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# The Use of CAI for Distance Teaching in the Formulation of Search Strategies\*

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## ABSTRACT

COMPUTER-ASSISTED INSTRUCTION (CAI) HAS PROVED an effective method of teaching in Library and Information Science (LIS) practices such as online searching and enduser instruction. The growing interest in electronic information retrieval, and especially the Internet, as well as the emphasis on lifelong learning skills stress the need for training in the formulation of search strategies. Distance education is especially suitable for training working adult students, and should therefore also be explored with regard to the teaching of skills in the formulation of search strategies. Since 1992 the Department of Information Science at the University of South Africa (Unisa) has been experimenting with a CAI tutorial in the formulation of search strategies. The experience gained from designing this CAI tutorial and from revising it in 1998, feedback from students and a literature survey are used to report on the design of CAI tutorials in the formulation of search strategies.

## 1 INTRODUCTION

Computer-assisted instruction (CAI) is a well-known and accepted method of instruction for independent studies. Synonyms for CAI include computer-assisted learning (CAL), computer-based education (CBE), and computer-based training (CBT).

A number of applications of CAI have been reported in the Library and Information Science (LIS) literature, for example, by Armstrong (1984), Armstrong and Large (1987), Bourne (1990), Caruso (1981), Davis

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(1993), Foster (1987), Gratch (1986), Large and Armstrong (1983a, 1983b), Lessing and Bothma (1995), Madland and Smith (1988), Richardson (1994), Scholz, Kerr, and Brown (1996), Sievert and Boyce (1985), Van Brakel (1988), Vander Meer, Rike, and Galen (1996), and Wood (1985). As early as 1972 Culkin (1972) discussed the use of CAI by LIS. Williams and Davis (1979) also reported on the early use of CAI in library instruction.

A Dialog search could not, however, trace many explicit references to the use of CAI in the distance teaching of LIS. Web-based training and distance teaching are, however, dealt with by Hawkins (1998) and Herther (1997). The EDUCATE program (End-user Courses in Information Access through Communication Technology) also aims at self-paced learning and distance education (Thomasson & Fjällbrant, 1996). However, it appears that this program is concerned mainly with Web-based training.

A number of the CAI programs reported on deal with aspects of online searching, the formulation of search strategies, bibliographic instruction, using the library catalogue and information literacy (Armstrong, 1984, Azzaro & Cleary 1994, Binkley & Parrott 1987, Eisenberg *et al.* 1978, Neilsen & Bremmer 1985, Williams & Davis 1979). There are, however, other CAI applications, such as those for cataloguing and bibliometrics (Hopkins & Blackburn 1996). Library orientation is covered by Nipp and Straub (1986), training of library staff members by Bayne (1993) and user education by Vander Meer, Rike and Galen (1996). Lawson (1990) did a cost comparison between library tours and CAI programs. She found that the majority of students using CAI learned as much, or more than, those students using more traditional methods of instruction.

The Department of Information Science at the University of South Africa (Unisa) has been using CAI since 1992 to teach the formulation of search strategies as part of a course in information organization and retrieval. Unisa is a distance teaching university which to a large extent has been based on the correspondence model (ie core and often even all tutorial matter is provided in printed format). For the last ten years, there has, however, been encouragement from the university management to explore other methods of teaching such as CAI and more recently the World Wide Web (WWW) and other Internet facilities.

In 1998, a new CAI tutorial on the formulation of search strategies was completed. This tutorial was designed in collaboration with The Unisa Department of Library Services. Unlike the 1992 edition, which was DOS based, the new tutorial can run under Windows 3.1 and Windows 95.

The development of the 1998 tutorial was based on:

- experience with the 1992 tutorial in terms of student feedback and observation of their reactions and behavior when working through the tutorial in a class situation (students were asked to complete an

evaluation form (see appendix A) when working through the tutorial in their own time and also when working through it during an annual workshop).

- an analysis of developments in online searching, particularly new trends in the formulation of search strategies (a number of database systems, for example, have online thesauri or word lists which make it easier to select suitable search terms).
- a study of the requirements for designing a multimedia study package for the distance teaching of information retrieval (Fourie 1994, Fourie & Snyman 1996).
- a literature survey on the use of CAI by LIS.
- a reconsideration of developments in CAI in general as well as in accepted practices (eg as reported in the papers presented at the *Fourth CBE/CBT conference and workshop: information technology effective education/training*, held 7-10 October 1996).
- a reconsideration of technological developments (this is one of the reasons that the 1998 edition is Windows based. The new edition also requires at least a 486 computer with a super VGA screen, 800 x 600 resolution and which can support 256 colours. This may be rather advanced for some students, but if we decided on less sophisticated technology, it may be fairly out of date when the CAI program, which is very time consuming to develop, is finally implemented. For the next few years, however, the Department will continue to supply the 1992 edition to students who do not have access to the required technology. All students who attend the annual workshop in online searching, however, will have to work through the 1998 edition of the tutorial.)

In this article, the Unisa experience with the design and use of the two CAI tutorials will be used to explore the design and use of CAI tutorials for distance teaching in the formulation of search strategies as well as the possible uses of such tutorials in programs in information literacy and enduser instruction. These considerations will serve as background to the discussion.

## 2 DISTANCE TEACHING AS A SUITABLE METHOD FOR BASIC AND LIFELONG TRAINING

Distance teaching is a well-documented method of teaching. Although it has been used for a long time, there was always the stigma of distance teaching being second rate and the disadvantages of distance teaching were often stressed. With the growing need for adult training and the emphasis on lifelong learning, the importance and value of distance teaching have become more widely recognized (Holmberg, 1993). This also applies to LIS, where studies by Barron (1990, 1991), for example, raised

the importance of distance teaching methods in meeting the need for continuing and lifelong education. Enquiries received by the Department of Information Science suggest that there is a particular need among practising information specialists for refinement of their search skills. Furthermore, there is an increasing need for all library users to be trained in search skills, especially as a result of the growing interest in information and library catalogues available via the World Wide Web (The challenge of Internet literacy: the instruction-Web convergence 1997, Craver 1997, Wood *et al* 1997).

Before considering these aspects as an incentive to develop CAI tutorials which meet the requirements of distance teaching, we shall examine distance teaching as a method of teaching displaying certain characteristics. Distance teaching is characterised by the geographic separation between the learners and the lecturers. There are other characteristics as well:

- Although the student is geographically separated from the teacher and teaching institution, contact sessions such as workshops or video conferences may occasionally be offered. Such classes, however, should not take up too much time and should be planned only for those aspects that *cannot be taught in any other way* (eg practical online searches). If search strategies, for example, can be mastered by means of other teaching methods, they should be employed.
- The teaching institution supports the student through the planning and development of study programmes, and it provides for the evaluation of the student's performance. It also provides guidelines, motivation and other forms of support.
- Distance students are mostly (working) adults studying separately from one another. This should be acknowledged in the teaching process. The needs, backgrounds, age groups and experiences of the students should be catered for (eg their subject interest in online searching). Although adults prefer to study independently they also need support and guidance in their studies.
- Any technology or media can be used, ranging from printed media to video conferences, computer-assisted instruction, and the Internet.
- Although distance education is based on one-way communication in which the study material is sent to students, there should also be opportunities for students to communicate with lecturers and fellow students. The latter (two-way communication) in particular can be improved by technology (Fourie 1994:52; Fourie & Snyman 1996:86).

When comparing these characteristics with those of CAI (as explained in the next section), the benefits of CAI for distance teaching will become clear. The requirements for a CAI tutorial will also be derived from these discussions.

### 3 WHAT IS CAI AND HOW CAN IT BE USED IN DISTANCE TEACHING?

*Thesaurus of ERIC descriptors* (1995) defines computer-assisted instruction as an interactive instructional technique in which a computer is used to present instructional material, monitor learning, and select additional instructional material in accordance with individual learner needs.

CAI offers a number of benefits that can be used effectively in distance teaching and especially distance teaching in the formulation of search strategies. These benefits are discussed by Allesi and Trollip (1991), De Villiers (1989), Nipp and Straub (1986), amongst others and include the following:

- Interaction with the learner is provided (eg by including questions and options for the learner to follow) (an example is given in figure 1).
- Immediate feedback is provided on answers to questions. If necessary, a learner can select an option for more guidelines or further examples.
- Branching can be used to allow for different interests, different learning styles as well as different entry levels. In CAI tutorials, learners are often also allowed to select the order in which they want to work through a tutorial.

FIGURE 1  
*Example of an activity*

<i>Research &amp; search strategies</i>	Screen 8 of 14	
<p>There are databases for almost all subjects, such as economics, medicine, geography, nuclear physics and chemistry. There are also different types of databases.</p> <div data-bbox="179 1367 497 1534" style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Instruction: Link a database type to an appropriate description by first clicking on the type and then on the description.</p> </div>	<p><b>Questions</b></p> <p><b>Bibliographic</b></p> <p><b>Numeric databases</b></p> <p><b>Full text databases</b></p> <p><b>Directories</b></p>	<p>Includes the complete text of for example, periodical articles, newspaper editions or encyclopaedias</p> <p>Include data concerning for example people and companies</p> <p>Include descriptions of the sources where the information can be found, sometimes including indexing terms and abstracts</p> <p>Include mostly statistical information</p>

- Sufficient opportunities can be provided for the drilling and practice of skills. The designer decides on, for example, the number of exercises or different cases to include and once the learner feels confident he or she can skip the rest of the exercises. It is possible to provide sufficient exercises to cater for the needs of slower learners. Sievert and Boyce (1985) deal with the drill and practice possibilities of CAI.
- Learners can work through the tutorial independently and in their own time. They can work through it at home, or at a workshop in a classroom situation.
- Learners can work at their own pace and they can repeat or skip work as they prefer.
- Simulations can be included. It is, for example, very useful in the formulation of search strategies to display the results of actual searches (an example is given in figure 2).

FIGURE 2  
*Example of search results that students can interpret*

Combining search terms		Screen 14 of 18
<p>It is very important to use the correct Boolean operators. It can make a big difference in</p> <ul style="list-style-type: none"> <li>• the number of records you retrieve</li> <li>• the actual records you retrieve and their relevance</li> </ul>	<p><b>Example of results</b></p>	
	<p>Retrieved Children      70 149 records                  Games                      4 677 records                  Search Children AND Games                  Total retrieved:            1 197 records</p> <p>Search Children OR Games                  Total retrieved:            73 629 records</p> <p>Search Children NOT Games                  Total retrieved:            68 952 records</p> <p>(Database searched: ERIC)</p>	

- Summative evaluation can be provided for by requiring students to complete exercises and questions. Formative evaluation to get feedback on the overall acceptability of a CAI tutorial can be catered for by evaluation forms to be completed by learners (such evaluation forms can be built into the program or they can be issued separately).
- CAI is especially useful when large student numbers are involved (Unisa has more than 100,000 registered students who could for example be involved in information literacy courses).

One of the main benefits of distance teaching is that students can work through the CAI at any time that fits in with the busy schedule of a working adult who may also have family and community responsibilities.

CAI tutorials also have disadvantages, which are covered by Allesi and Trollip (1991) and De Villiers (1989). These include:

- eyestrain if used over long periods of time
- the need for computer skills
- very time intensive to develop
- expensive to design
- requires large numbers of learners to make the design cost-effective
- impersonal in comparison with classroom instruction by lecturers (it can, however, be more personal for distance students who are used to studying in isolation from their lecturers and fellow students. One student evaluating the 1992 edition of the CAI tutorial commented: "It seems more personal in an impersonal sort of way than a study guide").

The benefits of CAI make it ideal for teaching the formulation of search strategies, especially with regard to the following:

- flexible learning opportunities
- opportunities to repeat the tutorial as many times as is necessary to master the work
- examples for different target groups and topics of interest
- different levels of entry and approaches
- the use of graphics to illustrate difficult concepts such as Boolean operators and truncation
- the inclusion of simulations of online searches and actual search results.

It is especially important for distance students to have an opportunity to master the formulation of search strategies in their own time so that a workshop can focus on the practical aspects. The Department of Information Science at Unisa has found that it is extremely useful if students use the CAI beforehand to do preparatory work on the formulation of search strategies. During the workshop we can then focus on the command language and search protocols for specific systems and on doing practical searches—things that students will not be able to do on their own at first. In this way the presentation of workshops can be justified (refer to the first characteristic mentioned in section 2). Prior knowledge of the formulation of search strategies should also be an advantage in training for OPACs, Webpacs and the Internet (discussions on search engines specifically emphasise the formulation of effective strategies).

#### 4 DESIGN OF A CAI TUTORIAL FOR DISTANCE TEACHING: THE FORMULATION OF SEARCH STRATEGIES

According to Vieira (1989) the design of CAI tutorials based on sound instructional design principles is non-negotiable. His views are shared by other instructional designers such as Dick and Carey (1990), Allesi and

Trollip (1991), Boshoff (1991), and Ehrlich and Reynolds (1992).<sup>1</sup> Numerous instructional design models can be found in the literature, each having its own strengths and weaknesses. There are, however, also many overlapping components. In 1994 the author completed a study on the design of multimedia packages for distance teaching (Fourie 1994:220). The instructional design model accepted was based on an analysis of curriculum and instructional design models from both conventional and distance teaching literature. The main phases are

- determination of the need and situation analysis
- formulation of aims and performance objectives and development of items for evaluation
- design of study material, including development of a teaching strategy and media selection and integration (eg the inclusion of sound and video)
- development and preparation (this includes story boarding and programming)
- implementation and use
- assessment of student progress
- formative and summative evaluation on a continuous basis throughout all phases.

Pistorius *et al* (1992) also discuss a CAI design model which is used by the Department of Computer Science and Information Systems at Unisa and has been adapted for the distance teaching situation. Their design model consists of the following steps: preparation and planning for the project, predesign, design, programming and formative evaluation and summative evaluation (Pistorius *et al* 1992:13).

The model by Fourie (1994) will be used in this article to explore the design of CAI tutorials for distance teaching in the formulation of search strategies. It should, however, be pointed out that the Department of Computer Science and Information Systems is responsible for the Centre for Software Engineering (Censi) which supports lecturers at Unisa in the design of CAI tutorials. Censi was responsible for the programming of the tutorials and also gave advice on the instructional design. The model by Pistorius *et al* (1992) therefore had a significant influence on the development of the CAI tutorials under discussion.

#### 4.1 DETERMINING THE NEED FOR A CAI TUTORIAL

The first step in the design of a CAI tutorial is to determine whether the tutorial is really necessary, and then to do a situation analysis to decide how it should be designed to meet the needs and requirements identified.

Growing interest in the Internet and library catalogues available via the World Wide Web has increased the need for skills in the formulation



of search strategies (Wood *et al* 1996). This applies to information specialists who should be able to train LIS users as well as to LIS users searching for their own information. In general there is wide acceptance of the possibilities offered by CAI and the need for such programs:

Computer-based learning is becoming a reality with the development of interactive multimedia study materials that are bringing together text, graphics, sound, and video into integrated tutorial packages that, with the future broadband integrated digital services network (B-ISDN), will be downloaded to students' personal computers. (Wilson 1994)

LIS departments normally have smaller student numbers, which does not really make it cost-effective to design CAI tutorials. The move toward training the wider community (eg students from other academic departments), however, has provided a larger target group. Since 1998, the Department of Information Science and Unisa Library Services have been jointly offering a postgraduate module in research information skills to students from the departments of Further Education and Chemistry.

When designing for distance teaching, the following needs in particular should be considered:

- Learners study in isolation from their lecturers and teaching institution and any medium which can help to 'bridge' this distance will be advantageous.
- Studies of online search styles and search behavior have shown that there are numerous ways to approach online searching (Wildemuth & Moore 1995, Wood *et al* 1996). CAI tutorials should therefore offer the benefit of different examples and solutions to information needs.
- The heterogeneous nature of distance students means that they have different needs. Their ages, background, working experience, cultures, computer skills and entry knowledge differ considerably.
- Problems experienced by online searchers and especially common mistakes as identified by case studies. Wildemuth and Moore (1995:294-295), for example, found that users often search inappropriately, underutilizing controlled vocabulary and using synonyms inappropriately. Both versions of the CAI tutorial consider the use of controlled vocabulary with special reference to thesauri.

#### 4.2 SITUATION ANALYSIS

A situation analysis is one of the most important steps in the design of CAI tutorials. A number of aspects should be considered in a situation analysis. We shall focus on the following:

- learning content (in this case the formulation of search strategies, what it implies, changes in emphasis, new methods, etc)

- learners (their styles, preferences, prior knowledge and especially their computer skills)
- available technology
- support (eg staff to develop and maintain the tutorial)

#### 4.2.1 ANALYSIS OF LEARNING CONTENT WITH REGARD TO THE FORMULATION OF SEARCH STRATEGIES

Major textbooks on online searching (eg Harter 1986, *Online Searching*. . . 1990 and Walker & Janes 1993) as well as training manuals for online services (eg Dialog) mention many of the same core aspects. These include:

- analysing the stated information need
- identifying main concepts
- identifying search terms (including the use of various resources to determine synonyms, etc)
- combining the search terms by means of Boolean operators
- truncating search terms to improve search recall
- grouping search terms and concepts together
- using proximity operators to specify word position and to increase search precision
- using different methods to expand and limit a search strategy (including field limiting)
- evaluating the search results and adapting the search strategy accordingly

Azzaro and Cleary (1994:98) identify similar but less detailed aspects. The list provided by Wood *et al* (1997:33) is also more or less the same. In the 1998 edition of the CAI tutorial, all of these aspects are covered. Our point of departure was the learners' research information need.

Once the learning content has been identified, it is broken down into smaller sections which can form separate or independent parts or topics of the tutorial. The benefit of a CAI is that you can follow a linear order in working through different topics, or allow students to branch according to their preferences.

Wood *et al* (1997:50) also emphasise the need for learners to be able to interpret search results and to be aware of the effectiveness of the searches performed. Examples of actual searches and their results were therefore included in the tutorial. An example can be seen in figure 2.

#### 4.2.2 ANALYSIS OF THE LEARNERS

The CAI should meet the needs of the learners and especially the needs of distance learners. For the latter, it is important to bear in mind that instructions on how to use the tutorial should be absolutely clear and that the examples as well as their solutions should be unambiguous. Unlike students in a class situation, the learners are not in a position to ask

questions and get immediate answers. Since distance education is characterized by heterogeneous target groups, it is especially important to allow for different entry levels and different topics of interest. For the 1998 edition of the Unisa tutorial, the following target groups were considered:

- students in library and information science (different levels, e.g., undergraduate and postgraduate);
- students of other academic departments doing a course in information literacy;
- practicing LIS workers requiring refinement of their search skills; and
- people from the wider public interested in searching the Internet and other electronic sources of information.

When developing the CAI tutorials, the following aspects were of special concern:

- students' prior experience with CAI;
- students' prior experience with computers; and
- students' prior experience with online searching and the formulation of search strategies.

Computer skills and computer literacy are a problem. In a class situation, this can easily be monitored and action taken if necessary. Fortunately the Department of Computer Science and Information Systems at Unisa has developed a CAI tutorial (Comuser) which is aimed at computer literacy (this program is also reported on by Pistorius *et al* 1992). Although students are advised to work through Comuser in their own time by either purchasing it from Unisa or using it at one of the computer laboratories provided by Unisa, they are still hesitant about doing so. The first morning of the workshop is therefore put aside for students to work through Comuser and the tutorial on search strategies. This has a positive influence on their ability to keep up with others during the workshop.

When analysing the learners, it is also very important to consider the needs of *adult* learners (Wilson 1994) as well as different learning styles (Wood *et al* 1997).

#### 4.2.3 ANALYSIS OF AVAILABLE TECHNOLOGY

One of the main aspects to consider is students' access to computers. Students may have their own computers or they may have access to computers at their offices or at study centers or computer laboratories provided by the university. Technological requirements, however, should not be set too low in order to accommodate the greater number of students. It takes a long time to develop and implement a CAI tutorial. Once it has been in use for two or three years, even sophisticated technological requirements will be out of date.

#### 4.2.4 ANALYSIS OF AVAILABLE SUPPORT

Support includes funds for design and development, staff with the necessary expertise, suitable software, and time available for the design, development, and maintenance of a program. Pistorius *et al* (1992:14) stress the importance of the development team. They suggest that the team should consist of a project manager, instructional designer, subject expert(s), programmer, graphic artist, and language editor. Bayne (1993) also refers to a team approach.

At Unisa, the team responsible for designing the 1998 edition consisted of the following role players:

- project manager and instructional designer (head of Censi)
- subject expert with knowledge of instructional design (from the Department of Information Science)
- subject experts acting as advisers and evaluators (subject librarians from the Unisa Library Services)
- a team member with an interest in CAI but no subject expertise;
- programmer (from Censi)
- graphic artist (from Unisa Library Services)

#### 4.3 FORMULATION OF OBJECTIVES OR OUTCOMES FOR THE CAI TUTORIAL

The purpose of a CAI tutorial should be clear to the learners. If objectives or outcomes are clearly formulated, they will help them to monitor their progress and performance so that they can come well prepared for practical sessions. It is also important to ensure that the questions, exercises or tests which are set support the objectives or expected outcomes.

The purpose of a tutorial as well as the objectives or outcomes should also be in keeping with the findings of the situation analysis for the learning content and the needs of the target group.

While formulating the objectives, the methods and type of assessment should also be considered.

#### 4.4 PERFORMANCE ASSESSMENT

It is not essential for a CAI tutorial to include items for performance assessment, but it is the opinion of this author that if skills are involved (such as in formulating search strategies), various forms of assessment should be allowed for. In the 1998 edition of the tutorial we used multiple-choice questions and pairing of items, among others. Open-ended questions are difficult to monitor since the author cannot allow for all possible responses.

The idea of a notebook (see figure 3) was introduced in the 1998 edition. Students use the notebook to keep a record of their information

**FIGURE 3**  
*The notebook concept*

*Analysis and main concepts* Screen 2 of 16

The first step is therefore to identify the topic.

This is done by thinking about the information needed by you or your client on whose behalf you are searching. Write down a short sentence or paragraph.

Instruction: Click on the notepad on one of the topics or type in your own topic.

Topics	
• The Internet and distance teaching	
• The effects of boycotts on academics in South Africa	
• Own Topic	

need, the sources they will use, main concepts, the combination of concepts etc. When completing the tutorial, the student can print the notebook. Unfortunately, it is not possible to provide individual feedback on students' notebooks indicating whether they are on the right track.

From student feedback on the 1992 edition of the CAI tutorial, it was clear that most students enjoy assessment and consider it a very important component in monitoring their own progress (for distance students there is no other way to monitor their progress).

A pretest was included in the 1992 edition to allow experienced online searchers (some Unisa students do work in LIS and may therefore be competent online searchers) to establish whether it is necessary for them to complete the tutorial. The pretest was difficult, because the intention was that, if students passed it, they knew enough to skip the tutorial. Students reported that they liked the fact that the pretest challenged their knowledge, but that they also need something to relate to their prior experience and entry knowledge. As a result of this feedback, the 1998 edition includes a pretest with two components:

1. Refresher—to link to the students' prior knowledge. We assumed that the students know something about searching the library catalogue, and based a couple of questions on this with the idea of forming a link between searching the library catalogue (which is often based on known items) and other methods of online searching.
2. Challenge—which is aimed at the experienced online searcher. Because of time constraints in the design of the tutorial, the challenge

questions are the same as at the final level of progress assessment. This will be changed in due course.

## 5 ACTUAL DESIGN OF A CAI TUTORIAL

Many sources deal with the design principles for CAI, for example Allesi and Trollip (1991), Boshoff (1991), De Villiers (1989), Pistorius *et al* (1992), and Wood *et al* (1997). Among other things they cover the selection of an authoring language, screen layout and design, navigation options, and use of color and fonts. These aspects will not be dealt with here, but it is important to bear in mind that they have a significant influence on the overall success of a tutorial. Some of the aspects to consider when doing the actual design include:

- how to gain students' attention
- order of presentation
- screen layout (which should be consistent)
- inclusion of suitable examples
- feedback and channeling of learners' actions (eg referring students to revise a particular section)
- provision of online guidelines on how to use the tutorial
- navigation between screens
- inclusion of a glossary

## 6 DEVELOPMENT, IMPLEMENTATION AND DISTRIBUTION

Because of the limited scope of this article, development and implementation will not be dealt with. In distance teaching, distribution methods should, however, be carefully considered. At Unisa we considered distributing the tutorial to

- all students, regardless of whether they have access to a computer (this can be very expensive)
- students who have access to a suitable computer (notices with reply slips should then be sent to students so that they can request the tutorial)
- study centres or computer laboratories

It should also be decided whether a tutorial will be distributed on floppies, stiffies, or CD-ROM, or whether it will be downloaded from the Internet.

## 7 EVALUATION

Students' performance as well as the efficiency and acceptability of a tutorial, should be evaluated.

Students' performance can be assessed by including tests. In the 1998 edition of our tutorial we preferred to use the term 'progress assessment.' Three levels of assessment ranging from very basic to advanced exercises were included. Students' comments on these will be collected in due time.

The importance of both formative and summative evaluation is stressed by Pistorius *et al* (1992), De Villiers (1989) and Dick and Carey (1990). Formative evaluation should be an integral part of the design and development of any CAI tutorial. After designing each section it should be evaluated by the design team and, where possible, students should be involved. On completion of the tutorial, it should also be evaluated by other experts. We used subject librarians from the Unisa Library.

Once a tutorial is implemented, students should be allowed to evaluate it. Valuable feedback can be gathered in this way. Appendix A includes the evaluation form used to evaluate the 1998 edition. Only minor adaptations were made on the form used to evaluate the 1992 edition. Although it is a detailed form, students never complained about completing it. Some even provided much more detailed feedback than required. One student, for example, drew a sketch of a student receiving a certificate from Garfield (which was the character used in the 1992 edition).

### 7.1 HOW DO STUDENTS EXPERIENCE THE CAI TUTORIALS?

From the feedback we have received, it is clear that students are excited about the new teaching medium. One student could not load the CAI tutorial because she did not have access to the required technology but commented: 'I felt as if I had the Rosetta stone in my hand! Thanks for everything.'

Words describing their feelings about CAI include *stimulating, useful, clear, interesting, reinforcing, humorous, amusing, challenging, relevant, and inspiring*. It is also seen as 'interesting, motivating and an aid to studies.'

Other comments included:

- 'Using characters enhances the relational possibilities for the user.' (In the 1992 edition Garfield and his master were used to provide dialogue around the formulation of search strategies, and in the 1998 edition the characters of a digger and geologist were designed to reinforce the analogy between the retrieval of information searching and the process of digging and mining for minerals and precious gems.) 'My three year old daughter kept looking over my shoulder at the characters.' There were, however, also a few students who did not like the use of characters and considered them unnecessary and boring.
- 'Relieve feelings of pressure to perform.'
- 'You don't feel embarrassed if you make a mistake because no-one is aware of it.'
- 'It forces one to learn quicker with sheer interest.'

Students also used the opportunity to point out sections where the explanations or examples were not clear enough and that online guidelines on how to use the tutorial should be included. These comments proved very valuable when revising the tutorial. Some considered the 1992 edition too

easy and user friendly and asked for more challenging tasks. We hope that the final level of assessment in the 1998 edition will be challenging enough!

## 7.2 SUMMATIVE EVALUATION

We have not yet attempted a summative evaluation of students' performance or to compare the success of CAI with other methods of teaching. However, Vander Meer, Rike and Galen (1996:158) include an example of a post-test. This may be addressed in future research.

## 8 CONCLUSION

CAI can play an important role in helping students to become *au fait* with the formulation of search strategies before attending practical sessions on online searching. Since it is no longer only information specialists who are interested in the formulation of search strategies, the target group is growing to include students from other disciplines and even members of the wider public who are interested in using internet search engines. This makes it all the more cost-effective to design CAI tutorials.

The experience of the Department of Information Science shows that students enjoy CAI and find it an effective method of teaching. It is, however, very important that the needs of distance students should be considered, and that detailed feedback from students should be collected.

## NOTE

- <sup>1</sup> The Dick and Carey model is widely accepted for CAI and is also used by Bayne (1993) with regard to LIS applications.

## REFERENCES

- Alexander, P. M. (Ed.). (1996). *Fourth CBE/CBT conference and workshop: Information technology effective education/training* (Proceedings of the fourth annual conference, Pretoria). Pretoria: Unisa, Department of Computer Science and Information Systems.
- Allesi, W. H., & Trollip, S. R. (1991). *Computer-based instruction: Methods and development*, 2<sup>nd</sup> ed. New Jersey: Prentice-Hall.
- Armstrong, C. J. (1984). The design and implementation of a microcomputer teaching package for online bibliographic searching. *Education for Information*, 2(1), 35-42.
- Armstrong, C. J., & Large, J. A. (1987). OST—online search tutor. *Education for Information*, 5(1), 41-48.
- Azzaro, S., & Cleary, K. (1994). Developing a computer-assisted learning package for end-users. *CD-ROM Professional*, 7(2), 95-101.
- Barron, D. (1990). The use of distance education in United States library and information science: History and current perspectives. *Education for Information*, 8(4), 325-339.
- Barron, D. (1991). The Library and Information Science Consortium: The profession's virtual classroom. *Wilson Library Bulletin*, 66(2), 41-43.
- Bayne, P. S. (1993). Computer-based training for library staff: From demonstration to continuing program. *Library Hi Tech*, 11(3), 51-79.
- Binkley, R. D., & Parrott, J. R. (1987). A reference-librarian model for computer-aided library instruction. *Information Services & Use*, 7(1), 31-38.
- Boshoff, C. J. (1991). Riglyne vir die ontwerp en evaluering van rekenaargestunde onderrigprogramme. In S. P. T. Malan en P. H. du Toit (Eds.), *Suksesvolle onderrig: riglyne vir dosente, onderwysers en opleiers* (pp. 130-149). Pretoria, South Africa: Academica.
- Bourne, D. E. (1990). Computer-assisted instruction, learning and hypermedia: An asso-



- ciative linkage. *Research Strategies*, 8(4), 160-171.
- Carson, C. H., & Curtis, R. V. (1991). Applying instructional design theory to bibliographic instruction: Micro theory. *Research Strategies*, 9(2), 60-76.
- Caruso, E. (1981). Computer aids to learning online retrieval. In M. E. Williams (Ed.), *Annual review of information science and technology* (vol. 16, pp. 317-335). White Plains, NY: ASIS.
- Craver, K. W. (1997). *Teaching electronic literacy: A concepts-based approach for school library media specialists*. London: Greenwood Press.
- Culkin, P. B. (1972). Computer-assisted instruction in library use. *Drexel Library Quarterly*, 8(3), 301-311.
- Davis, D. F. (1993). A comparison of bibliographic instruction methods on CD-ROM databases. *Research Strategies*, 11(3), 153-163.
- De Villiers, C. (1989). 'n Rekenaargestuende onderrigstrategie vir rekenaarwetenskap met besondere verwysing na afstandsonderrig. MEd-verhandeling, Universiteit van Suid-Afrika, Pretoria.
- Dick, W., & Carey, L. (1990). *The systematic design of instruction*, 3d ed. Florida: Harper Collins.
- Ehrlich, D., & Reynolds, L. (1992). Integrating instructional design and technology: A model and process for multimedia design. *Interactive Learning International*, 8(4), 281-289.
- Eisenberg, L. J. et al. (1978). MEDLEARN: A computer-assisted instruction (CAI) program for MEDLARS. In *Training and education for online*, edited by A Haygarth-Jackson, 1989. London: Taylor Graham:66-73.
- Foster, J. (1987). Computer-assisted instruction: Putting it to the test. *Canadian Library Journal*, 44(3), 161-165, 167-168.
- Fourie, I. (1994). *Ontwerp van 'n multimedia-studiepakket vir die afstandsonderrig van gerekenariseerde inligtingherwinning*. DLitt et Phil-proefskrif, Randse Afrikaanse Universiteit, Johannesburg.
- Fourie, I., & Snyman, D. (1996). Distance teaching in online searching. In D. I. Raitt & B. Jeapes (Eds.), *Online information* (1996 Proceedings . . . , London). Oxford, England: Learned Information.
- Gratch, B. (1986). Computer-assisted instruction: An unfulfilled promise. *Wilson Library Bulletin*, 61(4), 20-22.
- Harter, S. P. (1986). *Online information retrieval: Concepts, principles and techniques*. Orlando, FL: Academic Press.
- Hartley, R. J., et al. (Ed.). (1990). *Online searching: Principles & practice*. London: Bowker-Saur.
- Hawkins, D. T. (1998). Revisiting Web-based training: A correction and an update. *Online*, 22(Jan./Feb.), 55-56.
- Herther, N. K. (1997). Education over the Web: Distance learning and the information professional. *Online*, 21(Sept./Oct.), 63-66.
- Holmberg, B. (1993). Key issues in distance education: An academic viewpoint. In K. Harry, M. John, & D. Keegan (Eds.), *Distance education: New perspectives* (pp. 330-341). London: Routledge.
- Hopkins, T., & Blackburn, A. (1996). *Resources guide*. Loughborough: CTI Centre for Library and Information Studies, Department of Information and Library Studies, Loughborough University.
- Houston, J. E. (Ed.). (1995). *Thesaurus of ERIC descriptors*, 13th ed. Phoenix, AZ: ERIC.
- Large, J. A., & Armstrong, C. J. (1983a). The development of a microcomputer emulation for teaching online bibliographic searching. In A. Haygarth-Jackson (Ed.), *Training and education for online* (pp. 74-77). 1989. London: Taylor Graham.
- Large, J. A., & Armstrong, C. J. (1983b). The microcomputer as a training aid for online searching. *Online Review*, 7(1), 51-59.
- Lawson, V. L. (1990). A cost comparison between general library tours and computer-assisted instruction programs. *Research Strategies*, 8(2), 66-73.
- Lessing, A. J., & Bothma, T. J. D. (1995). Indiensopleiding van biblioteekpersoneel: Rigglyne vir rekenaargestuende lesmateriaal. *South African Journal of Library and Information Science*, 63(4), 187-189.

- Madland, D., & Smith, M. A. (1988). Computer-assisted instruction for teaching conceptual library skills to remedial students. *Research Strategies*, 6(2), 55-64.
- Martin, L. E. M. (Ed.). (1997). *The challenge of Internet literacy: The instruction-Web convergence*. New York: Haworth Press.
- Neilsen, M. A., & Bremmer, M. (1985). Computer-assisted instruction in the Australian university library. *Infuse*, 9(2), 12-15.
- Nipp, D., & Straub, R. (1986). The design and implementation of a microcomputer program for library orientation. *Research Strategies*, 4(2), 60-67.
- Pistorius, M. C.; Du Plooy, N. F.; Alexander, P. M.; & De Villiers, C. (1992). Computer-assisted instruction development model for a computer concepts course. *Computing & Control Engineering Journal*, (January), 13-18.
- Richardson, G. (1994). Computer-assisted library instruction? Consider your resources, commitment, and needs (experience of the University of Minnesota). *Research Strategies*, 12(Winter), 45-55.
- Scholz, A. M.; Kerr, R. C.; & Brown, S. K. (1996). PLUTO: Interactive instruction on the Web (Purdue Libraries Undergraduate Tutorial Online). *College & Research Libraries News*, 6(June), 346-349.
- Sievert, M., & Boyce, B. R. (1985). The evaluation of a drill and practice program for online retrieval. *Journal of Education for Library and Information Science*, 26(2), 67-78.
- Thomasson, G., & Fjällbrant, N. (1996). EDUCATE: The design and development of a networked end-user education program. *Education for Information*, 14, 295-304.
- Van Brakel, P. A. (1988). Indiensopleiding vir intydse inligtingherwinning deur middel van rekenaarondersteunde onderrig. *Suid-Afrikaanse tydskrif vir biblioteek- en inligtingkunde*, 56(1), 18-26.
- Vander Meer, P. F.; Rike, G. E.; & Galen, E. (1996). Multimedia: Meeting the demand for user education with a self-instructional tutorial (at Western Michigan University Libraries). *Research Strategies*, 14, 145-158.
- Vieira, L. (1989). Technology based training in SA. In A. W. Dorst (Ed.), *Southern African Conference on Educational Technology* (1st, 1989, Pretoria. Papers . . .) (pp. 601-611). Pretoria: Human Science Research Council.
- Walker, G., & Janes, J. (1993). *Online retrieval: A dialogue of theory and practice*. Englewood, CO: Libraries Unlimited.
- Wildemuth, B. M., & Moore, M. E. (1995). End-user search behaviors and their relationship to search effectiveness. *Bulletin of the Medical Library Association*, 83(3), 294-304.
- Williams, M., & Davis, E. B. (1979). Evaluation of PLATO library instruction. *Journal of Academic Librarianship*, 5(1), 14-19.
- Wilson, V. (1994). Developing the adult independent learner: Information literacy and the remote external student. *Distance Education*, 15(2), 254-278.
- Wood, F. E. (1985). Microcomputer-based training aids for online searching. In C. Armstrong & S. Keenan (Eds.), *Information technology in the library school: An international conference* (pp. 32-36). Aldershot: Gower.
- Wood, F. et al. (1996). Information skills, searching behaviour and cognitive styles for student-centered learning: A computer-assisted learning approach. *Journal of Information Science*, 22(2), 79-92.
- Wood, F. et al. (1997). *Information skills for student centered learning: A computer-assisted learning approach* (British Library Research and Innovation Report 37). Boston Spa, England: British Library Research and Innovations Reports.

## APPENDIX A

## Evaluation of a Computer-Assisted Instruction (CAI) Tutorial: Windows Version

## PERSONAL INFORMATION

Name:

Student number: Date:

## PRIOR KNOWLEDGE/EXPERIENCE

Indicate with crosses in the appropriate squares the level of your prior knowledge/experience:

Computers	extensive	average	none
Online searching	extensive	average	none
Search strategies	extensive	average	none
Computer-assisted instruction (CAI)	extensive	average	none

## COMPLETION OF THE CAI TUTORIAL

Did you complete the tutorial?

If not, please indicate the reasons (eg, do not have access to a computer).

If you were unable to complete the tutorial, you need not complete the rest of the form.

If you completed the DOS version, please complete the questionnaire on page 4 to 12.

## CONTENT

Rate the following aspects by ticking the appropriate column opposite each alternative:

	Excellent	Good	Average	Poor	Very Poor
Coverage of topic					
Examples					
Style of presentation					
Logical order of presentation					
Layouts of screens					
Use of colour					
Illustrations					
Navigation (did you know how to proceed?)					
Any suggestions?					

Indicate with ticks in the appropriate squares, the parts of the tutorial you found difficult to understand:

- Research and search strategies  
Specify
- Identifying search terms  
Specify
- Combining concepts and search terms  
Specify
- Searching on word stems  
Specify

- Grouping concepts and search terms  
Specify
  - Field searching  
Specify
  - Specifying word position  
Specify
  - Adapting search strategies  
Specify
- Did you spot any errors (such as spelling mistakes) in the tutorial?  
If yes, please list them:  
Which part of the tutorial did you enjoy most?  
Which part of the tutorial did you enjoy least?

**PERFORMANCE**

Indicate with a cross in the appropriate square if you could or could not answer the refresher questions

Yes      No

If no, why not?

Answer the Challenge questions BEFORE completing the tutorial

Yes      No

If no, why not?

Answer Progress Assessment, level 1

Yes      No

If no, why not?

Answer Progress Assessment, level 2

Yes      No

If no, why not?

Answer Progress Assessment, level 3

Yes      No

If no, why not?

Underline the words that best describe your feelings about the tutorial. (Underline as many words as you wish.)

stimulating	confusing	boring	clear
too difficult	challenging	too easy	frustrating
useful	uninteresting	useless/worthless	interesting

Underline the words that describe your feelings about the use of graphics. (Underline as many words as you wish.)

amusing	humorous	annoying	inspiring
distracting	frustrating	reinforcing	relevant
irritating	unnecessary	stimulating	boring

**USER FRIENDLINESS**

During the time that you worked throughout the tutorial, which of the following, if any, happened? Please tick the appropriate squares.

- Pressed the wrong keys and did not know how to continue with the tutorial.
- Did not know what was required of you?
- Looked up information in other sources in order to answer the question.

Any suggestions?

**CAI IN GENERAL**

What did you like about CAI as a medium of presentation?

What did you dislike about CAI as a medium of presentation?

Would you like any other tutorial matter to be presented by means of CAI? (Not applicable for this year.)

Any suggestions?

Thank you for your time and patience