Report on a pilot project: using a virtual classroom to develop literature review writing skills

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Skill in literature review writing is identified as a key performance indicator of a researcher's information literacy. This paper describes the first phase of a two-phase project to develop an on-line course (virtual classroom) in literature review writing skills, undertaken by members of the Department of Library and Information Studies at the ML Sultan Technikon. The course is a module of a research capacity-building initiative of the National Research Foundation (NRF). The authors discuss the information retrieval and organisational competencies underpinning the composition of an effective literature review. An account is given of the development of information literacy learning materials suitable for delivery in a virtual classroom environment. A summary of the evaluation of the first phase of the project is provided in the conclusion.

Introduction

This paper provides an interim report of research in progress within the iMEM (Information Management and Electronic Multimedia) Research Centre in the Department of Library and Information Studies at the M.L. Sultan Technikon. The principal focus of discussion is the first phase of a two-phase implementation of a project based on the use of a virtual classroom to provide learning opportunities in information literacy to a specific target group of technikon researchers.

A basic assumption of the study is that the attainment of competence in research literature review writing is an important ingredient in preparing technikon staff and students for masters' level research. A technikon is a South African institution of higher education offering professional and vocational programmes. Since being granted the right to award degrees in 1993, the technikon sector has encouraged development initiatives to upgrade staff qualifications and to build their institutional research culture. An effective research review is a key indicator of the successful performance of a matrix of information seeking, organising, synthesis and writing skills. The primary objectives of this project are to develop information literacy learning materials, and to investigate how these materials can be implemented effectively in an online learning environment (or virtual classroom) to develop competence in literature review writing.

Only the first phase of the project has been completed. Two significant outcomes of Phase One have been (a) the development of a module consisting of online learning materials based on the key competencies required for literature review writing, and (b) the testing of an appropriate project development model designed for the study. A further outcome has been the measurement and assessment of technical issues relating to user access to the online functionality of the site. In Phase Two, the intention is to assess the effectiveness of the learning materials themselves and to examine user attitudes towards the medium.

The project originated in the context of a larger undertaking commissioned by the South African National Research Foundation (NRF) Technikon Programme. The objective was the production of several modules for staff research capacity building at technikons. The South African NRF initiative was a response to a survey of the needs of researchers from institutions that had little or no research history. The Information Literacy module targets the development of literature review writing skills within a virtual classroom environment. The other modules are Supervision, Methodology, and Proposal Writing (South Africa. National Research Foundation 1999:3-4). With regard to the Information Literacy module, Gordon (1999:3) has argued that 'information literacy … must be an integral, interwoven part of the whole research process and not an ad hoc "add-on"', ensuring that the researcher

understands the flow of the current debate in his/her field, and is in touch with previous and ongoing research. It follows that the design of a capacity-building course in information literacy should incorporate training in the analysis of information needs and sources as a precursor to addressing information retrieval and organisation. A course of this nature may then proceed to focus upon the integration of retrieved information into a coherent academic discourse, namely the literature review.

The project is multidisciplinary, drawing on the theoretical frameworks of library and information science, curriculum and materials development and hypertext/multimedia design. While this endeavour may be associated traditionally with the field of library and information science, the guidelines developed in this study are rooted in current trends in the design and delivery of online education and training.

The structure of this paper follows that of the project itself. Preliminary attention is directed towards the competencies required for information retrieval and organisation. Thereafter, appropriate methods for incorporating these competencies into a course suited to a researcher in the contemporary Information Age, are considered.

The case for information literacy as the basis of competent literature review writing

During the past decade, educators and the library professionals have prioritised the importance of the problem of transforming learner proficiency into information skills. The final report of the Presidential Committee on Information Literacy published by the American Library Association (ALA) (1989) emphasised the significance of this dilemma as follows: 'How our country deals with the realities of the Information Age will have enormous impact on our democratic way of life and on our nation's ability to compete internationally. Within America's information society, there also exists the potential of addressing many long-standing social and economic inequities. To reap such benefits, people - as individuals and as a nation - must be information literate. To be information literate, a person must be able to recognise when information is needed and have the ability to locate, evaluate, and use effectively the needed information.'

Similar aims are echoed by the South African Department of Arts, Culture and Technology White Paper on Science and Technology *Preparing for the 21st Century*, which calls for the potential of information technology '...to be captured to serve people issues such as supporting education, providing household services and enabling social development' (1996: Section 2.6). These standpoints were endorsed in an address by the United Nations Secretary-General, Kofi Annan, who affirmed the role of information in democracy and development in his statement: 'If information and knowledge are central to democracy, they are the conditions for development' (Annan 1997).

During the decade since the ALA report, the concerted action of the United States library profession has influenced the introduction of information literacy courses into United States curricula at schools and colleges (*see* Palo Alto 1999 and Cornell 2000).

Embedding information literacy in a sound learning and teaching context

Using the criterion that the literature review represents a primary tangible indicator of a learner's information literacy, consideration was given to identifying the expectations of so-called 'assessors' of literature reviews, such as supervisors and research peers. An attempt was then made to identify the component competencies demonstrated in the process of this multifaceted output. Formulated in competency terms, the literature review approximates to Standard 4 (1.3) of the Association of College and Research Libraries' (ACRL) Information Literacy Competency Standards for Higher Education in that it '... integrates the new and prior information, including quotations and paraphrasings, in a manner that supports the purposes of the product or performance' (Association of College and Research Libraries Standards Committee 2000).

The developers of the South African Education, Training and Development Practitioner (ETDP) standards successfully used a similar approach that they referred to as 'Applied competence as outcome' (Cook, Meyer and Gamble 1998). The ETDP Final Report (1998:72) provides an informed consideration of the relationship between competence and performance, as follows: 'In most standards from other sectors, the category of "outcomes" describes the performance while "underlying knowledge" describes the competence. Our analysis was that applied competence is actually the "outcome" in which our constituency is interested. However, since competence can only be assessed through or in relation to performance, the performance should be described in the assessment criteria.

Thus we have inverted the usual relationship between how competence and performance are formulated in many standards' (1998:72).

The principles expressed in the ETDP approach have been incorporated into the rationale of designing a set of key competencies in this study. In Table 1, competencies in Column A are expressed as performance outcomes, while Column B describes the competencies in terms of assessment criteria: 'applied competence'. In particular, attention was paid to the integration of the more technical aspects of computer literacy with the intellectual processes of identifying, analysing, evaluating and synthesising information.

Table 1 Key Competencies

Column A: Key outcomes	Column B: Assessment criteria
By the end of the module, the learner will be able to:	The learner will be assessed on evidence of his/her ability to:
Analyse and define information needs	Identify correctly the discipline/s of the research
	Select appropriate primary and secondary sources within the discipline/s
Identify and select the best sources to use	Recognise authoritative sources and seminal works
	Identify and describe significant current research issues and debates
Search effectively	Use online reference sources and WWW resources to find information in an efficient manner
	Distinguish between conventional indexing and abstracting databases available online, and Internet search engines and subject directories
	Make effective use of search strategies such as Boolean operators and keyword searches
Retrieve the information and/or materials identified	Record reference sources accurately
	Copy bibliographic records to disk in an appropriate format
	Use both online and inter-library loan facilities to successfully acquire the literature
Evaluate the information retrieved and modify the search if necessary	Distinguish between authoritative sources (e.g. peer-reviewed articles) and personal website material
	Annotate, summarise and evaluate sources clearly in an appropriate style
Organise the information and/or materials	Categorise and group related sources according to their relevance to the critical questions of the current research project
	Associate summaries and annotations of the literature with the current research project
Synthesise the information into the research process	Integrate information, methodologies and findings from the literature with the current research project in an appropriate prose style
Reflect and acknowledge the literature review in the research output	Acknowledge and cite all references to the literature
	Use an appropriate reference style consistently

These competencies are congruent with the ALA definition of information literacy quoted above: '... a person must be able to recognise when information is needed and have the ability to locate, evaluate, and use effectively the needed information' (American Library Association 1989).

Course delivery: the case for a virtual classroom

In the prevailing research climate of the contemporary Electronic Age, traditional quantitative researchers tend to espouse technological idealism whereas non-traditional qualitative researchers tend to embrace a phenomenological 'no one best way' approach. Accordingly, it seems superfluous to have to plead a case for the 'virtual classroom' approach with its emphasis on technological applications that enhance the primarily qualitative domain of the learning process. Nevertheless, certain considerations bear contextual relevance in respect of the present study, particularly because the use of a virtual classroom appears ideally suited to the development of information literacy skills.

The concept of a virtual environment presupposes a basic level of computer literacy that is a prerequisite for research within the context of the requirements of the South African National Research Foundation's brief. By basic computer literacy we assume a learner's ability to use common software applications like word processors or browsers, to perform editing tasks such as cutting and pasting, and to save files to disk. As a consequence, design features of the 'virtual classroom' under discussion constitute a meaningful working model for courses designed to foster the development of information skills. The technikon researchers who constitute the primary target group of this project all have access to the necessary information and communication technology (ICT) equipment and software thanks to the success of the UNINET project ('... provid[ing] a computer network that works to the standards of the Internet, for the use of every academic, researcher and student in South Africa' Foundation for Research Development 1997). The expectation that researchers should be ICT literate is evidenced by the South African National Research Foundation's requirement that all research proposals now have to be submitted online.

Basic computer literacy aside, the virtual classroom has the inherent potential to combine a high level of interaction and collaboration amongst participants with direct access to the resources of the Internet. These built-in capacities underscore its appropriateness as a medium for training in information literacy.

The delivery of the information literacy module as an online resource was integral to the aims of the project. Gordon (1999:3-4) has argued that '... collaborative learning will be encouraged using an Asynchronous Learning Network environment', and also that '... in addition to competency-developing tasks and assignments, learners will be required to participate in seminar-style presentations and discussions, debates, group projects and the collaborative composition of research plans.'

Although Lotus LearningSpace application software was recommended in the proposal, the decision was taken to use another virtual classroom application, *viz.* WebCT (Web Course Tools), based on the authors' considerations of the findings of a pilot project also conducted at M.L. Sultan Technikon (*see* Naidoo, Stewart and Zheleva 1999). These findings reflect a discussion of the relative merits of each software package, and on the problems of incorporating 'experiential' type learning into the virtual classroom. Another advantage of WebCT is its widespread use by educational institutions in forty-seven countries, including South Africa (WebCT 1999). It should be acknowledged however that both software packages under consideration offered an integrated online learning environment that appeared to afford similar potential for significant interaction among participants.

Like LearningSpace, WebCT offers a typical online classroom suite of features which provides the instructor the means to author learning materials and administer student records, and the learner a cluster of Web-based access points to the virtual learning environment. Within this environment the learner is able to read notes, use the communication functions (such as e-mail and a bulletin board), and undertake assessment exercises. A menu-driven "learning path" (*see* Figure 1) devised by the course instructor guides the learner through the materials. Thus, while learners are able independently to initiate interactions with their classmates and instructor at any time, they are still able to consult the instructor's systematic learning programme via the learning path when the need arises.

The delivery of education and training through the use of virtual classrooms has emerged as a significant phenomenon with the expansion of the Internet. While many higher education institutions around the world have begun to offer teaching, learning and assessment materials to their students on intranets and the Internet, few have successfully moved from this relatively inert 'notes online' approach to the more integrated Virtual Learning Environment (VLE) or virtual classroom. The distinction between the two is crucial to an understanding of the project described in this paper. The former online strategy tends to perpetuate all the disadvantages of the traditional 'active teacher, passive learner' educational paradigm because in practice many educational intranets offer little more than the traditional study guide or course notes dredged out of their old paper-based format and given a web-based make-over. Even more alarming to anyone interested in promoting learner-centred education is that by de-

emphasising traditional classroom interaction, the online notes method can further isolate the learner from the teacher or facilitator, as well as learners from their fellow students.

By contrast, virtual classrooms emphasise learner-centredness and collaborative interaction, and are firmly based on the principles of corporate learning organisation theory (Senge 1994). For example, Ryan and Culwick (1997) found that adult learners responded best to online distance courses characterised by peer exchange, collaborative learning, easy access to tutors or facilitators and flexibility. Learners tended to reject software programs that provided online material but resembled bulletin boards - similar to online notes applications - even when they offered e-mail messaging. The main reason given by subjects was that this approach offered 'no sense of community'.

Tiffin and Rajasingham, authors of the influential *In Search of the Virtual Class* (1995:2) have argued that: 'To prepare people for life in an information society, an educational system is needed that is based on telecommunications rather than transport'. It can also be argued that a virtual classroom answers learners' needs in an information society by providing a shared electronic space in which members can interact with each other irrespective of geographic location or time zone. Interaction between facilitator and learners and between learners is provided by the use of computers and telecommunications networks. As a 'virtual space', it can be said to exist in a way that one-dimensional information sources cannot. Members 'possess a persona, "nodding and saywriting" are common features, emotions are displayed but all *virtually*' (Ryan and Culwick 1997).

In the South African context, the *Discussion Document: Lifelong Learning through a National Qualifications Framework* (1996) articulates the principles of outcomes-based education and training. Broadly, this approach promotes changing theories of language, learning and cognition which collectively can be discerned as moving away from the traditional transmission model. The learner-centred focus of the virtual classroom can be seen to support the new South African education paradigm by actively supporting learner 'participation in creating and enjoying knowledge' (South Africa. Ministerial Committee for Development Work on the National Qualifications Framework 1996:12).

Further support for learner-centred educational models is provided by the National Centre for Curriculum Research and Development (NCCRD); as follows: 'The shift in the discourse from "teaching" to "learning" in the last five years signals a move from concern with structures and systems to concern with learning outcomes for individual learners. A major factor which influences the new pedagogical thinking is the revolution in information technology which is transforming understandings of knowledge production and dissemination. The traditional roles and responsibilities of both learners and educators are being challenged in radically new ways. The importance of ensuring lifelong learning competencies for all learners has therefore gained in prominence' (South Africa. Department of Education 2000).

The virtual classroom environment has the potentiality to effectively advance these aims, while providing the ideal context for putting them into practice. Further evidence of the virtual classroom's capacity to facilitate teaching and learning emerged from Ryan and Culwick's experience with virtual classrooms (1997). Amongst the influences noted by the authors was an improved curriculum model, in which their findings endorse the recommendations of the NCCRD document in that they demonstrate a common shift in emphasis towards learner-centredness. Secondly, the virtual classroom significantly improved teamwork and team delivery amongst tutors, and encouraged the speed and frequency with which current materials could be incorporated into the course. Involvement with the programme had the additional effect of developing the tutors' ability to manage a virtual group. Ryan and Culwick regarded the latter as a transferable skill that impacted positively on the quality of their own professional development. The authors also observed an improvement in the quality of the student's experience. Students expressed the view that they felt 'part of a learning community' and appreciated the advantages of improved access to tutors and the opportunity for collaboration with their peers.

Materials development

The development of appropriate materials for course delivery presented a challenge to the research design team. While the software provided the framework of the Information Literacy virtual classroom, extensive authoring work was required by members of the project team to shape the content elements of the learning path in respect of aspects such as tutorial explanatory matter, as well as links to resources and assessment tools. The course outline was designed by the project leaders, and content-authoring (including HTML markup and web page design) was

undertaken by a group consisting of post-graduate and fourth-year B.Tech students in the Department of Library and Information Studies at the M.L. Sultan Technikon. Members of this group had the necessary skills and background in both information literacy and web authoring to accomplish the task. Fundamental to the design of the learning materials was a learner-centred orientation. In addition, the authoring criteria were influenced by the notion of 'knowledge-centred' learning with the emphasis on encouraging thinking, problem-solving and reflection in order to provide opportunity for a learning experience based on '... well-organised bodies of knowledge that support planning and strategic thinking' (Bransford, Brown and Cocking 1999:119). The learning path (*see* Figure 1) and its individual subsections have been designed with the objective of presenting a coherent content framework intended to foster 'inquiry, including critical thinking, problem solving, decision making, and communication at increasing levels of complexity' (United States of America. National Science Foundation 2000).

The project leaders adopted the following basic elements in order to structure each subsection:

Statement of outcomes

Each subsection opens with a statement of the intended outcomes for that unit, e.g. subsection 2.5 - Networking and collaborating on the Internet - begins thus:

By the end of this section you should be able to:
- Recognise the advantages of online networking and collaborating for the researcher
- Distinguish between e-mail, e-mail discussion groups and chatrooms
- Find online discussion groups active in your research area

Table of contents

The table of contents lists learning material within the micro-environment of each sub-section. Links to the subsections appear in the "learning path" menu, in a permanent frame to the left of the working sub-section window.

Introductory material

Each subsection has an introduction authored by the instructor, designed to orientate and inform the learner. Additional information relating to the subject area is also included in this section, along with definitions of key terms, relevant examples, advice and checklists. Where possible, important concepts are paraphrased and analogies drawn to assist learners to understand the subject material more fully.

Links to related sites

Hyperlinks to other sites on the World Wide Web are included here. Many libraries have websites that offer guidance, training and further links that may be explored by the learner.

Test-yourself quiz

Each subsection includes an online quiz in multiple-choice format, allowing learners to test their progress.

Each of the twenty subsections was edited by the project leaders in terms of style, accuracy, layout and reliability of the hypertext links. Evaluation of four subsections had been carried out prior to the main authoring activity so that comments and suggestions for improvement from participants in the first pilot group could be incorporated into the process. Because the present paper deals with the first of a two-phase project, it is essentially an ongoing open-ended endeavour with the availability of a second pilot phase to provide opportunity for additional feedback that may be incorporated into future re-designing or modifying the present set of materials.

The results arising from the implementation of the first pilot phase tended to confirm the functionality of the virtual classroom's online testing and assessment tools, and opened the way for the development of self-test quizzes in each of the subsections. Learners were able to post extended assignments to the instructor (*viz.* course leader) using the familiar e-mail attachment method. Opportunity arose for the testing of so-called 'communication tools' (in this case e-mail connectivity within the classroom environment) and student home pages, which included photographs of the participants and short biographical sketches written by the participants to introduce themselves to other members of their online community. It is intended that the synchronous 'chat room' facility and 'virtual chalkboard' will be implemented and tested in the second phase of the project. Figure 1 below represents the learning path.

Information Literacy for Researchers

1. Analysis of information needs and sources

   1.1 Clarification of concepts
   1.2 Identifying information needs
   1.3 Information skills
   1.4 Library services
   1.5 Primary, secondary and tertiary information   services
   1.6 Database service providers
   1.7 The Internet as a resource

2. Information retrieval

   2.1 Search strategies
   2.2 The world Wide Web (browsers, search engines and subject directories)
   2.3 Search engines
   2.4 Evaluating Internet documents
   2.5 Networking and collaborating on the Internet
   2.6 Designing a web page

3. The literature review

   3.1 The role of the literature review
   3.2 Organising the information
   3.3 Using the information
   3.4 Managing information on a personal computer
   3.5 Word processing for research
   3.6 Database management and its uses in research
   3.7 Reference techniques

Figure 1 Information literacy module - learning path

At the time of writing, the second pilot stage of the project has been implemented, and the project leaders of the other NRF project modules are involved as participant-observers to evaluate the course as a whole. A train-the-trainer workshop will mark the end of the piloting stages and the end of Phase One of the project. Representatives of the six participating technikons will attend the workshop, after which the final version of the course will be made available to the target group consisting of technikon staff members who are neophyte researchers. This first cohort will constitute the sample for Phase Two of the project in which learner success rates and the feedback from attitude surveys will be used to further evaluate the programme.

The project development cycle

As may be inferred from the above discussion, the project has followed a cyclical development management model, proceeding through a pattern of planning, implementation and evaluation in successive pilot phases (*adapted from* Kells 1988:4). Content, design and management in the later phases are thus influenced by participant feedback, focus group discussion and structured project leader reflection in each of the evaluation stages. The multifaceted nature of the project demands development skills in several areas over and above those of information literacy itself, and include

- network server management and maintenance;
- HTML and web authoring;
- a variety of IT-related skills including file conversion, digital imaging and database design;
- authoring of resource-based learning materials; design of assessment tools;
- project management and financial control.

In short, the project itself reflects many of the characteristics of its subject area, and in particular, team-based development work.

   The following steps constitute the project development process:

Phase one:

- Development of the course outline
- Installation and configuration of the network server and the WebCT virtual classroom software
- Authoring, HTML conversion and uploading of pilot content
- Registration of the first pilot group
- Implementation of the first pilot phase
- Evaluation of the first pilot phase
- Reconfiguration of the course outline
- Authoring, designing and uploading of additional course content (Sections 1, 2 and 3 of the Learning Path)
- Proofing and editing of new and revised course content
- Uploading of revised content to the WebCT server
- Registration of the second pilot group
- Implementation of the second pilot phase
- Evaluation of the second pilot phase
- Train-the-trainer workshop
- Registration of participants for the first programme offering

Phase Two:

- Monitoring of learner interaction with the site
- Scoring of tests, quizzes and assignments
- Survey of learner attitudes towards the medium
- Focus group discussion
- Reconfiguration of the course where indicated
- Final report

Current evaluation of the first phase implementation

While it is not feasible to attempt a mature evaluation of the first phase of an ongoing project with built-in mechanisms for further evaluative scrutiny, nevertheless certain evaluative considerations have presented themselves in respect of the first phase of the present Information Literacy virtual classroom project. Phase One has resulted firstly in (a) the construction of a module of online learning materials generated from a set of key competencies identified for competent literature review writing, and (b) opportunities for testing an appropriate project development model for the study. In Phase Two, an attempt will be made to evaluate the new materials by determining learner success rates, and survey learner attitudes towards the virtual classroom environment.

In addition to the development and evaluation of the learning materials, the first pilot phase also provided an opportunity to measure and assess technological issues associated with user access. Among these considerations, for example, was the student's ability to access the virtual classroom, as well as the student's facility with key features of the medium. In most cases, the measurement criteria adopted were the successful performance of certain critical tasks within the virtual environment.

At the start, six of the ten pilot group members were able to log in successfully during the first two weeks of the pilot (28 February to 10 March 2000), and an additional three did so by 10 April. (The tenth student joined the group later than the others.) Successful log-ins were tracked automatically by the administration software, while an additional indicator was the exchange of at least one internal e-mail message between the participant and the instructor. Some misunderstanding of the difference between the bulletin board (discussion forum) and the private mail was evident at first, and required instructor intervention outside the virtual classroom by way of 'external' e-mail messages or telephone calls to clarify the use of these features. Further indicators of competency in the use of the classroom were measured by the editing and supplementing of information on the student's personal home page, the completion and submission of an online quiz, as well as reacting to instructions posted on the calendar.

Total log-ins (student accesses) over an eight month period (28 February to 30 October 2000) are reflected in Figure 2. Students with low or zero accesses are new (pilot phase 2) participants. The large number of accesses by students 10 and 24 (shaded bars) reflect designer/builder log-ins and are therefore not representative of normal student use.

Because our target group (*viz.* technikon lecturers) were assumed to have basic computer literacy skills, only minor attention was given to addressing the issue of users' unfamiliarity with the medium. The sample that took part
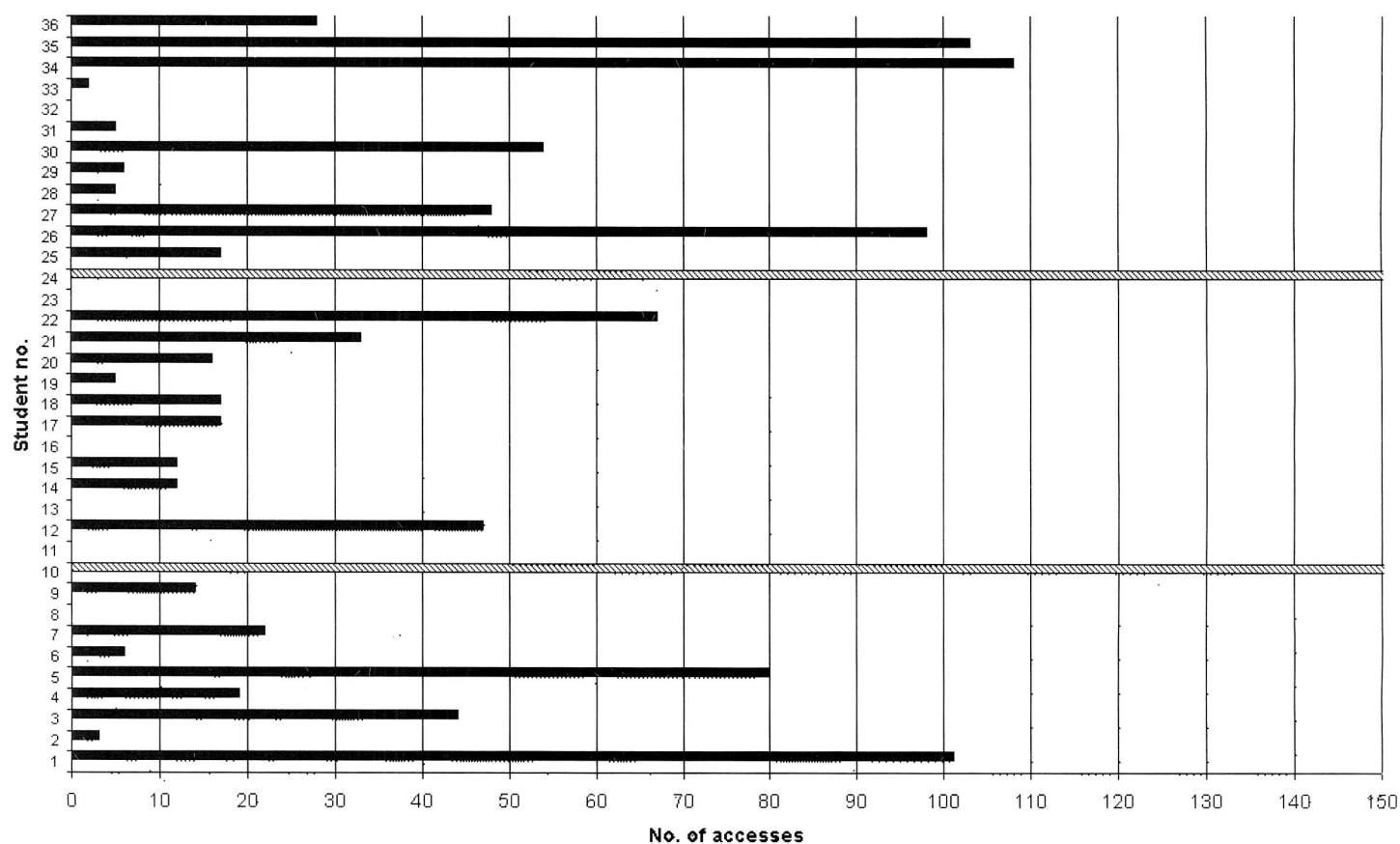
Figure 2 Total student log-ins Feb-Oct 2000

in the project accurately reflected the anticipated profile of envisaged technikon users. The universality of the findings of this project for samples with disparate levels of computer literacy skills (or none at all) is questionable. Computer illiteracy is clearly a major impediment to the successful roll-out of online learning on a wider scale in South Africa. The first phase of the present study indicates that fundamental requirements for the virtual classroom as a learning environment include prior learning of keyboarding skills (the ability to type e-mails, chat room messages and final full-length assignments), as well as unrestricted access to the Internet.

Finally, it should be borne in mind that in essence this paper constitutes an interim report of the progress of the first phase pilot study of an ongoing two phase information literacy virtual classroom project, and in no way purports to be a 'one best way' approach that promotes the virtual classroom as the elixir to cure all educational ills. It is however hoped that members of the research community will be provided with information concerning difficulties learners have encountered in using and becoming familiar with the online classroom within a specific information literacy context.

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