Investigating the Philosophical View of Teaching Circles Theorem

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Bright Asare asarebright6592@gmail.com	Circle theorem was seen as the most challenging mathematics topic most students' in Ghana run away from. During the WASCE, most students run away from answering mathematics questions that are in line with circle theorem. Such challenge has drawn the attention of mathematics teachers and researchers in mathematics education to find out the factors that drives students from attempting circle theorem question and the appropriate approach that can be used to teacher and to solve questions in circle theorem. The study aimed to investigate the philosophical view of teaching circle theorem. The literature review was based on ontological view of circle theorem, axiological view of circle theorem, and epistemological view of circle theorem. The study concluded that, the three philological view of mathematics has a unique significant effect on teaching and learning circle theorem.
Keywords: Ontological view; Axiological view; Epistemological view; Circle Theorem, Teaching.	

INTRODUCTION

Circle theorem has a very good history that spans several centuries, with contributions from various cultural settings and civilizations. Ancient Egypt records the earliest knowledge of circles as well as their properties as far back as 3000 BCE used in their architectural designs in the construction of circular tombs and monuments. In ancient Greece, the circle theorem also gained significant attention during the time of Euclid around 300 BCE (Park, 2020). His book 'Elements', is an extensive discussion of the properties of circles. Archimedes accurately calculated the value of pi (π) and formulas to calculate the area and circumference of a circle paving the way for advancement in calculus and integral calculus (B. & Dhar, 2020).

During the Islamic Golden Age (8th and 14th centuries CE), Islamic scholar Al-Khwarizmi wrote a book called 'Al-Jabr wa'l-Muqabalah', introducing concepts of algebra and discussing the application of algebraic concepts to geometrical figures including circles (Baharuddin & Abdullah, 2014). In the 16th and 17th centuries, European mathematicians further expanded the knowledge of circles. Johannes Kepler made notable contributions to the laws of planetary motion to explain the movement of celestial bodies in elliptical orbits around the sun (MIT, 2000). Rene

Descartes' contribution gave a precise representation and analysis of circles on graphs (His, n.d.).

In the 18th and 19th centuries, Leonhard Euler and Carl Fredrich Gauss worked further in analytical geometry and trigonometry depending on the understanding of circle geometry which led to the present-day study of circles and their theorems (Wells, 2015). Today, the circle theorem is an integral part of mathematics education and is studied and applied in various fields, including physics, engineering, and computer science. The exploration of and understanding of circles has evolved significantly over the years due to the works of various mathematicians throughout history.

Philosophies in mathematics education have become the fundamental way of seeing the essence of studying mathematics in terms of its nature and its values. In several respects, most mathematics paths require and demand thinking at a very abstract level. Philosophy of mathematics is like history, not a subject matter that provides a style of thought by the kind of questions it asks and the way we answer that particular question. There have been notions on how the circle theorem must be taught at the second circle education in Gana based on the challenges students encounter in learning the circle theorem. The circle theorem involves a lot of rules and formulas that need memorization. As a result of this students find it difficult to identify the correct ways and the kind of theorem to apply in solving problems. Students see the circle theorem as a mathematics topic that needs constant practice to understand.

Not only do students see the circle theorem as the most difficult topic in the mathematics syllabus in Ghana. Most teachers find it difficult to teach circle theorem at the second circle education in Ghana due to its complex nature and how its diagrams are been drawn. This challenge has become the concern of most researchers in mathematics education to find how the circle must be taught for students to understand. The current study investigates how the various philosophies in mathematics education can be used to teach circle theorem at the second circle education in Ghana.

RESEARCH METHOD

Various philosophies are used by mathematics teachers not only to teach mathematics but also to help them understand various ways in which mathematics could be presented to students. The next step is to explain the essence of using various philosophies in teaching and learning mathematics. This section presents studies of various philosophies in education in teaching and learning circle theorem. This study uses the literature review method. The study aimed to investigate the philosophical view of teaching circle theorem. The literature review was based on ontological view of circle theorem, axiological view of circle theorem, and epistemological view of circle theorem.

RESULTS AND DISCUSSION

The ontological views on the circle theorem.

Students' interest in the circle theorem is likely to have a positive impact on their understanding of solving questions on the circle theorem. The effectiveness and efficiency of learning the circle theorem are likely related to students' interest in the circle theorem. Students' interest in the circle theorem will be enhanced based on how it is been taught.

According to Sanger (2021), the circle theorem can be taught with the use of an ontology view as a philosophy of education. Ontology views refer to the branch of philosophy concerned with understanding the nature of existence and reality. In the context of the circle's theorem, the ontological view stems from the fundamental nature and existence of circles and their properties. This perspective seeks to understand circles as abstract objects with characteristics and behaviors that can be analyzed and proven through mathematical reasoning. One such trial inquiry is the nature of the circle itself. Scholars see the circle as a geometric entity with some specific quantitative and qualitative properties. They analyze the circle as a set of points equidistant from a central point and its relation to other geometric figures. Other scholars from the Platonist perspective posit mathematical objects, including circles, have an independent and objective existence. Thus, circles and their properties exist in a realm different from the physical world, and humans can access this realm through mathematical reasoning. From this angle, discoverable, rather than invented, mathematicians unearth the truth about circles that exist independently of human perceptions.

The nominalist on the other hand challenges the perception of the Platonist, that circles have objective existence. Nominalists argue that mathematical objects, including circles, are mental constructs created by humans. They are of the view that the circle theorem is a product of human invention and does not exist independently of human thoughts and language. They see circles as useful tools for modeling and understanding reality but as entities with intrinsic existence. Instrumentalism focuses on the use and utility of the circle theorem rather than its nature. The instrumentalist views mathematical objects including circles as practical tools for solving problems and making predictions. From their perspective, circle theorems are not necessarily concerned with the underlying nature of circles but with their effectiveness in solving mathematical problems.

Axiological views on circle theorem

Axiology is a branch of philosophy that deals with the study of value or the nature of values, including moral, aesthetic, and epistemic values. This focuses on the values and principles underlying the study and application of circle-related

theorems in mathematics. In context, axiology examines the inherent values and significance of the theorem as well as the potential ethical considerations and societal contributions yielded by the study.

The historical perspective delves into the evolution and development of circle-related theorems throughout different periods. It traces the origins of circle theorems from ancient civilizations, where mathematics was often intertwined with religion and cultural practices. The axiological value lies in understanding the cultural significance of the circle theorem as a concept by various societies over time. From the educational angle, axiological views of the circle theorem look into the value of teaching it to students. It relates to the transferrable skills and competencies that can be developed in students such as deductive reasoning, critical thinking, problem-solving, and spatial visualization. Also, the axiological values of inclusivity and diversity may be addressed in the teaching and learning of the circle theorem, by highlighting mathematical contributions from certain groups.

The philosophical perspective of the circle theorem investigates the deeper implications and ramifications arising from the study and applications of these theorems. It examines why the circle theorem holds value as a discipline and explores the nature of mathematical truths, the existence of an objective reality, and the role of abstraction in mathematical thinking. Ethical considerations that may arise when applying circle theorems are taken care of as their potential applications in technology, architecture, and engineering.

From the cultural dimension of the axiological view of the circle theorem, it explores how diverse cultures assign values to these theorems. It cuts into how circle theorems are represented in different artifacts, such as arts, literature, and architecture, their connections to traditional knowledge, and contributions to indigenous mathematics.

In line with the social perspective of the axiological view of the circle theorem, is the examination of a wider societal impact of these theorems. It looks into how its application contributes to human development, technological advancements, and scientific discoveries. Potential ethical considerations such as the responsible use of mathematical knowledge and the equitable distribution of benefits are much looked at.

Epistemological view of circle theorem

Epistemological view of circle theorem refers to the philosophical examination of how knowledge of the circle theorem is obtained, justified, and validated. Questions like: What constitutes valid proofs in the context circle theorem? How can we come to know and understand the circle theorem? This literature aims to provide a comprehensive overview of the epistemological view of the circle theorem by reviewing key theories, paradigms, and debates in the field.

One of the main theories that have put together and shaped the epistemological view of the circle theorem is formalism (Studies, 2013). It states that mathematical knowledge, including the circle theorem, is solely derived from

the manipulation of symbols and formal deductions following a set of predefined rules (Vax, 1997). According to this view, the process of proving circle theorems is purely deductive, relying on logical reasoning and axioms of Euclidean geometry. It emphasizes the role of formal education and the development of deductive skills.

An instrumental viewpoint of this is constructivism, positing that mathematical knowledge is actively constructed by the learner through mental construction and societal interaction. Thus, the role of intuition, problem-solving, and the creation of mental models are emphasized. The significance of engaging learners in hands-on activities, exploration, and discovering relationships among circle properties is looked into.

Empiricism is another perspective of the epistemological view of the circle theorem. The empiricist argues that mathematical knowledge arises from sensory experiences and observation of the physical world. In circle theorem, it highlights the concrete, visual representations of circles and their properties. They stress using diagrams, manipulatives, and real-life examples to facilitate understanding and construction of circle theorems.

There are also ongoing debates around the validity and justification of the circle theorem. One such centers on the use of intuition and visual reasoning in the process of proving circle theorems. Some mathematicians argue that intuition and visual reasoning play a crucial role in discovering and developing circle theorems while others emphasize formal deductive proofs as the only valid approach. This raises questions about the source of mathematical knowledge and the epistemic status of intuition and diagrammatic reasoning in the context of the circle theorem. Other debates pertain to the nature of proofs and their level of certainty. It revolves around whether there are different levels of proofs in mathematics. And if certain circles' theorems may be more 'securely established' than others through different types of argument (e.g., direct proofs, indirect proofs, or nested proofs). Others assert that all valid proofs in mathematics have equal levels of certainty, positing that once a proposition is given within a formal system, it is irrefutable.

CONCLUSION

The values connected to circle theorems are examined from an axiological perspective, including their relevance to society, history, education, and culture. This viewpoint explores the transferrable skills pupils learn, moral questions raised by mathematical applications, and multicultural dimensions of mathematical contributions.

On the other hand, the epistemological perspective looks at the justification, validation, and acquisition of circle theorem knowledge. Different philosophies, including formalism, constructivism, and empiricism, provide various methods for explaining and teaching these ideas. Discussions on intuition, visual reasoning, and the nature of mathematical proofs add to the richness of this philosophical inquiry.

Finally, a comprehensive strategy based on these ideologies can offer educators insightful information in the effort to improve the teaching and learning of circle theorems. Circle theorems have left behind a legacy that has continued to

develop and inspire subsequent generations of mathematicians and problem solvers. By taking into account the nature, values, and methods of learning about circles, we may design more efficient and interesting educational experiences for students.

Teaching circle theorem can be quite difficult sometimes due to its abstract concept nature and geometric thinking, but with the employment of the correct methods and strategies, educators can effortlessly convey it to the students. The employment of the use of visual aids to for better understanding, real-world illustrations for proper engagement and relevance to students, hand-on activities for active involvement and participation of the student, integration of technology, will make the student appreciate circle theorem.

In the future this study could be embarked on from different perspectives, areas and viewpoints. Policymakers, educators and stakeholders must see to enhancing the teaching of it since it has so many real life applications to be tapped..

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