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Profile of Pre-service Elementary Teacher Creativity in Developing Higher Order Thinking Skills-oriented Science Worksheets

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Abstract

The perspective of learning science as a way of thinking and inquiry can be realized if teachers can develop higher order thinking skills (HOTS)-oriented science worksheets. Therefore, it is very important to train the creativity of Pre-service Elementary School Teachers (PETs) in developing HOTS-oriented science worksheets in the education of prospective elementary school teachers. This study aims to describe the profile of PETs' creative thinking in developing HOTS-oriented science worksheets. Research involving PETs in one of the universities in Central Java. Data collection was carried out through a creative thinking assessment rubric on worksheet products on 38 PETs. Content analysis with an interactive model is applied in research. The results showed that the aspects of fluency, flexibility, and elaboration were obtained in the sufficient category. While the aspect of originality obtained unfavorable results. The results of the study concluded that creative thinking skills in developing HOTS-oriented science worksheets were still not good. Research recommends that lecturers immediately make efforts to select effective learning methods and tools to enhance PETs' creativity in developing HOTS-oriented science worksheets.

Keywords: Creative thinking skills, higher order thinking skills, science worksheets, elementary school.

Introduction

Science learning in the 21st century is faced with complex challenges and opportunities. Moreover, the Covid-19 pandemic has given unusual habits to the whole implementation of learning. Learning from elementary to higher education is carried out online (Biwer et al., 2021; Pratama et al., 2020). Meanwhile, ideally science learning should still be carried out in full as a product, process, and scientific attitude (Collette & Chiappetta, 1984; Syawaludin et al., 2022). Thus, it is necessary to support the components of the learning system, teacher readiness, support for teaching materials, and appropriate learning strategies.

The readiness of teachers to carry out science learning in elementary schools during the Covid-19 pandemic was reported to have encountered various problems, especially in science learning (Abtokhi et al., 2021; Ambawati et al., 2021; Saputro et al., 2020). Problems that arise include connectivity and internet problems that interfere with student communication access, increasing numbers of student learning difficulties, low personal control of student activity, lack of support for learning tools, especially student worksheets which can be accessed by students independently during online learning situations (Aini et al., 2020; Bahasoan et al., 2020; Pokhrel & Chhetri, 2021). This condition causes science learning to still be impressed as a material completion agenda, not yet training scientific thinking skills.

The problem of learning devices in the form of teaching materials such as student worksheets in science learning is still dominant. Previous research revealed that the use of student worksheets was carried out by teachers only with instructions with the dominance of using WhatsApp Group media (Pamungkas & Sartika, 2021; Wargadinata et al., 2020). However, the condition of the worksheets used is not yet oriented to higher order thinking skills (HOTS) so it needs to be developed (Kahar et al., 2021; Yennita et al., 2018). Students' analytical, evaluation, and creativity skills need to be trained in learning science, for example through a series of investigative processes or science experiments (Fauzia & Kelana, 2021; Kwangmuang, et al., 2021; Lu et al., 2021). Therefore, the support of learning tools such as HOTS-oriented worksheets is needed.

The development of HOTS-based science worksheets is a necessary skill as a professional teacher. The education curriculum for prospective elementary school teachers must be able to equip students to be skilled in developing HOTS-based worksheets.

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Achieving these outcomes requires creative thinking skills from prospective teachers through their learning experiences in higher education (Gursoy & Goksun, 2019; Wahyudi & Winanto, 2018). Creative thinking plays a role in analyzing the competence and content of science, analyzing and determining experimental strategies, to skills in deciding the flow of experiments on worksheets. The importance of creativity in developing HOTS-based worksheets needs to be monitored so that its implementation in the primary school teacher education study program can be optimal.

Creative thinking skills are imaginative powers that lead individuals to many possible ideas and solutions (Atmojo et al., 2019; Srikongchan et al., 2021). Creative thinking is a cognitive ability that performs divergent thinking so that one can solve problems effectively (Kuswanto, 2018; Zhu et al., 2019). Creative thinking skills in developing higher order thinking skills-oriented science worksheets are a person's ability to use imagination through various alternatives to create worksheets that meet the didactic requirements, content aspects, and presentation aspects that empower higher order thinking skills (HOTS) skills in students at school base. The stages of divergent thinking as a characteristic of creative thinking skills underlie creative production (Guilford, 1984; Runco & Acar, 2012; Said-Metwaly et al., 2021; Wechsler et al., 2018). Therefore, creativity studies can be carried out by assessing products made by PETs (Clary et al., 2011).

Education practitioners realize the importance of creative thinking skills in developing science student worksheets for pre-service elementary teachers (PETs). However, the study of the profile of creative thinking skills in this case has never been studied. Previous studies on creative thinking in prospective teachers currently has creative thinking skills tied to certain subject content (Rizal et al., 2020; Susanti et al., 2020). This is different from creative thinking of prospective teachers in developing their pedagogical skills, such as developing learning tools at school base. Therefore, this research needs to be conducted to gain an overview of the creativity of PETs in developing HOTS-oriented science worksheets. This study of creative thinking skills in terms of indicators of Torrance's creative thinking skills consists of aspects of fluency, flexibility, originality, elaboration (Torrance, 1974; Suryandari et al., 2018). The research is expected to provide a representative picture so that it can provide a view for educators in the primary school teacher education study program and stakeholders in taking policies that are relevant to the needs of professional elementary school teacher candidates.

METHOD

Research Design

This study uses a qualitative approach with a research focus to obtain an overview of the creativity of PETs in developing HOTS-oriented science worksheets. The design of this study uses a case study design in accordance with its objective, which is to explore and explain the study of creative thinking in PETs. Case study can be seen to satisfy the three tenets of the qualitative method: describing, understanding, and explaining (Tellis, 1997). The case study research design was seen as appropriate to the problems and aims of this study to explain the profile of thinking skills in developing HOTS-oriented science worksheets. This research problem is guided by a research question: how are PETs' creative thinking skills in developing HOTS-oriented science worksheets in terms of the aspects of fluency, flexibility, originality, and elaboration?

Participants

The subjects involved in this study were PETs at the Faculty of Teacher Training and Education, Universitas Sebelas Maret (UNS). The research subjects were 38 students who were taking elementary science learning courses. The selection of research subjects was carried out purposively by considering the existence of science learning lectures for students in that semester. Another consideration is the ease of access to research, the subject has the ability to develop learning tools in the form of worksheets, and UNS is an Educational Personnel Education Institution (LPTK) which has the primary school teacher education study program with an appropriate curriculum for optimal learning to produce professional and creative PETs in developing learning tools. The profile of PETs in developing HOTS-oriented science worksheets is carried out to provide an overview of the outcomes that have been held so far.

Data Collection

Data on the profile of creative thinking skills was obtained using a creative thinking assessment rubric on a science worksheet made by PETs. The worksheet product assessment rubric instrument was developed referring to aspects of fluency, flexibility, originality, and elaboration. The validity of the instrument for assessing creative thinking skills was carried out using the content validity test by Aikens with a score of $V > V_{table} = 0.83$ so that it meets validity. The reliability test using Cronbach's alpha with a Cronbach's Alpha value of $0.797 > 0.632$ (r_{table} at $N=10$, $\alpha=0.05$), it can be concluded that all items are reliable.

Analysis Data

Research data were analyzed using an interactive model consisting of data compaction, data presentation, and drawing conclusions (Miles et al., 2014). The collected data is condensed, namely the process of selecting or selecting the data that has been obtained according to the respective group of aspects of creative thinking skills. The researcher then presents the data with the aim of making it easier to understand the problems that exist in the research. Data presentation is carried out using table schemes and pie charts to then be followed by narrowing steps so that a conclusion can be drawn. The data is then categorized by conversion in Table 1.

Table 1: Category of Creative Thinking Skills in Developing HOTS-oriented Science Worksheets

No	Score	Category
1	>3,25-4,00	Very Good
2	>2,50-3,25	Good
3	>1,75-2,50	Enough
4	1,00-1,75	Not Good

Findings And Discussion

Data on creative thinking skills was obtained through product tests on science worksheets written by PETs. The aspects assessed are related to fluency, flexibility, originality, and elaboration. The scores for each aspect of creative thinking skills in preparing HOTS-oriented science worksheets are presented in Table 2, followed by indicators for each aspect.

Table 2: Pre-service Elementary Teacher Creativity in Developing HOTS-oriented Science Worksheets

No	Apect	Indicator	Score	Mean	Category
1	Fluency	Produce worksheets according to learning objectives	2.54	2,38	Enough
		Smooth flow of thinking in developing worksheets	2.22		
2	Flexibility	Using different perspectives in developing worksheets	2.28	2,21	Enough
		Generate worksheets with different activity ideas	2.14		
3	Originality	Thinking of ways to use worksheets that are unique	1.86	1,65	Not Good
		Generate new and unique worksheets	1.44		
4	Elaboration	Develop activity ideas in worksheets	2.24	2,16	Enough
		Parse the details of the activities on the worksheet	2.08		

The data in Table 2 shows that measurements are made on every aspect of creative thinking skills with qualitative categories. Creative skills indicators in developing HOTs-oriented science worksheets show unfavorable results. In terms of fluency, flexibility, and elaboration, the "Enough" category is obtained. The lowest category is in the aspect of originality which only "Not Good" category. In order to obtain an overview of the acquisition of the four aspects of creative thinking skills, a pie diagram is presented to determine the percentage of acquisition in each aspect in Figure 1.

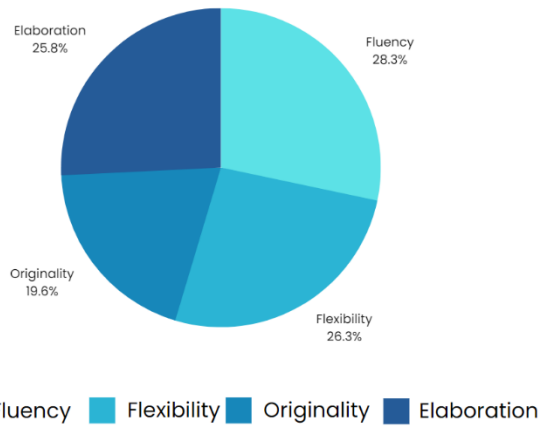

Figure 1: Pre-service Elementary Teacher Creativity in Developing HOTS-oriented Science Worksheets

Fluency skills are shown in how well a person is able to generate many ideas, many answers, solve many problems, and many questions smoothly (Paulin et al., 2020). The fluency aspect in this study is demonstrated by the ability of PETs to produce science worksheets by considering more than one choice. PETs skills in the aspect of fluency show the acquisition of skills in producing worksheets according to learning objectives get 2.54 (good category). On the ability of smooth flow of thinking in developing worksheets, a score of 2.22 (enough category) is obtained. Thus showing the acquisition of the fluency aspect of 2.38 (enough category).

Fluency skills assist PETs in developing and completing HOTS-oriented science worksheets. The results of this study indicate that PETs who have fluency skills can submit HOTS-oriented sciences worksheets on time. In addition to being timely, fluency PETs show the results of worksheets that fulfill all of its components, consisting of worksheet titles and identities, introductions, objectives, tools and materials, work steps, results, conclusions. This finding shows the fluency of thinking in compiling worksheets. Related research shows that there are fluency skills that play a role in achieving aspects of using language that are easily understood by students as worksheet users (Ernawati et al., 2019).

PETs profile on flexible skills is known through how PETs generate ideas, answers or questions that vary and can see a problem from a different perspective. With regard to the flexible aspect of developing HOTS-oriented science worksheets in this study it refers to the acquisition of using different perspectives in developing LKPD. The research findings show that the worksheets developed by PETs match the syntax of the learning model chosen by PETs with a score of 2.28 (enough category). However, the worksheets created still have activity ideas that are not much different from the existing worksheets. In this indicator, a score of 2.14 is obtained with the enough category.

Flexible thinking in the context of learning science and how to teach it through the development of worksheets includes ideas on how PETs can teach certain concepts through various activities. The findings of this study indicate that the activities created by PETs do not have many different parameters. The acquisition of flexible thinking in this study is in accordance with the results of previous research which reported that flexibility is still relatively low (Kulsum et al., 2019).

Measurement on the aspect of originality focuses on how PET is able to produce new and unique expressions and is able

to make learning combinations. Originality in the context of this study has indicators of thinking of ways to use worksheets that are unique and generate new and unique worksheets. Research findings on the skills of having ways to use worksheets that are unique are 1.86 with “not good” categories. PETs products in this indicator are measured at the characteristic level of worksheets made compared to existing worksheets. Novelty is found in the aspect of presenting worksheets in digital form and layout designs that are more attractive to students.

Originality is an important aspect of the ability to think creatively because it has an impact on obtaining quality products (Wojciehowski & Ernst, 2018). Findings on the originality indicator on the ability to produce expressions or something new and unique obtained a score of 1.44 ("not good" category). In this indicator it was found that most of the products made by PETs did not fulfill three aspects, such as attractive presentation, up to date materials, and efficiency. Most of the PET still follow the experimental steps and options that are already in the student textbooks. Very few PETs actually develop a different mode of investigation than usual.

PETs elaboration skills are demonstrated in the ability to enrich and develop ideas or products. The product in this research is HOTS-oriented science worksheets. PETs with good elaboration skills are known through their skills in developing activity ideas in worksheets and detailing activities in worksheets. The findings of this study indicate the acquisition of the ability to develop activity ideas in worksheets in the "enough" category with a score of 2.24. The activities in the worksheets have not fully trained the three HOTS aspects of students (analysis, evaluation, creation).

Other indicators of elaboration, namely the ability to parse details of activities in worksheets, are still classified as "enough" with a score of 2.08. Activities in LKPD contain work instructions that are not yet fully understood and implemented by students. PETs are still not skilled in detailing activities that lead to the stages of analysis, evaluation, and creativity. This lack of elaboration skills was also revealed from previous studies (Wijayati et al., 2019; Supriyanti & Halimatul, 2018; Yuniawati et al., 2020).

The acquisition of data on creative thinking skills on PETs in developing HOTS-oriented science worksheets shows that in general it is still not good. Attention is focused on the aspect of originality which is still in the lowest category. This finding is in accordance with previous findings on the low aspect of originality (Borodina et al., 2019; Sumarni & Kadarwati, 2020; Yustina et al., 2020). This shows that aspects of creative thinking skills in developing HOTS-oriented science worksheets need to be considered by lecturers in the practice of teaching science in elementary schools at the higher education level.

Conclusion

The results of the study show that in general the profile of creative thinking skills in developing HOTS-oriented science worksheets is still not good. Review the aspects of fluency, flexibility, and elaboration in the sufficient category. The review on the aspect of originality obtained the lowest with the unfavorable category. The results of this study can be concluded that PET's creative thinking skills in developing HOTS-oriented science worksheets are still not good enough and need to be improved. This research strongly suggests that lecturers can make efforts to select effective learning methods and tools to increase the pedagogical creativity.

Suggestion

The findings of this study indicate that the condition of creative thinking skills in developing science worksheets still needs to be improved. Therefore, lecturers at higher education institutions that produce professional elementary teacher candidates must be able to develop science learning in lecture classes. For further research, it is possible to develop innovative science learning models for prospective teachers in order to improve creative thinking skills in developing science worksheets in elementary schools.

Limitation

This research is limited to the study of creative thinking possessed by elementary school teacher candidates in developing HOTS-oriented science worksheets. Analysis of the profile of creative thinking skills is only limited to measuring aspects of fluency, flexibility, originality, and laboratory. Therefore, the results of this study do not describe the creative thinking skills possessed by students in developing worksheets in other subjects.

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