

**A Mixed Methods Case Study Exploring Visual Thinking in Proving Theorems in
Mathematical Analysis. The Case of Mean Value Theorem for Derivatives.**

¹Jonatan Muzangwa & ²Ugorji I. Ogbonnaya

¹Great Zimbabwe University , ²University of Pretoria ¹Presenting author: jonamuz@gmail.com

Key words: Mixed Methods, Visual thinking, Mean Value Theorem.

Introduction

There is a common view adopted from 19th century mathematicians that visual thinking in analysis, though heuristically useful, is not a means of discovery, let alone proof. Everyone appreciates a clever mathematical picture, but the prevailing attitude is one of scepticism: diagrams, illustrations and pictures prove nothing; they are pedagogically important and heuristically useful, but only a traditional verbal/symbolic proof provides genuine evidence for a purported theorem (Mancosu, 2005). However, some recent authors (Giaquinto, 2011; Guzman, 2002) take a different view and argue using some striking examples for a positive evidential role for visual thinking in mathematical analysis.

.Method

A sample of 50 undergraduate mathematics students participated in the study. The researcher employed both quantitative and qualitative methods. The participants were given a task to solve. The task involved making a representation of the mean value theorem , proving the mean value theorem and application of the mean value theorem. After solving the task a follow-up clinical interview was conducted using one student.

Discussion

In this context visual thinking meant the student`s ability to draw an appropriate diagram (with pencil and paper) to represent a mathematical concept, theorem or problem and to use the diagram to achieve understanding in proving a theorem or solving a problem. It was observed that a majority of students (74%) were represent the mean value theorem using a diagram. The role of the diagram was either adjunct or for illustrative in proving the mean value theorem. Further interviews also revealed that some students ` proofs were not linked to diagrams they produced.

Recommendations

Visualisation should be encouraged in proving theorems and statements in mathematical analysis. This idea brings the discipline of mathematical analysis very close to reality. Well labelled diagrams are helpful for illustration and also for sparking the idea of a proof.