University of Pretoria etd – Cloete L M 2001

Chapter 3

Project Description: computer program

Contents

3.1	Introduction	73
3.2	Research questions	76
3.3	Research methods	77
3.4	Development process	78
3.5	Needs analysis phase	81
3.5.1	Goal analysis	81
3.5.2	Target population analysis	82
3.5.3	Task analysis	91
3.5.4	Content analysis	95
3.5.5	Instructional strategies analysis	95
3.5.6	Media analysis	96
3.6	Design phase	96
3.6.1	User interface design	98
3.6.2	Content	99
3.6.3	Navigation	101
3.6.4	Input methods	101
3.6.5	Guidance	102
3.6.6	Feedback	102
3.6.7	Support	102
3.6.8	Progress evaluation	103
3.7	Development phase	103
3.7.1	Authoring	104
3.7.2	Layout of the program	104
3.7.3	Evaluation and testing	118
3.8	Implementation phase	118
3.9	Formative evaluation phase	119
3.9.1	Observations	120
3.9.2	Interviews and informal discussions	122
3.9.3	Focus groups	122
3.9.4	Student questionnaires	123
3.10	Results	124
3.10.1	How did the program assist students in the study of classification?	124

University of Pretoria etd – Cloete L M 2001

3.10.2	How did students experience the computerised format of the exercises?	126
3.10.3	How did students experience screen displays?	129
3.10.4	How did students experience the text layout?	131
3.10.5	How did students experience the language level?	133
3.10.6	How did students experience the pictures and colour?	135
3.10.7	How did students experience the sound?	137
3.10.8	How did students experience the content of the program?	140
3.10.9	How did students experience the navigation and interaction within the program?	143
3.10.10	How did students experience the assessment of performance?	146
3.10.11	How did students experience group work with the program?	149
3.10.12	How did students enjoy the program?	151
3.10.13	How did students experience the program in general?	154
3.11	Summary	155
3.12	Recommendations	156

University of Pretoria etd – Cloete L M 2001

3.1 Introduction

This chapter describes the design, development, implementation and evaluation of one of the components of the training programme for cataloguing students. This component comprises a specific training medium, namely a variety of exercises on a computer program (CD-ROM). It is the first time that this format has been used for training cataloguing students and, indeed, as part of a mix of media and technologies in a Technikon SA training programme. The other components of a mix of media and technologies had already been designed and developed as part of Technikon SA's training programmes and were merely adapted for the specific training of cataloguing students. The evaluation of these components as part of an integrated resource training programme is dealt with in chapter 4. Since the design, development and evaluation of the computer program was a major new development, it is dealt with exclusively in this chapter.

The goal of the chapter is to report on the investigation of the instructional and motivational effectiveness of a computer program as a means of providing additional practice for cataloguing students.

The case study is a response to the urgent need to conduct research on the provision of additional practice opportunities to students. Previously, students were only provided with printed course material. This material included all the course notes as well as exercises, activities and assignments. Students have to complete these exercises, activities and assignments on paper and submit them for evaluation and feedback. Since this is done mostly via the postal system, it means that students only receive the feedback after a period of about six weeks. By that time they have lost touch with the particular exercise or assignment. The nature of cataloguing demands as much practice as possible. The number of

University of Pretoria etd – Cloete L M 2001

existing exercises and assignments does not give students sufficient opportunity to practise cataloguing. The result of this is that students fail the practical examination paper in cataloguing badly.

The performance also had an effect on the through-put rate (the number of students who actually successfully completed the course). When students perform poorly in one particular subject they often cancel the entire course since they feel discouraged and cannot proceed with the next levels of the course.

Personal interviews were conducted with the students involved in this study. During contact classes, group discussions about problems students had with the subject were also held. A discussion thread on the issue is also still in progress on TSA COOL (virtual campus site of Technikon SA). About 30% of the students took part in these discussions. Written notes were taken during the personal interviews and group discussions.

The personal interviews and group discussions about the problems students have with the subject resulted in the following conclusions:

- Students find the subject content new and unfamiliar.
- They find the cataloguing and classification tools difficult to follow and apply.
- They need immediate feedback when they practise skills. The time it takes before they receive a written or printed assignment back can be anything from six weeks to two months.
- They need more opportunities to practise the skills.
- They need different methods to practise the skills.
- A great need for more personal contact with a lecturer or tutor was expressed. This concurs with Morgan, Ponticell and Gordon's (1998:20) finding that tutoring is a very powerful technique for

enhancing student learning across different types of students and learning areas. Tutors are available for students. The number of students studying Library and Information Studies are generally low, especially in remote areas, and students are distributed all over Southern Africa. It is therefore only possible to appoint tutors in the larger regions (Johannesburg and Durban) where the majority of students reside. The availability of the tutors is also limited since they perform these duties on a part-time basis.

The benefits of a computer program could be threefold:

- It provides interactivity (i.e. students give an answer and receive immediate feedback).
- It provides additional exercises in a different format.
- It provides alternative training methods to accommodate different learning preferences.

The challenge of such a development is, as White(1996:69) states, to create a rich learning environment, which is situated in real-life, or which closely resembles real-life within which the students can construct meaning. This means that a computer program should not merely repeat exercises that could also be made available in print format, but should closely resemble real-life cataloguing situations and add the dimension of interactivity.

The purpose is not to measure learning gain through pre-tests and post-tests alike, because Clark's (1994) contention that media do not influence learning and Russel's (1999) conclusion that there are no significant differences in performance between individual delivery media are accepted.

University of Pretoria etd – Cloete L M 2001

Students' response to such a program is evaluated. The advantages and disadvantages of the program as experienced by the students are addressed.

If the feedback generated by such an evaluation is positive, it would be worthwhile to introduce the computer program as a component of a training resource for cataloguing students.

The report in this chapter commences by listing the relevant research questions, the aspects of the questions as addressed by the computer program and the means of investigation of each question. This is followed by the research methods used to conduct the research, the needs analysis, design, development, implementation, evaluation and the results pertaining to the program. Finally, a summary is given, and conclusions and recommendations specific to the program are proposed.

The design of the program was started in 1999. The development, implementation and evaluation of the program took place in 2000.

3.2 Research questions

The development of a computer program forms part of a mix of media and technologies. Research questions 9, 10 and 11 (as set out in Table 1.2 of chapter 1) are addressed by the development of the computer program (as part of a resource training programme): The aspect addressed by each research question and the means of investigation are summarised in Table 3.1.

University of Pretoria etd – Cloete L M 2001

Table 3.1: Research questions and aspects addressed by the computer program

NO.	QUESTION	ASPECT	MEANS OF INVESTIGATION
9	What developments have taken place in the utilisation of a mix of appropriate media and technologies in training cataloguers?	New development	Questionnaires, observations, interviews, focus group discussions
10	What are the advantages and disadvantages of training cataloguers by means of a mix media and technologies?	Advantages and disadvantages as experienced by students	Questionnaires, observations, interviews, focus group discussions
11	How should training by means of a mix of media and technologies be designed to serve as an appropriate training mode?		Questionnaires, observations, interviews, focus group discussions

3.3 Research methods

The computer program was developed as a pilot test and addressed the classification part of the cataloguing course. This part was selected since the results of previous assignments and examinations, as well as interviews conducted with students who repeated the course, indicated that this is the part with which they experience the most difficulty.

The research is primarily a qualitative study. Questionnaires, interviews, observations and focus group discussions were used to evaluate students' experience of the program. Questionnaires were sent to all the students registered for the first registration period of 2000. Students completed the questionnaire after spending some time using the program. Observations were made and interviews and focus group discussions were held with

University of Pretoria etd – Cloete L M 2001

students (individually and groups of five to ten students) who could attend contact sessions at Technikon SA's main campus in Florida (Roodepoort, South Africa).

Observation entailed the researcher being present with the students while they worked with the program, to record noteworthy incidents and comments.

The interviews and focus group discussions were held to examine students' response to the program.

3.4 Development process

The merits of constructivist paradigms of learning are increasingly emphasised in research on education, and have to be considered during the design and development of courseware (Nicholson, 1994:36; Willis, 2000).

The computer program for the classification component was designed by the Integrated Technology Centre (ITC), a division of Technikon SA. They were responsible for the multimedia programming and graphical design. The contents were supplied by the lecturer.

The following phases were addressed during the process:

- Needs analysis phase:
  - Goal analysis
  - Target population analysis
  - Task analysis
  - Content analysis
  - Instructional strategies analysis

University of Pretoria etd – Cloete L M 2001

- Media analysis

- Design phase
- Development phase
- Implementation phase
- Formative evaluation phase

The development process is illustrated in the Table 3.2:

Table 3.2: The development process

COMPONENTS	NEEDS ANALYSIS →	GOAL ANALYSIS →	DESIGN →	DEVELOPMENT →	IMPLEMENTATION →	EVALUATION →	REVISION →
SPECIFICS	Syllabus needs Students' needs Lecturers' needs Needs from practice	Target population Learner characteristics Task analysis Content analysis Objectives Learning outcomes Evaluation criteria	Teaching strategy Design of study material Media selection User interface Instructional activities	Authoring Layout Preparation of students	Making program available Monitor Trouble shooting	Students' progress Performance assessment	
METHODS	Critical analysis of reported research (chap. 2)	Student profile Subject matter specialists Syllabus documents Critical analysis of reported research (chap. 2 & 3)	Research methodology (chap. 1) Design Criteria (chap. 3)	Chap. 3	Chap. 3	Observation Assessment of exercises Questionnaires Interviews Specific case studies (chap.3)	
PRODUCTS	Needs assessment report	Student profile Content outline Instructional objectives	Flow charts Instructional archetypes Scripts	Program documentation CD-ROMs	Program documentation	Program documentation Formative evaluation report (chap. 3)	Summative evaluation report (chap. 4)
FORMATIVE EVALUATION							

University of Pretoria etd – Cloete L M 2001

3.5 Needs analysis phase

During the needs analysis phase attention was paid to the following:

3.5.1 Goal analysis

The goal statement articulates the relationship between the training that is being designed and the desired performance (Milano & Ullius, 1998:98). During the goal analysis the purpose of the design was established. At first the goal could only broadly be formulated as: *"to educate students about a specific subject area, namely cataloguing and to train them in the necessary skills to practise cataloguing."*

It was necessary to formulate a clear statement that answered the question: *"Why do we want to use a training programme consisting of a mix of media and technologies for training cataloguing students?"* From the literature reviewed (chapter 2) and studies regarding students' needs (Van Wyk & Botha, 1999a; 1999b), it was possible to arrive at a more specific goal statement.

More specifically, the following questions were asked in order to formulate the goal:

- Why is the additional training programme needed?
- Who needs the instruction?
- What must the students do with the programme?
- When must they use the programme?
- Where will the programme be used?

By answering these questions the goal could be formulated as follows:

University of Pretoria etd – Cloete L M 2001

"To enhance training in the knowledge and skills of cataloguing for Library and Information Studies students by means of a training programme of mixed media and technologies that students can use at their own time where it is convenient for them."

A more specific goal for the computer program could then be formulated:

"*The computer program should be used in conjunction with, firstly, the printed course material to complement it and to form an integral part of a mix of training media and technologies.*"

The printed course is of a tutorial nature and supports a behaviourist paradigm. Students are expected to master a concept and complete the applicable activities and exercises before a new concept is introduced. The computer program had to provide the necessary practical exercises. These exercises could either be done on an individual basis or by small groups of students in contact class situations. Therefore the program had to partially support a constructivist paradigm.

3.5.2 Target population analysis

Since students' personal background and circumstances, educational background, professional background, expectations and experience of distance education, study methods and access to media and technology influence their studies, it was considered necessary to establish these factors by means of a questionnaire (annexure A). The profile of the cataloguing students had never been established before as very limited and often incomplete details are provided during registration. An extensive questionnaire was compiled to obtain as much information as possible about the student profile. The questionnaire was adapted specifically for

University of Pretoria etd – Cloete L M 2001

cataloguing students at Technikon SA from the questionnaire designed by Beneke (1998). The South African Advertising Research Foundation's Living Standards Measure (LSM) (1993) also provided useful information regarding the demographics, financial circumstances, lifestyle and media access that could be further explored in the questionnaire. It was assumed that the majority of students fell into the category LSM5 (the young aspirers). This was further supported by the results from the questionnaire.

Only a selection of the results relevant to this study are summarised in the following tables. The relevant personal and demographic information and its significance to this study is summarised in Table 3.3.

University of Pretoria etd – Cloete L M 2001

Table 3.3: Personal and demographic details of student profile

CHARACTERISTICS		PERCENTAGE	SIGNIFICANCE
Gender	Male	15	The majority of librarians are female.
	Female	85	
Language group	Afrikaans	8.57	Only about 14% of the students belong to the English language group. This an important consideration for the language level at which the training media are developed. English is the chosen medium of instruction since all the cataloguing tools and manuals are in English. It is too expensive to translate course material into any of the other official languages.
	English	14.29	
	Northern Sotho	20	
	Southern Sotho	14.29	
	Swati	2.86	
	Tsonga	0	
	Tswana	22.86	
	Venda	5.71	
	Xhosa	0	
	Zulu	11.43	
	Other	0	
Age	Under 25	22.86	The majority of students are young adults (under 40). The characteristics (discussed in chapter 2) of that age group have to be taken into account when designing training materials.
	25-29	28.57	
	30-34	14.29	
	35-40	28.57	
	Over 40	5.71	
Province of residence	Gauteng	44.44	The majority of students live in the northern part of the country (corresponds with majority of Tswana and Northern Sotho speakers) and KwaZulu-Natal. This means that many of the students have easier access to contact classes (presented in Johannesburg and Durban).
	Mpumalanga	2.78	
	North-West	13.89	
	Northern Province	5.55	
	Free State	5.55	
	Eastern Cape	0	
	Northern Cape	2.78	
	Western Cape	2.78	
	KwaZulu-Natal	22.22	

University of Pretoria etd – Cloete L M 2001

The educational background relevant to the study and its significance is summarised in Table 3.4.

Table 3.4: Educational background of students

CHARACTERISTICS		PERCENTAGE	SIGNIFICANCE
Final school qualification	Matriculation with exemption certificate	22.22	The majority of students have passed the Senior Certificate examination, but would not have been accepted at university for studying Library and Information Science.
	Senior Certificate (without matriculation exemption)	75	
	Grade 10 (standard 8)	0	
	Other	2.7	
Average percentage in final school examination	70-100	0	The majority of students had an average pass mark at school and are not the top performers.
	60-69	19.35	
	50-59	35.48	
	40-49	32.25	
	33⅓ - 39	16.12	

The professional background relevant to the study and its significance is summarised in Table 3.5.

University of Pretoria etd – Cloete L M 2001

Table 3.5: Professional background of students

CHARACTERISTICS		PERCENTAGE	SIGNIFICANCE
Number of years working in a library/ information centre/ department	First year	14.71	The majority of students are still inexperienced librarians/ information workers.
	1-5 years	44.12	
	6-10 years	23.53	
	11-15 years	11.76	
	More than 15 years	5.88	
Most recently completed library qualification	National Certificate	18.18	The majority of students are unqualified library and information workers and have therefore not received any higher education training.
	Lower Diploma	6.06	
	Unqualified	75.76	
	Other	0	
Demographic area of library/ information centre/ department where students work	City (e.g. Johannesburg, Cape Town, Durban)	52.94	The majority of students work in larger urban areas where access to facilities such as electricity and telecommunications infrastructure is available.
	Large town (e.g. Rustenburg, Pinetown, Kroonstad)	26.47	
	Small country town (e.g. Hammanskraal, Brandfort, Colenso)	17.65	
	Rural area without a town in the immediate vicinity	2.94	
Type of library where students work	Large public/ community library (main library)	40	The majority of students work in the public and community library sector. Examples selected for cataloguing in the training media should resemble items that would typically have to be catalogued in these types of libraries.
	Branch library of a large library	20	
	School library/ Media centre	0	
	Academic library (e.g. university, technikon, college)	14.29	
	Provincial library	2.86	

University of Pretoria etd – Cloete L M 2001

CHARACTERISTICS		PERCENTAGE	SIGNIFICANCE
	Special library or information centre (e.g. engineering, law libraries)	14.29	
	Information department that forms part of a larger organisation	8.57	
Section/ department of library/ information centre/ department where students work	Reference desk	14.29	None of the students work in a cataloguing section (accept those in one-person libraries who sometimes have to perform cataloguing tasks). This means that students have not been exposed to the work and procedures in such a department. Training materials should be designed to introduce students to cataloguing.
	Lending desk	25.71	
	Interlibrary loans	2.86	
	Acquisitions	8.57	
	Cataloguing	0	
	Serials	2.86	
	Children's section	2.86	
	Physical processing (e.g. inking, covering, binding of materials)	8.57	
	All sections (such as a one-person library)	25.71	
	Other	5.71	
Number of staff members that work with students	20 or more	8.57	At present many libraries are understaffed. The majority of students have less than 5 staff members to assist them at their work. This usually means working extra hours and having less time for studies.
	Between 10 and 20	17.14	
	Between 5 and 10	17.14	
	Between 2 and 5	34.29	
	1	22.86	
Current post designation	Librarian	8.57	The majority of students are library assistants, which is the typical designation of an unqualified library worker (especially in the community and public library sector) who performs various administrative duties.
	Assistant librarian	5.71	
	Library assistant	62.86	
	Library clerk	0	
	Administrative assistant	5.71	
	Casual worker	5.71	
	Other (information officers)	11.43	

CHARACTERISTICS		PERCENTAGE	SIGNIFICANCE
Students' abilities to carry out their tasks at work	I consider myself an expert in the tasks that I have to perform.	41.18	The majority of students have worked 1-5 years in libraries performing administrative tasks in which they have received training. However, they would have no training or expertise in professional duties.
	I perform tasks that I was trained in.	32.35	
	I perform tasks that I have experience in, but was not trained in.	14.71	
	I perform tasks in which I have no training or experience, but I am coping.	11.76	
	I am not coping with my work.	0	

The study methods and circumstances relevant to the study and their significance are summarised in Table 3.6.

University of Pretoria etd – Cloete L M 2001

Table 3.6: Study methods and circumstances

CHARACTERISTICS		PERCENTAGE	SIGNIFICANCE
Study space	The dining room/ kitchen table	37.14	The availability of study space gives an indication of whether students have space to accommodate additional training media and equipment. The majority of students do not have appropriate study space.
	My bedroom	37.14	
	I study at work	5.71	
	I study at a friend's/ relative's house	0	
	A study room at home	11.43	
	A library (other than my workplace, e.g. public library, Technikon library)	8.57	
During the academic year students only complete the assignments and leave most of the studying for the examinations	Yes	48.57	Students focus mainly on the examinations and during the academic year only do what is essential to obtain a valid yearmark. Additional training material should contribute to students' final marks, otherwise they will not readily participate in it.
	No	33.33	
	Sometimes	19.44	
Average number of hours per week devoted to studies	5 hours or less	57.14	Students do not have much time to devote to their studies since they all work full time. Study time also has to be divided among all the subjects.
	Between 5 and 10 hours	34.29	
	Between 10 and 15 hours	5.71	
	More than 15 hours	2.86	
Students' evaluation of personal level of competence in studying in English	Excellent	31.43	All the study material is compiled in English, but the level of language has to meet the students' language abilities. For the majority of students English is not their first language.
	Good	42.86	
	Satisfactory	22.86	
	Unsatisfactory	2.86	
	Very poor	0	
Students' expectation of contact with lecturers during the academic year	Weekly	11.76	Students expect regular contact with their lecturer and this will have to be incorporated in the training media.
	Monthly	50	
	Quarterly	38.24	

University of Pretoria etd – Cloete L M 2001

CHARACTERISTICS		PERCENTAGE	SIGNIFICANCE
Type of contact with lecturers that students prefer	Personal counselling by appointment	38.88	Students could select more than one type. The majority of students prefer personal, face-to-face contact during a personal meeting or contact classes. Only a small number prefer electronic communication.
	Contact classes	63.88	
	Telephonic communication and counselling	27.77	
	Written communication and counselling	11.11	
	Counselling via e-mail messages	19.44	

The media and technology facilities relevant to the study and its significance is summarised in Table 3.7.

University of Pretoria etd – Cloete L M 2001

Table 3.7: Media and technology facilities for study

CHARACTERISTICS		PERCENTAGE	SIGNIFICANCE
Availability of radio	Yes	83.33	Although radios are readily available, this broadcast medium is not considered ideal for the nature of cataloguing subjects where demonstration and practical application are very important.
	No	16.67	
Availability of television sets	Yes	77.77	Television could be utilised either for live broadcasts and videoconferencing or for viewing recorded lectures. The former is expensive at this stage and logistically difficult to organise. All participants should be available at the same time. For the latter, students must also have video recorder/playback equipment.
	No	22.23	
Availability of audio tape recorder	Yes	69.44	As is the case with radios, taped sound recordings are not considered an ideal broadcast medium for the nature of cataloguing subjects.
	No	30.56	
Availability of VCRs	Yes	69.44	The availability of VCRs and television sets makes video recorded lectures a possibility.
	No	30.56	
Access to computers	Yes	72.22	The high number of students who have access to computers makes the utilisation of computer programs a possibility.
	No	27.78	
Access to the Internet	Yes	41.66	Access to the Internet is still problematic for some students. During interviews it became clear that the Internet is available at the workplace, but students are often not allowed to use it for personal studies. Internet cafés are not always in a close proximity of students' residence. More Internet access could be made available at TSA regional offices and study centres.
	No	58.34	

3.5.3 Task analysis

The task analysis is conducted to determine the content needs to be included in the instruction for the students to achieve the learning objectives for that specific instruction (Smith & Ragan, 1999:63). The task analysis can be conducted by traditional processes such as:

University of Pretoria etd – Cloete L M 2001

- investigating what has been taught on the subject in the past
- trial-and-error (teaching and observing where there are problems)
- following the structure of the subject content

For the purpose of this course the outcomes-based method was used in combination with the above traditional approaches. The learning goals or tasks were formulated according to outcomes that have to be achieved by the students.

The cataloguing process consists of a number of activities. The diagram in Figure 3.1 summarises the most important activities performed in most libraries.

It is not possible to immediately include all the content of the cataloguing course as indicated in the figure, since the content is complex and involves different aspects. The contents include descriptive cataloguing, assignment of access points, classification, assignment of subject headings, indexing, abstracting, copy cataloguing and authority work.

As a pilot project, the first component of the cataloguing process for which a training programme was designed was the **classification module**. The motivation for this decision was that students' results, personal interviews and group discussions revealed that students found the classification module the most problematic part of their studies. Comments such as "*classification is the most difficult part of the entire Library and Information Studies course*" were often made.

University of Pretoria etd – Cloete L M 2001

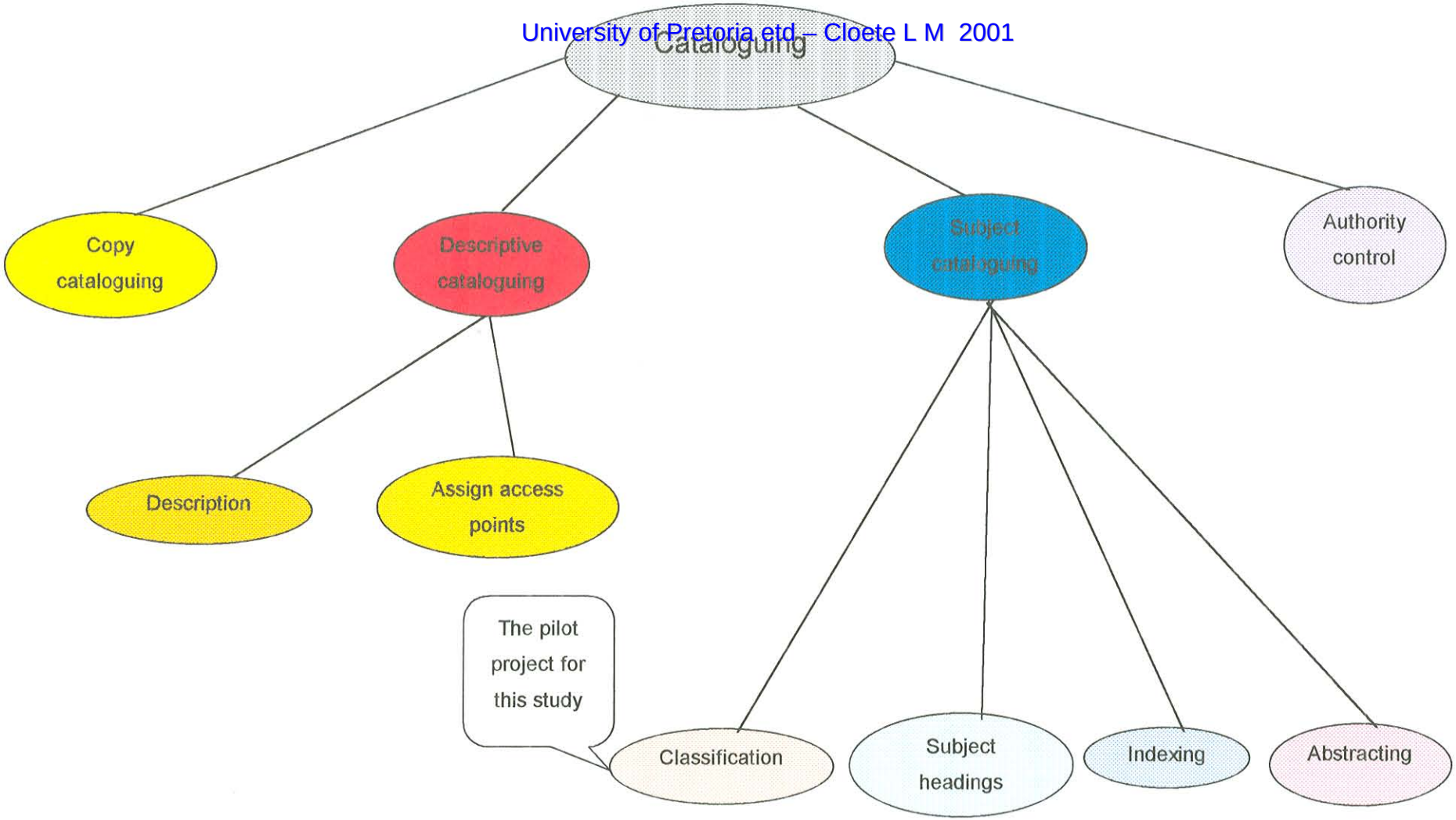


Figure 3.1: Cataloguing process

University of Pretoria etd – Cloete L M 2001

The **broad outcome** for the classification module was formulated as follows:

"*To do subject description of information sources according to DDC21*"

Laurillard (1994:288) emphasises the importance of learning objectives for providing guidance in the design process and for enabling the students to know what to expect and what is expected of them.

Although objectives are considered fundamental to behaviouristic approaches to education, they are not exclusive to behaviourism (Laurillard, 1994:288).

Beattie (1994:249) suggests that learning objectives in the following three domains of Bloom's taxonomy should be formulated:

- The cognitive (thinking and knowing) domain which involves the skills of recall, recognition, comprehension, application, analysis, synthesis and evaluation
- The psychomotor (practical) domain
- The affective (attitudes and values) domain

The **learning objectives** were formulated as follows:

Students should be able to:

- determine the subject of an entity
- determine the discipline in which an entity should be classified
- recognise and use the main classes of the DDC21

University of Pretoria etd – Cloete L M 2001

- find a subject entry in the relative index with its corresponding classification number
- look up a classification number in the schedules
- assign classification numbers to entities by using the index and the schedules of the DDC21
- describe tables 1, 2, 3, 4, 5, 6 and 7 and their functions
- use the tables for building classification numbers
- build classification numbers by combining notations in the schedules

3.5.4 Content analysis

The content analysis was performed to find out what the program ought to contain. It was conducted by analysing existing study material. The content had to comply with the syllabus (described in chapter 2).

The development of a computer program coincided with the revision and design of the printed course material. That process is briefly discussed in chapter 4.

3.5.5 Instructional strategies analysis

The different potential instructional strategies had to be investigated to determine the most appropriate strategy for the training programme. It would also ensure that the computer program would be as effective as it would be understandable.

Tutorials are applied in the printed course material. The following strategies were analysed to be utilised in the computer program:

University of Pretoria etd – Cloete L M 2001

Drills and practice

The lecturer determines how many problems a student has to complete in order to master a specific concept. With cataloguing in particular, it is important that students get as much practice as possible. Reinforcement of cataloguing skills is the key to successful training. Problems presented must not be too difficult or too easy. The selection of problems must also not be too limited.

Simulations

A simulation is ideal for teaching actual, real-world cataloguing problems as encountered when cataloguing materials for a library. One of the most important advantages of simulations for training classification is the fact that the **complexity** of the learning can be controlled. Students can be presented with various real-world cataloguing problems, but the level of complexity can be changed to teach a certain aspect.

3.5.6 Media analysis

The only media considered for this part of the project was the computer program (CD-ROM) used in conjunction with the printed course material. A complete media analysis was conducted to determine the media that should be included in the final training resource programme. The analysis is discussed in chapter 4.

3.6 Design phase

The printed study text for first- and second-year level was designed and developed first. The text was written in OBET and took into account the techniques for instructional design suggested by Mayer (1999:152-156) (discussed in chapter 2 under research question 5). Upon completion of

University of Pretoria etd – Cloete L M 2001

this process, the computer program was designed. A team approach was followed, involving the subject expert (lecturer) who had to provide the content and the Integrated Technology Centre (ITC) of Technikon SA, which performed the programming.

The computer program was designed as pre-programmed computer-based learning (Bates, 1995:188). The following features of computer learning programs motivated the design of such a program for the training of classification model (Bates, 1995:189, 191-192):

- The student interacts solely with the computer; there is no direct contact through the computer with a tutor, instructor or other students.
- The student has to work though pre-designed material, interacting by answering questions and choosing options.
- The program reacts to students' responses and controls routes through the material.
- The program provides feedback to the students' responses.
- With the use of questions and responses from students followed by feedback from the program, dialogue with the student is simulated.
- The program can assess the student and keep record of the progress.
- The program can identify areas where further study is necessary and prevent students from moving to new material until previous material has been mastered.
- The program can allow students to select materials, levels of difficulty or pathways through the subject matter.
- Video, audio and animated graphics can be integrated within the program.

University of Pretoria etd – Cloete L M 2001

- Pre-programmed computer-based learning can be combined with other forms of instruction such as printed materials, video tapes, audio tapes and broadcasts.
- Students are allowed to work at their own pace.

The design of the program has to make provision for interactivity, individual work and group work. For this, content, user interface and the infrastructure has to be considered (Harris, 1999:153). The researcher included navigational aspects and input methods under infrastructure and also added guidance, feedback, support and progress evaluation. All these aspects should support the content and learning objectives.

3.6.1 User interface design

The user interface is critical to the success of a computer-based training programme. There is nothing else to keep the student interested in learning except the computer (Lee & Mamone, 1995:107). The interface should firstly attract students and secondly keep them interested. The following factors were considered:

- The level of simplicity or complexity expected from the students (based on their previous experience).
- Screen sizes: The content should be designed to accommodate the smallest or most common screen size that students will use
- Screen layout: This involves consistent placement of information, colour combinations and object size.
- The loading time of graphics and sound: This should not be so slow that it will discourage the students from using the program

University of Pretoria etd – Cloete L M 2001

- Interactivity to keep the student involved in the learning process: The student should input information, get a response and spend some time thinking about the answer.

The population analysis established the characteristics of students who have to use the program. It is essential during the design process to be specifically aware of how much computer experience the students have. According to the analysis, students have very little computer experience.

The interface should be transparent to the students, allowing them to move easily through the course without having the interface interfere with their learning. It should contain signs and signals that direct the student appropriately. The design of buttons, menus, labels and other commonly used interface elements had to be carefully considered (Lohr, 2000:45). The interface had to be as clear and simple as possible.

3.6.2 Content

The actual content of the program consists of different types of classification exercises. These include:

- true and false questions
- multiple-choice questions
- completing diagrams and flow charts
- placing books in their correct positions on shelves

The content for each type of exercise or unit is randomly arranged by the program. This means that the order in which questions appear is different each time the student attempts the exercises. This eliminates guessing answers after a previous attempt.

University of Pretoria etd – Cloete L M 2001

The content had to be supported by the appropriate **graphics** and **audio**. During prototyping it was important to experiment with background and text colours to find a suitable combination. It was decided to keep colours simple and use only a few consistently throughout the program.

Audio had to consist of a human voice that introduced the program and gave responses to answers, as well as computer sounds that indicated responses. It was decided to experiment with the human voice and computer sounds and determine during the formative evaluation process how students experienced the audio and what they preferred. A voice with a British accent was used because it was the only voice available at that time.

People with computer experience as well as students with very little experience were asked during the design process to evaluate the graphics and sound. The experienced people (lecturers and programmers) were satisfied with the graphics and preferred the human voice to computer sounds. They believed a voice with a South African accent would be more appropriate. The students were satisfied with the graphics and voice and indicated that they enjoyed the sounds. In the questionnaire for the formative evaluation of the program, which had to be completed by all the students, a section was included on screen layout, colours and the audio to determine how students experienced these aspects. The results are discussed in section 3.10.

University of Pretoria etd – Cloete L M 2001

3.6.3 Navigation

Since students' computer experience was limited, it was decided to make the interaction as simple as possible. It was decided that students would have to follow a predetermined route through the program that coincided with their printed course material. The learning events are also short and confined to one screen. Therefore students' input has to be short, for example, selecting a letter to correspond with an answer, selecting true or false, or entering a number. Only after completion of these exercises are students expected to proceed with more advanced interaction, such as moving an object from one position to another. To keep students meaningfully involved, feedback is provided after each response.

Unnecessary levels of menus and decisions about paths to take interfere with learning (Lee & Mamone, 1995:108). The screens were therefore kept as consistent as possible.

3.6.4 Input methods

Although there are various input methods, the keyboard and mouse are the methods with which students are most familiar and it was decided to use these methods. Since the students have very few typing skills, it would take them far too long to answer a long question and reduce the effectiveness of their learning. They therefore merely have to type in letters or click on an option. The more advanced input involves clicking and dragging objects with the mouse.

University of Pretoria etd – Cloete L M 2001

3.6.5 Guidance

Students should know what to do at every step throughout the program. The guidance comes in the form of navigational help files that should be consulted before starting the exercises. Interactive feedback and explanations are provided after each response from the student. Whenever reading on-screen is required, the text remains on the screen until the students respond with an input or answer.

3.6.6 Feedback

"Action without feedback is completely unproductive for a learner" (Laurillard, 1993:61). It is also important that feedback is used. An action should be adjusted according to the feedback to enable learning. Laurillard (1993:61-62) distinguishes between two types of feedback, namely intrinsic and extrinsic feedback. Intrinsic feedback is given as a natural consequence of action. In the program the student gets an indication after his/her input, of whether the answer is correct or incorrect. Extrinsic feedback is usually in the form of an external comment, approval or disapproval. Extrinsic feedback is more helpful if it includes suggestions on how to improve on an action. If the answer is incorrect, a brief explanation of the correct answer is given.

3.6.7 Support

Provision should be made to give students support throughout their use of the program. Support should be available not only for content-related problems, but very importantly, for problems that students may encounter with the running of the program.

University of Pretoria etd – Cloete L M 2001

After completion of each section, students have the option to review the section. The questions with correct answers are then displayed. After completion of the flow charts and book classification sections, students also have the opportunity to make print-outs of those screens. The print-outs can be added to their printed study text or own notes for future reference.

The student should have the opportunity to describe the problem he/she has encountered. Depending on the type of problem, it should either be investigated and solved by the lecturer (if it is more content-related) or it should be referred to a bugmaster (a system specialist). Feedback should then be provided to the student who reported the problem. A help function is available to assist students with navigation through the program.

3.6.8 Progress evaluation

Progress evaluation plays an important motivational role. As students progress through the program, an evaluation bar indicates to them how they are performing. After completion of a unit, they receive a report comparing their score with their previous score. The incentive is therefore to attempt to improve the score each time they do a particular section.

3.7 Development phase

The development phase involved the final authoring of the program and integration of all the components. The researcher provided all the content for the exercises. The programmer from ITC had the major responsibility of integrating the graphics, audio and text during the development phase.

University of Pretoria etd – Cloete L M 2001

3.7.1 Authoring

At this stage the text, audio, graphics and sound files were integrated. The program was developed in Authorware. Authorware was selected as it is powerful and flexible and can be adapted to perform many functions, including creating different types of exercises (Vaughan, 1998:164). As far as possible, the program was developed to meet the standards of personal computers mostly in use by private individuals and libraries, since those are mostly the computers on which the program would run. The following minimum requirements are necessary to run the program:

- Pentium II
- 64 MB memory
- 16-speed CD-ROM drive
- Sound card
- Windows 95/98/2000 or NT

The program was developed to start running and loading automatically so that the minimum input is required from the users when they use it for the first time.

3.7.2 Layout of the program

The program consists of:

- an introduction
- the option to look at the help files
- the exercises, namely:
  - a true or false section
  - multiple-choice section

University of Pretoria etd – Cloete L M 2001

- a section where missing text should be filled in
- a book classification section
- a flow chart

The following screen captures illustrate the layout of the program:

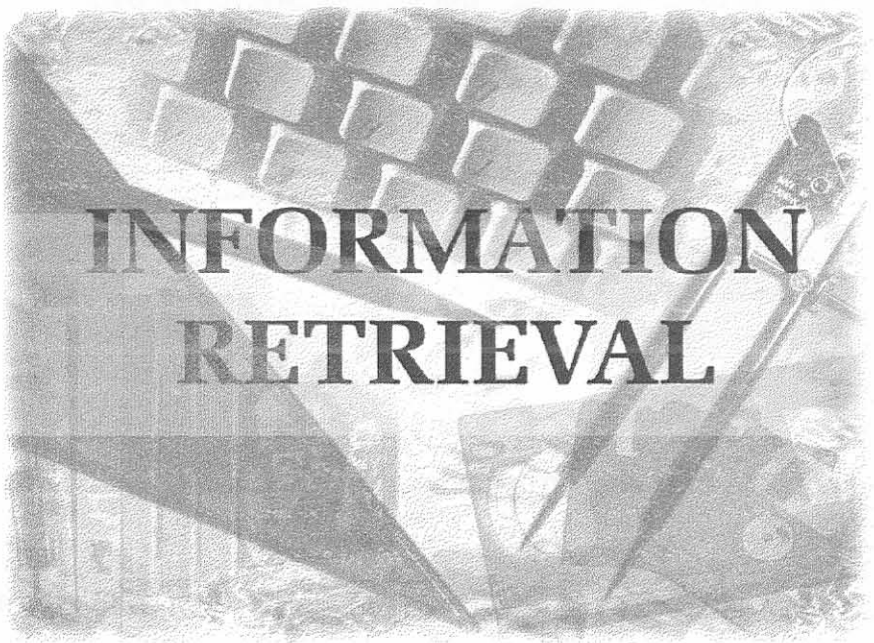


Figure 3.2: Introduction to the program

Two colours are used and different types of media are displayed as background. The selection of media was twofold: information resources are available in different formats and media, and this program forms part of a training resource consisting of different media and technologies. The inclusion of mathematical instruments was the programmer's idea. It was accepted by the researcher since it symbolises the precision involved in this subject matter. Many students over the years have also compared the subject with mathematics.

University of Pretoria etd – Cloete L M 2001

Figure 3.3: Welcome and introduction screen

The above screen is displayed (with the wording changing as seen in Figure 3.4) while a brief audio introduction is given. The introduction gives a brief description of the course in general. It then indicates where the classification module fits into the course as a whole. Reference is also made to the relevant chapters from the study guide.

University of Pretoria etd – Cloete L M 2001

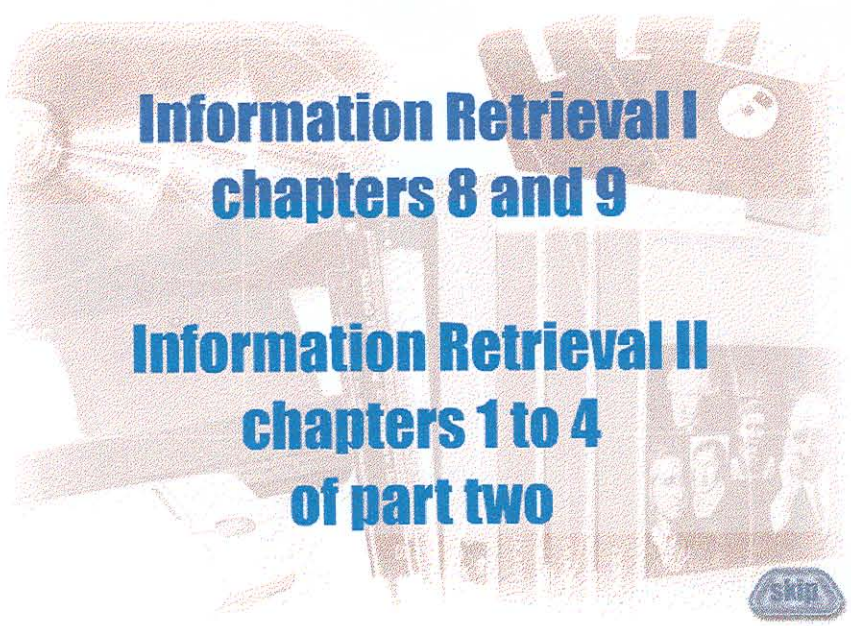


Figure 3.4: Screen with wording to emphasise aspects of the introduction

Users have the option to skip the introduction and proceed with the exercises. When students use the program for the first time, they have to listen to and read the introduction. This is indicated to them in an accompanying letter (annexure D).

Users may first access the **navigational help files** that explain the navigation of the program. Alternatively, they may proceed with the exercises. When students use the program for the first time, they have to work through the help files before starting the exercises. This is indicated to them in the accompanying letter. The following screen captures illustrate the help screens:

University of Pretoria etd – Cloete L M 2001

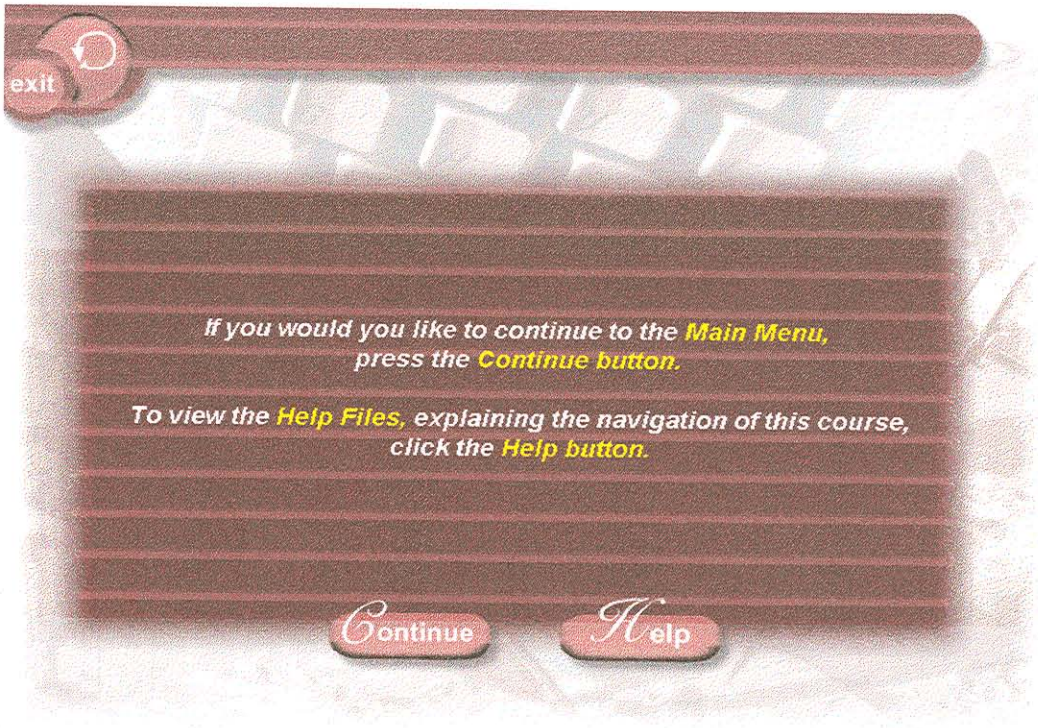


Figure 3.5: Providing the option to view the help function

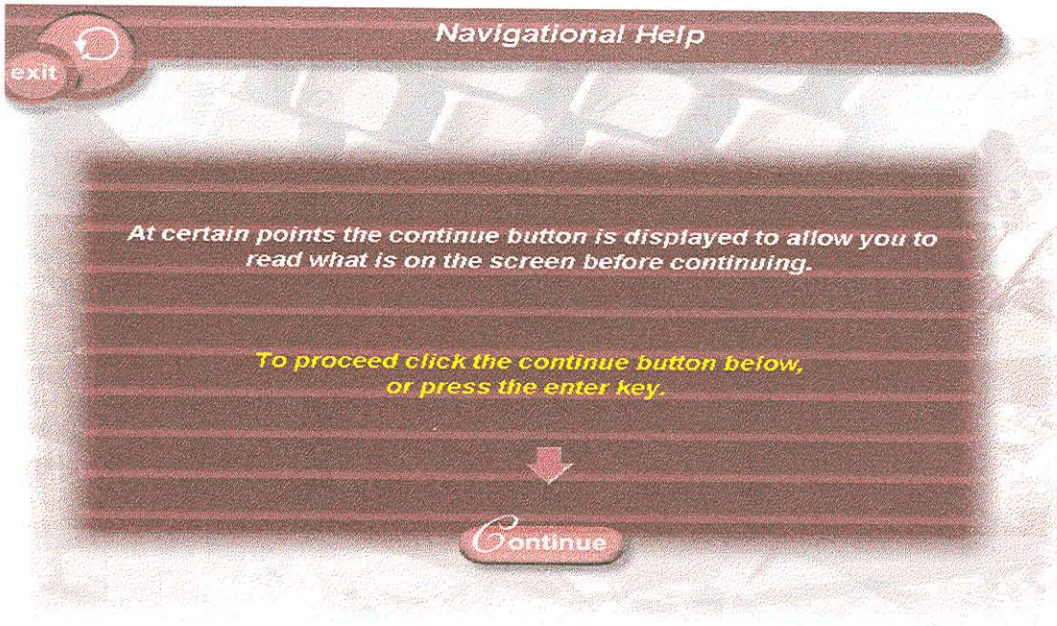


Figure 3.6: Use of the continue button

University of Pretoria etd – Cloete L M 2001

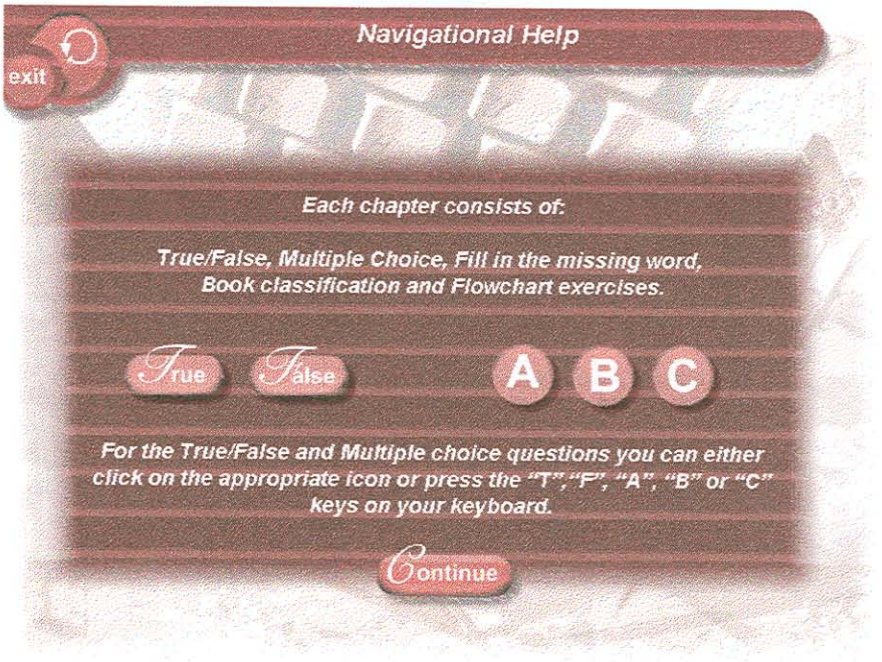


Figure 3.7: Different types of exercises explained

University of Pretoria etd – Cloete L M 2001

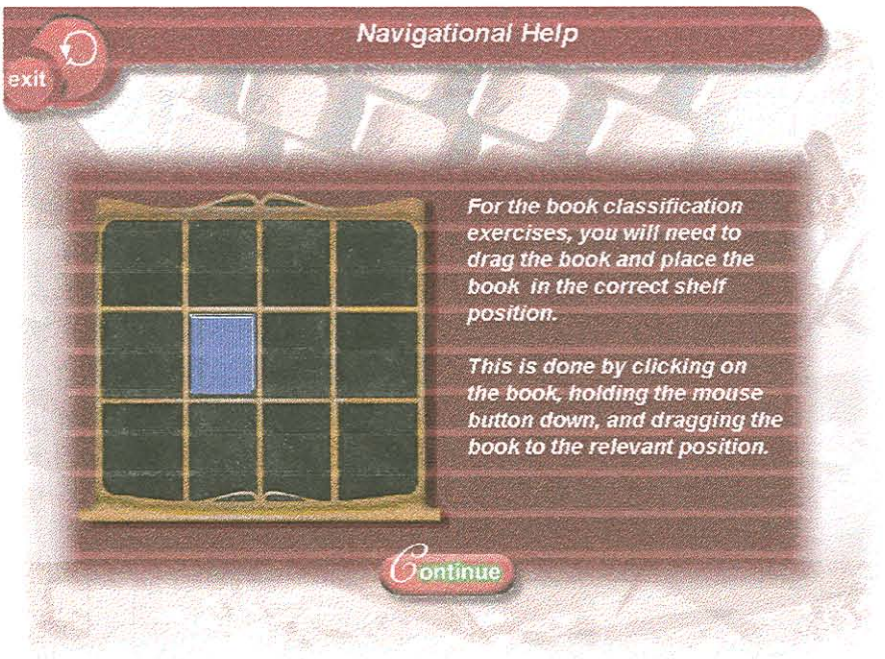


Figure 3.8: Book classification explained

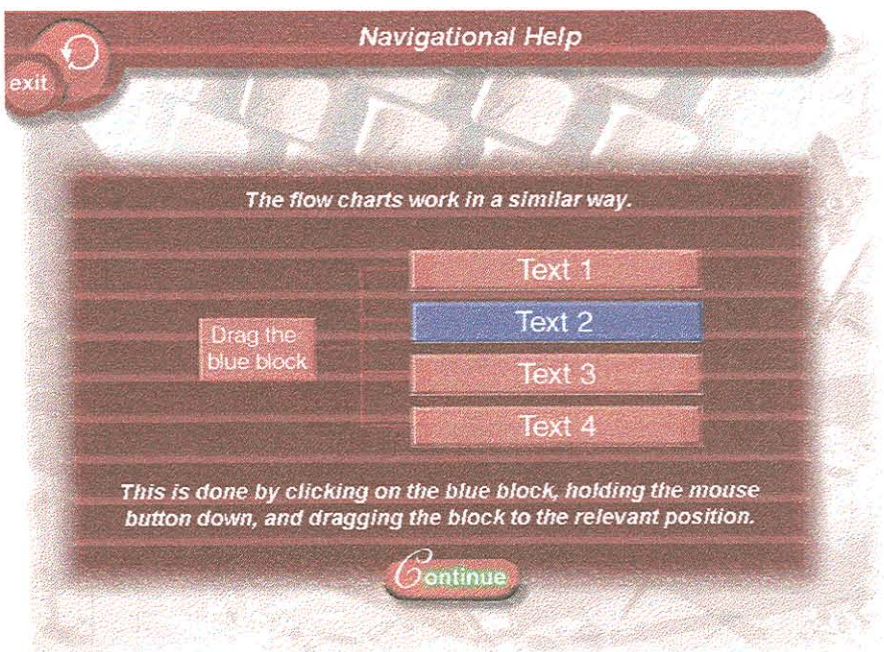


Figure 3.9: Flow charts explained

University of Pretoria etd – Cloete L M 2001

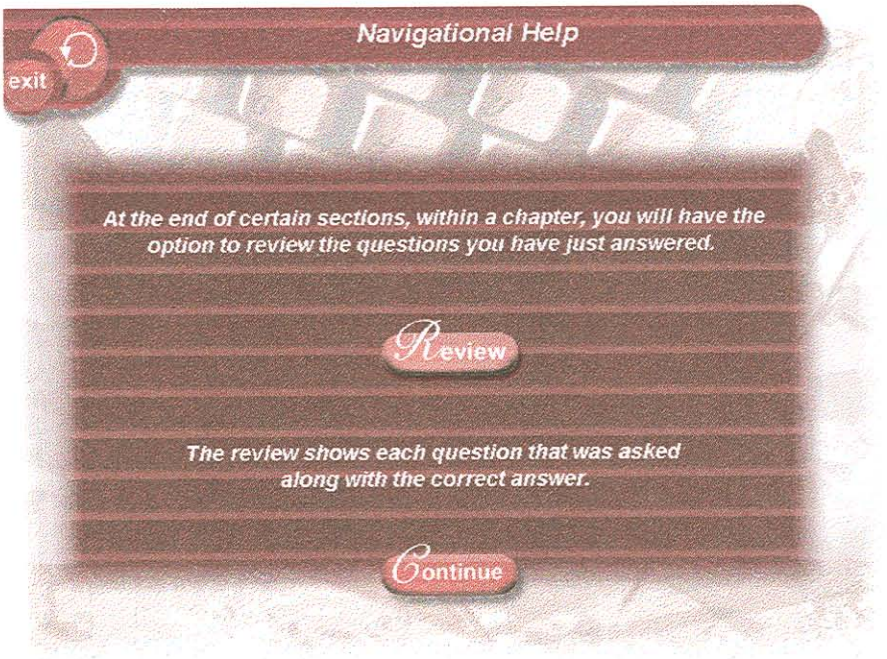


Figure 3.10: Option to review explained

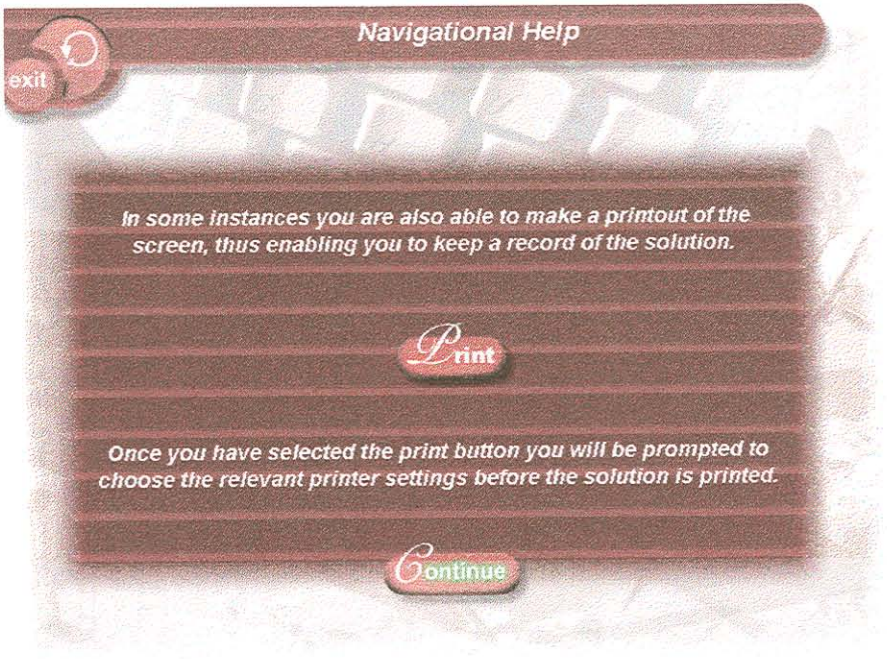


Figure 3.11: Option to print explained

University of Pretoria etd – Cloete L M 2001

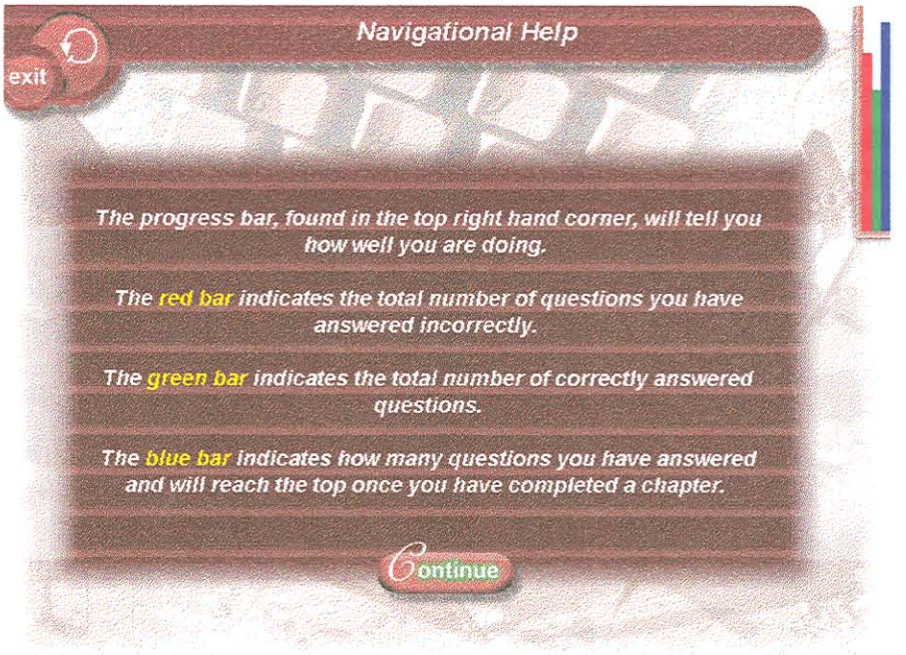


Figure 3.12: Progress bar explained

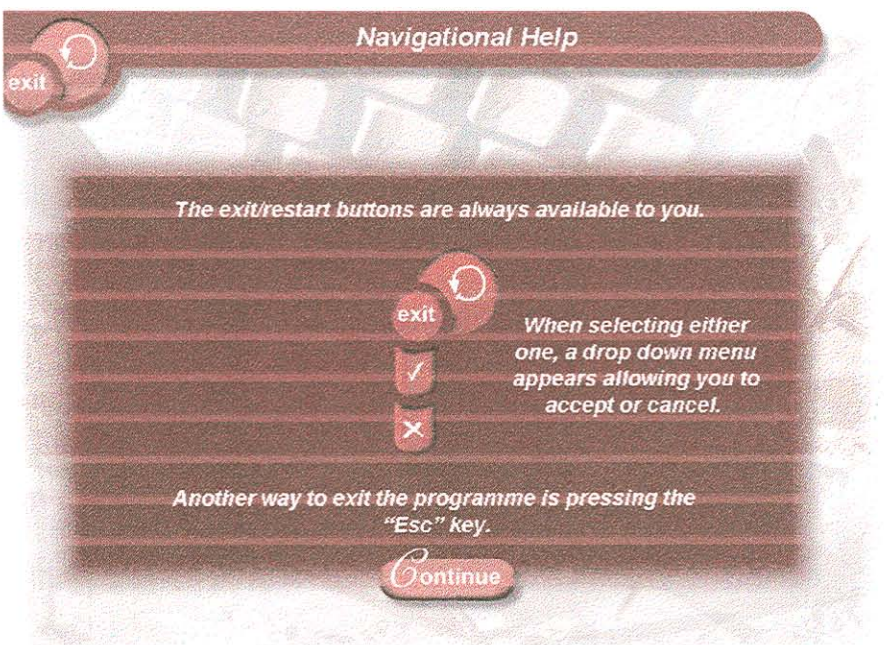


Figure 3.13: Exit/restart buttons explained

University of Pretoria etd – Cloete L M 2001

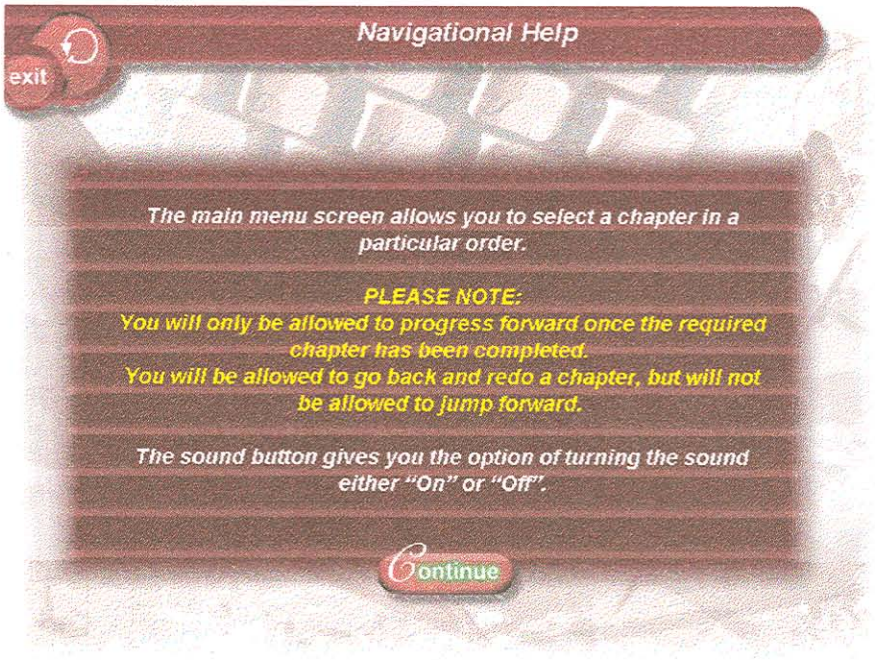


Figure 3.14: Main menu explained

The **main menu** is organised according to the relevant chapters from the study guides for the first and second years of the subject. Students have to start with chapters 8 and 9 from the first year. At this point the other chapters are not accessible. After completion of these chapters, the students are allowed to continue with chapter 1 from the second year. They then progress to chapters 2, 3 and 4. The reason for this sequence is to allow students to revise first-year work before they attempt the second-year work. From there on they have to follow the sequence. A summary becomes accessible after completion of all the chapters. The summary contains new questions from all the chapters and serves as a revision exercise. It allows the students to integrate the work from all the chapters.

University of Pretoria etd – Cloete L M 2001

Figure 3.15: Main menu

The first section in each chapter is a set of true and false questions. Immediately after selection of an answer, the correct answer with a brief explanation is given.

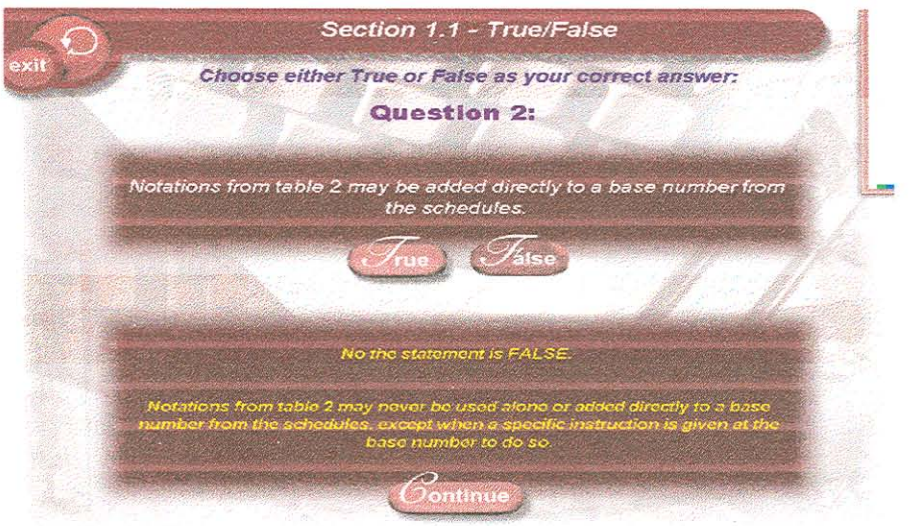


Figure 3.16: True and false section

University of Pretoria etd – Cloete L M 2001

The next section is a multiple-choice section. After the student's response, the correct option is given.

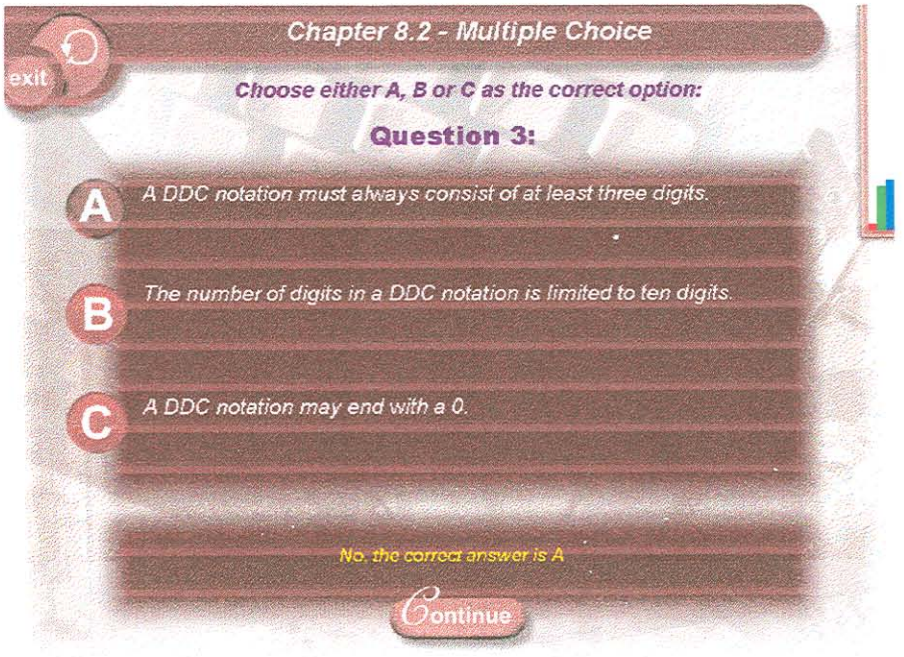


Figure 3.17: Multiple-choice section

In the book classification section, book classification according to the Dewey Decimal Classification (DDC) system is simulated. This exercise can be done individually or jointly by small groups. The exercise is performed by placing books in the correct positions on shelves. The shelves have the classification numbers. The student has to select the correct number for each book. This can only be done if the student can correctly classify the book according to DDC. There are more numbers on the shelves than there are books, so students cannot guess the numbers of the last books. The student has two opportunities to place the books. Thereafter it is done by the program. After completion of this exercise the student has the option to make a print-out of the screen.

University of Pretoria etd – Cloete L M 2001

In terms of constructivist assessment the multiple-choice exercises and the simulations provide individualised guidance and immediate feedback.

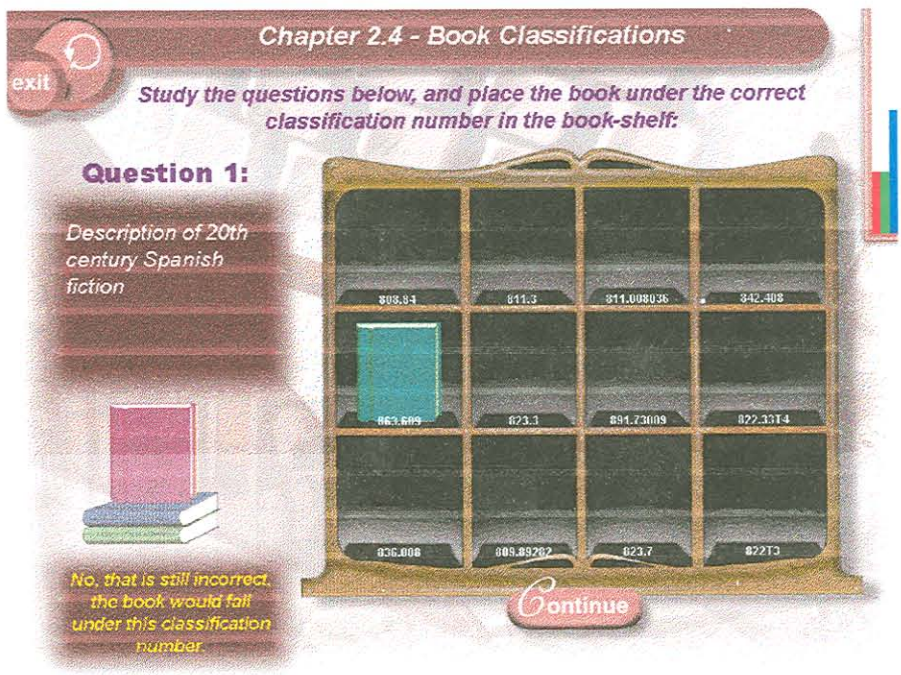


Figure 3.18: Book classification section

The last section is the flow chart section where students have to click and move blocks to their correct positions in a flow chart. This section was developed since following steps in the correct sequence is very important for successful classification. It gives students the opportunity to actually follow the flow charts presented in the DDC and the study guide.

University of Pretoria etd – Cloete L M 2001

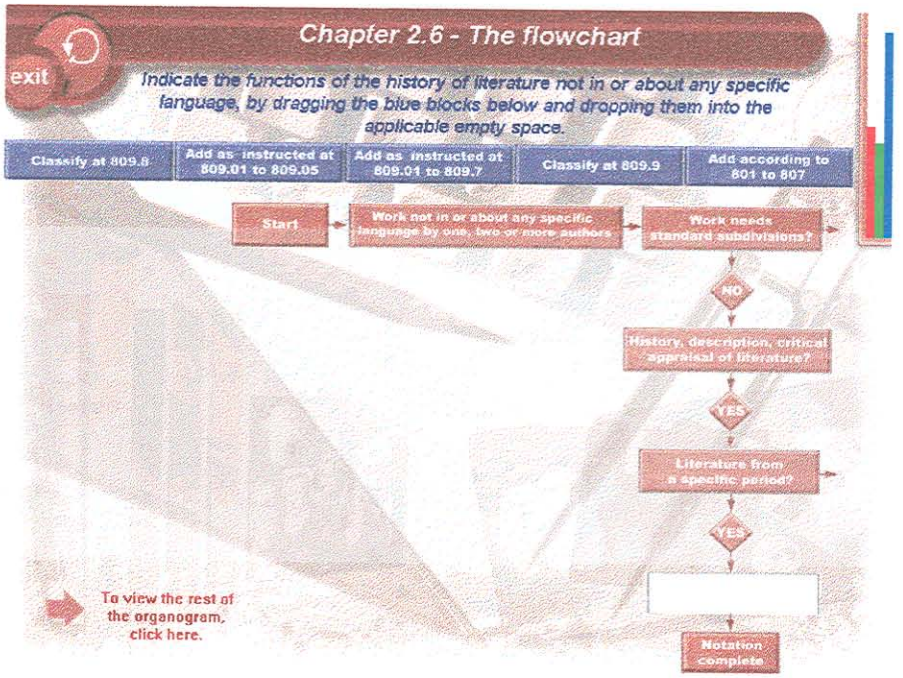


Figure 3.19: Flow chart section

After completion of a chapter, students can see how they have performed and compare this with their previous performance in the chapter.

University of Pretoria etd – Cloete L M 2001

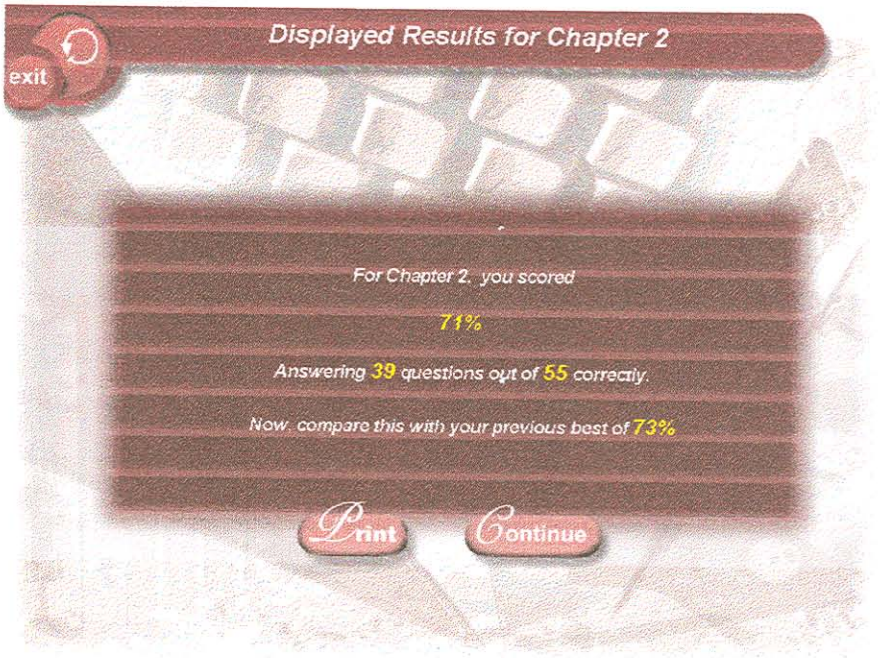


Figure 3.20: Display of results

3.7.3 Evaluation and testing

Testing involved review for content errors and evaluation for instructional effectiveness. Subject matter experts were used to review the content for accuracy, clarity and understandability. During the prototype development the program was tested for technical errors such as links that did not work, incorrect flow through the parts and inconsistent navigation. A pilot test with two students was also conducted.

3.8 Implementation phase

The program was issued in CD-ROM format to all the students of a specific registration period (1st registration 2000) for evaluation. The CD-ROM was accompanied by a letter (annexure D) explaining the purpose of the program and a questionnaire to be completed for the formative

University of Pretoria etd – Cloete L M 2001

evaluation (annexure B). The students had one month in which to use the program and return the questionnaire. During this period students also had the opportunity to discuss the program with the lecturer (researcher) and fellow students via telephone, fax, e-mail and the discussion group facility on TSA COOL. All the comments and questions were noted. There was also a contact session at the main campus where the program was illustrated and students could use it in small groups. During this session personal interviews and focus group discussions were held with the students. Observations were made while they worked and their comments and other noteworthy incidents were recorded. The information was gathered and then organised to be used in conjunction with the questionnaires for the formative evaluation phase.

3.9 Formative evaluation phase

Laurillard (1994:287) defines formative evaluation as " ... the collection and analysis of data on the pedagogic value of a teaching program, defined in terms of the learning processes it promotes and the learning outcomes it achieves".

According to Lee and Mamone (1995:267), formative evaluation occurs from the time that the need for a training programme is established until the final product is delivered to "ensure the instructional soundness, quality, and suitability of a training program".

Formative evaluation forces the developers to think from the start in terms of what students are supposed to get out of the training (Laurillard, 1994:287). It is an essential part of the development process. It provides the means for the research to be carried out and for the practitioners to become more reflective of their work (Laurillard, 1994:293).

University of Pretoria etd – Cloete L M 2001

Formative evaluation is limited to a focus on a specific context. The purpose is to improve a specific programme or product (Patton, 1990:156). For formative evaluation, questions are included to identify any parts of the programme that may be ineffective.

During the formative evaluation the following is addressed (Alexander & Hedberg, 1994:242; Beattie, 1994:246; Hale & French, 1999:166):

- Effectiveness of user interaction
- Process feedback
- Any technical problems
- Content problems
- Navigation problems
- Learning experiences
- Merit of the programme (how did it assist students?)

The following methods were used to conduct the formative evaluation:

3.9.1 Observations

According to Laurillard (1994:289), observation is more efficient if it is focused. Therefore a template for recording observations should enable focused observation to be recorded easily. For example, the amount of time it takes students to perform certain actions or exercises in the program or which options they select most frequently could be recorded. Open-endedness plays an important role in observations. Through observations unintended outcomes of the program can be evaluated. Laurillard (1994:290) considers observations an extremely rich and useful data collection method that can be carried out very quickly. The

University of Pretoria etd – Cloete L M 2001

unconstrained data collection process complements the closed evaluation techniques such as questionnaires and structured interviews.

The value of observations can be summarised as follows (Patton, 1990:203):

- The researcher can understand the program activities and impacts through the detailed descriptive information about what occurred in the program and how the participants reacted to what has occurred.
- He/she can better understand the context within which the program operates.
- He/she can be open, discovery-oriented and inductive in approach.
- He/she can observe things that may routinely escape conscious awareness among participants.
- He/she can learn about things that participants may be unwilling to discuss during interviews.

In this evaluation exercise one or more students used the program and discussed it as they used it. Students worked in pairs or small groups. This "conversation" was observed (without interference). This method can reveal a great deal about students' experience of the program, particularly about the screen design or interface, pointing out things that might interfere with learning and might otherwise have gone unnoticed (Beattie, 1994:254). This helps designers to understand not only where the program fails, but why, and what needs to be done about it. (Laurillard, 1994:290). One must, however, keep in mind that what students say they "like" or "prefer" may not necessarily be the best for learning.

University of Pretoria etd – Cloete L M 2001

3.9.2 Interviews and informal discussions

Interviews can be in-depth with individuals or in small groups. Alternatively, casual conversation may be recorded. Interviewing is considered a labour-intensive evaluation technique and is therefore used with small numbers of students (Laurillard, 1994:290). The open-ended nature of interviews can help to establish what aspects should be further investigated with the closed form of the questionnaire (Laurillard, 1994:290). On the other hand, certain information obtained from questionnaires can be further investigated in more depth by interviewing respondents to the questionnaires. Interviews and informal discussions were held with the students who used the program in groups and with individual students who attended a contact session. These interviews were conducted after the questionnaires had been completed. The interviews and discussions provided the researcher with the opportunity to clarify certain comments made by the students and aspects indicated in the questionnaire.

3.9.3 Focus groups

Focus groups are useful in the planning and design phases if there is a formative question to ask that will guide the design of the programme. (Beattie, 1994:255). A focus group consists of a small group of students convened separately or jointly to determine their experience of the training programme. The purpose of the focus groups was the same as that of the interviews and discussions. Focus group discussions were held during the contact session.

University of Pretoria etd – Cloete L M 2001

3.9.4 Student questionnaires

Questionnaires are used to test the experience of the wider population of students. The questionnaire was administrated to all the students registered for Information Retrieval II for the first registration period of 2000. (annexure B).

The guidelines compiled by Steenekamp (1984) for the CSIR and those for setting up questionnaires compiled by the University of Pretoria, Department of Information Technology, Research Support (1981) were followed in the design of the questionnaires.

The purpose of the questions was to obtain simple reflections from the students' recent experience with the program. Only closed questions were asked so that students had to indicate a rating of their experience. They had to select one of the following ratings:

SA	=	Strongly agree
A	=	Agree
N	=	Neither agree nor disagree (cannot decide)
D	=	Disagree
SD	=	Strongly disagree

Students' experiences of the following aspects were determined:

- How the program assisted them in classification
- Computerised format of the exercises
- Screen displays
- Text layout
- Language level
- Graphics
- Sound

- Content
- Navigation and interaction
- Assessment of performance
- Group work with the program
- Enjoyment of the program

3.10 Results

Only three students had difficulty in using and accessing the CD-ROM. The low figure was surprising since the majority of students had never used CD-ROM in their studies before. Difficulties were mainly due to incorrect personal computer settings. These difficulties were quickly resolved when the students contacted their lecturer, tutor or the network administrator.

In the summary of the results presented here, the SA and A ratings were combined, as well as the D and SD ratings. This was done to provide a more compact presentation. Detailed findings are provided in annexure E.

3.10.1 How did the program assist students in the study of classification?

Students' impressions of how the program assisted them in the study of classification were established. The purpose was therefore not to determine whether students' performance in the module improved or not with the use of the program. In other words, students were not tested before and after working through the program. The results of pre- and post-testing of performance are also influenced by other factors that do not form part of the scope of the study.

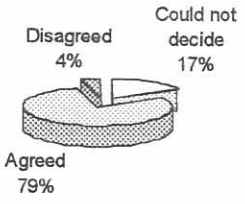
Students had to indicate to what extent they agreed that the program:

University of Pretoria etd – Cloete L M 2001

- helped them with their classification
- helped them to understand the contents on classification in the study guide better
- helped them to answer questions for self-evaluation and assignment questions

The finding to all the above statements is summarised and indicated in Table 3.8.

Table 3.8: Assistance in classification

Aspect	Finding
The program assisted students in their study of classification.	

During the observations it was also clear that students reacted positively to the different training medium. Comments from the students indicated that they appreciated the fact that they were given exercises in a different format that was more closely related to "real-life" classification situations.

University of Pretoria etd – Cloete L M 2001

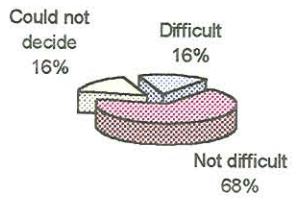
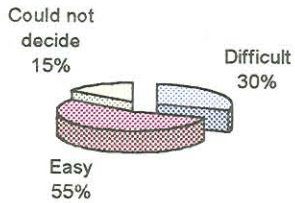
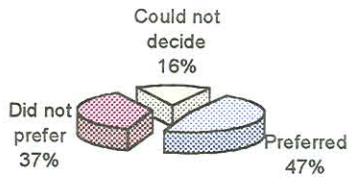
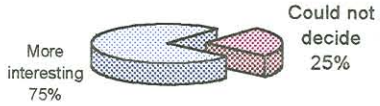
3.10.2 How did students experience the computerised format of the exercises?

Most of the students had never used computers in their training before. Some had limited experience of word processing tasks and routine computerised tasks, such as issuing library materials, at the libraries where they work. It was therefore surprising to find, especially during the observations, that the students quickly worked out for themselves how the program worked. Some students had to read the help file first, but others managed simply by following the instructions. The following aspects were evaluated:

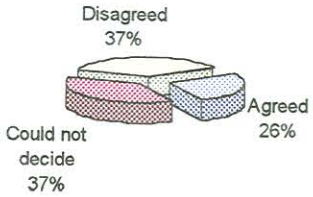
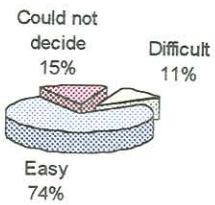
- Difficulty because of the computerised format
- Preference for pen-and-paper format
- Whether the computerised format made the exercises more interesting
- The use of the mouse (clicking and dragging was a new activity for students)

University of Pretoria etd – Cloete L M 2001

Table 3.9: Computerised format of the exercises

Aspect	Finding
Did students find it difficult to do the exercises because of the computerised format?	
Did students who usually have difficulty working on computers find the exercises easy to do?	
Would students have preferred to do the exercises in a pen-and-paper format?	
Did the computerised format make the exercises more interesting than an equivalent pen-and-paper format?	

University of Pretoria etd – Cloete L M 2001

Aspect	Finding
Where students had the option to use either the mouse or the keyboard they preferred the keyboard instead of the mouse.	
Did students find the use of the mouse and clicking and dragging objects difficult?	

There is some contradiction in the preference for pen-and-paper format versus computerised format. Nearly half of the respondents still indicated a preference for the pen-and-paper format, but admitted that the computerised format made the exercises more interesting. Respondents indicated no preference for using the mouse or keyboard where they had a choice. They found it easy to use the mouse. The following comment regarding the computerised format was made by a student:

"*They say you learn by doing and this is how the CD works for me. I remember the details better if I do it on the computer.*" (Meyer, 2001)

University of Pretoria etd – Cloete L M 2001

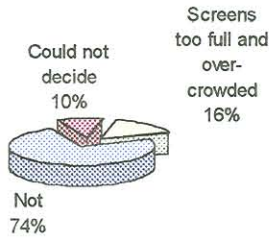
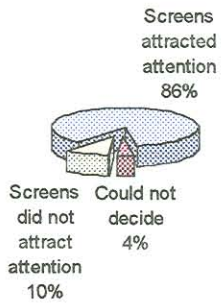
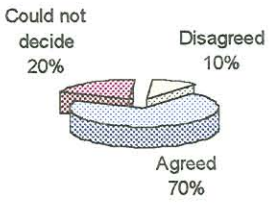
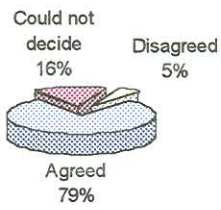
3.10.3 How did students experience screen displays?

Since the screen displays form an integral part of the interface, the evaluation of students' experience of them is considered important. It should be noted that owing to students' limited experience of computerised training, they could not compare the layout with any other layouts. The following aspects were evaluated:

- Fullness of screens
- Attracting attention
- Similarity of each screen
- The understanding of the meaning of each picture, button and symbol

University of Pretoria etd – Cloete L M 2001

Table 3.10: Screen displays

Aspect	Finding
Did students find the screens too full and overcrowded?	
Did the screens attract students' attention?	
The fact that each category of questions has the same screen layout in every chapter helps students to understand how to answer the questions.	
Students knew what each picture, button and symbol on the screens meant.	

University of Pretoria etd – Cloete L M 2001

Since students reacted positively to the screen display, the display will be maintained during further developments of the CD-ROM.

3.10.4 How did students experience the text layout?

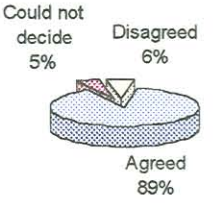
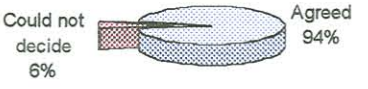
The text-layout is also an important aspect influencing students' interaction with the program. The following aspects were evaluated:

- Ease of reading the font
- Attractiveness of the font
- Font size
- Colour
- Amount of text on the screen

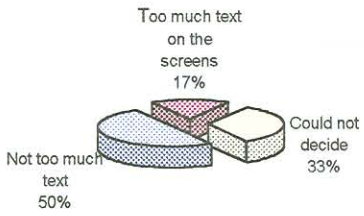
All the respondents (100%) indicated that the text layout was easy to read (refer to annexure E).

University of Pretoria etd – Cloete L M 2001

Table 3.11: Text layout

Aspect	Finding
The font used for the text was easy to read.	
The font was attractive.	
The font size was readable and acceptable.	
Students liked the colours used for the text.	

University of Pretoria etd – Cloete L M 2001

Aspect	Finding
Was there too much text on the screens?	

The students reacted positively to the text layout. It will be maintained for further developments.

3.10.5 How did students experience the language level?

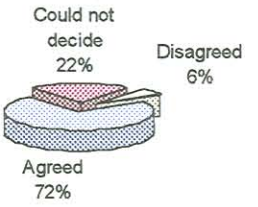
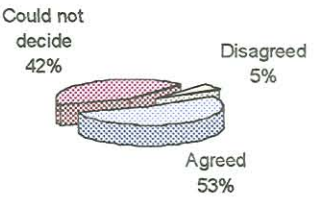
The student profile indicated that English was not the home language of the majority of students. It was therefore important to determine if the language level used in the program was satisfactory. The following aspects were evaluated:

- Whether the language contributed to understanding the program
- The length of sentences
- Vocabulary
- Possibility of looking up unfamiliar terms

All the respondents (100%) indicated that the vocabulary made the program easy to understand (refer to annexure E).

University of Pretoria etd – Cloete L M 2001

Table 3.12: Language level

Aspect	Finding
The language used made it easy to understand the program.	
The length of the sentences made the program easy to understand.	
Students could look up any unfamiliar terms or phrases in the study guide.	

The students indicated that the language level and length of the sentences assisted them in understanding the program.

From the observations of and comments from students it became clear that students did not consult the study guide often to look up any unfamiliar terms. In fact, they do not consult the study guide often, even when preparing for assignments. This is a concern to be addressed at a later stage.

University of Pretoria etd – Cloete L M 2001

The language level will be maintained for further developments.

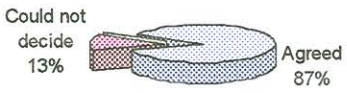
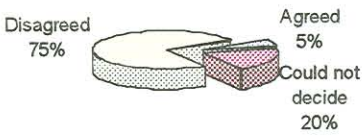
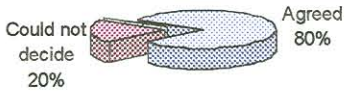
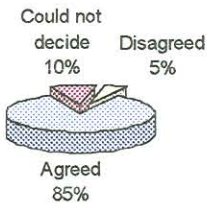
3.10.6 How did students experience the pictures and colour?

Pictures and choice of colour also contribute to the effectiveness of the interface. The following aspects were evaluated:

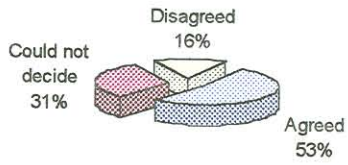
- Creating the feeling of classifying real books
- Whether pictures distracted students' attention
- Experience of colours
- Preference for more pictures

University of Pretoria etd – Cloete L M 2001

Table 3.13: Pictures and colour

Aspect	Finding
The use of pictures of books and a bookshelf in the book classification exercises made it feel as if students were classifying real books.	
The pictures of books and a bookshelf distracted students so that they could not concentrate on the exercises.	
The colours used for pictures were pleasant to look at.	
The colours used for the backgrounds of screens were pleasant to look at.	

University of Pretoria etd – Cloete L M 2001

Aspect	Finding
Students would have liked more pictures in the program.	

The majority of students experienced the pictures and colours positively. The colour scheme will be maintained for future developments. More graphics could be used. The following comment was made by a student about experiencing the book classification exercise as if real books were being classified:

"*You can imagine shelving the books from your screen.*" (Ngubane, 2001)

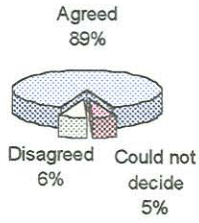
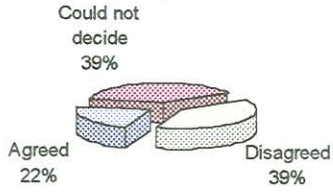
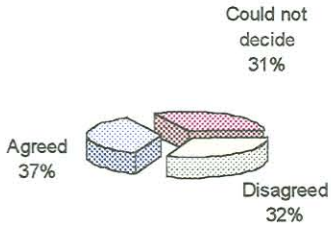
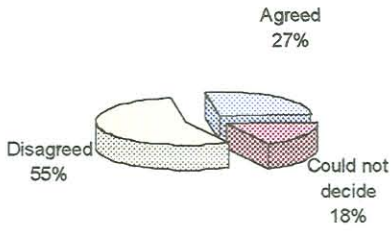
3.10.7 How did students experience the sound?

The sound involved two components: a human voice and computer sounds. The following aspects were evaluated:

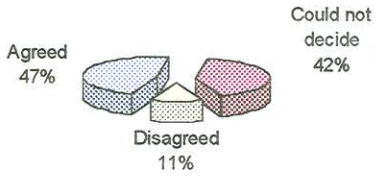
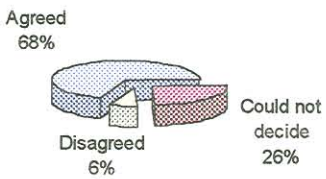
- Satisfaction with the voice used for the introduction
- Accent of the voice
- Preference to have the sound option on or off
- Preference for the human voice
- Preference for the computer sounds

University of Pretoria etd – Cloete L M 2001

Table 3.14: Sound

Aspect	Finding
Students were satisfied with the voice used for the introduction to the program.	
The accent of the voice was too British.	
Students would have preferred a voice with a South African accent.	
Students preferred to have the sound option off.	

University of Pretoria etd – Cloete L M 2001

Aspect	Finding
Students preferred the human voice that told them when an answer was correct and incorrect.	
Students preferred the computer sounds that indicated to them when an answer was correct or incorrect.	

Although it was initially decided to use a voice with a South African accent, a British accent voice was available during the recording of the computer program. Students' reaction to this was tested. The majority of students were satisfied with the voice used for the introduction to the program and it can therefore be maintained for future developments.

It was clear, especially during the observations, that students liked the sounds and human voices that responded to their answers. Students indicated that it did not really matter to them whether computer sounds or human voices were used. The current selection of sounds and human voices will therefore be maintained for further developments.

University of Pretoria etd – Cloete L M 2001

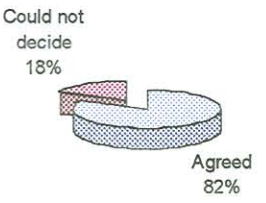
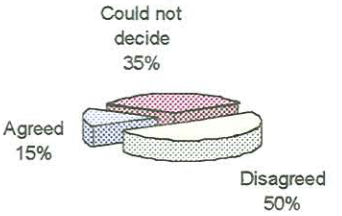
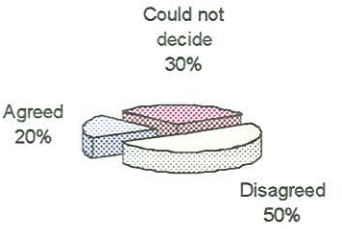
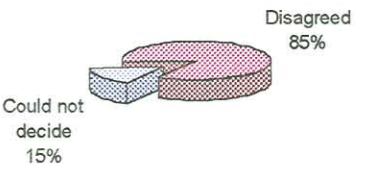
3.10.8 How did students experience the content of the program?

The following aspects were evaluated:

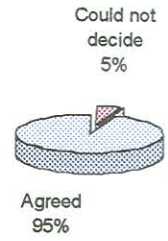
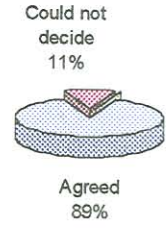
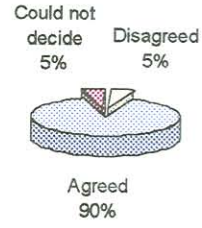
- Whether students who enjoy classification were also satisfied with the program
- Whether students found the content too difficult
- Whether students who do not enjoy classification were satisfied with the content
- Whether students who do not enjoy classification were not satisfied with the content either
- Whether the content helped students to understand the printed study material better
- Whether students found the review section after each chapter useful
- Whether students found the summary at the end of the program useful

University of Pretoria etd – Cloete L M 2001

Table 3.15: Content

Aspect	Finding
Students who enjoy classification were also satisfied with the program.	
Students who enjoy classification found the content too difficult.	
Students who do not enjoy classification were satisfied with the content.	
Students who do not enjoy classification were not satisfied with the content of the program either.	

University of Pretoria etd – Cloete L M 2001

Aspect	Finding
The content helped students to understand their printed study material better.	
Students found the review section after each chapter useful.	
Students found the summary at the end of the program useful.	

In the past, when only printed material was used in the training of the classification module, students indicated that they found the module very difficult and therefore not a very pleasant experience. It was therefore anticipated that they would also find the content of the computer program difficult and would indicate that they did not enjoy classification. As indicated by the results, the opposite was experienced. The majority of students enjoyed the program and were satisfied with its content.

University of Pretoria etd – Cloete L M 2001

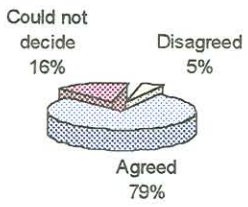
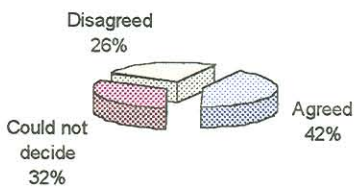
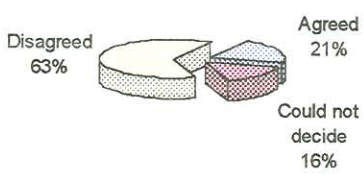
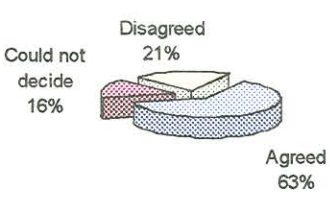
3.10.9 How did students experience the navigation and interaction within the program?

The ability of students to find their way around the program is very important. It can determine whether students continue practising with the program or "give up" because the program is too difficult. The following aspects were evaluated:

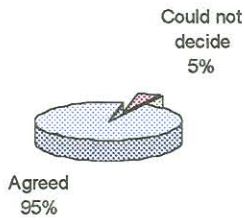
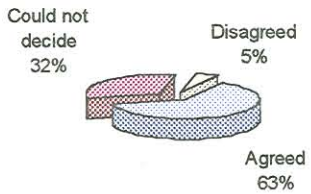
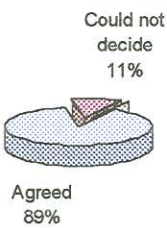
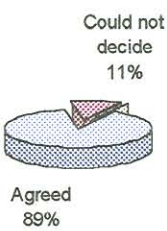
- Whether students felt as if the program addressed them personally
- Whether there were times when the students were uncertain about what to do
- Whether students got lost in the content
- Whether students always knew where they were in the program
- Whether the introductory statements in the program explained the purpose of the program clearly
- Whether it was easy to get help from the help files
- Whether directions were clear and easy to follow
- Whether students knew what each icon meant and when to click on it
- Whether students found the option to make a print-out of a screen useful

University of Pretoria etd – Cloete L M 2001

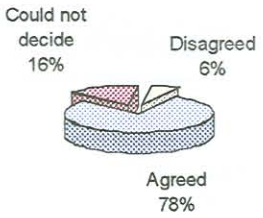
Table 3.16: Navigation and interaction

Aspect	Finding
Students felt that the program addressed them personally.	
There were times when students were uncertain about what to do.	
Students got lost in the content.	
Students always knew where they were in the program.	

University of Pretoria etd – Cloete L M 2001

Aspect	Finding
The introductory statements to the program explained the purpose of the program clearly.	
It was easy to get help from the help files.	
The directions were clear and easy to follow.	
Students knew what each icon meant and when to click on it.	

University of Pretoria etd – Cloete L M 2001

Aspect	Finding
Students found the option to make a print-out of the screen useful.	

From the results it seems that the navigation is satisfactory. During the observation of students it was clear that there were times when the students were not sure what to do next. This happened mostly when students did not read the help files before attempting the exercises. Within the exercises the help files are not available. Clear instructions are, however, given at each exercise and question. During further developments the navigational help files should be made available at all times.

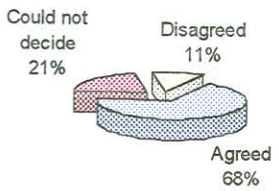
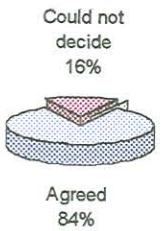
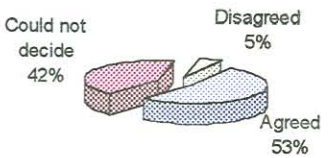
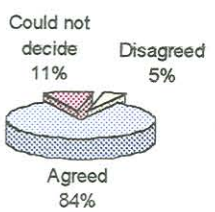
3.10.10 How did students experience the assessment of performance?

Students' performance in the program could be a motivational factor to continue using the program in order to improve performance. The following aspects were evaluated:

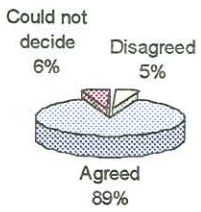
- Usefulness of the progress bar
- Clarity of answers and explanations
- Preference for more attempts to do book classification
- Usefulness of percentage marks for performance
- Usefulness of comparison with previous performances

University of Pretoria etd – Cloete L M 2001

Table 3.17: Assessment of performance

Aspect	Finding
Students found the progress bar useful.	
The answers and explanations were clear.	
Students would have preferred more than two attempts at the book classification section.	
Students found the percentage marks awarded for performance useful.	

University of Pretoria etd – Cloete L M 2001

Aspect	Finding
Students found the comparison of their percentage marks with the previous performance useful.	

All the respondents felt it was helpful to receive the correct answer immediately and, where applicable, explanations of incorrect answers (refer to annexure E).

The immediate feedback provided by the program, which includes correct answers as well as explanations, was highly appreciated. The following comment was made by a student in this regard:

"*... the good thing is when you are wrong, it provides instant feedback.*" (Opperman, 2001)

Students also appreciated the fact that their performance was measured and that they could compare it with previous performances. This is similar to points ratings in many computer games.

The following comment was made by a student about the fact that questions are randomised, which therefore provides the opportunity to repeat practise:

"*The most wonderful part is that when you work on the CD the second and third time, it changes to other questions whereby you can work it a lot of times.*" (Makhubela, 2001)

University of Pretoria etd – Cloete L M 2001

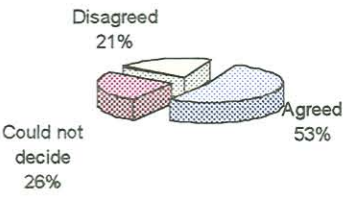
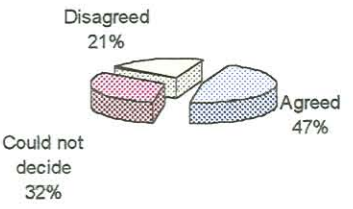
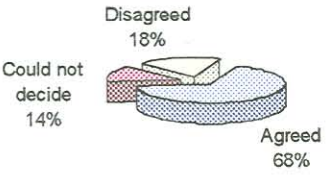
3.10.11 How did students experience group work with the program?

The program lends itself to individual as well as group work. Students often express the desire to get together and practise cataloguing. It was therefore decided to determine how students experience group work with the program. The following aspects were evaluated:

- Whether students usually like working in a group
- Whether students would have liked to do the program in a group
- Whether students would have preferred to do the exercises on their own

University of Pretoria etd – Cloete L M 2001

Table 3.18: Group experience

Aspect	Finding
Students usually like working in a group.	
Students would have liked to do the program in a group with others.	
Students preferred to do the exercises in the program on their own.	

From the results there is no definite preference for doing the program in a group or individually. Students who worked on it during observations preferred to work in groups. The program is suitable for group work or individual work.

University of Pretoria etd – Cloete L M 2001

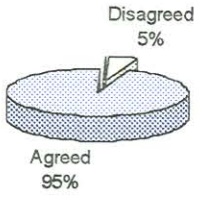
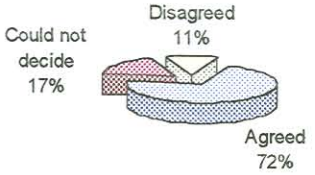
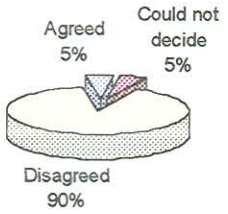
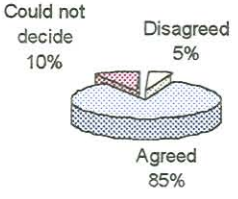
3.10.12 How did students enjoy the program?

Enjoyment of the program is also considered a strong motivational factor. The following aspects were evaluated:

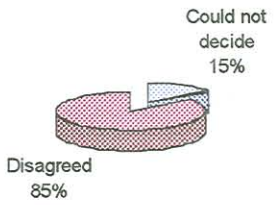
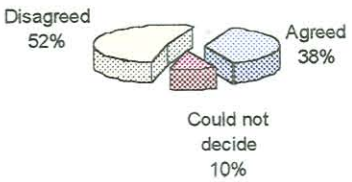
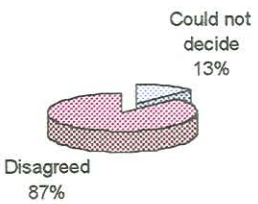
- Challenging aspect of the program
- Stimulating aspect of the program
- Boredom with the program
- Whether students who enjoy classification also enjoyed practising with the program
- Whether students who enjoy classification did not enjoy practising with the program
- Whether students who do not enjoy classification enjoyed practising with the program
- Whether students who do not enjoy classification did not enjoy practising with the program either

University of Pretoria etd – Cloete L M 2001

Table 3.19: Enjoyment of the program

Aspect	Finding
Students found the program challenging.	
Students found the program stimulating.	
Students were bored with the program.	
Students who enjoy classification also enjoy practising with the program.	

University of Pretoria etd – Cloete L M 2001

Aspect	Finding
Students who enjoy classification do not enjoy practising with the program.	
Students who do not enjoy classification, enjoy practising with the program.	
Students who do not enjoy classification do not enjoy practising with the program either.	

Results on the measurement of enjoyment of the program were very positive. Follow-up discussions with students confirmed that the different medium contributed significantly to the enjoyment.

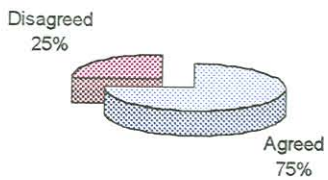
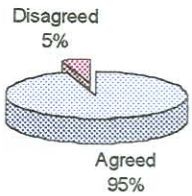
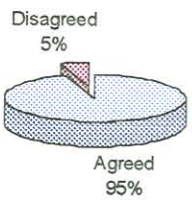
University of Pretoria etd – Cloete L M 2001

3.10.13 How did students experience the program in general?

The following aspects were evaluated:

- Whether there was enough time to complete the program
- Whether students would use the program again
- Whether students would recommend the program to others

Table 3.20: Experience of program in general

Aspect	Finding
There was enough time to complete the program.	
Students would use the program again.	
Students would recommend the program to others.	

University of Pretoria etd – Cloete L M 2001

The students who had difficulty in completing the program attributed it to the fact they had too many other subjects and work commitments.

The fact that an overwhelming majority of students would use the program again and recommend it to others is an indication that further multimedia developments of the course are necessary.

3.11 Summary

This chapter described the design, development, implementation and evaluation of one of the components of the training programme for cataloguing students, namely a variety of exercises on a computer program. The goal of the chapter was to investigate the instructional and motivational effectiveness of a computer program as a means of providing additional practice for cataloguing students.

Students adapted quickly to the new format and did not experience difficulty in understanding the program and working through it.

The lack of immediate feedback was identified as one of the main problems of learning cataloguing through distance training (as identified under research question 7). With this program students could immediately follow up incorrect answers.

Students expressed positive responses to the program and its value in their learning of classification. The results clearly indicate that they appreciated the fact that they were given exercises in a different format that were more closely related to "real-life" classification situations.

University of Pretoria etd – Cloete L M 2001

Students also found the program enjoyable, which is a strong motivational factor.

The program was found to be suitable for individual as well as group work.

It has been determined that the computer program is effective both instructionally and motivationally.

3.12 Recommendations

This investigation has demonstrated that the overall effect or outcome of the evaluation was positive. It is recommended that the screen layout, text layout, language level, graphics and sound selection be maintained. The content should be expanded to include the other components of the cataloguing course as well. The navigational help files should be accessible at all times in the program. A useful addition would be references to further explanations in the printed study material. This would also encourage students to refer more to their study material.

With reference to the specific research questions under investigation in this chapter the recommendations are summarised as follows (Table 3.21):

University of Pretoria etd – Cloete L M 2001

Table 3.21: Summary of recommendations

NO.	QUESTION	ASPECT	RECOMMENDATION
9	What developments have taken place in the utilisation of a mix of appropriate media and technology in training cataloguers?	New development	Maintain the computer program and expand it to include other components of cataloguing
10	What are the advantages and disadvantages of training cataloguers by means of a mix of media and technologies?	Advantages and disadvantages as experienced by students	**Advantages** ➢ Motivation ➢ More practice opportunities ➢ Interactivity ➢ Enjoyment **Disadvantages** ➢ Students have to get used to the new medium before they can focus on the content ➢ A lot of help and guidance need to be included in the development ➢ Students regard the different media as separate entities and do not use them in conjunction with other training materials and media
11	How should training by means of a mix of media and technologies be designed to serve as an appropriate training mode?		Simplicity should be maintained Computer programs should be included

University of Pretoria etd – Cloete L M 2001

Chapter 4 will present the project description of the training resource consisting of a mix of media and technologies.