Contribution ID: **40** Type: **Oral Presentation**

KNOWLEDGE AND KNOWER CODES AND THE INTEGRATION OF MATHEMATICS CONCEPTS WHEN CONDUCTING PHYSICS EXPERIMENTS

Thursday, 4 October 2018 17:40 (20 minutes)

Lack of mathematical knowledge has often been considered responsible for high failure and drop-out rates in Physics, both at school and higher education levels. Failure in problem solving has frequently been used as evidence for inadequate mathematical knowledge, since mathematical concepts are used as a tool for physics problem solving. Physics knowledge is underpinned by physical theories that originate from observed phenomena, but are explained using mathematical language, such that mathematical concepts are incorporated into the physics knowledge structure. In addition, experiments are an integral component for knowledge formation and conceptualization.. The problem is that the structural role of mathematical concepts, together with experimentation are ignored during teaching and learning of physics. The purpose of this study was to identify how mathematical concepts are integrated into the knowledge building process using experimentation in the understanding of mass density at introductory physics level.
The investigation was carried out using pre-services teachers being trained to teach Natural Sciences. The pre- service teachers were then interviewed in terms of their attitude towards physics, and how it should be taught and who should learn it, which revealed their dispositions to the subject. Generally, those who scored low marks in the experiment had a negative attitude towards the subject, felt that they naturally, physics was not their subject and were studying it because it was a compulsory module. Those who scored higher marks answered the questions from a physics perspective and understood the mathematical nature of the concept of density. The research used the Legitimation Code theory as a theoretical framework. The analysis of the results suggested that the mathematization stage could be the most difficult because it requires visualization skills and understanding a phenomenon from a physics perspective.
The investigation was important in that it highlighted the importance of not only experimentation, but understanding that mathematical concepts, in physics but are an integral part of the structure, have physical meaning and are used within the constraints of the physical situation they represent.

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Session Classification: Parallel Session 2

Track Classification: Track D - Teaching and Learning of Physics Concepts