examination to the National Assessment. The National Assessment (NA) is an evaluation program for the quality of formal education at the primary and secondary levels, encompassing

The AKM assesses the fundamental skills students require, enabling them to cultivate personal competencies for self-improvement and contribute positively to society (Mawaddah, Noorbaiti, Aulia, Eryanto, & Mahlina, 2022). AKM implementation evaluates cognitive learning outcomes, including reading, literacy, and numeracy (Kemendikbud, 2020). The term numeracy was introduced in the Crowther and Cockcroft Reports in the United Kingdom, meaning skills that enable a person to cope with the mathematical demands of everyday life and provide an understanding of information presented mathematically, for example in graphs, charts, tables with reference to increasing or decreasing percentages (Cockcroft, 1982). Numeracy skills refer to the capability or inclination to think critically about quantitative information (Gittens, 2015). These skills are cultivated through practical situations where individuals must handle information and resolve problems by engaging with mathematical content, ideas, or reasoning presented in diverse contexts (Jonas, 2018).

Numeracy should not be thought of as relating only to a simple or basic level of mathematical knowledge, but as a complex competency (Gal, Grotlüschen, Tout, & Kaiser, 2020). Understanding numeracy is one of the factors that influence well-being. Increasingly involving the need to be able to access, use, and apply various mathematical skills and knowledge in numeracy skills is something that every individual needs to prepare themselves to face the challenges of the 21st century (Rosa & Orey, 2015).

The Program for International Student Assessment (PISA) is designed to evaluate students' proficiency in science literacy, reading literacy, and mathematical literacy. Conducted every three years, PISA assesses the literacy of 15-year-olds. In 2015, Indonesian students had an average literacy score of 386, ranking 69 out of 72 countries (OECD, 2016), which then declined to 74 out of 79 countries in 2018 (OECD, 2019). The mathematical literacy skills assessed by PISA align with numeracy skills, evaluating an individual's capacity to apply mathematics in problem-solving across various societal contexts.

The numeracy skills of Indonesian students have been reported as relatively low (Fitra, Putri, & Susanti, 2018). Examining regional education profile data on the pusmenidik.kemdikbud.go.id website reveals that, in Aceh, students' numeracy skills fall below the minimum competency level. This indicates that less than 50% of students in Aceh have attained the minimum competency threshold. Mahmud and Pratiwi (2019) attribute the low numeracy skills to students' difficulties in counting, lack of exposure to non-routine problems, and infrequent practice in solving such problems (Ate & Lede, 2022). Undoubtedly, numeracy skills are important in professional and everyday life (Jain & Rogers, 2019; Sepúlveda,
Rodríguez, & Peake, 2020; Xiao, Barnard-Brak, Lan, & Burley, 2019). Additionally, fostering proficient numeracy skills aligns with sustainable development goals (Bellini, Crescentini, Zanolla, Cubico, Favretto, Faccincani, Ardolino, & Gianesini, 2019). Teachers’ and students' expressed need for supplementary problems underscores the demand for additional materials to enhance numeracy skills (Wulandari, Kurniati, Hikmah, & Wahidaturrahmi, 2023). Consequently, creating numeracy problems emerges as a viable solution, aiding students in mastering numeracy skills and providing tailored teaching materials to address specific learning needs.

The preparation of AKM numeracy problems on numeracy skills is based on PISA (Kemendikbud, 2020). AKM numeracy problems consist of three components: content, cognitive level, and context (Kemendikbud, 2020). Context is an important part of numeracy questions because context will be a stimulus that leads students to enter into these questions (Kurniawan, Budiarto, & Ekawati, 2022). As educators, teachers must adeptly select appropriate contexts for presenting mathematical problems integrated with students' immediate environment (Magen-Nagar, 2016). Problems encompassing diverse contexts presented in AKM are anticipated to be solved by students utilizing their numeracy skills (Kemendikbud, 2020). Therefore, contexts should be derived from situations, circumstances, and facts closely related to students' daily lives.

Real-world contexts offer tangible experiences for students, enhancing their competencies (Berisha & Bytyqi, 2020; Kilpatrick, Swafford, & Findell, 2001), rendering learning meaningful (Sullivan, Zevenbergen, & Mousley, 2003; Widjaja, 2013), improving students' literacy (Kaiser & Willander, 2005; Kolar & Hodnik, 2020), and boosting students' learning motivation (Clarke & Roche, 2018; Nyman, 2016). Various contexts can be seamlessly integrated into mathematics learning (Wijaya, den Heuvel-Panhuizen, Doorman, & Veldhuis, 2018), including the context of biodiversity conservation.

The study of biodiversity conservation presents an intriguing context. According to Indonesian Law No. 5 of 1990, biodiversity conservation involves managing biological natural resources wisely to ensure their continuity, maintaining and enhancing the quality and value of their diversity. Given Indonesia's current relatively high environmental threat level (Maskun, Assidiq, Mukarramah, & Bachril, 2021), biodiversity conservation efforts have become crucial. This is partly attributed to the lack of awareness among the local community about the environment, specifically their attitudes toward preserving it to maintain a balanced ecosystem. Utilizing the context of biodiversity conservation, it is anticipated that students will develop the capacity to address environmental issues, form positive attitudes and behavioral patterns
conducive to environmental well-being, and foster an awareness of the importance of biodiversity conservation.

Biodiversity refers to the ecological complex formed by living organisms, including animals, plants, microorganisms, the surrounding environment, and the combination of various ecological processes associated with them, such as ecosystem diversity, species diversity, and genetic diversity (Adom, Umachandran, Ziarati, & Sawicka, 2019). The study of biodiversity encompasses the systematic examination of various living organisms and the technologies by which biodiversity can be maintained and used sustainably for the benefit of humankind (Xu, Chau, Chen, Zhang, Li, Dietz, Wang, Winkler, Fan, Huang, Li, Wu, Herzberger, Tang, Hong, Li, & Liu, 2020). Bee cultivation activities are a crucial aspect of biodiversity conservation, with this study explicitly focusing on the context of bee cultivation activities. Aligned with the Sustainable Development Goals (SDGs), the mathematical problems associated with bee cultivation activities correspond to Goals 4 (Quality Education) and 8 (Decent Work and Economic Goals).


Numerous studies have been conducted on the development of numeracy problems for AKM. Purnomo, Sa’dijah, Hidayanto, Sisworo., Permadi, and Anwar (2022) developed a numeracy test instrument for AKM in Indonesia that meets valid, practical, and effective criteria. Yalcin (2019) explored gender-based differences in student competence in literacy, numeracy, and problem-solving. Aulia and Mutaqin (2022) developed AKM numeracy questions in the context of agriculture. Salsabila, Johar, and Yanti (2023) created AKM questions related to farmer activities. Fattahillah, Sriyati, and Amprasto (2023) developed a module based on Banyuwangi's custom ritual ethnobotany to enhance plant literacy and problem-solving regarding biodiversity. Mumu, Prahmana, Sabariah, Tanujaya, Bawole, Warami, and Manim (2021) researched students’ ability to solve mathematical problems in the context of environmental issues.

Based on the description above, it is evident that no research has developed AKM numeracy problems in the context of biodiversity conservation. Therefore, the problem
formulation in this study is: What are the characteristics of numeracy problems in the context of biodiversity conservation for Year 7 students that meet the criteria of being valid, practical, and having potential effects?

**Method**

This research is a Research and Development (R&D) research. The development model used was the development research proposed by Tessmer (1993), consisting of two stages: the preliminary stage and the formative evaluation stage. The formative stage consists of self-evaluation, expert review, one-to-one, small group, and field test stages. Figure 1 presents the stages of Tessmer’s (1993) development. This research was conducted at one of junior high school in Banda Aceh, Indonesia involving three students in the one-to-one stage, six students in the small group stage, and 27 students in the field test stage.

At the preliminary stage, several reference sources related to the study were assessed. After collecting related information and theories, the next step was determining the location and subjects for the trials at the school that became the research location. The next stage was self-evaluation. The activity carried out was to analyze the need for question development and the requirements for question development. This includes analyzing the provisions for preparing numeracy questions and determining the material and competencies required. The provisions can be found in books published by Pusmenjar (Center for Assessment and Learning), Kemendikbud (The Ministry of Education and Culture), and Kemendikbudristek (The Ministry of Education, Culture, Research, and Technology) regarding AKM numeracy. At this stage, outlines, numeracy question products, answer keys, scoring guidelines, and validation instruments used to validate the products being developed were also designed. The result of this stage is called prototype I.

The next stage was expert review to obtain input or suggestions from experts to improve the problems developed. The experts in this study consisted of two lecturers in the mathematics education study program, two mathematics teachers, and one biology teacher who carried out
assessments and analyzed the content, construct, and language parts of the problems so that they were declared valid and could be used for trials. The validation sheet for the problems or test items was adopted from Lewy, Zulkardi, and Aisyah (2009), as shown in Table 1.

Table 1. Components of validity test for test items

<table>
<thead>
<tr>
<th>Content</th>
<th>Construct</th>
<th>Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>The test items measure critical thinking skills in accordance with:</td>
<td>Test items are in accordance with the following supporting theories and criteria:</td>
<td>- Following EYD (revised spelling of Indonesian Language)</td>
</tr>
<tr>
<td>- Basic Competencies</td>
<td>- Developing the ability to analyze, evaluate and create</td>
<td>- test items are not complicated</td>
</tr>
<tr>
<td>- Indicators</td>
<td>- Rich in concepts</td>
<td>- Questions do not contain multiple interpretations</td>
</tr>
<tr>
<td>- Learning Objectives</td>
<td>- Appropriate to the grade level</td>
<td>- Question and answer boundaries are clear</td>
</tr>
<tr>
<td></td>
<td>- Inviting further concept development</td>
<td>- Uses common language</td>
</tr>
</tbody>
</table>

The assessment results from the experts were analyzed using Aiken's V (1985) formula. After the data were analyzed, conclusions were drawn according to the validity criteria. A question is valid if it is appropriate to measure the intended construct (Loevinger, 1957). Simultaneously with the expert review stage, a one-to-one stage was carried out, namely a trial by asking three students to work on the test developed. After doing the test, these students were asked to give their opinions regarding the test items.

The revised results of the expert review stage and the one-to-one stage were retested in small groups of six students. In addition, at the small group stage, a practical test of the items was also carried out by administering response questionnaires to students after they had worked on the test. According to Van den Akker (1999), practicality can be assessed based on the extent to which users perceive the product as easy to use and appealing under normal conditions. Bachman and Palmer (1996) asserted that a product is considered practical if it can be completed by test takers within a specified time limit, utilizing available human resources, and meeting existing material constraints. On the other hand, Luppy, Anwar, Linuhung, Agustina, and Rahmawati (2020) stated that if the results obtained are better than 60% then the product can be said to be practical. The criteria for practicality were adapted from Riduwan and Akdon (2013), as presented in Table 2.

Table 2. Practicality criteria

<table>
<thead>
<tr>
<th>Score Interval (%)</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 &lt; P ≤ 100</td>
<td>Very Practical</td>
</tr>
<tr>
<td>60 &lt; P ≤ 80</td>
<td>Practical</td>
</tr>
<tr>
<td>40 &lt; P ≤ 60</td>
<td>Quite Practical</td>
</tr>
<tr>
<td>20 &lt; P ≤ 40</td>
<td>Impractical</td>
</tr>
<tr>
<td>0 &lt; P ≤ 20</td>
<td>Very Impractical</td>
</tr>
</tbody>
</table>

The final stage was a field test on 27 students. The results of this trial were calculated to see the potential effects of the numeracy questions with a context of biodiversity conservation.
being developed. There are five levels of effectiveness in testing a product: participant response, participant learning, use of new knowledge and skills, learning outcomes, and organizational impact (Guskey, 2000). This study tested the potential effect of students' scores in doing the items. The criteria for student scores are in displayed in Table 3.

<table>
<thead>
<tr>
<th>Score</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>score = 100</td>
<td>Excellent</td>
</tr>
<tr>
<td>75 ≤ score &lt; 100</td>
<td>Good</td>
</tr>
<tr>
<td>50 ≤ score &lt; 75</td>
<td>Average</td>
</tr>
<tr>
<td>0 ≤ score &lt; 50</td>
<td>Poor</td>
</tr>
</tbody>
</table>

**Results and Discussion**

This study produced a product of numeracy problems with a context of biodiversity conservation for Year 7 students that have the characteristics of being valid, practical, and having potential effects through Tessmer's development model stages, including preliminary, self-evaluation, expert review, one-to-one, small group, and field testse.

At the preliminary stage, results showed that the Ministry of Education and Culture's policy regarding the implementation of AKM aims to measure students' skills in reading, literacy, or numeracy. Next, this study was conducted at one of the junior high schools in Banda Aceh, with Year 7 students as the research subjects. In the initial stage, a curriculum analysis was carried out to determine that the context of biodiversity, especially beekeeping, an essential element that should be integrated into the learning process. Additionally, the context of beekeeping has not been integrated into mathematics learning. Subsequently, a content analysis was undertaken, leading to the decision to focus on numbers and statistics as the subject matter for developing numeracy problems. The conclusion drawn in the initial stage is the need to develop numeracy problems within the context of beekeeping.

The self-evaluation stage consisted of two stages: analysis and design. The results of the analysis carried out are that the curriculum implemented at Junior High Schools is an independent curriculum (*Kurikulum Merdeka*). A curriculum with extensive extracurricular teaching, where the content provided to teachers will be more effective to enable students sufficient time to learn concepts and improve their skills. The material tested on AKM numeracy is then linked to the context in which it will be used. In this case, the problems used the context of biodiversity conservation for Year 7 students. By using the context of biodiversity conservation, it is hoped that students will be able to solve problems related to the environment—form attitudes and behavior patterns that are good for the environment, and build awareness of the importance of biodiversity conservation. Number was chosen because this
content can be linked to the context of biodiversity conservation and is also initial material in Year 7 mathematics learning at school.

Next, the design stage produced problems consisting of 20 items, including four multiple choice, four complex multiple-choice, five long answer, 4 short answer, and 2 matching problems. Items were developed to meet the components measured in the AKM: content, cognitive level, and context. The content used was number domain, with subdomains of 12 items in number operations, 2 items in representation, and 6 items in size properties. The context used was a socio-cultural context with a focus on the context of biodiversity conservation. However, the scope of biodiversity conservation is broad, so it is limited to the conservation of biodiversity related to bee cultivation activities. The stimulus themes for the questions presented include educational tours to Trigona bee cultivation sites, design of honeycomb media, cultivation of stingless bees (*Trigona Sp*) Jantho, Aceh Besar, Indonesia, honey production in Sulawesi, Indonesia, pesticides that threaten bees and human beings, and consumption of honey from the world's best honey producers. The result of this stage is the prototype I.

The expert review stage involved two lecturers from the mathematics education study program at Universitas Syiah Kuala, two mathematics teachers and one biology teacher. Novita and Hartono (2012) stated that, at expert review stage, the prototype is validated by experts based on its construct, content, and language. The results of calculating the expert assessment scores revealed that the problems are within the valid criteria (0.88). The results of the validity analysis are declared valid if they obtain the value ≥ 0.6; If the value < 0.6, it is declared invalid (Azwar, 2015). Therefore, it can be concluded that the test items developed in this study meet valid criteria in terms of construct, content, and language. However, revisions need to be made based on comments and suggestions from experts. The comments and suggestions from experts on the validation process are presented in Table 4.

### Table 4. Comments and suggestions from experts

<table>
<thead>
<tr>
<th>No.</th>
<th>Expert</th>
<th>Suggestions and Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>E1</td>
<td>The problems are good and meet the criteria for AKM numeracy questions. Nevertheless, some revisions are necessary, particularly addressing the omission of efforts to emphasize sustainability and the significance of biodiversity conservation. Additionally, researchers should focus on improving the clarity of writing and employing effective and efficient language.</td>
</tr>
</tbody>
</table>
| 2.  | E2     | - True False statements should not appear twice—the most, best, because it is a waste of time (like question number 13).  
- Problem 1: If there is a right-angled path then the length must be calculated using the Pythagorean triple.  
- Problem 4: The image is not clear. There must be an image of what the trigona bee looks like.  
- Problem 4: The size of the wood the students have is short. If it's rectangular, lots of it will be thrown away. |
| 3.  | E3     | It is good, but now children are less interested in literacy and numeracy |
| 4.  | E4     | The questions developed are in accordance with the context of biodiversity conservation. However, there are some spelling errors in several items. |
| 5.  | E5     | - |
Some changes before and after revisions based on comments and suggestions from experts are as follows.

![Figure 2. Stimulus 2 before revision](image1)

![Figure 3. Stimulus 2 after revision](image2)

In Figure 2, the problem only displays images of honeycomb media. Based on the expert’s suggestion, the image is not clear and there should be an image of what the trigona bee looks like. The result of the revision is shown in Figure 3.

Next, a revision was made to Problem 13, namely:

<table>
<thead>
<tr>
<th>Statement</th>
<th>True</th>
<th>False</th>
</tr>
</thead>
<tbody>
<tr>
<td>The highest production of <em>Trigona bivae</em> bee honey is at region D.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The highest production of <em>Trigona bivae</em> bee honey is at region B.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The least production of <em>Trigona bivae</em> bee honey is at region A.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The least production of <em>Trigona bivae</em> bee honey is at region C.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Figure 4. Question number 13 before revision](image3)

In Figure 4, based on the expert’s suggestion, true and false statements should not appear twice. So, revision was made to the form of the question. The result of the revision is as follows:

<table>
<thead>
<tr>
<th>Statement</th>
<th>Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>The highest production of <em>Trigona bivae</em> bee honey</td>
<td>A (Luwu Utara)</td>
</tr>
<tr>
<td>The least production of <em>Trigona bivae</em> bee honey</td>
<td>B (Bone)</td>
</tr>
<tr>
<td></td>
<td>C (Soppeng)</td>
</tr>
<tr>
<td></td>
<td>D (Gloeck)</td>
</tr>
</tbody>
</table>

![Figure 5. Problem 13 after revision](image4)

In line with the implementation of validation at the expert review stage, a trial (one-to-one stage) was carried out on three students. These three students were asked to do the test developed. The following is one of the problems and the student’s answers at the one-to-one stage.
In addition, the three students were also asked to provide comments and suggestions (opinions) regarding the test items. The feedback indicated that specific items were overly lengthy, the presented images were too small, and some words were not comprehensible. The revisions, incorporating the comments and suggestions from the students, are as follows.
The results of the revisions at the expert review stage and the one-to-one stage produced prototype II which was then tested at the small group stage. The small group trial was carried out on six students. They were asked to do the test, provide comments and suggestions (opinions) regarding the questions, and fill out a student response sheet to evaluate the practicality of the questions. This student response questionnaire sheet was adapted from Muzalifah (2021) and the practicality criteria was adapted from Riduwan and Akdon (2013).

The results of the practicality test of the questions can be seen in Table 5.

<table>
<thead>
<tr>
<th>Statement (P)</th>
<th>Practicality (%)</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>The questions are in accordance with the material I have studied</td>
<td>86.7 %</td>
<td>Very Practical</td>
</tr>
<tr>
<td>The questions use language that is clear and easy for me to understand</td>
<td>86.7 %</td>
<td>Very Practical</td>
</tr>
<tr>
<td>The questions do not have a double meaning</td>
<td>86.7 %</td>
<td>Very Practical</td>
</tr>
<tr>
<td>The sentences or statements contained in the questions are easy for me to read</td>
<td>93.3 %</td>
<td>Very Practical</td>
</tr>
<tr>
<td>The questions and images are presented attractively and clearly visible</td>
<td>90 %</td>
<td>Very Practical</td>
</tr>
<tr>
<td>The letters used can be seen clearly both in terms of type and size</td>
<td>93.3 %</td>
<td>Very Practical</td>
</tr>
<tr>
<td>The instructions for implementing the questions are clear and easy for me to understand</td>
<td>90 %</td>
<td>Very Practical</td>
</tr>
<tr>
<td>The problems given motivate me to study harder</td>
<td>90 %</td>
<td>Very Practical</td>
</tr>
<tr>
<td>The questions given are related to everyday life problems so that I am challenged to work on them</td>
<td>80 %</td>
<td>Practical</td>
</tr>
<tr>
<td>The information contained in the questions can increase my knowledge</td>
<td>100 %</td>
<td>Very Practical</td>
</tr>
</tbody>
</table>

Average 89.7 % Very Practical

The results of the student response questionnaire for the practicality test of the test items show that the numeracy problems in the context of biodiversity conservation for Year 7 students...
are in classified in the very practical category, with the average practicality of the questions is 89.7%. The practicality of the questions developed can also be known from the problems that students can work on. The practicality of the questions developed in this study can be proven by students at the small group stage who can do the problems well (Purwitingrum & Prahmana, 2021). According to Van den Akker (1999), practicality refers to the extent to which users (and other experts) perceive the intervention as appealing and usable under 'normal' conditions. This aligns with Risnawati, Andrian, Azmi, Amir, and Nurdin (2019) who mentioning that the practicality test was conducted to assess the instrument's practical usability by students. Consequently, the developed test items meet practical criteria. This stage produced prototype II. The results at this stage indicate no revisions needed to the prototype II, so the test items from the prototype II would be tested at the next stage.

At the field test stage, the test items were tested of 27 students. The results at this stage can be seen in Table 6.

Table 6. Results of field test stage

<table>
<thead>
<tr>
<th>Score</th>
<th>Number of Students</th>
<th>Percentage</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score = 100</td>
<td>0</td>
<td>0 %</td>
<td>Very good</td>
</tr>
<tr>
<td>75 ≤ score &lt; 100</td>
<td>20</td>
<td>74%</td>
<td>Good</td>
</tr>
<tr>
<td>50 ≤ score &lt; 75</td>
<td>4</td>
<td>15%</td>
<td>Fairly good</td>
</tr>
<tr>
<td>0 ≤ score &lt; 50</td>
<td>3</td>
<td>11%</td>
<td>Poor</td>
</tr>
</tbody>
</table>

Based on the data in Table 6, out of the 27 students who participated in the trial, three fell within the poor criteria, four met the fairly good criteria, and 20 achieved the good criteria. However, no students have yet scored in the very good criteria. According to Ajizah et al. (2023), analysis of the effectiveness of the questions can be seen from the results of the average score at the field test stage—which should at least be in the fairly good criteria in the range 50 ≤ score < 75. The average score of the students at this field test stage is 75.39, categorizing it within the good criteria. This indicates that the developed questions are effective and have the potential effect on students’ skills. May (2020) argued that students' knowledge related to mathematics learning in everyday life proves valuable in problem-solving, particularly in numeracy. Additionally, engaging with non-routine problems enhances students' mastery of addressing complex issues by applying strong reasoning skills (Kurniati, Purwanto,., As’ari, & Dwiyana, 2019).

Besides, based on the trial at the small group stage, a practicality level of 90% was obtained on the statement “the problems and images are presented attractively and clearly visible” as well as “The problems given motivate me to study harder”. This is in line with Listiadi (2021) stating that students who are motivated to carry out learning activities will be able to achieve optimal learning outcomes. Then, 100% of student state that the information in
the problems can increase their knowledge. This means that numeracy questions in the context of biodiversity conservation developed in this study add new knowledge to students regarding biodiversity conservation in bee cultivation activities. Therefore, it can be said that numeracy questions in the context of bee cultivation developed in this study have a potential effect on students' skills. However, student-centered learning utilizing numeracy skills is essential to enhance students' comprehension of mathematical concepts and foster the development of their numeracy skills (Nurjanah, Dahlan, & Wibisono, 2020; Sa’dijah et al., 2021).

The numeracy problems developed serve as a tool for assessing students’ numeracy skills and offer an opportunity to deepen their understanding of beekeeping. Students can engage in beekeeping in their home gardens, as bees can gather food from plants in this setting. Bees are known to forage in various environments, including forests, plantations (Jasmi, 2017), agriculture, and agroforestry areas (Rahman, Baral, Sharma, Samsudin, Meyer, Lo, Artati, Simamora, Andini, Leksono, Roshetko, Lee, & Sunderland, 2019). The inclusion of knowledge about the benefits of honey in the numeracy questions enables students to understand the importance of consuming honey for health. Bees produce various products such as honey, propolis, beeswax, pollen, and royal jelly, all offering human health benefits (de Carvalho, Schneider, de Jesus, de Andrade, Amaral, David, Krause, Severino, Soares, Bastos, Padilha, Gomes, Capasso, Santini, Souto, & de Albuquerque-Junior, 2020). Honey, in particular, is widely recognized for its positive impact on human health, leading to increased market value (Rowan & Pogue, 2021). Moreover, in some countries, bee colonies aid in pollinating crops, contributing to enhanced crop productivity, especially in annuals and fruit crops (Armstrong, Brown, Davies, Whyatt, & Potts, 2021; Phillips, 2020).

**Conclusion**

Based on the research results and discussions in this study, it can be concluded that numeracy questions with a context of bee cultivation for Year 7 students have been successfully developed, meeting the criteria of being valid, practical, and having potential effects, rendering them suitable for use. The 20 test items align with AKM numeracy components, encompassing 6 stimuli related to bee cultivation activities involving cognitive knowledge levels such as application and reasoning.

The problems achieved valid criteria, as assessed by experts, with an average value of 0.88. Practicality was determined through student responses to a questionnaire, yielding an average value of 89.7%, indicating the questions' high practicality. The potential effect of the test items was assessed based on the field test results, resulting in an average student score of 75.39, falling within the good criteria. Teachers can employ these numeracy problems to
enhance students' numeracy skills. Future researchers are encouraged to explore other biodiversity conservation contexts beyond bee cultivation activities and across various mathematics topics.

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