

**STUDENTS' IMAGES OF SCIENCE IN KENYA: A  
COMPARISON BY GENDER DIFFERENCE, LEVELS OF  
SCHOOLING AND REGIONAL DISPARITIES**

**BY**  
**JOHNSON M. CHANGEIYWO**  
**BEd(Sc.)(Hon.), Nairobi, 1984; MEd, Brock, 1991**

**A THESIS**

**Submitted to the Graduate School in partial fulfillment of the  
requirements for the award of the degree of Doctor of Philosophy in  
Education of Egerton University**

**August, 2000**



Eger241256

X

**EGERTON UNIVERSITY LIBRARY**

## ABSTRACT

The students' shortfall in science education in developing countries has persisted to date. The performance in science subjects is still poor compared to other subjects in Kenya irrespective of various curricula changes that have taken place. Therefore, there is need to find out the nature and extent of students' images of science and technology. The purpose of this study was to investigate students' images of science in the contemporary Kenyan societies. The objectives of the study were: - to find out the nature and extent of images of science held by students; and to find out if there was any statistically significant difference in the students' images of science with respect to (i) Gender difference, (ii) Levels of schooling, and (iii) Regional disparities

In the design of the study, both qualitative and quantitative techniques were employed. A detailed description of the 623 (participants from Upper Primary School, Secondary School and Teacher Training College) students' stereotype understandings about scientists and science was obtained. Both "Describe-A-Scientist's-Appearance" (DASA) and modified "Interview-About-Instances" (IAI) procedures were used in data collection. The combination of these procedures revealed a more accurate understanding of the students' images of science in Kenya. The Chi-square ( $X^2$ ) test was used in data analysis and the statistically significant findings were reflected at a significance (alpha) level of 0.05. The reliability and validity of the findings were achieved by using a large stratified sample size and employing two procedures of data collection as well as ensuring that there was a consistency of the researcher's interactive style of data collection and interpretation of the participants' meanings in data analysis.

The findings of this study indicate that most Kenyan students believe that a scientist is mostly a middle-aged male possibly with beards, grey hair and a bald head. Students hold the view that scientists usually wear a white lab-coat (Doctors' clothes), eye glasses or spectacles, hand gloves, mouth and nose masks. They believe that scientists are always surrounded with scientific instruments, machines and equipment. They further stated that a scientist is usually a very keen, active, intelligent, more observant, calm, and not sociable person who has learned a lot irrespective of one's age.

The study found out that the scientific facilities, instruments, equipment and machines are highly associated with the scientists with their work to the extent that they seemed to neutralize the gender bias dimension of the students' images of scientists and science. It was noted that when instruments and machines are applied in certain fields, it could make some tasks and/or occupations, which otherwise could not have been considered, to qualify as scientific enterprises. The findings show a slight inclination towards foreign, possibly European, cultural background. The conception of traditional and religious beliefs seemed to have an effect on students' images of scientists and science. Students believe that people who have strong traditional and religious inclinations do not believe in scientific values.

The findings of the study indicate that there is no statistically significant difference in students' images of science with respect to gender difference. However the findings did show that there is a statistically significant difference in students' images of science with respect to various levels of schooling. Students from lower levels of schooling have a stereotype image of scientists and science as compared to those from higher levels of schooling, especially those from colleges. Furthermore, the findings of the study show that there is a statistically significant difference in students' images of science with respect to regional disparity. Students from the rural areas have a stereotype image of scientists and science as compared to those from urban areas.

The findings of this study provide an insight into the possible causes and/or sources of students' negative attitudes towards science education. The results have certain implications for the educational policy makers and curriculum implementers especially when they are trying to come up with science education or related instructional programmes at various levels of schooling.

## TABLE OF CONTENTS

TITLE .....	i
COPYRIGHT.....	ii
APPROVAL.....	iii
DECLARATION.....	iv
ACKNOWLEDGEMENTS.....	v
ABSTRACT.....	vi
TABLE OF CONTENTS.....	viii
LIST OF TABLES.....	xi
LIST OF FIGURES.....	xiv
<b>CHAPTER ONE: INTRODUCTION .....</b>	<b>1</b>
1.1 Background Information.....	1
1.2 Statement of the Problem.....	6
1.3 Purpose of the Study.....	7
1.4 The Objectives of the Study.....	8
1.5 Hypotheses of the Study.....	9
1.6 Significance of the Study.....	9
1.7 Limitations of the Study.....	12
1.8 Definition of Terms.....	13
<b>CHAPTER TWO: A REVIEW OF THE LITERATURE .....</b>	<b>15</b>
2.1 Distinction and Relationship between Science and Technology.....	15
2.2 The Role of Science and Technology in Development.....	25
2.3 Science and Technology Education in Kenyan Schools.....	33
2.4 Science and Technology Education in Kenyan Rural Context.....	52
2.5 Science and Technology Education from Gender Perspective.....	65
2.5.1 Introduction to Gender Perspective.....	65
2.5.2 Development of Gender Stereotypes from Home Environment.....	70
2.5.3 Development of Gender Stereotypes from Nursery School Level.....	71
2.5.4 Development of Gender Stereotypes from Primary School Level.....	71
2.5.5 Development of Gender Stereotypes from Secondary School Level.....	72
2.5.6 Development of Gender Stereotypes from General Life Contexts.....	73
2.5.7 Cognitive Styles and Development of Gender Stereotypes.....	77
2.5.7.1 Reflective and Impulsive cognitive styles.....	77
2.5.7.2 Serialist and Holist Cognitive Styles.....	78
2.5.7.3 Field-independence and field-dependence cognitive styles.....	79
2.6 Images of Scientists, Science and Technology in the Society.....	81
2.6.1 Introduction to Images of Scientists.....	81
2.6.2 Review of Research Work on Students' Images of a Scientists.....	82
2.6.3 Examination of the images of scientists and science in developing countries.....	88

2.7	Review of Methodologies used in studying Images of Scientists and Science in Science.....	89
2.8	Theoretical Framework of the Study.....	95
2.8.1	Introduction to Constructivism.....	95
2.8.2	Development of a Constructivist Perspective in Education.....	96
2.8.3	Development of Knowledge from a Constructivist perspective.....	103
2.8.4	Teaching and Learning processes from a Constructivist perspective.....	104
2.8.5	Curriculum under a Constructivist Perspective.....	105

### **CHAPTER THREE: METHODOLOGY .....107**

3.1	Research Design.....	107
3.2	Population.....	108
3.3	Sample.....	109
3.4	Instrumentation.....	113
3.5	Procedure of Data Collection.....	115
3.6	Data Analysis.....	119

### **CHAPTER FOUR: RESULTS AND DISCUSSIONS .....124**

4.1	Describe-A-Scientists-Appearance(DASA) Approach.....	121
4.2	Students' Stereotype of a Scientist's Appearance.....	121
4.2.1	Primary School Level.....	121
4.2.1.1	From Urban Areas.....	122
4.2.1.2	Agriculturally high potential areas.....	124
4.2.1.3	Arid and Semi-Arid Lands (ASAL).....	126
4.2.2	Secondary School Level.....	130
4.2.2.1	From Urban Areas.....	130
4.2.2.2	Agriculturally high potential areas.....	134
4.2.2.3	Arid and Semi-Arid Lands (ASAL).....	139
4.2.3	College Level of Education.....	144
4.3	Important findings from DASA approach.....	146
4.4	Interview-About-Instances (IAI) Approach.....	148
4.4.1	Appearance of Scientists and Technologists.....	148
4.4.1.1	Male in Lab-coat Vs Female in Lab-coat.....	148
4.4.1.2	Male, Clean Shaven Vs Male with Beard.....	151
4.4.1.3	Male with Eye Glasses Vs Male Without Eye Glasses.....	154
4.4.1.4	Happy Female Vs Serious (Sad) Female.....	156
4.4.1.5	Young Female Vs Older Female.....	158
4.4.1.6	Male in Lab-coat Vs Male in Casual Shirt.....	160
4.4.1.7	Untidy Male Vs Tidy Male.....	162
4.4.1.8	Male Without Bald Head Vs Male With Bald Head.....	164
4.4.1.9	African Male Vs European Male.....	168
4.4.1.10	European Male Vs Asian Male.....	170
4.4.1.11	Asian Male Vs African Male.....	173

4.4.1.12 African Female Vs European Female.....	175
4.4.1.13 Asian Female Vs African Female.....	177
4.4.1.14 European Female Vs Asian Female.....	180
4.4.2 Work Place of a Scientist.....	182
4.4.2.1 Library Vs Traditional School Laboratory.....	182
4.4.2.2 Traditional School Laboratory Vs Modern Chemistry Laboratory.....	184
4.4.2.3 Traditional School Laboratory Vs Agricultural Test Plots.....	186
4.4.3 Nature of Tasks.....	190
4.4.3.1 Reading a Book Vs Noting an Instrument Reading.....	190
4.4.3.2 Discussing with another Scientist Vs Listening to a Cassette with Headphones.....	192
4.4.3.3 Reading a Book Vs Entering Information Into a Computer.....	195
4.4.4 Employment or Nature of Occupation.....	198
4.4.4.1 Male Analytical Chemist Vs Female Analytical Chemist.....	198
4.4.4.2 Female Science Teacher Vs Male Science Teacher.....	200
4.4.4.3 Male Pharmacist Vs Female Pharmacist.....	203
4.4.4.4 Female TV Technician Vs Male TV Technician.....	206
4.4.4.5 Male Boiler Technician Vs Female Boiler Technician.....	209
4.4.4.6 Female Medical Doctor Vs Male Medical Doctor.....	213
4.4.4.7 Male Geologist Vs Female Geologist.....	215
4.4.4.8 Female Nuclear Reactor Operator Vs Male Nuclear Reactor Operator.....	218
4.4.4.9 Male Agronomist Vs. Female Agronomist.....	222
4.4.4.10 Male Surveyor Vs Male Draftsman.....	225
4.5 Summary.....	229

**CHAPTER FIVE: SUMMARY, CONCLUSION, IMPLICATIONS AND  
RECOMMENDATION.....232**

5.1 Summary of the Study.....	232
5.2 Conclusion of the Findings.....	248
5.3 Implications of the Study.....	241
5.4 Recommendation.....	243

**REFERENCES.....247**

**APPENDICES.....257**

APPENDIX A. Images of Science and Technology: Diagrammatic Illustrations.....	257
APPENDIX B. The Questionnaire .....	257
APPENDIX C. List of Variables on the Working File.....	261
APPENDIX D. Research Authorisation Letter .....	272