

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

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at Three South African Universities

by

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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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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

	Page
Title	i
Declaration	ii
Acknowledgements	iii
Dedication	iv
Abstract	v
Table of contents	vii
List of Tables	xiii
Chapter 1: Introduction	1
1.1 Background	1
1.2 The South African Context	1
1.3 Alternative Conceptions	4
1.4 Rationale to the study	6
Chapter 2: Literature review	9
2.1 Background literature	9
2.1.1 Self-efficacy	9
2.1.2 Confidence	10
2.1.3 Alternative Conceptions	11
2.1.4 The South African School Situation	12



2.2	Research questions	13
Chapter 3: Theoretical framework		14
3.1	Introduction	14
3.2	Alternative Conceptions	14
Chapter 4: Research methodology		20
4.1	Research Design	20
4.2	Test Design	20
4.3	Pilot Study	23
4.4	Sample	24
4.5	Test Validity and Reliability	26
	4.5.1 Content Validity	26
	4.5.2 Reliability	27
	4.5.2.1 Split-half Method	27
	4.5.2.2 Cronbach Coefficient Alpha	28
4.6	Ethical Issues	28
Chapter 5: Results and Analysis		30
5.1	Introduction	30
5.2	Educational Background	30
5.3	Conceptual Understanding	31
5.4	Item by Item Analysis	35



5.5	Analysis of Multiple-Choice Section	37
5.5.1	Item 6	38
5.5.2	Item 7	40
5.5.3	Item 8	42
5.5.4	Item 9	44
5.5.5	Item 10	46
5.5.6	Item 11	48
5.5.7	Item 12	50
5.5.8	Item 13	53
5.5.9	Item 14	55
5.5.10	Item 15	57
5.5.11	Item 16	59
5.5.12	Item 17	62
5.5.13	Item 18	64
5.5.14	Item 19	66
5.5.15	Item 20	69
5.5.16	Item 21	71
5.5.17	Item 22	72
5.5.18	Item 23	74
5.5.19	Item 24	77
5.5.20	Item 25	78
5.6	Summary	80

Chapter 6: Analysis of Written responses	84
6.1 Introduction	84
6.2 Coding and Analysis of Written Explanations	84
6.2.1 Item 6	85
6.2.2 Item 7	88
6.2.3 Item 8	90
6.2.4 Item 9	93
6.2.5 Item 10	95
6.2.6 Item 11	98
6.2.7 Item 12	100
6.2.8 Item 13	102
6.2.9 Item 14	103
6.2.10 Item 15	105
6.2.11 Item 16	107
6.2.12 Item 17	110
6.2.13 Item 18	111
6.2.14 Item 19	114
6.2.15 Item 20	116
6.2.16 Item 21	118
6.2.17 Item 22	120
6.2.18 Item 23	122
6.2.19 Item 24	124
6.2.20 Item 25	126

6.3	Summary	128
Chapter 7: Discussion and Conclusion		132
7.1	Introduction	132
7.2	Discussion	132
7.2.1	Conceptual Dimensions	135
7.2.1.1	Kinematics	135
7.2.1.2	Newton's First Law	137
7.2.1.3	Newton's Second Law	138
7.2.1.4	Newton's Third Law	139
7.2.1.5	Superposition Principle	140
7.2.1.6	Gravitation	141
7.2.2	Confidence Levels	143
7.3	Alternative Conceptions or Lack of Knowledge	144
7.4	Conclusion	145
7.5	Limitations to the Study	147
7.6	Implications to Teaching	148
References		150
Appendices		156
Appendix A: Consent Form		156
Appendix B: Test Instrument		157
Appendix C: Performance and Confidence Levels of Students		180

Appendix D: Scatter Plots of Students' Performance and Confidence Levels	191
Appendix E: Students' Educational background	195

LIST OF TABLES

		Page
Table 3.1	Decision matrix for a group of students (a class) and for a given question. Based on combinations of correct or incorrect answers and of low or high average CRI.	17
Table 4.1	Basic Mechanical Conceptual Dimensions Included in the Test.	22
Table 4.2	Codes of Students Cohorts Participating in the study.	26
Table 5.1	Average Performance and Average Confidence Levels of the Students from the Eight Students Cohorts.	33
Table 5.2	Overall Performance Matrix of all the Students Confidence and for all Items.	34
Table 5.3(a-t)	Average Performance and Average Confidence Levels of Cohorts of Students for each of the Twenty Items.	39-79

LIST OF TABLES (continues)

		Page
Table 5.4	Item Difficulty for the UPmaj Cohorts and Differences Between Confidence Levels for Correct and Incorrect Responses, for all Items and all Cohorts.	81
Table 6.1(a-t)	Frequencies of Written Responses for each of the Twenty Items for the Combined UL and the UPmaj Cohorts.	86-127
Table 6.2	Alternative Conceptions and Incorrect Explanations Revealed by the Written responses.	129