

Developing an Internet-based information resource for communication and education purposes - a case study

A thesis

by

Friedel van Zyl

*submitted in partial fulfilment
of the requirements for the degree*

**Magister Artium
(Multimedia)**

in the

Department of Information Science

University of Pretoria

Supervisor: Prof Dr Johannes Cronje

October 2001

Abstract

Candidate: Friedel van Zyl
Supervisor: Prof. Dr. J.C. Cronjé
Department: Information Science
Degree: MA (Information Science)
Title: Developing an Internet-based information resource for communication and education.purposes - a case study

This thesis reports on an investigation into the different elements/aspects concerning the design and development of a web site in order to facilitate effective learning and efficient communication between students and fellow students as well as lecturers and students. Contact learning and traditional communication are discussed in general versus distance learning and electronic communication. The pro's and con's of the above are set out as the research problems. The study comprises of four groups of respondents reacting on dimensions of education (content), communication, structure and design. The main contribution is to determine who the target population is and what the presentation of the content should be like to satisfy the need of this user.

It was found that a web site could promote learning and communication amongst all parties. The effectiveness of this project depends on how the design-related issues are applied and whether or not the content fulfils the needs of the target group.

Keywords: Interactive multimedia; effective learning; computer-mediated-communication; web design; enrolled students; potential students; self-regulated learners; Program in Interior Design.

Samevatting

Kandidaat: Friedel van Zyl
Promotor: Prof. Dr. J.C. Cronjé
Departement: Inligtingkunde
Graad: MA (Inligtingkunde)
Titel: Die ontwikkeling van 'n Internet gebasseerde inligtingsbron vir doeleindes van kommunikasie en opvoedkunde - 'n gevalle studie

In hierdie verhandeling word verslag gedoen oor 'n ondersoek na aspekte rakende die ontwerp en ontwikkeling van 'n webblad ter bevordering van effektiewe leer endoeltreffende kommunikasie tussen studente en mede studente sowel as studente en dosente. Kontakonderrig en tradisionele kommunikasie versus afstandsonderrig en elektroniese kommunikasie word in die algemeen bespreek. Die voordele/nadele in albei gevalle word uiteengesit as die navorsingsprobleme. Die studie bestaan uit vier groepe respondente wat reageer op dimensies van onderrig (inhoud), kommunikasie, struktuur en ontwerp. Die hoofbydrae is om vas te stel wie die teikengroep is en op watter wyse die inhoud aan gebied moet word om te voldoen aan dié gebruiker se behoeftes.

Daar is bevind dat 'n webblad leer en kommunikasie by alle partye kan bevorder. Die effektiwiteit van hierdie projek is afhanklik van hoe die ontwerpbeginsels toegepas word en of die inhoud aan die behoeftes van die teikengroep voldoen al dan nie.

Sleutelwoorde: Interaktiewe multimedia; effektiewe leer; rekenaargesteunde kommunikasie; webontwerp; ingeskrewe studente; voornemende studente; selfgereguleerde leerders; Program in Interieur Ontwerp.

Acknowledgements

I wish to sincerely thank the following people:

- ❖ My supervisor, Prof. Johannes Cronjé, for forcing me to finish this thesis!
- ❖ My dearest family, for their patience and loving support.
- ❖ My sister Maryke, for her moral support and cooperation in completing this thesis during many late hours of the night.
- ❖ My mother Yvonne, for checking the grammar and interest in my studies.
- ❖ Helene Coetzee, for rendering her services in assisting me with authoring the web site and providing valuable tips in general.
- ❖ Friends, family and classmates who showed constant interest in my progress throughout the three years.
- ❖ Leon Rossouw, for his valuable technical advice and support.
- ❖ My Heavenly Father for granting me the opportunity to complete this thesis with strength and knowledge.

Brief Table of Contents

Abstract	ii
Samevatting	iii
Acknowledgements	iv
Brief Table of Contents	v
Detailed Table of Contents	vi
List of Tables	xii
List of Figures	xiv
List of Appendices	xv
1. Introduction	1
2. Literature Review	12
3 Design, development and production	51
4. Evaluation	83
5 Findings	90
6 Conclusions and recommendations	111
References	131
Appendices	136

Detailed Table of Contents

Abstract	ii
Samevatting	iii
Acknowledgements	iv
Brief Table of Contents	v
Detailed Table of Contents	vi
List of Tables	xii
List of Figures	xiv
List of Appendices	xv
1 Introduction	1
1.1 Overview	1
1.2 Motivation for the study	2
1.2.1 The research problem	2
1.2.2 Purpose and objectives of the study	3
1.3 Research questions	4
1.3.1 Research sub-questions	4
1.4 Value of the research	4
1.5 Research methodology	5
1.5.1 Research design	5
1.5.2 Population and sample	5
1.5.3 Data collection technique	5
1.5.4 Data collection methods	6
1.6 Output	7
1.6.1 Description of the product	7
1.6.2 Description of the product team	8
1.7 Overview of research report	10

2	Literature review	12
2.1	Introduction	12
2.2	WWW and the Internet	13
2.2.1	Education through the Internet	13
2.2.2	Portals vs. Search engines	14
2.3	Educational issue	16
2.3.1	Applications of Interactive multimedia	16
2.3.2	Effective learning	17
2.3.2.1	Learner activities	22
2.3.3	The target population	24
2.3.3.1	Identifying the audience	24
2.3.3.2	Accommodating your audience	25
2.3.3.3	The choice of a browser	25
2.3.3.4	The bandwidth of the internet connection	26
2.3.3.5	Who and where is the target population?	26
2.4	Communication issues	27
2.4.1	Effective communication	27
2.4.1.1	Essential learning communication	27
2.4.1.2	General information communication	27
2.4.1.3	Social communication	28
2.4.2	Limitations of computer communication	29
2.4.3	Traditional vs. Electronic communication	29
2.4.3.1	Bulletin boards	29
2.4.3.2	E-mail	30
2.5	Structural issues	30
2.5.1	Navigation	30
2.5.1.1	Linear, Hierarchical and mixed Hierarchical	30
2.5.1.2	Concentric	31
2.5.1.3	Hypermedia	31
2.5.1.4	Explicit structures	32
2.5.1.5	Implicit structures	32
2.5.1.6	Navigation headings	33
2.5.2	Storyboard	35
2.5.3	Hardware	35

2.5.4	Software	35
2.5.5	Delivery platform	36
2.5.5.1	Virtual Reality Modeling Language (VRML) and Hyper Text Markup Language (HTML)	37
2.5.5.2	Bandwidth for VRML	37
2.5.5.3	Application of VRML	38
2.6	Design issues	38
2.6.1	Importance of the design process	39
2.6.2	General design principles	39
2.6.2.1	Simplicity	40
2.6.2.2	Consistency	40
2.6.2.3	Clarity	41
2.6.2.4	Aesthetic considerations	42
2.6.2.5	White space	42
2.6.2.6	Interface layout and design	42
2.7	Building blocks	43
2.7.1	Text	43
2.7.2	Text attributes	44
2.7.3	Screen grids	47
2.7.4	Line lengths	47
2.7.5	Colour combinations	47
2.7.6	Images, graphics and Animation	48
2.7.7	Buttons	50
2.8	Summary of review	50
3	Design, development and production	51
3.1	Introduction	51
3.2	Stage 1: Analysis	53
3.2.1	Purpose	53
3.2.2	Limitations	54
3.3	Analysis methods	54
3.4	Sampling	56

3.5	Results	57
3.5.1	Goal analysis	57
3.5.2	Target group analysis	58
3.5.3	Content analysis	63
3.5.3	Media analysis	63
3.6	Stage 2: Design	65
3.7	Designing for a specific delivery system	67
3.8	Sequencing of content	68
3.9	Design specifications	69
3.10	Screen design principles	71
3.11	Evaluation instruments	74
3.12	Stage 3: Development	74
3.12.1	Introduction	74
3.12.2	Authoring tool	74
3.12.3	Planning/ Storyboarding	76
3.13	Prototype and evaluation	76
3.13.1	Phase 1	76
3.13.2	Evaluation of phase 1	77
3.13.3	Phase 2	77
3.13.4	Evaluation of phase 2	79
3.13.5	Phase 3	80
3.13.6	Evaluation of phase 3	80
3.13.7	Phase 4	81
3.14	Stage 4: Production	82
3.14.1	Introduction	82
4	Evaluation	83
4.1	Introduction	83

4.2	Model for evaluation	86
4.2.1	Participant-oriented model	86
4.2.2	Summative evaluation	87
4.3	Samples used to conduct the summative evaluation	88
4.4	Evaluation instruments	89
4.4.1	User interface rating form	89
4.4.2	Expert interface rating form	89
4.5	Other data collection methods	89
5	Findings	90
5.1	Introduction	90
5.2	Objectives to be met by the evaluation instruments	91
5.3	Findings	92
5.3.1	Results from the user interface rating form	93
5.3.1.1	Students	92
5.3.1.2	Interpretation of the data	94
5.3.1.3	Lecturers	96
5.3.1.4	Interpretation of the data	98
5.3.1.5	Computer-based Training (CBT) group	98
5.3.1.6	Interpretation of the data	100
5.3.2	Results from the expert interface rating form	102
5.3.2.1	Experts	102
5.3.2.2	Interpretation of the data	103
5.3.2.3	Comments and suggestions from the experts	103
5.4	Research questions and findings	106
5.4.1	Research question 1	106
5.4.2	Research question 2	108
5.4.3	Research question 3	109
5.4.4	Research question 4	110
5.5	Summary	110

6	Conclusions and recommendations	112
6.1	Introduction	112
6.2	Research sub-questions supporting the main question	112
6.2.1	How can effective learning be achieved?	112
6.2.1.1	Dimension: Layout	113
6.2.1.2	Dimension: Content	114
6.2.1.3	Dimension: Navigation	115
6.2.1.4	Dimension: Communication, Support and ease of use	116
6.2.2	How can comfortable communication channels be incorporated?	116
6.2.2.1	Dimension: Layout	117
6.2.2.2	Dimension: Communication, Support and ease of use	117
6.2.3	What will make a web site work?	117
6.2.3.1	Dimension: Layout	119
6.2.3.2	Dimension: Navigation	119
6.2.3.3	Dimension: Communication, Support and ease of use	120
6.2.4	How should the web site be structured?	120
6.2.4.1	Dimension: Layout	121
6.2.4.2	Dimension: Content	121
6.2.4.3	Dimension: Navigation	122
6.3	Overall functionality of this program	122
6.3.1	Exceptions	125
6.3.1.1	Positive exceptions	125
6.3.1.2	Negative exceptions	126
6.4	Limitations of the study	125
6.5	Recommendations	127
6.5.1	Recommendations for the program as a product of this research	127
6.5.2	Recommendations for similar programs/ further studies	129
6.6	A final word on Internet based Information Resource	130

List of Tables

Table 1.1	Research Questions and data collection methods	7
Table 1.2	The distribution of tasks between the project team [♠]	9
Table 2.1	Issues addressed through the research	12
Table 2.2	A comparison between Evaluative and Generative thinking skills	18
Table 2.3	Different learning categories	21
Table 2.4	Different learning areas and learner activities	23
Table 2.5	Description of the Implicit structure	32
Table 2.6	A comparison between combinations of different software and hardware	36
Table 2.7	A suggestion for a suitable font	46
Table 3.1	Stages in the development process of the program	52
Table 3.2	Purpose of the analysis phase	53
Table 3.3	Data collection methods during the analysis phase	54
Table 3.4	Results of the target population analysis with regard to the general information [♠]	59
Table 3.5	Results from the target analysis regarding communication issues[♠]	61
Table 3.6	Media elements applied to promote learning and communication	64
Table 3.7	Matters taken in consideration during the design phase	66
Table 3.8	Design objectives	67
Table 3.9	Sequencing of the content	68
Table 3.10	Design specifications regarding text as implemented in the program for effective learning and communication	70
Table 3.11	Design specifications regarding graphics, white space and colour	71
Table 3.12	Screen design principles applied to the program	72
Table 3.13	Derivation of design specifications	73
Table 3.14	Derivation of the design specifications regarding the composition of the site	74
Table 3.15	Comparison between <i>Front Page</i> and <i>Dreamweaver</i>	75
Table 4.1	Topics addressed by the Research questions	84
Table 4.2	Formative evaluation during the development phase	85
Table 4.3	Evaluation stage of the program	86
Table 4.4	Summative evaluation process	87
Table 5.1	Evaluation instruments to meet the objectives	91
Table 5.2	Results from the students [♠]	92
Table 5.3	Results from the lecturers [♠]	97

Table 5.4	Results from the CBT group [ϕ]	99
Table 5.5	Results from expert interface rating form [ϕ]	102
Table 5.6	Questions and comments regarding research question 1	106
Table 5.7	Questions and comments regarding research question 2	108
Table 5.8	Questions and comments regarding research question 3	109
Table 5.9	Questions and comments regarding research question 4	110
Table 6.1	Aspects of the dimensions relevant to question 1 (Effective learning)	112
Table 6.2	Aspects of the dimensions relevant to Question 2 (Communication)	116
Table 6.3	Aspects of the dimensions relevant to Question 3 (design)	118
Table 6.4	Aspects of the dimensions relevant to Question 4 (structure)	120
Table 6.5	Comments from respondents that lead to essential changes in the program	123
Table 6.6	Comments from experts that affected the final recommendations	
Table 6.7	Summary of the limitations and the effect on the research	126
Table 6.8	Final recommendations to the program as product of the research	128

List of Figures

Figure 3.1	Profile of the Potential students in terms of computer skills	57
Figure 3.2	Profile of the Enrolled students in terms of computer skills	57
Figure 3.3	Computer access, Internet connection and need for a web site (Potential students)	58
Figure 3.4	Computer access, Internet connection and need for a web site (Enrolled students)	58
Figure 3.5	Comparison between the Enrolled students and the Potential students with regard to general information	59
Figure 3.6	A comparison between the communication needs of the Enrolled students and the Potential students	62
Figure 3.7	Ways of searching for information on the Internet by the target population	62
Figure 3.8	Purpose of the web site	62
Figure 3.9	An example of consistency [♠]	73
Figure 3.10	An example of simplicity [♠]	73
Figure 3.11	Homepage of the first phase[♠]	77
Figure 3.12	Homepage of the second phase[♠]	78
Figure 3.13	Example of a web page in phase 2[♠]	79
Figure 3.14	Icons used in phase 2	79
Figure 3.15	Homepage of the third phase[♠]	80
Figure 3.16	Home page of the fourth phase[♠]	81
Figure 3.17	An example of a page in phase 4[♠]	81
Figure 4.1	Planning-Evaluation cycle	83
Figure 5.1	Composition of respondents	90
Figure 5.2	Elements of layout rated by the students	94
Figure 5.3	Outcome of the layout as rated by the different respondents	104
Figure 5.4	Outcome of the navigation as rated by the different respondents	105
Figure 5.5	Outcome of the content as rated by the different respondents	105
Figure 5.6	Outcome of the communication, support and ease of use as rated by the different respondents	106
Figure 6.1	The success rate of effective learning through the program	113
Figure 6.2	The success rate of the communication channels incorporated in the program	117
Figure 6.3	Success rate of the design principles applied to promote the functionality of the program	119
Figure 6.4	Success rate of the overall structure and workability	

	of the program	121
Figure 6.5	Overall success of the program in terms of the sub questions	122

List of Appendices

Appendix A:	Questionnaire 1	Open Day-Potential Target Population	136
Appendix B:	Questionnaire 2	Target Population Analysis	138
Appendix C:	Questionnaire 3	Evaluation of Prototype Web site	144
Appendix D:	Questionnaire 4	Expert Evaluation of a Prototype Web site	147