A mobile application assessing knowledge analysis and creative thinking skills of science teachers

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Abstract. Teachers with a good level of assessment literacy will bring their students towards good learning, because assessment and learning are two integrated concepts. The purpose of this study is to describe the pre-service elementary school teachers’ ability in understanding the concept of creative thinking assessment literacy in science subject. The method used in this study is a qualitative descriptive method. And the research sample are 25 pre-service elementary school teachers of 7th semester elementary school teacher education major. The instruments used were multiple choice test instruments about assessment of creative thinking literacy in science subjects. The results of the analysis show that the understanding of pre-service elementary school teachers about creative thinking assessment literacy in science subjects is 68% and is in the "fair" category, while the understanding of assessment literacy in science subjects is based on seven indicators of assessment literacy standards which are 70.86% and are in the "very good" category, and the understanding of creative thinking in science subjects based on four indicators of creative thinking is 73.25% and is in the "very good" category. Pre-service elementary school teachers must have better pedagogical and professional competence so that it is easier to carry out learning and assessment that is suitable for the development of elementary school students.

1. Introduction
In the era of globalization, improving the quality of education must start from the elementary school level, especially in improving the quality of the learning process [1-3]. Creativity education has grown in the past 10 years in Indonesia because experts have called on schools to prepare students with skills that enable them to be innovative and creative [4]. Given the importance of the ability to think creatively, the Indonesian government has integrated creative thinking skills into the education curriculum. Therefore, the ability to think creatively is one aspect that must be developed to develop students' thinking skills at a higher level.

The cognitive abilities of the conceptual dimension are the basis for developing the knowledge dimension at a higher level [5]. To be able to realize a quality assessment, of course the teacher must have good assessment skills. However, the ability of teachers to plan and carry out assessments in class
in general is still lacking [6-8]. Many teachers have a low level of assessment literacy, which has caused the teacher's assessment of students to not be maximal. Therefore, the ability to design and compile creative thinking instruments must be trained to hone their abilities in assessing the process and results of student learning early (prospective teachers).

Research related to creative thinking and assessment literacy has been carried out for years. Among them, conducted a study of pre-service and in-service teachers using a Classroom Assessment Literacy Inventory survey [9]. Teacher assessment literacy [10]. About increasing student creativity through training [11]. Creative thinking can be trained in elementary school children [12]. Fostering creative learning at [13].

This study aims to analyze the assessment skills of science creative thinking assessment of prospective elementary school teachers. Research conducted by previous researchers related to creative thinking skills and assessment literacy carried out separately by measuring different research variables. Therefore, in this study researchers tried to integrate assessment literacy skills and creative thinking in an activity that requires assessment literacy skills to be able to design and develop quality creative thinking instruments.

2. Method
The approach used in this study is a descriptive qualitative approach. The sample in this study were 25 pre-service elementary school teachers on their VII semester who had passed the Learning Evaluation Course. The instrument used to collect data on the students' assessment literacy of creative thinking is 73 test questions in the form of multiple choices. To describe the level of understanding of students in the lecture process of basic physics courses, a scale of five is used as follows [14]:

| Score                                | Understanding category |
|--------------------------------------|------------------------|
| X ≥ M + 1,5 SD                       | Very Good              |
| M + 0,5 SD > X > M + 1,5 SD          | Well                   |
| M + 1,5 SD > X > M – 0,5 SD          | Pretty Good            |
| 0,5 SD > X > M -1,5 SD               | Not Good               |
| X ≤ M – 1,5 SD                       | Very Poor              |

3. Results and discussion
The data results on assessment literacy skills of creative thinking on science subjects of pre-service elementary school teachers are as follow:

3.1. Assessment literacy skills of creative thinking on science subjects
Pre-service elementary school teachers’ creative thinking assessment literacy skills in science subjects can be analyzed using descriptive statistical tests, and the results can be seen in table 2 below.

| Interval            | Total Student | Percentage | Categories |
|---------------------|---------------|------------|------------|
| Score above 38      | 2             | 8 %        | Very good  |
| Score 32 s/d 37     | 8             | 32 %       | Well       |
| Score 26 s/d 31     | 7             | 28 %       | Pretty good|
| Score 20 s/d 25     | 7             | 28 %       | Not good   |
| Score below 19      | 1             | 4 %        | Very bad   |
| Average             | 68 %          | Not good   |

Based on the data analysis results of pre-service elementary school teachers' understanding regarding the creative thinking assessment literacy in science subjects, the average data was obtained that 68%
were in the "Good" category, and 32% were in the "Fair" category. This shows that pre-service elementary school teachers still need to get the knowledge and understanding of good creative thinking assessment literacy on science subject, so that they can carry out their duties as teachers in carrying out effective and efficient assessment and learning.

3.2. Assessment literacy skills
The ability to understand science assessment literacy for pre-service elementary school teachers is obtained as shown in table 3 below:

| Assessment Literacy Standards                                      | Value (%) | Level of understanding |
|-------------------------------------------------------------------|-----------|------------------------|
| Choosing an Assessment Method                                     | 84        | Well                   |
| Developing Assessment Method                                      | 73        | Enough                 |
| Managing Assessment                                               | 80        | Well                   |
| Using Assessment Result in Decision-making                        | 72        | Well                   |
| Developing Assessment Procedures                                  | 67        | Less                   |
| Communicating Assessment Result                                   | 69        | Less                   |
| Recognizing Unethical, Illegal, and Inappropriate Assessment Methods | 51        | Less                   |
| Average                                                           | 70.86     | Enough                 |

Based on data from the analysis of the pre-service elementary school teachers' understanding about assessment literacy, an average of 70.87% was found in the "Good" category. This needs to be considered by the pre-service elementary school teachers to further enhance their understanding of assessment standards. The teacher's knowledge of assessment literacy in limited trials based on the Assessment Literacy Standard (Standar Literasi Asesmen / SLA) proposed by Folante and Fazio can be obtained as in the picture above, the following is a discussion for each assessment literacy standard as follows [15]:

3.2.1. Choosing an assessment method. The understanding of pre-service teachers on the standard of "choosing assessment method" is 84% and in the "very good" category. The teacher must have the skills to choose the right assessment method as a guide in making decisions. Skills for selecting assessment methods that are appropriate, useful, comfortable to manage, sufficiently technical, and fair, are very necessary for the use of data as a guide in supporting decision making. Teachers must be familiar with the types of data that come from various forms of assessment, including their strengths and weaknesses. In particular, teachers must familiarize themselves with the assessment criteria and selection of assessment methods that are consistent with the lesson plan.

3.2.2. Developing assessment method. The understanding of pre-service teachers on the standard of “developing the assessment method” is at 73% and is in the "good" category. A teacher must have the skills to develop an appropriate assessment method in making decisions about teaching. Teachers tend to use assessment tools that have been published by outside sources, but most of the assessment data used in decision making is likely to come from assessment methods built by the teacher themselves.

3.2.3. Managing assessment. The understanding of pre-service teachers on the standard of “managing assessment” is at 80% and is in the "very good" category. The teacher must have the skills to manage, assess, and interpret the results of the assessment. Being able to choose and develop a good assessment method is not enough. Teachers must also be able to apply good assessment methods appropriately. They should also have the skills to manage assessment methods, scores, and interpret the results of different assessment methods.
3.2.4. **Using assessment result in decision-making.** The understanding of pre-service teachers on the standard of "using the results of the assessment when making decisions" is at 72% and is in the "good" category. The teacher must have the skills to utilize the results of the assessment to make decisions about each student, to plan teaching, to develop the curriculum, and to improve the quality of the school. Assessment results are generally used to make educational decisions at various levels, at the classroom level to make decisions about students, at the community level to make school decisions, and at the education level to make decisions related to the goals and outcomes of educational organizations. Teachers play a major role in the decision-making process at each level, and they must be able to effectively utilize the results of the assessment.

3.2.5. **Developing assessment procedures.** The understanding of pre-service teachers on the standard of "developing assessment procedures" is at 67% and is in the "Fair" category. The teacher must have the skills to develop assessment procedures to ensure the accuracy of student achievement levels based on the results of the assessment. Establishing the level of student achievement is considered a major part of teacher professional practice because it shows the results of student performance and teacher scores given to students' performance. The teacher must use the principle of assessment to ensure an accurate level of student learning outcomes.

3.2.6. **Communicating assessment result.** The understanding of prospective teachers on the standard of "communicating assessment results" is at 69% and is in the "fair" category. Pre-service teachers still have a difficulty on how to communicate the results of the assessment to various parties, including parents of students, other educators, leaders (principals), the general public, even the local education office. What is happening now is that the teacher only communicates the results of the assessment to parents through receiving student report cards at the end of the semester. Therefore, the teacher must have the skills to communicate the results of the assessment to students, parents, and other educators. The teacher needs to report the results of the assessment to students and parents regularly. In addition, teachers continue to be asked to report or consult on the results of assessments with other educators. To communicate the results of student assessments effectively to others, the teacher must be able to use the assessment terms appropriately and to communicate the meaning, limitations, and implementation of the assessment results. Furthermore, teachers sometimes need to protect their own assessment processes and interpretations, and they may also need to help the community interpret the assessment results appropriately.

Assessment is the process of obtaining and providing important information to make alternative decisions about improving teaching and learning practices. Therefore, each assessment activity is a process that is deliberately planned to obtain information or data and based on the data then a decision is made. In relation to learning activities, a systematic assessment process can determine the decision to what extent learning objectives have been achieved by students [16, 17].

3.2.7. **Recognizing unethical, illegal, and inappropriate assessment methods.** The understanding of pre-service teachers on the standard of "recognizing unethical, illegal, and inappropriate assessment methods" is at 51% and is in the "fair" category. This happens because the teacher only understands that the assessment carried out meets the established assessment standards, but sometimes the teacher does not realize that in the assessment process, there are assessment methods that do not fit certain subject matter, so the teacher must understand the content of the subject matter in order to avoid inappropriate assessment methods. Teachers must have the skills to be aware of the assessment methods and usage of assessment data that is unethical, illegal or inappropriate. Teachers need to have knowledge of their ethical and legal responsibilities and their accountability regarding assessment. All student assessment activities need to emphasize justice, the rights of all parties involved, the code of ethics of professional conduct, starting from planning and compiling data to interpret, utilize, and communicate the results of the assessment. In addition, teachers must make efforts to stop inappropriate practices as soon as they are detected, and must participate more in the wider educational community to determine the appropriate scope of the professional code of ethics for assessment.
3.3. Creative thinking skills on science subject

From the results analysis of teacher knowledge improvement based on creative thinking indicators, the results obtained as shown in table 4 are as follows:

| Creative Thinking Indicators | Value (%) | level of understanding |
|------------------------------|-----------|------------------------|
| Fluency                      | 70        | Well                   |
| Flexibility                  | 82        | Well                   |
| Originality                  | 76        | Well                   |
| Elaboration                  | 65        | Less                   |
| Average                      | 73.25     | Well                   |

Based on the results of the analysis in the table above, the average increase in participants' knowledge is 73.25% and is in the "very good" category. From the results of increasing the teacher's knowledge, the teacher is considered to have understood the concept of creative thinking skills. Knowledge of creative thinking skills is only obtained from incomplete reading sources, so that his knowledge is also considered insufficient. Knowledge of new creative thinking skills is obtained from training in this research and development, whereas creative thinking skills are suggested to be applied in assessment instruments in the 2013 curriculum. This is in line with one of the main goals of science education, namely to help students develop higher order thinking skills, which enable them to face the challenges of everyday life, through adopting knowledge into activities that encourage students to use higher order thinking skills such as critical, creative, reasoning, and reflective process skills [18].

Based on the picture above, the increase in knowledge of each indicator of creative thinking in science subjects is explained as follows:

a. On the creative thinking indicator of fluency, the results of the analysis on the fluency indicator are at 70% and are in the "fair" category. This shows that pre-service teachers do not understand this indicator well, therefore, pre-service teachers must try to understand by studying various sources or examples of questions related to these indicators, so that pre-service teachers can apply it in designing and compiling creative thinking instruments in science subjects.

b. On the creative thinking indicator of flexibility, the results of the analysis on the flexibility indicator are at 82% and are in the "very good" category. Pre-service teachers have understood the term flexible, but sometimes pre-service teachers are stuck with such unfamiliar terms so they do not understand this indicator of creative thinking well. The flexibility aspect in creative thinking ability is an important ability that students must have in solving problems [18]. Develop a variety of perspectives and flexibility that apply knowledge creatively and pleasantly [19,20].

c. On the creative thinking indicator of originality, the results of the analysis on the originality indicator are at 76% and are in the "fair" category. Knowledge of the creative thinking indicator of originality has been well understood, although it was in the fair category, it is expected that with this good knowledge, pre-service teachers can develop their knowledge in the form of applications in designing and compiling creative thinking instruments in science subjects. The preparation of creative thinking instruments is focused on two basic elements, namely the novelty and conformity with the problem [21], because creative people usually approach problems in new ways [21]. Kangan and Marjaana explains that creative thinking is a process of thinking that is original, reflective, and produces a complex product [22].

d. On the creative thinking indicator of elaboration, the results of the analysis on the elaboration indicator are at 65% and are in the "fair" category. Participants have well understood the indicators of creative thinking, so that it will be easier also in designing and developing creative thinking instruments for science subjects that will be tested to students to find out students'
thinking skills in solving the problems of science given. By using a test technique in the form of a question, that students who have different abilities will have different creative abilities too [23].

Good assessment literacy skills will greatly determine the success of prospective teachers in planning and preparing quality creative thinking instruments to measure the ability of students’ creative thinking. Teachers who have good assessment literacy will be in a good position to integrate assessment into directed, effective, and efficient learning [24].

4. Conclusion

Based on the results of the analysis and discussion, it can be concluded that the understanding of pre-service elementary school teachers about creative thinking assessment literacy on science subjects is at 68% and in the "fair" category, the understanding of the assessment literacy of science subject based on seven indicators of assessment literacy standards is at 70.86% and is in the "very good" category, and the understanding of creative thinking on science subject based on four indicators of creative thinking is at 73.25% and is in the "very good" category.

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