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An Analysis of the Functionality of the Philosophy of Mathematics and the Philosophy of Education in Facilitating Conceptual Understanding in Mathematics Learning Activities

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ABSTRACT: This research aims to analyze how much functionality the philosophy of mathematics and philosophy of education have on students' conceptual understanding in mathematics learning activities. Mathematical philosophy provides the essence related to basic mathematical concepts that students must understand, while educational philosophy has the role of helping understand the correct pedagogical approach to convey these concepts to students in learning activities. This research is descriptive research with literature study. This research shows that a deep understanding of the philosophy of mathematics and philosophy of education can provide an educator with aspects of the diversity of learning strategies, increase students' understanding of mathematical concepts and can further strengthen a more reflective and in-depth learning approach.

KEYWORDS: Philosophy of Mathematics, Philosophy of Education, Mathematics Learning, Understanding Concepts, Pedagogy.

I. INTRODUCTION

Humans are God's most perfect creation, endowed with intellect. Humans can use their intellect to guide all their actions. According to Socrates, humans are zoon politikon, or social animals, while according to Max Scheler, humans are Das Kranke Tier, or the sick animal, always troubled and restless (Miranda, Kamaluddin, and Fitriani 2023). This is what drives humans to continually develop their ways of thinking in order to solve problems, one of the paths being through education. Education is a process that fully involves humans, carried out by humans, between humans, and for humans (Miranda, Kamaluddin, and Fitriani 2023). The importance of education in human Life. Through education, people can learn to develop ways of thinking in making decisions and analyzing the outcomes of those decisions. Education requires philosophy, as the field of education not only encompasses practical aspects limited to experience but also covers broader, deeper, and more diverse issues. It does not rely solely on experience or reality in education and cannot always be resolved within educational science alone (Simangunsong 2021). Therefore, education can enable individuals or society to face challenges and problems of the past, present, and future (Sari and Armanto 2021).

The philosophy of education is a discipline that delves into educational issues from a philosophical perspective. The role of the philosophy of education includes its significant contribution to constructing curriculum, pedagogy, and assessment strategies in educational activities. This can influence decision-making, curriculum development, and instructional practices, impacting students' holistic development and learning Mathematics originates from the Greek word mathematicos, meaning exact science, derived from mathema or mathesis, which means teaching, knowledge, or science (Sari and Armanto 2021). Mathematics also requires philosophy, as there are fundamental concepts within mathematics that students need to understand well and accurately. The role of the philosophy of mathematics in the field of mathematics is essential, as it delves into the essence of these fundamental concepts to be conveyed to students.

Based on the explanation of these facts, the researcher is interested in analyzing the functionality of the philosophy of education and the philosophy of mathematics in facilitating conceptual understanding in mathematics learning activities

II. METHOD

This research is a descriptive study using a literature analysis approach following Creswell's procedures (Ismail, Dewi, and Simamora 2022). Several data sources analyzed include articles focusing on research in the philosophy of education and the philosophy of mathematics. Data collection and classification were carried out by reviewing previous studies that focus on the role

of the philosophy of education and the philosophy of mathematics. The stages of the literature analysis are illustrated in Figure 3.1 below:

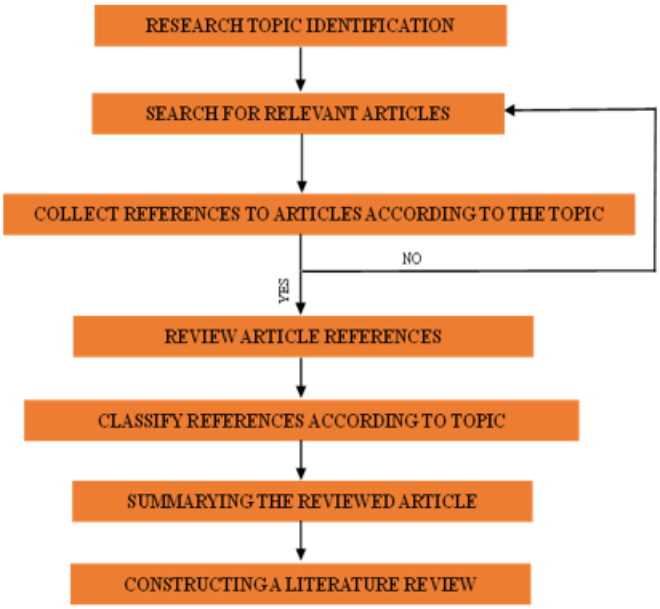

Figure 3.1 Cresswell (2009) literature review procedure Based on the figure, the explanation is as follows:

1. Identifying the Research Topic: In this stage, the researcher identifies the research topic to be explored, including aspects such as philosophy of education, philosophy of mathematics, the role and position of mathematical philosophy and education, concepts, and mathematics learning.
2. Searching for Relevant Literature: In this stage, the researcher gathers data in the form of relevant articles related to the research being conducted using electronic media (Google Scholar, journal websites like Shinta and Garuda).
3. Collecting References According to the Topic: At this stage, the researcher collects and sorts references that align with the research topic. This ensures that the data used as research support is valid.
4. Reviewing Articles: The data collected in stage 3 is then reviewed by the researcher to examine the substance of each article that will be used as supporting data in the research.
5. Classifying Articles: After reviewing, the researcher groups the articles to align with the formulated research topic.
6. Summarizing Articles: At this stage, the researcher summarizes the articles reviewed in stages 4 and 5. This serves as an analysis of the articles that have been classified and reviewed.
7. Constructing the Literature Review: The results of the researcher's analysis of each topic are then narrated by constructing a literature review

III. RESULTS AND DISCUSSION

1. Result in this research, there are four main topics examined, which include:

a. Philosophy of Mathematics
b. Philosophy of Education
c. Mathematics Learning with an Innovative Approach
d. Media, Methods, and Modules for Mathematics Learning

Regarding the follow-up to the identification of topics that have been formulated, the collected article data will be described through several tables. Table 1 contains data on all relevant articles related to this research topic.

Table .1 Relevant Topics and Articles in Previous Research.

Research Topic	Refernce
Philosophy of Mathematics	(Hidayat 2023) (Fedi et al. 2021) (Ernest et al. 2016) (Ismail, Dewi, and Simamora 2022) (Mahendrawan, Yanuarti, and Asmarawati 2021) (Nugraheni 2021) (Prabowo 2009) (Sinaga et al. 2021)
	(Suyitno 2014) (Sari and Armanto 2021) (Sadewo, Purnasari, and Muslim 2022)
Philosophy of Education	(Sesady, M. 2019) (Busthan 2022) (Fedi et al. 2021) (Ginting and Situmorang 2008) (Harahap and Fauzi 2018) (Miranda 2023) (Simangunsong 2021)
Mathematics Learning and Innovative Approaches	(D'ambrosio Ubiratan 1985) (Suryo Bintoro 2021) (Maskar and Anderha 2019) (Eko Digdoyo 2019)
Media, Methods and Mathematics Learning Modules	(Muthia, Netriwati, and Sugiharta 2018) (Pinahayu 2016) (Lasarus 2020) (Qiftiyah 2020) (Parnabhakti and Fidiawati 2021)

In this study, the description of the literature review can be seen in Table 1 above. There are 28 articles grouped into 4 topics. The first topic is related to the philosophy of mathematics. In this topic, the researcher obtained information related to the philosophy of mathematics from 11 relevant articles, including articles by (Hidayat 2023), (Fedi et al. 2021), (Ernest et al. 2016), (Ismail, Dewi, and Simamora 2022), (Mahendrawan, Yanuarti, and Asmarawati 2021), (Nugraheni 2021), (Prabowo 2009), (Sinaga et al. 2021), (Suyitno 2014), (Sari and Armanto 2021), (Sadewo, Purnasari, and Muslim 2022). The study by (Sari and Armanto 2021), which focuses on the relationship between mathematics and the philosophy of education, shows that the philosophy of mathematics is a branch of philosophy that examines the foundations and implications of mathematics. Moreover, the research findings in this article indicate that the relationship between mathematics and the philosophy of education is a continuous and interconnected one. However, one of the weaknesses of this article is that the researcher did not provide an in-depth analysis of specific philosophical theories or mathematical principles. The article only discusses the relationship between two variables: the philosophy of mathematics and the philosophy of education. The article also lacks empirical data, as no case studies are used to validate the claims made regarding the synergy between mathematics and philosophy in the educational field. Additionally, the article places

too much emphasis on the abstract side, which reduces its relevance to discussions on everyday educational practices. The researcher found a functional relationship between the philosophy of mathematics and conceptual understanding in mathematics learning (Ernest et al. 2016)Moreover, in-depth philosophical discussions were found in the study by (Sadewo, Purnasari, and Muslim 2022). Based on the literature gathered on the topic of the philosophy of mathematics, the researcher concluded that there has yet to be in-depth research on the functionality of the philosophy of mathematics in supporting conceptual understanding in mathematics learning.

Table .2 Focus of research in the philosophy of mathematics

Philosophy of Mathematics	
Research Focus	Reference
About the relationship between mathematics and educational philosophy	(Sari and Armanto 2021) (Sadewo, Purnasari, and Muslim 2022)

In the topic of the philosophy of education, there are 7 relevant sources, including articles by (Sesady 2019), (Busthan 2022), (Fedi et al. 2021), (Ginting and Situmorang 2008), (Harahap and Fauzi 2018), (Miranda 2023), and (Simangunsong 2021). The study (Simangunsong 2021), which focuses on the philosophical foundations of knowledge, historical context, and the role of philosophy of education in learning activities, shows that philosophy plays an important role in understanding and teaching mathematics. Furthermore, philosophy also plays an important role in the historical aspects related to mathematical knowledge and the challenges faced by educators. The weaknesses of this article include the lack of empirical evidence related to the philosophical discourse and the historical references of mathematics. Additionally, the article overgeneralizes the philosophy of education. Empirical evidence found by the researcher is presented in (Fedi et al. 2021), which empirically explores the humanistic philosophy in the history of education. (Ginting and Situmorang 2008) contribute to understanding the historical development of knowledge, including mathematics, thus contributing to historical understanding in the context of education.

Table .3 Focus of educational philosophy research

Philosophy of Education	
Research Focus	Reference
Philosophical basis of knowledge, historical context, role of educational philosophy in learning activities	(Simangunsong 2021)

In the topic of mathematics learning and innovative approaches, the researcher successfully gathered 4 relevant sources. These sources include (D'ambrosio Ubiratan 1985), (Suryo Bintoro 2021), (Maskar and Anderha 2019), (Eko Digdoyo 2019). Penelitian (Maskar and Anderha 2019) focuses on the application of innovative approaches in teaching geometry. The findings of this study indicate that the application of a transformative approach to geometry is a relevant way to help students understand the material. The weakness of this article lies in the limited exploration with local motifs, which requires broader application for teaching other subjects. Based on this explanation, the researcher concludes that in the learning process, to help students understand the concepts of the material, the use of an approach is necessary.

Table.4 Mathematics Learning Focus and Innovative Approaches

Mathematics Learning and Innovative Approaches	
Research Focus	Reference
Innovative approach to learning	(Maskar and Anderha 2019)

In the fourth topic related to Mathematics Learning Media, Methods, and Modules, the researcher successfully classified five relevant sources, which include (Muthia, Netriwati, and Sugiharta 2018), (Pinahayu 2016), (Lasarus 2020), (Qiftiyah 2020), and (Parnabhakti and Fidiawati 2021). The study by (Muthia, Netriwati, and Sugiharta 2018) focuses on the development of learning media. The article concludes that the use of appropriate learning media can enhance students' motivation and learning outcomes. Similar results were also found in (Pinahayu 2016). Based on this explanation, the researcher concludes that the use of suitable and engaging learning strategies and media can improve students' motivation and learning outcomes.

Table .5 Focus on developing learning media

Media, Methods and Mathematics Learning Modules	
Research Focus	Reference
Development of learning media	(Muthia, Netriwati, and Sugiharta 2018)

2. Discussion

a. Philosophy of Mathematics

Philosophy, derived from the English word "philosophy" and the Greek words philein or philos, meaning love and wisdom (Sari and Armanto 2021), is defined by Aristotle (382-322 BCE) in (Sari and Armanto 2021)as a field of knowledge that encompasses truth regarding the sciences of metaphysics, logic, rhetoric, ethics, economics, politics, and aesthetics. Based on the definitions elaborated by several scholars, we can conclude that philosophy is a field of study focused on understanding the fundamental truths of various issues. Mathematics, derived from the Greek word mathematikos, meaning certain knowledge, comes from mathema or mathesis, which means teaching, knowledge, or science (Herman 2003, in (Sari and Armanto 2021)). Philosophy and mathematics have a strong connection, as the philosophy of mathematics is a branch of philosophy that delves into the foundations and implications of mathematics. Based on the review of articles within the topic of the philosophy of mathematics, it can be stated that the role of the philosophy of mathematics in knowledge is crucial. It helps in understanding the foundations of mathematical knowledge, determining the truth and validity of mathematical theories, and developing critical and analytical thinking. This highlights that the function of the philosophy of mathematics in comprehending concepts within mathematics learning activities is vital, as an in-depth understanding of the philosophy of mathematics greatly influences students' grasp of foundational mathematical concepts.

b. Philosophy of Education

Education is an essential part of human life experience (Busthan 2022). Etymologically, education comes from the word "educate," while "to educate" means "to assist" individuals in mastering knowledge, skills, behaviors, and attitudes that are inherited from their environment or society (Busthan 2022). Education can be carried out with the guidance of more mature individuals, though it can also be pursued independently. Philosophy and education share a significant relationship, based on the aspects of ontology, epistemology, and axiology in their application to education. This relationship aligns with findings from several articles classified under the philosophy of education, highlighting the crucial role of educational philosophy in learning activities. Based on this explanation, the researcher concludes that the function of educational philosophy in students' conceptual understanding within learning activities is vital. This is because educational philosophy is, in essence, a field of knowledge that answers questions and phenomena in the realm of education from a philosophical perspective. c.Mathematics Learning with an Innovative Approach

Learning is essentially the process through which students address real-life problems (Suryo Bintoro 2021). In learning activities, it is essential to incorporate ideas and apply appropriate approaches to help students grasp material concepts. The approach used in learning activities has been studied in research (Maskar and Anderha 2019)which found that implementing a transformative geometry approach is an effective method for helping students understand the material. This aligns with findings from several articles reviewed on the same topic, demonstrating that the role of the approach in conceptual understanding and learning outcomes is highly significant. Based on this explanation, it can be concluded that the approach used in learning activities influences students' conceptual understanding and learning outcomes.

d.Media, Methods, and Modules for Mathematics Learning

Media refers to all physical tools that can present messages and stimulate students in the learning process (Muthia, Netriwati, and Sugiharta 2018). Meanwhile, a module is a teaching material created in a comprehensive and systematic manner that contains a set of planned and designed learning experiences to support students' learning activities (Harahap and Fauzi 2018). A module is a common and systematic way of delivering learning material to students (Ramdani et al. 2023). Based on the review of several relevant articles on the topic of Mathematics Learning Media, Methods, and Modules, including (Lasarus 2020), (Pinahayu 2016), the researcher can describe the critical role of media, methods, and modules in learning activities. This is because media, methods, and modules, as supporting factors in learning activities, impact students' conceptual understanding and learning outcomes.

IV. CONCLUSION & SUGGESTION

Based on the findings and discussion of this research, the researcher can conclude that the functionality of the philosophy of mathematics in facilitating conceptual understanding of mathematics in learning activities is quite significant. Additionally, the functionality of the philosophy of education in enhancing the understanding of mathematical concepts in learning activities is also considerable. The approach, use of modules, methods, and media in mathematics learning activities likewise influence students' conceptual understanding of mathematics. suggestion This research, using a literature review method, is limited to the study of educational and mathematical disciplines. It is hoped that future research can expand by exploring other branches of knowledge,

thereby broadening understanding of the role and function of philosophy in various fields of knowledge and having a positive impact on students' learning outcomes.

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