Performance and Confidence Levels of Students Entering Physics at Three South African Universities

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by

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Submitted in partial fulfillment to satisfy the requirements for the degree of Master of Science in Science Education

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University of Pretoria

Pretoria

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July 2007

DECLARATION

I declare that the dissertation that I hereby submit for the degree in Masters of Science (Science Education) at the University of Pretoria has not previously been submitted by me for the degree purposes at any other university.

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ACKNOWLEDGEMENTS

The completion of this works would not have been possible without the advice, guidance and assistance from my supervisors Dr M Potgieter and Dr E Gaigher. Thank you both for pushing me when I seemed to be stuck and not making progress. Your encouragement, support and guidance made it possible for me to undertake and perform this study. I have greatly enjoyed working with you and learning from you. My sincere gratitude also goes to the University of Limpopo and the NRF for their financial support, and I am also grateful to Ms Elsie Venter, from the Centre for Assessment and Evaluation at UP, for data capturing and statistical analysis.

I thank the students who participated in the study. Thank you for taking time off your academic activities to spend it on the test. The study would not have been possible without your participation.

My sincere gratitude goes to my colleagues at UNIFY for their constant support. In particular, I thank Mr Stimela Mathabatha, whom I regard as my mentor, for the support, encouragement and positive contributions he made throughout this study. I thank you for the fruitful discussions we had, and had learned a lot from your critical comments. Ke a leboga Tlou.

I would like to thank my husband and my children for their understanding, encouragement and support throughout this study. I would not have made it if it were not for your encouragement and support. Thank you for always being there for me. Ke leboga go ba gona ga lena baPhalaborwa.

Last but not least, I would like to thank God Almighty for giving me the strength and courage to persevere in this study.

DEDICATION

This dissertation is dedicated to my mother Maisaka Margaret Mushi, my late father Lori Lawrence Mushi, my late brother Malesela Michael Mushi and my late aunt Manthepe Rosina Mabusela.

ABSTRACT

A test instrument, made up of 25 items, derived from existing standardized tests from literature, was used to probe for the students' knowledge and understanding of basic mechanics concepts, as well as the confidence in the correctness of their answers. The test was administered to 982 first entering physics students; enrolled at three South African universities, at the beginning of the year before any formal instruction could take place. Data collected for this study included students' responses from multiple-choice questions and open-ended explanations to their chosen answers. The analysis of the multiple-choice responses and the written explanations revealed the existence of alternative conceptions among students and that the students' accuracy of judgment about their knowledge and understanding of basic mechanics concepts is different among the different cohorts.

Physics education research, has over a number of years, revealed that students have alternative conceptions about physical processes. These alternative conceptions are accumulated from the students' past personal experiences, interactions with people around them and the environment they live in. It was found from the study that the strength of the known alternative conceptions differs among the different cohorts. There are those alternative conceptions that are easier to correct with sound teaching. These alternative conceptions exist mostly in worst performing cohorts and less so in the best performing cohorts. There are those alternative conceptions that persisted despite better teaching. These alternative conceptions are found in all the cohorts.

The certainty of response analysis revealed the differences in the relationship between performance and confidence among the students from the three universities. It was also found that students make incorrect judgment about their knowledge and understanding of basic mechanics concepts. The overall trend emerging from the study was that students seem to be overconfident about their knowledge and understanding of basic mechanics concepts, but that students with a good command of mechanics concepts made the best judgment about the correctness of their answers.

The item-by-item analysis of students' responses revealed that in most cases the best performing students make quality judgment about their performance, while poor performing student always make inaccurate judgments about their performance. Analysis of the students' written explanations and item difficulty revealed that the Hasan *et al.* (1999) study is lacking in the differentiation between lack of analytical skills and the presence of alternative conceptions. Lack of analytical skills cannot be classified as evidence of the presence of alternative conceptions. The student may be having knowledge of the necessary concepts, but lack higher order analytical skills to be able to interpret situation presented.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (continues)