



**IMPLEMENTING A PROBLEM-BASED LEARNING MODEL IN THE
TRAINING OF TEACHERS FOR AN OUTCOMES-BASED
TECHNOLOGY CURRICULUM**

by

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BSc, HED, B Ed, M Ed

submitted in accordance with the requirements for the degree of

PHILOSOPHIAE DOCTOR

(Curriculum Studies)

in the

DEPARTMENT OF TEACHING AND TRAINING STUDIES
FACULTY OF EDUCATION
UNIVERSITY OF PRETORIA
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JUNE 2000





This thesis is dedicated to the memory of my father, whose standards shaped my own.

ACKNOWLEDGEMENTS ARE MOST GRATEFULLY EXTENDED TO:

- My supervisor, Professor Roy Killen from the University of Newcastle in Australia, who is appointed as a professor extraordinary at Pretoria University's Faculty of Education. It was a great privilege to complete this study under his academic mastership. It was an exceptional learning experience to be the scholar of a person who is internationally acclaimed in the field of education.
- My co-supervisor, Professor Nic Basson for his major contribution to my sense of professional identity and for his competent guidance and encouragement throughout all my years of study.
- André Swanepoel and Rina Owen of the University of Pretoria for the statistical analysis of empirical data.
- The National Research Foundation and the University of Pretoria for financial assistance which made this study possible. The knowledge claims made in this research are not necessarily representative of those institutions.
- Marté Smit for all her effort with the graphics and editing.
- My mother for consistent and selfless support and love through the many years of study.
- Gerrit for precious love and being there for me.
- SOLI DEO GLORIA – My Lord who gives my life purpose and vision.

Our underlying frames, gestalts, paradigms, big pictures are everywhere in doubt. The task is to understand how we acquire frames, how we communicate them, and how we change them in ourselves and others - Peter Vail.

The significant problems we face cannot be solved at the same level of thinking we were at when we created them - Albert Einstein.

TABLE OF CONTENTS

List of tables	viii
List of figures	ix
List of appendixes	x
List of acronyms and abbreviations	xi
Glossary of working terms	xiii
Summary	xvi
Opsomming	xvii

CHAPTER 1

GENERAL INTRODUCTION, STATEMENT OF THE PROBLEM AND OVERVIEW OF THE STUDY

1.1 Introduction.....	1
1.2 The importance and impact of technology on the global and local society	4
1.3 International and national perspectives on technology education	6
1.3.1 International perspectives on technology education	7
1.3.2 National perspectives on science, technology and mathematics education	13
1.3.2.1 Problems and difficulties facing mathematics, science and technology education in South Africa	13
1.3.2.2 The history of technology education in South Africa	19
1.3.2.3 The Technology 2005 project and Curriculum 2005	21
1.3.2.4 Who will teach technology education in South Africa?	23
1.4 Problem formulation and research questions	30
1.5 Research methodology and design	31
1.6 Significance of this research	33

1.7	Overview of the study	34
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CHAPTER 2

A REVIEW OF THE LITERATURE ON CURRICULUM DEVELOPMENT AND REFORM, WITH PARTICULAR REFERENCE TO SOUTH AFRICA

2.1	Introduction	37
2.2	Defining curriculum: Key dimensions and concepts	38
2.3	Philosophical foundations of curriculum	40
2.3.1	Perennialism	42
2.3.2	Essentialism	43
2.3.3	Progressivism	44
2.3.4	Reconstructionism	47
2.3.5	Post-modernism	48
2.3.6	An eclectic approach to educational philosophy	51
2.4	A new paradigm for the restructuring of education in South Africa	51
2.4.1	Introduction of the new paradigm evolving in South African education and training	51
2.4.2	The shaping of the National Qualifications Framework	57
2.4.2.1	The vision of the NQF and key principles underpinning the NQF	58
2.4.2.2	The structure of the National Qualifications Framework	60
2.4.2.3	Organising fields and Learning Areas	69
2.4.3	The outcomes-based approach: Intentions and implications for curriculum development	76
2.4.3.1	What are the outcomes in an outcomes-based curriculum approach? An exploration and definition	76
2.4.3.2	Critical cross-field outcomes and the vision of lifelong learning	84
2.4.3.3	Specific outcomes	91
2.4.3.4	Using of outcomes in the curriculum design process	95
2.5.4	Curriculum management and development structures envisaged for South Africa	103

2.5.4.1	Future structures and institutions responsible for curriculum development and management in South Africa	103
2.5.5	Concluding comments on an outcomes-based educational approach	109
2.6	Summary	113

CHAPTER 3

INVESTIGATING PROBLEM-BASED LEARNING AS A STRATEGY TO OPERATIONALISE OUTCOMES-BASED EDUCATION IN THE TRAINING OF PRE-SERVICE TECHNOLOGY TEACHERS: DESIGNING AN OBE-PBL MODEL

3.1	Introduction	115
3.2	Outcomes-based education: From theory to practice	116
3.2.1	Purpose and premises of OBE to be operationalised in practice	116
3.2.2	Norms and Standards for South African Educators who need to facilitate OBE	127
3.3	Problem-based learning: A teaching strategy with the potential to operationalise OBE in practice	132
3.3.1	Defining teaching strategies and methods	132
3.3.2	Defining problem-based learning	133
3.3.3	A problem-based curriculum framework and problem-based learning models ...	136
3.3.4	Characteristic features of problem-based learning	140
3.3.4.1	Learner collaboration and co-operative work	140
3.3.5	Conceptual dimensions of PBL	141
3.3.5.1	Information processing and constructivist theory	141
3.3.5.2	Recall and transferability of knowledge	142
3.3.5.3	Meta-cognitive processes associated with PBL	142
3.3.6	PBL and its effects on learner attitudes and motivation	144
3.3.7	PBL and knowledge acquisition: Depth versus breath	146
3.3.8	Designing a problem-based learning task	149
3.3.8.1	The nature and criteria for problems in problem-based learning	149
3.3.9	Problem-solving in problem-based learning	156
3.4	What is technology education? Perceptions and definitions	161
3.4.1	Defining technology	161

3.4.2	Defining technology education in the curriculum	162
3.5	The nature and structure of technology education	172
3.5.1	The synergy between mathematics, science and technology – a cross-disciplinary nature	172
3.5.2	The problem-based nature of technology education	177
3.5.2.1	The technological process used in South African curricula	187
3.6	Appropriate methodology for facilitating learning in technology education	189
3.7	The OBE-PBL model	194
3.8	Summary	196

CHAPTER 4

RESEARCH DESIGN, METHODOLOGY AND INTERVENTIONS

4.1	Introduction	198
4.2	Research design	198
4.3	Research methodology	201
4.4	Instrumentation	202
4.4.1	The pre- and post-test written by experimental and control groups	202
4.4.2	The attitude questionnaire	203
4.4.3	The Learning and Motivation Strategy Questionnaire in Science (LEMOSS)	204
4.4.4	Written reports on the pre-service teachers' perceptions on technology and technology education	205
4.4.5	The semi-structured interview schedule for pre-service teachers	206
4.4.6	The log-books kept by the pre-service teachers of their one month practice experience	207
4.5	Background information on data resources	208
4.5.1	The pre-service teachers	208
4.5.2	The experimental and control groups	211
4.5.2.1	Selection of participating high schools	211

4.5.2.2	Selection of experimental and control groups	212
4.6	Research interventions	216
4.6.1	Research interventions with the pre-service technology educators	217
4.6.2	Research interventions with the experimental and control groups in the authentic context	228
4.7	Summary	234

CHAPTER 5

ANALYSIS AND PRESENTATION OF QUANTITATIVE AND QUALITATIVE RESULTS

5.1	Introduction.....	236
5.2	Quantitative results	236
5.2.1	Pre-test results comparison between the experimental and control groups	237
5.2.2	Post-test results comparison between the experimental and control groups	241
5.2.3	Pre- and post-test results comparison per group	247
5.2.4	Results from the attitude questionnaire.....	248
5.2.5	The relation between LEMOSS, achievement and the attitude questionnaire	252
5.2.6	General conclusion: Quantitative results.....	268
5.3	Qualitative results.....	281
5.3.1	Method of qualitative data analysis.....	281
5.3.2	Results: Perceptions of pre-service teachers prior to the PBL training intervention.....	284
5.3.3	Results from the interviews with the pre-service teachers and their log-books.....	288
5.3.4	General conclusion: Qualitative results.....	308
5.4	Summary	309

CHAPTER 6

DISCUSSION OF RESULTS, REFINEMENT OF THE OBE-PBL MODEL AND
RECOMMENDATIONS FOR FUTURE RESEARCH

6.1	Introduction.....	310
6.2	Discussion of results	310
6.3	Reflections on the critical research questions	321
6.4	Assessment of the OBE-PBL model to answer the overarching research question	330
6.5	Recommendations for the refinement of the OBE-PBL model	333
6.6	Limitations of the research design	340
6.7	Recommendations for future research in PBL	341
6.7.1	Replications of the present research using modified methodology to overcome limitations of the present research	342
6.7.2	Direct extensions of the present research to encompass new ideas.....	343
6.7.3	Related research that was not prompted by the present research	343
6.7.4	New research questions that were raised by this study	344
6.8	Summary	347
	REFERENCE LIST	348
	APPENDIXES	368



LIST OF TABLES

Table 1.1:	Qualifications of teachers in science across the provinces in South Africa.....	15
Table 1.2:	Qualifications of teachers in mathematics across the provinces in South Africa	16
Table 2.1:	Principles underpinning the National Qualifications Framework	59
Table 2.2:	The organizing fields and sub-fields	70
Table 2.3:	The learning areas for the General and Further Education and Training bands.....	71
Table 2.4:	Credits and Learning Areas for the category of fundamental learning	73
Table 2.5:	Credits, Learning Areas and sub-fields for the category of core learning	75
Table 2.6:	Credits, Learning Areas and Subfields for the category of elective learning	76
Table 2.7:	The difference between aims, goals, objectives and learning outcomes	78
Table 2.8:	Definitions and descriptions of the term "outcome".....	78
Table 2.9:	The twenty most common competencies in Spencers & Spencers' (1993) Competency Dictionary	81
Table 2.10:	Comparison of generic competencies.....	88
Table 2.11:	An example of a specific outcome with assessment criteria	93
Table 2.12:	The relationship between Tyler's questions and elements of the curriculum definition	99
Table 3.1:	Selected roles to be performed by prospective teachers.....	131
Table 3.2:	Models of the design/problem-solving process	180
Table 3.3:	The technological process as conceptualized in South African curricula	187
Table 4.1:	Data sources, instruments and methodology used	201
Table 4.2:	Fields in the LEMOSS questionnaire	204
Table 4.3:	Demographic data of the sic pre-service teachers.....	209
Table 4.4:	Faculty of Education: Time table for the Higher Education Diploma (Post Graduate).....	210
Table 4.5:	Number of learners in the experimental and control classes in each school	212
Table 4.6:	Number of learners in the experimental and control classes in each school without school E	213
Table 4.7:	Pre-test results before pairing off.....	214
Table 4.8:	Pre-test results after pairing off	216
Table 4.9:	Comparative summary between the experimental and control group interventions	223
Table 5.1:	Pre-test: An energy and energy efficiency technology-science test.....	238
Table 5.2:	Pre-test results comparison per group	241
Table 5.3:	Post-test: An energy and energy efficiency technology-science test.....	242
Table 5.4:	Post-test comparison between experimental and control group	246
Table 5.5:	Pre- and post-test results comparison per group	247
Table 5.6:	Attitude questionnaire for the experimental group	248

Table 5.7:	Meaningful differences in achievement: This methods has helped me to learn how to solve problems.....	254
Table 5.8:	Meaningful differences in achievement: Do you enjoy this new method in the teaching of a subject?	255
Table 5.9:	Code 1: Perceptions of technology and technology education prior to the training intervention.....	284
Table 5.10:	Code 2: Perceptions of technology and technology education after the training intervention.....	289
Table 5.11:	Code 3: Pre-service teachers' experience of PBL training	291
Table 5.12:	Code 4: Pre-service teachers' experience with PBL in practice	296
Table 5.13:	Code 5: Pre-service teachers' perceptions of outcomes-based education after the PBL training and practice experience ...	305

LIST OF FIGURES

Figure 2.1:	Educational philosophies underpinning curricula	42
Figure 2.2:	A proposed structure for National Qualifications Framework.....	63
Figure 2.3:	The relationship between qualifications, unit standards and outcomes	68
Figure 2.4:	Fundamental life performance roles	86
Figure 2.5:	The subject-based curriculum development process.....	96
Figure 2.6:	The outcomes-based curriculum design process	98
Figure 2.7:	A cyclic curriculum development model	101
Figure 2.8:	Interactive relationships between curriculum development functions and relevant bodies in service of the NQF	109
Figure 3.1:	Models for problem- and inquiry-based learning used in medical training	139
Figure 3.2:	The APU model of interaction between mind and hand	168
Figure 3.3:	Eisenberg (1992) model representing the characteristic features of technology education	171
Figure 3.4:	An example of a technological design model.....	184
Figure 3.5:	An example of a technological design model.....	185
Figure 3.6:	Project work in technology education.....	193
Figure 3.7:	The OBE-PBL pre-service technology teachers' training model.....	195
Figure 4.1:	A conceptual framework for the research design.....	199
Figure 4.2:	Process of creating statistically equivalent experimental and control groups in each school.....	215
Figure 6.1:	The refined OBE-PBL model	334
Figure 6.2:	The Situational Learning Facilitation Model	339

LIST OF ACRONYMS AND ABBREVIATIONS

LIST OF APPENDIXES

Appendix 1:	The 66 specific outcomes for the eight Learning Areas.....	368
Appendix 2:	The breakdown of competencies for each of the seven educator roles.....	371
Appendix 3:	The specific outcomes, assessment criteria and range statements for technology education in Curriculum 2005 for the senior phase	373
Appendix 4:	Attitude questionnaire for the experimental group	380
Appendix 5:	Meta-learning checklist and format of the resource kit.....	381
Appendix 6:	Perceptions on technology, technology education and appropriate teaching methodologies to facilitate learning in technology education prior to their PBL training: typed copies of the pre-service teachers' written comments	389
Appendix 7:	Semi-structured interviews with pre-service teachers after their PBL training and classroom interventions: Transcripts	393
Appendix 8:	The Learning and Motivation Strategy Questionnaire in Science (LEMOSS)	400
Appendix 9:	Specific outcomes, assessment criteria and range statements for selected outcomes in the natural science Learning Area	404

LIST OF ACRONYMS AND ABBREVIATIONS

ABET	Adult Basic Education and Training
ANC	African National Congress
C2005	Curriculum 2005
CEPD	Centre for Education Policy Development
CERI	Centre for Educational Research and Innovation
CFC	Consultative Forum on Curriculum
CUMSA	Curriculum Committee for South Africa
ECD	Early Childhood Development
ETDP	Education, Training and Development Practitioners
ETQAs	Education and Training Quality Assurers
FET	Further Education and Training
FETC	Further Education and Training Certificate
FRD	Foundation for Research Development (South African)
GET	General Education and Training
GETC	General Education and Training Certificate
HEDCOM	Heads of Education Department Committee
HETC	Higher Education and Training Council
HSRC	Human Sciences Research Council
IEA	International Association for the Evaluation of Educational Achievement
IEB	Independent Examinations Board
INSET	In-service Education and Training
LSEN	Learners with Special Education Needs
NEPI	National Education Policy Investigation
NGOs	Non-governmental Organisations
NICD	National Institute for Curriculum Development
NILLD	National Institute for Lifelong Learning Development
NQF	National Qualifications Framework
NSBs	National Standards Bodies
NSF	National Science Foundation (American)
NTB	National Training Board
NTT	National Task Team

OBE	Outcomes-Based Education
OECD	Organisation for Economic Co-operation and Development
PBL	Problem-based Learning
PRESET	Pre-service Education and Training
PTT	Provincial Task Team
RDP	Reconstruction and Development Programme
RPL	Recognition of Prior Learning
SACATE	South African Council for the Accreditation of Teacher Education
SAQA	South African Qualifications Authority
SGBs	Standards Generating Bodies
STS	Science Technology Society
TIMSS	Third International Mathematics and Science Survey

GLOSSARY OF WORKING TERMS

In this thesis, the following meanings are assigned to key terms, consistent with their current use in South Africa.

Accreditation	A procedure by which an authoritative body gives formal recognition that an institute, body or person is competent in terms of a specific purpose.
Applied competence	Is the combination of a learner's demonstrated ability, in an authentic context, to consider a range of possibilities for action (practical), and based on an understanding of the underpinning knowledge and thinking (foundational), to adapt to changing unforeseen circumstances (reflexive).
Assessment	The process of collecting and interpreting evidence of learner achievement.
Assessment criteria	The criteria included in a unit standard to determine the achievement of specific and critical outcomes.
Competence	The capacity for continuing performance within specified ranges and contexts, resulting from the integration of a number of specific outcomes.
Core learning	The specific core knowledge, skills and attitudes required for the completion of a particular qualification i.e. the required specialism for the purpose of the qualification.
Credit	The recognition by an accredited body that a learner has satisfied the outcomes of a unit of learning expressed as a credit value at a specific level. Credits may be accumulated until conditions for a qualification have been met.
Curriculum framework	The philosophical and organisational framework for a specific curriculum.
Curriculum 2005	The renewed curriculum framework for compulsory school years (Grade 1 through 9) and which was said to be based on transformation OBE principles. Curriculum 2005 specifies the 66 specific outcomes for the eight Learning Areas, together with the assessment criteria and range statement for each specific outcome. The 2005 is a time frame label indicating that the new curriculum framework had to be phased in all

grades up to grade 12 by the year 2005.

Elective learning

Optional credits within a formal learning programme that may be of personal interest or professional relevance, or that open the door to a range of possible career and vocational choices.

Evaluation

The process whereby the information obtained through assessment is interpreted to make judgements about a learner's competence.

Integration of education and training

The human resource development policy rejects the rigid division between "academic" and "applied", between "theory" and "practice" and between "knowledge" and "skills" in order to avoid the past perception that education possessed higher academic status than training. Both have equal status and importance.

Learning Area

It represents a broader knowledge field which is informed by the commonalities it shares with other areas of learning which ensure that fragmented views of learning are counteracted. Learning programmes will be developed which integrate learning experiences from various Learning Areas.

Lifelong learning

Ongoing learning through a continuous supportive process that stimulates and empowers individuals to acquire and apply knowledge, values, skills and critical understanding, required to respond confidently and creatively and to rise to the challenges of a changing social, political and economical environment.

Outcomes-based education

A learner-centred, result-orientated approach based on the belief that all learners can learn and succeed. It implies that learning institutions control the conditions for success. Curriculum design starts from a clear definition of the significant learning that learners have to achieve – all decisions about instructional strategies, learner assessment and organisation of the learning environment are linked directly to the outcomes that learners have to demonstrate.

Problem-based learning

Is the learning that results from the process of working toward understanding or resolution of a problem. The problem

is encountered first in the learning process and serves as a focus or stimulus for the application of problem-solving or reasoning skills, as well as for the search for information or knowledge needed to understand the mechanisms responsible for the problem and how it might be resolved. It also implies a curriculum design approach where the outcomes are organised around problems. PBL also implies a particular strategy for facilitating learning.

Programmes

A planned combination of learning outcomes, which results in credit accumulation towards the achievement of a qualification.

Technology education

Concerns the technological knowledge and skills, as well as the technological processes, and involves understanding the impact of technology on both the individual and society. It is ultimately designed to promote the capability of and to stimulate learners to contribute towards problem-solving.

SUMMARY

Since the democratic elections in South Africa in 1994, the socio-political transformation impacted on the paradigms that are evolving in education and training in two important ways – it introduced a new philosophical base for education and training, and it established new systemic structures for organising and managing education and training. These reforms were based on a vision of lifelong learning for all South Africans and both the philosophical base and structures for its implementation were based broadly on the concept of transformational outcomes-based education. Introduction of this new paradigm set in motion a process of curriculum reform across all fields of education and training. For the years of compulsory schooling, the new curriculum framework was known as Curriculum 2005. This structure divided the school curriculum into eight Learning Areas, one of which was called Technology and that was never previously presented in public South African schools.

The realities of a new paradigm and a new Learning Area compelled teacher educators to design new programmes and methodologies to prepare prospective and in-service teachers for the daunting task of teaching. This research focused on preparing pre-service final year high school teachers in the natural sciences to facilitate learning in technology from an outcomes-based perspective. This research explored problem-based learning (PBL) as a curriculum design type where the entire curriculum of a particular course is organised around problems and as a strategy to be used for training the pre-service teachers. The rationale for using PBL is the following:

- It is a strategy which has the potential to operationalise OBE principles in learning environments.
- It is a strategy which enhances the transferability of competence from university classroom to the real workplace, because of its embedded characteristic of authenticity.
- The syntactical nature and structure of PBL and technology education show strong similarities.

The outcome of the literature review was the development of a model called the OBE-PBL model. This model was implemented on two levels. First, it was used during the six month training of the pre-service teachers and second, the pre-service teachers had to

implement this model when they had to facilitate learning in technology education in real schools for one month. Quantitative data were gathered to determine how successful the pre-service teachers were in transferring their competencies gained through the OBE-PBL model in the authentic situation. The pre-service teachers taught the control groups in the schools according to the traditional instructional paradigm, while the experimental groups were taught according to the OBE-PBL model. Pre- and post-test, as well as experimental and control group comparisons were conducted to determine whether statistically significant differences were present and what the nature of these differences were. Data of a qualitative nature were gathered from learners, as well as through interviews with the pre-service teachers about their OBE-PBL training and classroom experience of implementing it.

The results showed that the pre-service teachers transferred their OBE-PBL competencies to such an extent that the post-test results of the experimental group were significantly better than their pre-test results. The post-test results of the experimental group were not significantly better than the post-test results of the control group. However, the experimental group learners performed significantly better in higher cognitive questions that demanded meta-cognitive skills. Pre-service teachers indicated that the complete OBE-PBL experience was challenging but valuable, and one said that she has learnt the most in this course than she had learnt the whole year. The practice experience highlighted that some had a narrow view of their role as an OBE facilitator of learning in a PBL environment. After an in-depth reflection on all the dimensions of the findings, particular recommendations are made on how to develop and refine the OBE-PBL model further to enhance its suitability and impact on the training of pre-service teachers for technology education.

OPSOMMING

Sedert die demokratiese verkiesing in Suid-Afrika in 1994 het die sosio-politiese transformasie 'n direkte impak gehad op die paradigmas wat tans besig is om te ontvou in onderwys en opleiding op twee vername wyses – 'n nuwe filosofiese grondslag is bekengestel, asook 'n nuwe sistemiese struktuur wat verantwoordelik is vir die organisasie en bestuur van onderwys en opleiding. Die hervormingsinisiatiewe word aangedryf deur 'n visie van lewenslange leer vir alle Suid-Afrikaners en is gebaseer op die beginsels van

transformatiewe uitkomsgebaseerde onderwys (UGO). Vir die verpligte skoolfase het die vernuwingsinisiatiewe gekulmineer in a kurrikulumraamwerk genaamd Kurrikulum 2005. Volgens hierdie raamwerk word die kurrikulum in agt Leerareas verdeel, waarvan Tegnologie een is wat nog nie vantevore amptelik in publieke skole aangebied is nie.

Die realiteite van 'n nuwe paradigma en Leerarea het onderwyseropleiers genoop om voor- en indiensprogramme te herkonseptualiseer en nuwe metodologieë te eksplorieer om onderwysers toe te rus vir hul groot opgaaf. Hierdie navorsing het daarop gefokus om voornemende hoërskool onderwysstudente voor te berei om leer te fasiliteer in tegnologie-onderwys vanuit 'n uitkomsgebaseerde perspektief. Probleemgebaseerde leer (PBL) is geëksplorieer as 'n kurrikulumontwerpbenadering waar probleemscenario's gebruik word om die kurrikulum te organiseer, asook 'n opleidingstrategie vir die onderwysstudente. Die rasionaal vir die implementering van PBL is die volgende:

- Die strategie het die potensiaal om UGO-praktykbeginsels te oprasionaliseer.
- As gevolg van die outentieke karakter van PBL kan bevoegdhede wat tydens opleiding ontwikkel word effektiewer oorgedra word na die werksplek.
- Die sintaktiese struktuur van PBL en tegnologie-onderwys toon sterk ooreenkomste.

Die uitkoms van die literatuuroorsig was die konstruksie van 'n model genaamd die UGO-PBL model. Hierdie model is op twee vlakke geïmplementeer. Eerstens is dit gebruik vir die ses maande opleiding van die onderwysstudente en tweedens moes hulle die model implementeer tydens die fasilitering van leer in tegnologie vir een maand in skole. Kwantitatiewe data is ingesamel om vas te stel hoe effektief die onderwysstudente hul bevoegdhede kon oordra na die praktysituasie. Die kontrolegroepe is onderrig volgens 'n tradisionale instruksie-transmissiemodel, terwyl die intervensies met die eksperimentele groepe op die UGO-PBL model gebaseer was. Kwalitatiewe data is vanaf leerders verkry, asook vanaf ondehoude wat met die onderwysstudente gevoer is oor hul UGO-PBL opleiding en praktykervaringe.

Die resultate het getoon dat die onderwysstudente hul UGO-PBL bevoegdhede sodanig oorgedra het dat die natoets van die eksperimentele groep beduidend beter was as hul voortoets. Die natoets van die eksperimentele groep was egter nie beduidend beter as die natoets van die kontrolegroep nie. Alhoewel, in sekere vrae wat as hoë kognitiewe vrae geklassifiseer was en wat meta-kognitiewe vaardighede vereis het vir beantwoording

daarvan, het die eksperimentele groep beduidend beter presteer. Die onderwysstudente het aangedui dat die omvattende UGO-PBL ervaring uitdagend en waardevol was en een het gemeld dat sy meer in hierdie kursus geleer het as in enige ander kursus gedurende die jaar. Data wat verkry is vanaf die praktykimplémentering het egter getoon dat sommige onderwysstudente 'n verskraalde persepsie gehuldig het oor hul rol as UGO leerfasiliteerders in 'n probleemgebaseerde leeromgewing. Na afloop van deeglike refleksie op die veelvuldige dimensies van die bevindinge, word aanbevelings gemaak oor hoe om die model te verfyn sodat die geskiktheid en impak daarvan op die opleiding van tegnologie onderwysstudente kan verhoog.