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Grade 10 Physical Science Learners' Understanding and Application of Concepts of Evidence in Experimental Design

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ABSTRACT

One of the most important challenges of the secondary school science teacher is to help learners to obtain, analyze and evaluate evidence using experimental and investigative methods. The understanding and application of concepts of evidence play a central role in setting up valid experiment and is usually ignored in the secondary school science curriculum. Recognizing the significance and value of an understanding of evidence in developing learners' ability to carry out appropriate experimental work in science, the question arises of learners' understanding of 'concepts of evidence' in experimental design. In this study the researcher endeavored to answer some of the questions concerning learners' understanding of evidence: What understanding do learners entering the Further Education and Training (FET) band have of the concepts of validity in experimental design? What is the effect of an intervention on their understanding of concepts of validity? How well do learners show their ability to apply concepts of evidence to an assessment task?

The study investigated the ability of a sample of grade 10 Physical Science learners, in one Gauteng Province secondary school to use and understand the concepts of evidence before and after an intervention, and their ability apply these ideas about evidence in an assessment sheet task. First, a survey of learners' understanding of the concepts of validity was conducted using a written diagnostic test, consisting of three probes that had been previously used to diagnose learners' understanding of validity in experimental design. Second, an evaluation of changes in such understanding due to a specific teaching intervention was completed using the same diagnostic test. Finally, the 2004 Grade 9 Common Tasks for Assessment (CTA) investigation task was administered to the same subjects in order to investigate whether or not their understanding of concepts of evidence would be apparent in this CTA investigation task.

Several key findings emerged from the data. The major findings of this study were that the sample investigated began the study with a level of understanding equal to a group of Foundation University students tested in a previous study and that their understanding did not change much during the intervention. In fact, analysis of the results from the probes in the diagnostic test revealed that learners had little problem choosing the independent

variable and controlling variables. However, the findings from the probes indicated that the intervention did not seem to have had a major effect since the difference in the number of responses between the pre-test and post- test was relatively small. Moreover, the results also revealed that it was possible to analyze learners' responses using the existing model of learners' understanding of validity, and that the majority of learners fell into Level C in the model which refers to the application of previous understanding in a new situation.

The results from the CTA investigation task revealed that learners' understanding of concepts of evidence could be demonstrated in new science context. In fact, the results revealed that learners showed ability to apply their understanding of concepts of evidence in experimental design to the assessment task. Moreover, the CTA results indicated that the understanding of identifying variables, constructing graphs; describing the relationship between variables in a graph; formulating the investigative questions were the most applied concepts of evidence by learners. Finally, the results of this study highlight the need for providing secondary science learners with opportunities to practice and develop concepts of evidence. In the light of these findings it is recommended that children need to be explicitly taught about the purpose of science investigations and introduced to important ideas about evidence if their ability to perform investigation tasks is to be improved.