



Teachers Conception of Students Creativity

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Abstract. Creativity is one of the skills of the 21st century. Therefore, students' creativity needs to be developed, especially in mathematics classroom. To increase student creativity, it is necessary to understand the perceptions of mathematics teachers on student creativity, so that teachers can train students to think creatively. This study aims to describe the teacher's perception of student creativity based on 4P framework, which consisted of four dimensions: Person, Press, Process, and Product. This research is a qualitative descriptive study with 33 pre-service teachers as subjects. The results of this study indicate that: 3 teachers view creativity as Person, 2 teacher view creativity as Press, 26 teachers view creativity as Process, and 32 teachers view creativity as Product. Many of them (27 of 33 teachers, or 81.8%) showed that each dimension of creativity was found not mutually disjoint. The combinations were varied from two dimensions, such as Process and Product, and three dimensions, such as Person, Process, and Product. Others (6 of 33 teachers or 18.2%), stated that creativity was only in one dimension, that was Product. By knowing the teacher's perception of student creativity, it is hoped that the teacher can design learning that can develop students' creative thinking abilities so that students' creativity will increase.

Keywords: Creativity, Teachers' Perception, 4P.

1 Introduction

Creativity is one of the 21st century skills students should develop [1]. Creative thinking produces creativity, where creativity is one of the most sought-after and valued skills of 21st century. Creative thinking is one of the abilities that the world of work wants [2]. Thus, creativity needs to get attention and be developed in students.

Numerous explanations of creativity have been provided by specialists [3, 4]. Some definitions concentrate on the procedure, while some emphasize the innovative results [5]. For example, creativity can be considered a cognitive process that involves the generation of unique ideas or concepts, or the result of new connections between existing ideas or concepts. Creativity generally refers to the generation of inventive ideas, approaches, or activities. This is often seen with original and valuable works of art or scientific hypotheses. Over a hundred definitions of creativity [6], the common thread is a purposeful effort to create something new [6]. For instance, Bergström in [7] defines creativity as "performance in which individuals generate something novel and unforeseen".

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A. Mustofa et al. (eds.), *Proceedings of the International Joint Conference on Arts and Humanities 2023 (IJCAH 2023)*, Advances in Social Science, Education and Humanities Research 785,

https://doi.org/10.2991/978-2-38476-152-4_191

The concept of creativity in mathematics is an interesting topic for many researchers. Previous study state that professional-level mathematical creativity is defined as "the ability to produce original works that significantly extend knowledge (which may also include significant synthesis and extension of known ideas)" [8]. They suggests that it can be defined as "someone's ability" or "open ability," new questions for other mathematicians. Mathematical originality is a fundamental characteristic of mathematicians [9,10]. Ervynck links mathematical uniqueness to advanced mathematical thinking [10]. One conceptualization of mathematical uniqueness is the perspective that innovative behavior is considered rare and that exceptional individuals produce it quickly and easily [11]. Other researchers argue that innovative behavior is related to prolonged mathematical activity and reflection, as well as the rational and adaptive use of information [12,13]. Research shows that mathematically unique individuals may not show high performance in school mathematics [14]. Originality in mathematics does not come only from a strong knowledge base. It is based on the ability to break away from established thinking, to identify alternative possibilities, and to apply various mathematical knowledge to identify possibilities [15,16,17].

One's understanding of creativity will impact the actions taken. Particularly for educators, the teacher's understanding of creativity guides them in assisting their students to think creatively. Aiken asserts that the teacher plays a crucial role in fostering creative thinking in the classroom [18]. Previous studies indicate that teachers typically do not possess a thorough understanding of creativity. Mullet et al. comprehensively reviewed the literature on teachers' perception of creativity, published in a total nine countries between 1999 and 2015, and found that teacher's understanding of creativity is generally novice or inadequate [19]. Educators often associate creativity with limited concepts, such as imagination or freedom of expression [20].

The underdeveloped understanding of creativity by teachers can lead to the fact that teachers use narrower or even wrong lenses when they recognize the creativity of students in their behavior, activities, and performance, and thus lose opportunities to encourage the creative development of students. To support teachers in nurturing creativity in their classrooms, it is important to comprehend their perspectives on creativity. The teacher's perception of student creativity is also shaped by their experience in guiding students. As teachers gain more experience, their perception will gradually evolve and align with the accurate understanding.

Munandar suggested four aspects of innovation (4P): Person, Press, Process, and Product [21]. Sternberg & Karami clarified that the characteristics and correlates of creative individuals that are not found, or that are found to a lesser degree, in individuals who are less creative [22]. Press refers to environmental forces that stimulate creative thinking and behavior [23]. Process refers to the mental operations people execute when they think creatively, such as generation of a preinventive structure [22]. Product refers to the outcomes of the innovative process, such as a poem, painting, sculpture, symphony, scientific breakthrough, dance routine, or anything else [22]. Based on the above explanation, the purpose of this study is to describe the teachers' conception of students' creative thinking.

2 Method

This research is qualitative descriptive study. The data taken from 33 pre-service teachers who enroll Program Pendidikan Profesi Guru (PPG) Prajabatan 2023 or Preservice Teacher Professional Education Program 2023. PPG Prajabatan is a professional education program to produce teachers who are professionals and lifelong learners, also have commitment to be role models and love their profession [24]. This program is for undergraduates from both educational and non-educational majors for prospective teachers. The teachers were given a question of teachers' conception of creativity: Explain what does creativity mean to you? The selected answer then selected to support this paper in English. Consequently, there is a possibility that the gathered information may have been misunderstood despite our diligent attempts to faithfully replicate the educators' replies in the English language. The answers were analyzed using 4P framework of creativity (Person, Press, Process, and Product) below.

Table 1. Dimensions of Creativity (4P)

Dimension of Creativity	Definition
Person	the characteristics and correlates of creative individuals that are not found, or that are found to a lesser degree, in individuals who are less creative [22]
Press	environmental forces that stimulate creative thinking and behavior [23]
Process	the mental operations people execute when they think creatively, such as generation of a preinventive structure Finke et al. (in [22])
Product	the outcomes of the creative process [22]

3 Result and Discussion

Teachers' conception of creativity based on 4P framework is summarized in the table 2.

Table 2. Teachers' Conception of Creativity Based on 4P Framework

Dimension of Creativity	Teachers' Conception	N
Person	Freedom of expression, curiosity, actualizing	3
Press	The atmosphere of the teaching-learning process is effective and fun, support	2
Process	Think freely, connecting ideas, creating new ideas, problem-solving, cognitive activity	26
Product	Ability, skills, behavior pattern, something new, something amazing, something useful, unique solution, innovation	32

The result based on teachers' conception, many of them (27 of 33 teachers, or 81.8%) showed that each dimension of creativity was found not mutually disjoint. The combinations were varied from two dimensions, such as Process and Product, and three dimensions, such as Person, Process, and Product. But there was no answer that indicated that creativity is a composition of four dimensions. For example, a teacher stated that:

“Creativity is the ability to create something new, whether it's really new or obtained by connecting several existing things and making it new. In learning, teachers are required to be able to develop creativity in creating an atmosphere for the teaching and learning process to become effective and fun learning.”

From the answer, it can be concluded that creativity is in the dimensions of Product, Process, and Press. Product, from teacher's view that creativity is the ability to create something new. Process, from activity of connecting several existing things. Press, from environment that should be developed by teacher to form effective and fun learning. Previous study discovered that future teachers appeared to view the utilization of materials in terms of establishing an enjoyable atmosphere [20]. This notion should be further developed to ensure that future teachers recognize the educational potential of various materials in facilitating young learners' comprehension of mathematical concepts. Additionally, they asserted that creativity originates from the teacher rather than the student [20]. Future teachers believed that, as knowledgeable adults and facilitators of students' experiences, teachers should possess a creative mindset towards mathematics that they can impart to their students. Otherwise, students may adopt a more conservative approach.

“Creativity is the ability of students to solve problems so that students are able to create original ideas or new ideas and apply them in problem-solving.”

From the answer, the teacher viewed creativity is an ability, and ideas or original ideas, therefore in the dimension of Product. The teacher also said that creativity is related to problem-solving. It is in the dimension of Process.

Other answer (6 of 33 teachers or 18.2%) stated that creativity is only in one dimension, that is Product.

“Creativity is the ability that a person has to find and create something new, new ways, new models that are useful for himself and others.”

From the answer, the teacher claimed that creativity is an ability, therefore it is the result of a series of processes. This indicated that the teachers' conception of creativity was generally lacking [19], but some definitions of mathematical creativity concentrate essentially only on the product [5]. However, Zamir & Leikin found that creativity is dynamic in nature, and teachers' knowledge and skills can be developed [25].

The first dimension is Person. Some of the characteristics of creative individual that is proposed by the teacher were free of expression, curios, and actual. The attributes suggested by the educators are somewhat distinct from the attributes outlined by Feist

of imaginative individuals in art and science, such as being inclined to embrace novel encounters, less traditional and less dutiful, more assured, self-approving, motivated, aspiring, influential, antagonistic, and spontaneous [26]. Sternberg & Karami defined some personality attributes that associated with creativity such as: (a) receptiveness to new experiences, (b) diligence in relation to one's work but not necessarily in relation to other aspects of one's life, (c) acceptance of uncertainty, (d) ability to embrace failure, (e) readiness to take calculated risks, (f) intellectual autonomy, (g) belief in one's own capabilities, (h) self-acknowledgment, (i) mindset of growth, (j) not regarding one's ideas as definitive, (k) willingness to adapt environments to align with one's interests and needs, and (l) recognition of the boundaries of knowledge [22]. Sternberg & Karami also asserted that for many individuals, creativity serves as a means to fulfill their potential and discover what that potential truly entails [22]. The findings were corroborated by Daskolia et al. who highlighted those educators perceive creative thinking as a personality trait that allows for unrestrained expression [27].

The second dimension is Press, that is environmental forces that stimulate creative thinking and behavior [23]. The teacher stated that environment that allow students to have effective and fun learning is necessary. Also, teachers need to support their students in learning. These responses were supported by Mullet et al. who argued that some teachers recognized that the environment and personality of the student played a role in the creative process [19]. Mullet et al. also suggested that teachers need better training to understand and recognize students' creative activities and behaviors and improve teachers' ability to design and implement creativity-enhancing curriculum [19]. In terms of motivation and creativity, teachers suggested giving students the freedom to choose what to work on [28]. This allows student to seek out questions that they are highly intrinsically motivated to pursue. In class, teachers can let students choose their own topics for individual or group projects.

The third dimension is Process. The mental operation that are executed in creativity according to the teachers are connecting ideas, creating new ideas, and problem-solving. These answers are fit with Hadar & Tirosh, who developed a framework for creative thinking in school mathematics, such as (1) provide alternative solution for a given solution, (2) have more than one solution, (3) use more than one pathway to solve the task, (4) take mathematical knowledge outside mathematics, (5) identify and implement mathematical principles, (6) find connections between mathematical ideas, (7) use mathematical procedures to solve problems from other contexts, (8) pose mathematical problems, and (9) explore mathematical ideas [29]. They embrace four primary elements of creativity: fluency, flexibility, originality, and elaboration. As fluency is seen as a key characteristic of teachers' knowledge and expertise, teachers' statements about creativity in mathematics teaching were classified into one of three four groups - flexibility, originality, and elaboration. They contended that in teaching mathematics, teachers' notions of creativity consist of two primary types. The actions taken by teachers that foster student creativity were referred to as teacher-directed notions, while connecting creativity with opportunities provided during mathematics instruction were referred to as student-directed notions. In this framework, teacher-directed notions of creativity encompassed mathematical or pedagogical aspects. The ' mathematical flexibility of the teachers was related to the transformation of mathematical activities and the use of different problem-solving methods or different teaching methods. The category of mathematical novelty involved the creation of

original mathematical activities that are not found in the textbook. Teachers' pedagogical flexibility pertained to modifying the instructional environment and adjusting activities to match students' cognitive abilities, specifically, generating new pedagogical ideas. Pedagogical uniqueness encompassed curriculum and in-class implementations, as well as teachers' actions and statements that are unconventional or out of the ordinary. On the other hand, student-directed notions of creativity encompassed the elements of adaptability, which involves generating various student-derived solutions to problems that differ from previously generated ones; novelty, which involves generating new and innovative ideas and offering rare, insightful solutions to a problem; and elaboration, which involves student actions such as generalizing mathematical concepts and elevating the level of mathematical discussions [30].

The fourth dimension is Product. The outcome of creative process according to the teacher were ability, skills, behavior pattern, something new, something amazing, something useful, unique solution, and innovation. One of the teacher's answers is shown below.

“The ability to utilize all the potentials that exists within the individual, so that he can produce something new and different from what that has existed before, includes attitudes, thought, ideas and works that are useful for him/herself and society.”

These result in accordance with Mullet et al. who found that creativity leads to products or ideas that are new, useful or of valuable to society [19]. In relation to innovation, Oliveira et al. found that their subjects had a misguided perception of creativity as a synonym for innovation [31]. While creativity entails the capacity to generate fresh concepts, innovation entails implementing these concepts to create a novel product.

4 Conclusion

Pre-service teachers' conception of students' creativity according to 4P framework is still incomplete. Majority of teachers seen creativity as combination of two or three dimensions and some of them seen it as one dimension, that is Product. However, innovation is inherently fluid, and it is feasible to enhance educators' understanding and abilities. Some of the characteristics of creative individual (Person) that is proposed by the teacher were free of expression, curios, and actual. Teachers need to establish effective and fun learning, also teachers need to support their students in learning (Press). Creativity is mental process of connecting ideas, creating new ideas, and problem-solving (Process). The outcome of creative process according to the teacher were ability, skills, behavior pattern, something new, something amazing, something useful, unique solution, and innovation (Product). By knowing the teacher's perception of student creativity, it is hoped that the teacher can design learning that can develop students' creative thinking abilities, so that students' creativity will increase.

5 Acknowledgement

This research is supported and funded by Universitas Negeri Surabaya.

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