

Understanding Philosophy of Mathematics Education Through Numeracy Task with the Context of Covid-19 Pandemic

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ABSTRACT

Philosophy as a science that studies general objects of knowledge needs to be introduced in various activities, such as solving problems related to numeracy in the context of the COVID-19 pandemic. Hence, this study aims to explore students' understanding of the general philosophy of completing numeracy tasks. Data were collected from 59 student teacher candidates who studied the course of philosophy of mathematics education at the university in Surabaya, East Java, Indonesia. The numeration task is open-ended using the context of the COVID-19 pandemic. Descriptive analysis by grouping student answer models, and student responses in terms of epistemological, ontological, and axiological aspects related to numeracy tasks. The results of the analysis show that there are five solution models of the numeracy task made by students. While related to epistemology, students mentioned five views of the task, as for the ontological and axiological aspects, students mentioned three views.

Keywords: *Philosophy of mathematics education, Numeracy, Covid-19 pandemic.*

1. INTRODUCTION

Philosophy of mathematics education can be classified dichotomously based on education that determines the goals of mathematics education to be pursued, and pedagogical theories that suggest effective teaching and learning strategies. The first part can be called an axiological goal, because it places a normative value on educational goals, and the last is an epistemological claim, because theories about teaching and learning are always based on how knowledge acquisition works [1]. Ontology is one of those philosophical concepts that are recognized by most theorists as well as researchers, but most seek to move quickly, under, or around to meet face-to-face. Epistemology, unlike ontology, is often embraced by researchers, theorists, and researchers as a productive site for research [2]. Tobin, Jubran, & Laghi [3] describe epistemology as the study of the basis upon which knowledge rests, i.e., determining the conditions for such knowing, and that it always lurks a layer or two deeper than any question in science.

Ontology, epistemology, and axiology lay the foundations for how people, as individuals, understand

the world they live in, the decisions they make about issues related to truth, and what is considered valuable to individuals, as well as to society in general [1]. Ontology, or the study of being, creates a framework for how an individual, connected in society, understands the reality in which he or she lives. The strength of ontology is that it provides the key to unlocking the way reality is understood, by taking as its object of study the actual existence of things, matter, concepts, experiences, and words [1].

Epistemology, or the study of knowledge, receives more emphasis in rationalist society because it explains why people collectively decide certain things are true, and others are not. Science, and the interpretation of scientific results, are changing the way society acts at all stages of life. Axiology, or the study of value or goodness, is clearly the philosophical school of the three that has received the least attention, although it is basically related to one's actions in everyday life [4]. If epistemology is about what one knows and how one knows what one knows – what is on the inside – and ontology is about what one needs to know – what is on the outside – then the most fundamental challenge created by complexity is that it does not can again be considered as indivisible. Axiology is a theory of value,

and values are aspects of human behaviour that emerged during evolution and gave it goals, objectives, and opinions which through certain knowledge led to an action [5].

Numeracy is the ability to handle numbers and data to evaluate statements or information based on problems that include estimation and mental processes in real-world contexts. Research that discusses how numeration has been widely carried out, Craig states that numeracy plays an important role because it helps people to live decently now and continue to participate in society. Numeration reflects changes in modern life [6].

Numeracy is not only related to the application of the concept of numbers but includes the idea of being able to communicate effectively with others through basic mathematical concepts [7]. Numeracy is not just an understanding of concepts and competencies related to numbers and measurements, but also skills and attitudes of confidence in handling and interpreting quantitative data [8].

Numeracy is related to the ability to handle numbers and data to evaluate statements or information based on problems that include estimation and mental processes in real-world contexts (Traffer's in [9]). Numeracy is understood as competence in interpreting and using numbers in everyday life, at home, at work and in society [10]. Numeracy includes a person's competence in identifying, understanding, and using the concept of numbers in various contexts [11]. Numeracy is related to the use of mathematics to solve problems related to numbers so that numeracy needs to be taught since elementary education [12].

The aim of this study is to describe the results of the numeration analysis of prospective mathematics teacher students using the context of the Covid-19 pandemic associated with philosophical knowledge of mathematics education in general which includes epistemological, ontological, and axiological.

2. RESEARCH METHOD

This research is an exploratory descriptive study that aims to describe the numeration of prospective mathematics teacher students in the context of Covid-19. The subjects chosen were prospective mathematics teacher students who were following the undergraduate mathematics education program at the State University of Surabaya as many as 59 students. Subjects will be given a numeration assignment sheet which includes problem solving, numeracy understanding, and general philosophical aspects of knowledge. The numeracy test was prepared by the researcher himself with first being validated by an expert lecturer. This numeracy test is used to determine students' numeracy skills. The time given for the numeracy test is a maximum of 40 minutes. Task: One isolation room for Covid-19 patients contains

3 patients. One bed measures 2.2 m x 1 m with a distance between beds of 1.3 m. Then, one of the distances between the bed and the bedroom wall is 1.4 m. How large is the isolation room for the Covid-19 patient? In your opinion, what are the epistemological, ontological, and axiological aspects of the math task/problem? Describe as completely as possible.

Data analysis was carried out descriptively by examining the results of the numeration task, categorizing the results of student answers, calculating the number and percentage of students in the categories, and concluding the categories of student answers. Checking the validity of the data is carried out by looking at the accuracy (accuracy) of the data, the credibility of the source, and the authenticity of the data from the participants [13].

3. RESULTS AND DISCUSSION

The results of the completion of the numeracy task made by the students showed that there were 44 students (74.57%) who answered correctly and 15 students (25.43%) answered incorrectly or unrealistically in the context. Most of the students relatively have the skills and abilities to complete divergent numeracy tasks associated with the Covid-19 context. This context is included in the general social and work context [14]. Students already have sufficient mathematical abilities such as geometry, measurement, numbers, and arithmetic operations, as well as data processing so that they do not experience difficulties in doing numeracy tasks ([7], [12]). The errors made were more technical errors in calculations, not conceptual errors.

Numeracy is a competency in interpreting and using mathematical concepts for various contexts [10]. These competencies can look at a problem with divergent solutions or solutions and answers. This competence gave birth to student solutions consisting of 5 categories [7]. Irrational models produced by 16,95% of students and others provide additional data or provide space for

the movement of patients, nurses, or doctors. Students' understanding of numeracy is relatively good.

(integrated) in interpreting a numeracy task completion activity.

Table 1. Epistemological Category Numerical Tasks by Students

Model	Description	N	Percentage
E1	The numeracy tasks are associated with knowledge of how to get the area of a room by sketching and finding the area.	13	22,03
E2	The numeracy task was associated with information on the problem, such as bed size, 3 patients, distance between bed and wall	25	42,37
E3	Numerical tasks are understood as information that is sensed by the senses, such as a bed.	6	10,17
E4	Numerical tasks are understood as knowledge of the concept of flat shapes	12	20,34
E5	Numerical tasks are understood as knowledge of context and concepts such as beds, room shapes, distances, formulas for the area of a rectangle.	3	5,08

Numeracy and the Covid-19 pandemic can be a theme in understanding the philosophy of mathematics education, which is associated with general aspects of philosophy, namely epistemological, ontological, and axiological [4]. The complete results of the epistemological categories made by students are shown in Table 1. The epistemic view of students tends to be knowledge related to information on the problem by

The complete results of the ontological categories made by students are shown in Table 2. From an ontological perspective, students tend to review the existence of isolation rooms according to realistic conditions with various sizes (model O1) by 69.49%. This is in accordance with the focus of the task to determine the area of the isolation room. The condition of the room area is adjusted to the existing

Table 2. Ontological Category Numerical Tasks by Students

Model	Description	N	Percentage
O1	The task of numeracy is associated with the existence of isolation rooms of whatever size, according to reality.	41	69,49
O2	The numeracy task is associated with the existence of a room for the isolation of Covid-19 patients.	7	11,86
O3	The numeracy task is associated with the presence of Covid-19 (the context).	11	18,64

42.37% and implicit mathematical knowledge in the matter which is 20.34%, while those who look at context aspects such as the Covid-19 pandemic situation and the mathematical concepts contained such as the shape of the bedroom, the area formula, or the distance of 5.08%. Based on these results, it can be hypothesized that students' epistemic conceptions are not yet complete

data/information and the existing context ([9], [12]).

The complete results of the axiological categories made by students are shown in Table 3. From an axiological point of view, students tend to place their tasks in relation to the problems contained in the questions, namely determining the area of one Covid-19 isolation room by 50.85%. The external goal of the task

Table 3. Axiological Category Numerical Tasks by Students

Model	Description	N	Percentage
A1	The numeracy task is associated with controlling covid-19 with the distance between beds and one room for 3 patients.	16	27,12
A2	Numerical tasks are associated with their usefulness for calculating the area of a room.	30	50,85
A3	The axiology of the numeracy task is not explained.	3	5,08

for controlling covid-19 and his understanding of the pandemic was 27.12%. These results illustrate that awareness of the benefits of a task, or the value of a task has emerged associated with COVID-19 [4]. These three aspects are integrated and interrelated in the view of truth that students believe in [5]. The view of the three aspects in mathematics education is strung from the aspects of axiology, epistemology, and ontology [1]. The results of this study indicate that students tend to view numerical tasks as being used to determine the size of the isolation room (axiology), and the knowledge associated with this task is related to task information such as room size, distance between beds, and distance between beds and walls (epistemological). Thus, the existence of isolation rooms according to realistic conditions with various sizes (ontological) and certain considerations. This thinking is consistent and coherent with the views of [1]. It's just that in mathematics education because it involves knowledge of mathematics, education, and mathematics education need to think about other more appropriate approaches. This is as explained by Bicudo [15] who says that the deconstruction of characteristics between, the origins of mathematics education, and the search for ontological, epistemological, and axiological understandings, can lead to dangerous paths, because one will be asked to traverse different philosophical and scientific conceptions of mathematics, education, and mathematics education.

4. CONCLUSION

Students' epistemic views tend to have knowledge related to information on questions (model E2) by 42.37% and implicit mathematical knowledge in questions by 20.34%, while those who look at context aspects such as the COVID-19 pandemic situation and mathematical concepts contained such as the shape of the bedroom, the area formula, or the distance of 5.08%.

On ontological perspective, students tend to review the existence of isolation rooms according to realistic conditions with various sizes (model O1) by 69.49%.

Then, on axiological point of view, students tend to place their tasks in relation to the problems contained in the questions, namely determining the area of one Covid-19 isolation room by 50.85%.

As a suggestion from the results of this study, learning needs to be related to philosophical aspects that can explore students' views and beliefs about a task. In addition, it is necessary to design follow-up research, such as in learning that relates aspects of numeracy and philosophy of mathematics education, so that an effective and quality learning design or strategy is produced.

AUTHORS' CONTRIBUTIONS

All the authors have designed this study together. All authors contributed to the revision of the manuscript. The scriptwriter has completed the final version

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