# بسم الله الرحمن الرحيم

### **Dedication**

#### This would is dedicated to:

- o To my Parents
- $\circ$  To my Brothers and Sisters
- o To my Friends

#### **ACKNOWLEDGEMENT**

I would like to express my gratitude and hearty to my supervisor Professor: Izzeldin Mohamed Osman, the supervisor for his continuous guidance and encouragement to complete this study.

My thanks to him not only express for his thoughtful insights about flow, clarity and coherence, but also for his standards and valuable comments. His sincere advices and friendship, and father feeling during any bit of this research, give me confidence in my self and my work. I will remain grateful indeed to him for all that.

Deep thanks should also be extended to Professor Doctor: Johannes Cronje for his support, his encouragement, and his friendly spirit.

Also deep thanks should be extended to: Professor Doctor Saugent Blequenant and Doctor Dolf Stein.

I extend my heartiest appreciation for all my teachers of the Faculty of Education of Sudan University of Science and Technology. Also great and hearty thanks to Ustaz: Afaf the head master of Nosiaba Basic School in Khartoum.

Last, my special thanks to my colleagues in Computer Integrated Education in Sudan University of Science and Technology.

I gratefully acknowledge my thanks and deep indebtedness to all of these.

#### **ABSTRACT**

This research investigates the effectiveness of a learning package on Mathematics Instruction for Grade 5 in Sudanese Schools. The learning package is a mathematics lesson on fractions. During this research the researcher will determine the extent to which the learning objectives were met, as well as to assess the usefulness of the learning package for Sudanese schools.

The learning Package was tested on 50 students, from Nosiaba Basic School in Khartoum. The students worked through the learning package for 45 minutes after that they filed in the questionnaires.

Hannafin and Peck adequacies of evaluation (Pedagogical adequacy, Cosmetic adequacy, Technical adequacy, and Curriculum adequacy) and the theories of Behaviorism are the basis of discussion on evaluation of the effectiveness of the learning package programme.

Various evaluation instruments are discussed, as they relate to the four adequacies of evaluation. [Multiple instruments should be used in any evaluation. Each instrument has inherent strengths and weaknesses. Multiple instruments also provide more credibility and may produce different results that could be missed with a single evaluation instrument].

The most important findings in this research are: All the students found that, the programme was very informative and well presented. It helps the learners to identify each navigation buttons and move from link to link, slide to slide without any difficulty. The presentation is motivational, simple, clear and understandable.

It is an interactive and informative programme for learners. It is easy to use.

### الخلاص\_\_\_ة

هدفت هذه الدراسة الي تقويم و دراسة فعالية الحزمة التعليمية في تدريس الرياضيات للمرحلة الأساسية المستوى الخامس.

الحزمة التعليمية هي عبارة عن مادة تعليمية في الرياضيات (الكسور) مقدمة بواسطة الحاسوب. ومن خلال هذا البحث يقوم الباحث بتحديد الى أى مدى حققت الحزمة التعليمية الأهداف التعليمية إضافة الى ذلك قياس فعالية استخدام الحزمة التعليمية في المدارس السودانية.

قام الباحث بإختار عينة مكونة من (٥٠ طالبة) من طالبات مدرسة نسيبة الأساسية بنات ببرى بولاية الخرطوم.

استخدم الطلاب (عينة الدراسة) الحزمة التعليمية داخل معمل الحاسوب بجامعة السودان للعلوم و التكنولوجيا لمدة ٥٥ دقيقة ثم قام الطلاب بملء الاستبيان.

النواحي التقيمية الأربعة للعالمان (Hannafin and Peck) [الناحية الجمالية ، الناحية التقنية ، الناحية التعليمية ، و الناحية المنهجية] و نظرية السلوكيون تعتبر من أساسيات مناقشة تقويم فعالية الحزمة التعليمية .

ناقش الباحث عدة وسائل لجمع المعلومات في هذا البحث و التي أفادت كثيراً في جمع معلومات حول تقويم الحزمة التعليمية من النواحي التقويمية الأربعة الآتية: [الناحية الجمالية ، الناحية التعليمية ، و الناحية المنهجية].

ومن أهم النتائج التي توصل إليها الباحث ما يلي:

- الحزمة التعليمية ممتعة.
- ♣ الحزمة التعليمية جيدة في عرض و تقديم المعلومات.
- ❖ مساعدة الدارسين (الطلاب) على التعرف على أزرار التنقل من قسم الى آخر ومن شريحة الى اخرى في الحزمة التعليمية بدون صعوبة.
  - \* عرض المعلومات فعال ، مبسط ، واضح ، و سهل الفهم.
    - \* البرنامج سهل الإستعمال.

# TABLE OF CONTENT

| COVER AND TITLE PAGE DEDICATION ACKNOWLEDGEMENTS ABSTRACT Arabic ABSTRACT TABLE OF CONTENTS | i<br>ii<br>iv |
|---|---------------|
| LIST OF TABLES LIST OF FIGURES Chapter 1  | ix<br>2       |
| Research proposal   |               |
| 1.1 Introduction  | 1             |
| 1.2 Aim   | 1             |
| 1.3 Context   | 2             |
| 1.3.1 National Context  | 2             |
| 1.3.2 Institutional Context   | 2             |
| 1.4 Data Collection Resources   | 3             |
| 1.4.1 Primary Resources   | 3             |
| 1.4.2 Secondary Resources   | 3             |
| 1.5 Overview of the research design   | 6             |
| 1.5.1 Research questions  | 6             |
| 1.5.2 Methodology   | 7             |
| 1.5.2.1 Research Methodology  | 7             |
| 1.5.2.2 Evaluation Methodology 1.5.2.2.1 Formative Evaluation                               | 7<br>7        |
| 1.5.2.2.2 Summative Evaluation  | 7             |
| 1.5.2.2.3 Static evaluation   | 7             |
| 1.5.2.2.4 Dynamic evaluation  | 8             |
| 1.5.2.3 Data collection matrix  | 8             |
| 1.5.3 Target Population   | 8             |
| 1.5.4 Subjects  | 8             |
| 1.5.5 Limitations   | 9             |
| 1.5.6 Significance of the research  | 9             |
| 1.6 Definitions of the key terms  | 9             |
| Chapter 2   |               |
| Literature survey   |               |
| 1.2 Introduction  | 13            |
| 2.2 Classifications of educational software   | 13            |

|     | 2.2.1    | What is Computer - Based Education?             | 15  |
|-----|----------|---|-----|
|     |          | Advantages of Computer-Assisted Instruction     | 16  |
|     |          | Categories of Computer- Based Learning in       | 1.7 |
|     |          | Mathematics Education                           | 17  |
|     | 2.2      | .3.1 Changes in Technology                      | 18  |
|     | 2.2      | .3.2 Changes in Pedagogy                        | 18  |
|     | 2.2      | .3.3 Re-Examining Frameworks                    | 19  |
|     | 2.2.4    | Distant education                               | 20  |
|     | 2.2      | .4.1 What is distant education?                 | 20  |
|     |          | .4.2 Properties                                 | 22  |
|     |          | .4.3 Is Distance Education Effective?           | 22  |
|     |          | .4.4 How is Distance Education Delivered?       | 23  |
|     |          | .4.5 Which Technology is Best?                  | 23  |
|     |          | .4.6 Effective Distance Education               | 24  |
|     |          | .4.7 Key Players in Distance Education          | 25  |
|     |          | aviorism  | 26  |
|     |          | What is Behaviourism and what is it good for?   | 26  |
|     |          | Background and Description of Behaviorism in    |     |
|     |          | Relation to Learning                            |     |
|     |          | Behaviorist Concepts                            | 28  |
|     |          | Use of Behaviorism in Learning and Specifically | 30  |
|     |          | Instructional Technology                        | 50  |
|     | 2.3.5    | How behaviorism influences instructional        | 31  |
|     |          | technology?                                     | 31  |
|     | 2.3.6    | When is constructivism used and when is         | 33  |
|     |          | behaviorism used, in designing instruction?     | 33  |
| 2.4 | Drill    | S   | 33  |
|     | 2.4.1    | Drills in Mathematics Teaching                  | 33  |
|     | 2.4.2    | Instructional Principles: Drill                 | 34  |
|     | 2.4.3    | Underlying Design                               | 35  |
|     | 2.4.4    | Basic Structure of a Drill                      | 36  |
|     |          | Summary of Drills                               | 37  |
|     | 2.4.6    | Advantages and Disadvantages of Using Drill     | 20  |
|     |          | Activities on the Computer-Based Drills         | 38  |
|     |          | .6.1 Advantages                                 | 38  |
|     | 2.4      | .6.2 Disadvantages                              | 39  |
|     | 2.4.7    | Examples of drill programme                     | 39  |
| 2.5 | What     | : makes good educational software?              | 39  |
|     | 2.5.1    | Cosmetic adequacy                               | 39  |
|     |          | Technical adequacy                              | 40  |
|     |          | Curriculum adequacy                             | 40  |
|     |          | Pedagogical adequacy                            | 41  |
| 2.6 |          | s for Interface Design for Effective Learning   | 4.4 |
|     |          | Multimedia                                      | 41  |
| 2.7 | _        | are the aspects to consider for good teaching   |     |
|     |          | athematics?                                     | 45  |
|     |          | Why is mathematical power important?            | 46  |
|     | <b>-</b> | Ting to mathematical power important:           |     |

| 2.7.2 Behaviorism and Mathematics   | 46         |
|---|------------|
| 2.7.3 Mathematics Education and Its Root in                                 | 47         |
| Philosophy S-R Behaviouristic Theory of Learning                            | 7/         |
| Chapter 3   |            |
| Decearch methodology  |            |
| Research methodology  3.1 Introduction                                      | 48         |
| 3.1.1 Historical method   | 48<br>48   |
| 3.1.2 Descriptive method  | 48         |
| 3.1.2 Descriptive method 3.1.3 Statistic method                             | 48         |
| 3.2 Target population   | 48         |
| 3.3 Sample of Research  | 48         |
| 3.4 Research Procedure  | 49         |
| 3.5 Evaluation Methodology  | 49         |
| 3.5.1 Formative Evaluation  | 49         |
| 3.5.2 Summative evaluation  | 50         |
| 3.6 Research Tools  | 51         |
| 3.6.1 Learning Package  | 51         |
| 3.6.2 Evaluation Tools  | 53         |
| 3.6.2.1 Evaluation Matrix   | 53         |
| 3.6.2.2 Pre-test & Post-test  | 54         |
| 3.6.2.3 Observations  | 56         |
| 3.6.2.4 Questionnaire   | 56         |
| 3.6.2.5 An Interview  | 57         |
| 3.7 Statistic Methods   | 58         |
| 3.7.1 T -Test   | 58         |
| 3.7.2 $\chi^2$ Square   | 58         |
| Chapter 4   |            |
| ·   |            |
| Data and Data Results and Discussion  |            |
| 4.1 Introduction  | 60         |
| 4.2 Does the learning package attain the set objectives                     | 60         |
| effectively?  |            |
| 4.2.1 Understanding   | 63         |
| 4.2.2 Application   | 64         |
| 4.2.3 Analysis  | 64         |
| 4.3 Will learners enjoy working with the computer-                          | 67         |
| based drill while learning the subject?                                     | 67         |
| 4.3.1 Pedagogical adequacy  | 67         |
| 4.3.2 Cosmetic adequacy   | 68         |
| 4.3.3 other effective aspects   | 70         |
| 4.4 Has the learning package adequate Instructional Design (ID) principles? | 73         |
| 4.4.1 Pedagogical adequacy  | 73         |
| 4.4.2. Cosmetic adequacy  | 7 <i>5</i> |
| 4.4.3 Technical adequacy  | 76         |
| common adoquacy   | , 0        |

## Chapter 5

| Conclusion & Recommendations  |    |
|---|----|
| 5.1 Conclusion  | 79 |
| 5.2 Recommendations   | 80 |
| 5.3 Recommendations for Future Evaluations  | 81 |
| REFERENCES  | 82 |
| APPENDIX A: The test (pre-test &post-test)  | 85 |
| <b>APPENDIX B:</b> The questionnaire for the students.  | 89 |
| APPENDIX C: The questions of an interview.  | 91 |
| <b>APPENDIX D:</b> Student's marks of the test to measure the validity and reliability of the test by Pearson's Equation. | 92 |
| <b>APPENDIX E:</b> The marks of the questionnaire to measure the validity and reliability by Pearson's Equation.          | 92 |
| <b>APPENDIX F:</b> Examples of drill programmes on the Web.   | 93 |
| <b>APPENDIX G:</b> Examples of drill and practice software programmes on the Web to Download.                             | 94 |

## LIST OF TABLES

| 1  | Research studies related to this dissertation  | 4  |
|----|--|----|
| 2  | Research questions matched with instruments.   | 8  |
| 3  | Types of distant education.  | 22 |
| 4  | Behaviorist ID Characteristics   | 29 |
| 5  | Field Test Evaluation  | 50 |
| 6  | Research Matrix  | 54 |
| 7  | The results of the pre-test & post-test  | 61 |
| 8  | The percentage of the students whom passed the pre-test and post-test                                | 62 |
| 9  | The students' degrees according to understanding, application, and analysis level.                   | 62 |
| 10 | The indication differences between the average of the pretest & post-test scores of understanding.   | 63 |
| 11 | The indication differences between the average of the pretest & post-test scores of the application. | 64 |
| 12 | The indication differences between the average of the pretest & post-test scores of the analysis.    | 65 |
| 13 | The pedagogical adequacy of the programme  | 67 |
| 14 | The cosmetic of the programme  | 68 |
| 15 | The effectiveness of the learning package  | 70 |
| 16 | The pedagogical adequacy of the programme  | 73 |
| 17 | The cosmetic of the programme  | 76 |
| 18 | The technical of the programme   | 76 |
|    |  |    |

## LIST OF FIGURES

| 1  | Basic Structure of Drill   | 36 |
|----|--|----|
| 2  | Screen capture from <i>learning package</i> (Index Page)                         | 52 |
| 3  | Screen capture from <i>learning package</i> (main menu Page)                     | 52 |
| 4  | Screen capture from <i>learning package</i> (Drills Page)                        | 53 |
| 5  | The learning package helps me to solve the activities.                           | 68 |
| 6  | The screen consistent and easy to use.   | 69 |
| 7  | The learning package is exciting   | 70 |
| 8  | The learning package makes me more self confident in Mathematics                 | 71 |
| 9  | The directions are clear and easy to follow                                      | 74 |
| 10 | The learning package offers flexibility of use                                   | 75 |
| 11 | There are clear instructions (documentation) on how to use the learning package. | 77 |
| 12 | I can access to menus/icons at any stage during the programme.                   | 78 |
|    |  |    |