

https://dspace.org/

A case study of South Africa's teachers' understandings of the nature of science and classroom instructional practices.

Beauchamp, Nondyebo Julia

2011-05-27
http://hdl.handle.net/10539/9952

Downloaded from a DSpace repository. https://dspace.org/

DECLARATION

I declare that, apart from the assistance acknowledged, this report, titled:

"A case study of South Africa's teachers' understandings of the nature of science and classroom instructional practices" is my own work. All sources that I have used or quoted have been acknowledged by means of complete citation and referencing. This report is being submitted to the University of the Witwatersrand in partial fulfillment of the requirements for the degree of Masters of Science in Science Education. It has not been previously submitted for any degree or examination at any other university.

_____ _____

N.J. BEAUCHAMP **DATE**

ACKNOWLEDGEMENTS

The research study would not have been possible and successful without the knowledge and support of my supervisor, Dr Elaosi Vhurumuku. His guidance and helpful advice during the time of writing this report is greatly appreciated. My sincere thanks and gratitude goes to: the Department of Education; the principals of the participating schools; the teachers who participated in this study; and the National Research Foundation for the financial assistance. I am grateful to the Department of Education and the school principals for giving me permission to conduct my study.

May God bless everyone who was involved in this study!

DEDICATION

This study is dedicated to my husband, Zwelibanzi; for his unwavering support and encouragement throughout the writing of this report and to my beloved daughters Yolisa, Lusanda and Nikiwe, for their understanding and Ousi, for her support.

TABLE OF CONTENTS

CONTENTS **PAGE**

Declaration ……..…….. …i

Acknowledgements …….……. ii

Dedication …….……iii

Table of contents …….…….....iv

List of figures …….……..viii

List of tables …….…….ix

List of acronyms …….……x

List of appendices …….…….xi

Abstract …….…….xii

CHAPTER 1: Introduction into the study

1. Introduction ……..…….1

1.1 Background and rationale …….……..2

1.2 The purpose of the study …….……3

1.3 Research questions …….…… 3

1.4 Theoretical framework …… ……...4

1.5 Research methodology outline …….. …….….5

1.6 Chapters outline …….….5

1.7 Conclusion ……..……..6

CHAPTER 2: Literature Review

2. Introduction ……..……7

2.1 The Nature of Science ……..…..…….....7

2.1.1 What is the Nature of Science? ……..……..7

2.1.2 Some basic tenets of the NOS ……..……8

2.1.2.1 The theory-laden nature of scientific knowledge ……..9

2.1.2.2 Scientific knowledge is tentative ……..9

2.1.2.3 The creative and imaginative nature of scientific knowledge 10

2.1.2.4 Social and cultural embeddedness of scientific knowledge …10

2.1.2.5 There is no ONE scientific method ……..…..…11

2.1.2.6 The relationship between scientific theories and laws ……..11

2.2 Instructional practice ……..……..……..12

2.3 Theoretical framework …….....12

2.3.1 Categorizing teachers' NOS understandings …….12

2.3.2 Teaching about NOS …….13

2.3.3 Teaching practices …….15

2.4 Literature review ……...15

2.4.1 Studies done on teachers' understandings of NOS ……16

2.4.2 Studies done on teaching about NOS …….....17

2.4.3 Studies done on teachers' understandings of NOS and instructional practices …….19

2.5 Conclusion …….19

CHAPTER 3: Research Methodology

3. Introduction ……..……20

3.1 The research design ……...20

3.2 Methodological approaches to studying NOS and instructional practices…..21

3.2.1 Methods used to study teachers' NOS understandings …….21

3.2.2 Methods used to study teachers' instructional practices ……22

3.3 Sampling and participants ……23

3.4 Data collection ……24

3.4.1 Teachers' NOS understandings ……24

3.4.2 Classroom instructional practices ……25

3.4.2.1 Classroom observations ……25

3.4.2.2 Interviews …….....26

3.5 Data analysis ……27

3.5.1 Data from the interviews …….....27

3.5.2 Data from classroom observations ……28

3.6 Issues of validity and reliability ……...28

3.7 Ethical issues ……29

3.8 Conclusion ……30

CHAPTER 4: Results and Discussion

4. Introduction ……31

4.1 Teachers' understandings about the nature of science …….31

4.1.1 Teachers' understandings about what science is ……..33

4.1.2 Teachers' understandings about the role and purpose of experiments in science…….35

4.1.3 The relationship between theories and laws and their roles in science……..37

4.1.4 Resolving scientific disputes …….39

4.2 Teaching about NOS……...……41

4.2.1 Results from interviews …….42

4.2.1.1 The teachers' teaching philosophy……..42

4.2.1.2 Teaching NOS aspects.……43

4.2.1.3 Planning for LO3 achievement……44

4.2.2 Results from classroom observations ……45

4.3 The nature of interactions between teachers' NOS understandings and their instructional practices ……46

4.3.1 The teachers' classroom practices: results from lesson observations..46

4.3.2 The post-classroom observation interviews ……...50

4.4 Conclusion ……..51

CHAPTER 5: Conclusions, Implications and Recommendations

5. Introduction ……52

5.1 Teachers' understandings about NOS …….52

5.2 Teaching about NOS…….54

5.3 The interactions between NOS understandings and practices …….55

5.4 Implications and recommendations …….55

5.5 Limitations of the study …….....56

5.6 Conclusion …….....57

REERENCES ……58

APPENDICES ……...65

LIST OF FIGURES

Figure 3.1 A summary of study's methodological design …….. 21

LIST OF TABLES

Table 4.1 Teachers' understandings on selected NOS aspects ……..……32

Table 4.2 Summary of the main ideas about how the teachers teach about NOS ……..41

Table 4.3 Results of the classroom observation for each teacher ……48

LIST OF ACRONYMS USED IN THE STUDY

LO - Learning outcome

NCS - National Curriculum Statements

NOS - Nature of Science

NOSS - Nature of Science Scale

OBE - Outcomes Based Education

TOUS - Test on Understanding Science

VNOS - Views of Nature of Science

WISP - Wisconsin Inventory of Science Processes

LIST OF APPENDICES

Appendix A	Teacher Interview Schedule ……..….	65
Appendix B	Subject Information Sheet …….…….	67
Appendix C	Example of lesson observation notes summary..…….	68
Appendix D	Example of teacher interview transcript…….....69	
Appendix E	Letter to the principal ……..77	

A case study of South Africa teachers' understandings of the nature of science and classroom instructional practices

Julia Beauchamp

ABSTRACT

This study investigated South Africa's secondary school teachers' understandings of the nature of science (NOS) in relation to their instructional practices. The participants were three Grade 10 Physical Science teachers conveniently selected from three schools in the Gauteng province of South Africa. Teacher understandings of the nature of science were elicited through semi-structured interviews. The core questions for the interviews were adapted from the Views of Nature of Science Questionnaire (VNOS) – Form C developed by Abd-El-Khalick, Lederman, Bell and Schwartz (2002). The nature of science tenets explored were: what is science?: the role and purpose of experiments in science: the difference between scientific theories and laws in science and how scientists settle scientific disputes. Teacher instructional practices were ascertained through semi-structured interviews and lesson observations. The results were analyzed using a combination of typological analysis and interpretive analysis. These results show that on the selected NOS tenets, the sampled teachers hold a mixture of naïve and sophisticated understandings. These understandings are, however, largely naïve. It was found that the teachers only teach about NOS implicitly. None of the teachers was found to explicitly teach about the NOS. It also came out that the teachers were experiencing difficulties in both interpreting and implementation of Learning Outcome 3 of South Africa's new science curriculum. It is concluded that the interaction between teachers' NOS understandings and their instructional practices occurs without the teachers being aware of it, i.e. unconsciously. Recommendations for teaching, curriculum implementation and future research are suggested.

Key words

nature of science, instructional practices, teachers, scientific literacy, positivism, constructivism, curriculum, learning outcomes