Chapter 2

Literature review

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2.1   Introduction

This chapter examines the second objective of the study: to address the research questions by means of a literature survey. Table 2.1 displays the issues relevant to the research questions.

Table 2.1   Issues addressed through the research

Topic of issues	Questions
WWW and the Internet	◆ What is the www/internet? ◆ How can the internet be used in education? ◆ What is search engines/portals?
Educational issues (Content issues)	◆ What does the target population need to know - general info and specific info? ◆ How will effective learning take place on the web-based program? ◆ What is the level of skills and ability of the learner within the program? ◆ In what way will distance learning be combined with real class contact?
Communication issues	◆ What methods of communication are necessary to ensure effective learning? ◆ What does the learner need to have access to these communication channels? ◆ What different groups will be communicating through this web site?
Structural issues	◆ How should the web site be structured to ensure logic and easy use for the target population?
Design issues	◆ What will make the web site work? ◆ Which design principles should be applied to ensure an effective site?

To introduce multimedia as the final product of this research, the following description by Phillips is appropriate:

According to Phillips, **Interactive Multimedia** (IMM) is the provision of computer software with information. **"Multimedia"** describes the presence of text, pictures, sound, animation and video. **"Interactive"** means power of the user to control the environment by a computer. IMM is the technology implemented in a software package and not the delivery mechanism nor the hardware platform.

Because of the popularity of IMM, the quality of software packages are often not on standard and to prove that, a quote from the Wall Street Journal shows that many products do not sell:

Thus the reason for Phillips (1997:8) to insist that software content must be appropriate, the user interface must be effective and the graphic design must be well planned. The performance should also be responsive and without errors.

2.2   WWW and the Internet

The Internet as an international network of computers linked up to exchange information. The word **Internet** is a contraction of international and network. To get on to the Internet you simply connect your computer to any of these networked computers via a service (or Access) Provider. (Kennedy, 1997:6; Sachs & Stair, 1997:4)

Sachs & Stair (1997: 2) further divides the Web into four components:
♦ The global Internet is the carrier of the information.
♦ The Web servers hold the information.
♦ The Web Browser software shows the information.
♦ A universal addressing scheme finds the information.

The Internet is not about computers, but about people, communication, sharing knowledge. "It's about overcoming physical boundaries to allow like minds to meet. And that's why you want it." (Kennedy, 1997:411)

2.2.1 Education through the Internet

Clarke (1998:2) believes that the existing global connectivity of computer systems has provided the development of the World Wide Web (WWW). As the WWW is a large-scale system of computerized, interconnected hypermedia resources accessible from computers connected to it, it can thus create a facility to deliver information, including educational resources to the desktop of your computer.

Greaves, cited by Clarke (1998:2), sees the situation in S.A universities at this stage as "a challenge of a transformation model that involves increased access, massification and a changing student population with diverse educational backgrounds and levels of preparedness." Greaves explains that this challenge can only be met when the institutions become information-based where the processes of teaching, learning and research are re-engineered with the aid of information-technology itself.

Through the Internet, learning resources can now be distributed across international boundaries and through this method, information can be gathered beyond the traditional resources of library and textbooks. (Harasim, 1996)

Bacon (1997) states that the learner can now access material, which has been otherwise inaccessible and the educational needs can be fulfilled by the provision of relevant resources.

2.2.2 Portals vs. Search engines

Webster defines a portal in Crawford (2000) as: "A door, gate, or entrance, especially one of imposing appearance, as to a palace." In a more specific manner a portal can be described as: "A web site that provides a particular entrance to the rather staggering wealth of information, products, and services that exist in cyberspace. A portal is any site that attempts to organize and streamline the on-line universe for anyone who chooses to (virtually) enter through that particular door." (Crawford, 2000).

Elliott Masie, President of the Masie Center, a leading consulting group for learning and technology based in Saratoga Springs, New York, defines a learning portal as " a single point of access for learning from multiple sources." (Crawford, 2000)

Learning portals specifically bring together existing best practices in training and education. Two learning portals are mentioned:

♦ Generic portals can be helpful to about any population of learners.
♦ Prescriptive portals can be personalized to the individual student's needs.

The advantages of a prescriptive portal are:

♦ Individual needs assessment.
♦ Assess the individual's learning style preference.
♦ Prescribes a learning path based upon the learning style.
♦ Check progress and report results.

Technology has provided an overwhelming world of information, which is available anytime.

Portals have arrived to help us focus through an entry to a subset of specific information, organized in a logical way. The learning portals take us to a collection of training-related information and individual learning goals. (Crawford, 2000)

A learning portal is a web site that provides its users with the same easy access and focus to specific information in the training- and educational space.

According to Franklin (2001), search engines are special sites to help people find information on different sites. There are differences in the ways search engines work. All search engines however perform three basic tasks which includes:

♦ They search the Internet by specific important words.
♦ They keep an index of the words they find and where they find them.
♦ They allow users to look for combinations of words found in that index.

An Internet directory, on the other hand has become a very popular search tool. The advantage of being listed on a directory versus a search engine is the fact that a directory is created by human editors from manual submissions. This eliminates automatic software submissions but most valuable is the fact that a directory powers many other indices and portals. The traffic on such a directory or portal is also of major importance opposed to that of an ordinary search engine. (Bruemmer, 2000)

2.3   Educational issues (Content)

Issues concerning the use of the WWW as an advantage for learning and education in general will be discussed under the following headings:

2.3.1   Applications of Interactive Multimedia (IMM)

Phillips (1997:9) refers to the designers of games and stresses that the engaging interaction between the user and system as well as the seductive interfaces and presentation are often lost in IMM education.

He also states that IMM can improve the quality of education although there is an ethical responsibility to the design of educational programs in order to make a distinction between facts and fiction.

Phillips believes that the advantages of IMM are mainly in the mixed media such as animation, text, graphics etc. Only now can the user decide which path he prefers to follow through the learning material and especially which medium is best for a required message. Is it text for thought or animation for dynamic information?

Because of this user control, each learner builds up his own knowledge and this results in a student-centered learning approach. A situation of life-long learning develops. Tutors need to upgrade their skills continuously. Because of the rapid movement of technology, changes become essential. (Phillips, 1997:11)

According to Phillips (1997) IMM can accommodate different learning styles. That refers to the "individual's characteristic ways of processing information, feeling and behaving in learning situations". (Smith, 1983) It is thus important to extend learning strategies to help students to be more flexible in their mental processing and not to limit them to a style.

Making use of technology related to the computer-environment could accommodate these different styles and limitations. Clarke (1998:8) sees the benefit of the computer linked to the web as a potential supporting tool for learning in your own space, time and pace.

IMM is not the sole answer to a given educational problem, but it is definitely a great extension to a situation by means of instructional aids, interactive tutorials and reference work. (Phillips, 1997:13)

Linda Slack-Smith of the School of Biomedical Sciences states that course material must be reviewed in advance and different teaching approaches should be used. (Phillips, 1997:14) The combination of self-study and computerized assessment for example, has resulted in flexible time management and learner responsibility. It also promoted active learning.

When applying IMM, Phillips (1997) stresses that it is important to remember that the program should be:

♦ Small and focussed.

Add detail later because we never know how quick a learner deals with the given information but keep it tight and focussed initially.

♦ Appealing.

Present the information in an attractive manner so that it pique the users' curiosity and draw their attention to the content. Information can be rejuvenated when using the right graphics and enough interactions.

♦ Flexible and portable.

It is useful to consider a wider audience while developing the product.

♦ Modular.

Finishing one part of a module means that you don't have to go back to it again and while using a multimedia resource such as sound it can be stored centrally. When updating is required, it is only necessary to change the central resource.

In this regard, Laurillard (1994:204), and Phillips (1997:204), emphasize that the learner should concentrate on the content of the program and not how the program is operated. Refrain from using long pieces of music when returning to the main menu. The educational nature of the program should always be of utmost importance because that will determine whether learning from IMM is more effective than from traditional methods.

2.3.2   Effective Learning

Laurillard (1993:13) quotes Ramsden by stating that: "The aim of teaching is simple: it is to make student learning possible." There have been changes in approach in teaching but most important is the change in practice. The teacher at university level should know something about student learning and not only imparting knowledge. That is also the reason for looking into the nature of academic learning at university level and thus finding out what make student learning possible.

Learning has been described as a high-level thinking by some academics and they see learning not only as a product, but also as a series of activities. (Laurillard, 1993:14) More than accuracy is needed and the integrating of background reading receives credit. It is clear that high level knowledge is one part, but handling that knowledge is the actual concern.

Laurillard further implies that if formal education were embedded in more natural activities, students would be able to make their own sense. Nevertheless, situated cognition is not enough. It is still necessary to abstract knowledge and represent the knowledge in a formal way, so that it can be generalized. (Laurillard, 1993:20)

Laurillard believes that an interaction between student and teacher develops, rather than an action on the student. This would provide a structure capable of its own improvement and should result in an improved quality of learning. (Laurillard 1993:95)

Vockell (1989:5) distinguishes between two thinking skills:
♦ Metacognitive skill implies that a learner is aware of thinking while performing a task and it improves the performance of that task. The absence of this skill leads to a failure of learning.
♦ Critical and creative thinking imply that the learner differentiates between **evaluative** and **generative.**

A comparison between the two thinking methods is set out in Table 2.2.

Table 2.2 A comparison between Evaluative and Generative thinking skills

Evaluative	Generative
"Reasonable, reflective thinking that is focussed on what to believe or do"	Development and application and ideas in solving problems.
"A concept of critical thinking"	People who understand facts and concepts and who can apply them in a new situation.

(Harvard Educational Review 32; 1962)

According to Vockell & Van Deusen (1989:16-18), video technology is actively involved in teaching higher order thinking skills.
More recently, the computer provides an excellent tool for teaching higher-order thinking skills (HOTS). That leads to interactive capabilities and the ability to present and stimulate problems. The computer can teach initial skills and promote generalisation. The computer can also be a more efficient tool to time-honoured techniques such as writing, collecting, analysing and categorising information.

- Students can do real thinking in the revision process much more effectively e.g. 50 minutes on thinking and 10 minutes on copying the manuscript. This means that more time is spent on higher-order tasks than trivial activities.

- The computer is not directly teaching HOTS but indirectly enhances the thinking skills by using their time more effectively.

- The computer offers advantages of individualization and immediate feedback.

- Each student can tailor the skills to his own need, he can proceed at his own pace, repeat the process as often as necessary and this is suited for co-operative learning.

- The computer can not replace the tutor; therefore it is best to combine the computer and the teacher in a well-planned program or lesson.

- With direct instruction, the learning is academically focussed. Teacher-directed classrooms with logically sequenced instructional materials or teacher guidance has the following advantages:

  - The goals are clear to students.
  - A time is allocated to the class.
  - The performance of the student is monitored.

Vockell & Van Deusen (1989:18) believe that for basic skills such as reading and mathematics, direct teaching (instruction) is proved to be more effective.

The disadvantages of students alone at the computer are social isolation, which ends up in mood states. Difficulty arises in summarising and explaining their learning tasks and there is no social comparison.

Research by Cohen, Kulik and Kulik, Rosenshine, cited by Vockell & Van Deusen (1989:28) show that small groups working together on HOTS computer programs are almost always preferable to students working alone.

De Jong and Simons, as compiled in Pieters, Simons & De Leeuw (1990:81) formed a theory of **self-regulation** in learning. Three levels regarding **self-regulation** of tasks were compiled:

- Knowledge and Conceptions (Metacognitive).

- Executive control/regulation.
- Transformation/ executive skills.

Self-regulated learners can

- prepare their own learning;
- take necessary steps to learn;
- regulate learning;
- provide own feedback, and
- concentrate and motivate.

Therefore such a student is an **"active"** learner, but there are impediments to active learning such as student factors and interactive factors.

Metacognitive knowledge, which entails thinking, problem solving, learning, remembering or third person's cognition, can be interpreted as to how somebody think or learn. The steering of this cognition is the executive control process.

Simon as compiled in Pieters, Simons & De Leeuw (1990:42), states that executive control process is the control structure governing the behaviour of thinking man is a strategy or program that marshals the cognitive resources for performance of a task.

The self–regulated learner can form the ability to be his own teacher. Sub skills of this learner is:

- The preparation of learning.
- Orientation of learning goals.
- Planning of learning activities and choice of learning goals.
- Self-motivation.
- Finding prior knowledge and skills for new learning.

This learner is able to shift between different learning activities. He can execute learning activities, which leads to knowledge, comprehension and integration and problemsolving. (Pieters, Simons & De Leeuw, 1990)

According to Van Brakel (1996), more attention should be given to adding issues of learning management in the self-directed model of learning. A web-based study, computer mediated communication and learning management guides can support the clarification of these issues.

Learning activities should be tuned to learning goals. To understand a part of a domain of knowledge, the learner should engage in other learning activities than when he wants to be able to apply that part of that domain.

Learning for recall is different to learning for understanding or integration. Thus, all learning shouldn't be active, not referring to the amount of effort but to the quality of the learning activity used.

Learning according to Shuell, (Pieters, Simons & De Leeuw 1990) is divided into different categories. These categories are displayed in Table 2.3 and discussed by the researcher.

Table 2.3   Different learning categories

Category	Discussion
Active learning	The student must do certain things while processing incoming information in order to learn the material in a meaningful manner.
Constructive learning	New information must be elaborated and related to other information in order for the student to retain simple information and to understand complex material.
Cumulative learning	All new learning which builds upon and utilises the learner's prior knowledge in ways that determine what and how much is learned.
Goal-directed learning	The success of the learning is dependent on the fact that the learner is aware of the goal in general and works towards an expectation appropriate for that specific outcome.

Salomon as cited by Pieters & Simons (1990) believes in **mindfulness,** which implies that a student should strive for activity in learning and problemsolving as a value in itself. De Jong and Simons as compiled in Pieters, Simons & De Leeuw (1990), differ slightly from the above by stating that the essential thing to do is to be **constructive** and **mindful** at the right moment.

2.3.2.1   Learner Activities

Shuell as cited by Pieters, Simons & De Leeuw (1990) differentiates between areas of learning. These areas are dependent on certain learner activities. Table 2.4 summarises the effect of the areas as well as the activities on active learning.

Table 2.4   Different learning areas and learner activities as IN Pieters, Simons & De Leeuw (1990:81)

Areas of Learning	Learner Activities	Effect of active learning
Quality and quantity	♦ Quality of learning is affected because some learners can only apply certain learning activities and although they learn extensively it is not efficient.	♦ Active learning can reach specific learning goals ♦ Active learning as a part of self-regulated learning might be an important goal of education. ♦ Studies suggest that active learning causes better learning performance.
Student character	Students see the fundamentals of learning differently: ♦ copying information and ideas ♦ construction of knowledge individually	♦ Construction of knowledge can lead to active learning
Learning goals	♦ Some students take learning for granted and do not set explicit goals Experiment has shown that a lot of students fail to vary learning approach according to task demands and imposed learning goals	♦ Students loose the opportunity of active learning because they misinterpret the formulation of goals.
Motivational and affective factors	♦ Students can be afraid of changing their learning approach. ♦ Active during learning in an unproductive way makes them feel secure.	♦ Students over learn e.g. underline every word to memorize instead of thinking about the study material. ♦ They do not believe in active learning. ♦ Shuell describes students who can not learn 'actively' as to mind orientated. That refers to a fixation on certain parts of the regulation process.
Skill of active learning	♦ A student must make use of certain activities to obtain the necessary skills for learning e.g. analysis and elaboration. ♦ Research on learning styles shows that students use surface processing strategies and other students have difficulty in active learning	♦ Metacognitive knowledge lacks, so students do not know the different learning activities and when to use a specific one.
Regulation skills	♦ Students do not plan properly and only when a problem arise they think. ♦ Very few students monitor, check and test their learning activities that it is tuned to their goals.	♦ Research showed that the amount of regulatory activity and the nature of testing the learning goals predict the performance of the student. ♦ Active learning seems to depend on regulation styles.

Computer assisted instruction requires a certain ability of abstract reasoning to transfer the information into adequate regulation activities. Computer questions can not be as tailor-made as a human tutor can.

Venezky and Osin (1991:2) state that a classroom without a teacher is not the answer. Text is an evolution not a revolution. Computer assisted instruction can be a meaningful aid in "teacher directed" settings and home learning.

The support role will not be "directly instructional but will be spent in management, testing, grading, scheduling and communicating."(Venezky & Osin, 1991:2)

According to Laurillard cited by Phillips (1997:64), there are two models of education that affect the design of an educational program. They are **'didactic'** and **'communication'** models, which can be used to analyze the pedagogical principles within educational media. She differentiates between two types of knowledge:

♦ Perceptual knowledge is known as the definite knowledge in a subject. It is also known as 'instructive' or 'didactic'.
♦ Conceptual knowledge obtained through social interaction and experience. (Laurillard, 1987)

Knowledge is not something that you get from one person, but rather a development of one's own perspective. By following this model the learner takes more responsibility for what they learn and how they learn it.

Even on traditional campus, distance learning are widely used and subsequently face-to-face communication becomes less. This gives the student the opportunity for interaction with the teacher who plays an absent and indirect role.

2.3.3   The target population

Defining the target population for your web site is an important factor early in the planning of the project. Issues concerning the audience are discussed.

2.3.3.1.   Identifying the audience

The more specifically you can catalogue the needs of the people reading your web pages, the better you'll be able to meet the needs. The background information, which will be revealed in

the content, is predicted by the prior knowledge of the target population. That will also affect the detail of the terminology explanation.

Sachs and Stair (1997:63) believe that the usefulness is often easier to provide to a narrow target set than to the whole web audience. To select a specific topic and direct the focus is much more useful to those who need that specific information.

2.3.3.2   Accommodating your audience

Wilson (1996) advises to keep in mind the problems that your target population will be trying to solve, while reading the pages. It is also important to keep in mind that other than the specific audience might also peep at the site and therefore you should do a similar categorization.

2.3.3.3.   The choice of a Browser

According to Sachs and Stair (1997: 8), the earliest Web browsers showed only text. Mosaic was developed and caused a tremendous change. From there Netscape Navigator took over and presently it is possible to show text, graphics, sounds, movies and other small software applications written in Java and JavaScript. The success of a browser is that no typing is necessary. A mouse click takes you to the information indicated by a hyperlink, which hides the address of other resources.

Sachs and Stair (1997:101) inform that there are numerous people still using text browsers and some people choose to turn off the graphics to speed up the response of their modem lines. It is important to accommodate these visitors.

Wilson (1996) emphasizes that the choice of browser has an effect on the audience who will be visiting the site. It is wrong to assume how someone will be viewing your site. Rather try to accommodate people with a wide variety of capabilities. On the other hand, it is also true that the content of the web site might need the features of a specific browser to be presented effectively.

It is always important to maximize the value and usable content, minimize the size of the document and the load time, keeping in mind that everybody might not use the same browser. Some users will have a slower link by which they retrieve the information on your web page.

2.3.3.4   The bandwidth of the Internet connection

The most important differences between designing for the web and other traditional media designs resolve around perceived performance. And the ways in which the Internet connection will affect the audiences' perception of the product quality.

The way in which you use graphics, size of images and the layout of the page as such, will be perceived differently depending on the speed of, and quality of the user's Internet connection.

On the other hand Veen (1998) believes that web pages should look good viewed in any browser on any computer. He further states that the World Wide Web can serve the information needs of any user with any device at any speed, but only when the site is build and designed by a smart author. He adds that the biggest web myth is that you can not design well without high bandwidth. As a matter of fact, Veen found that design solutions have emerged from the problem with bandwidth limitations. For example, cascading style sheets offer the designer the possibility to do much more with much less.

2.3.3.5   Who and where is the target population?

According to Phillips (1997:50), a feasibility study for any software production is to know your target audience. He suggests that the following questions should be asked in order to identify the target group successfully:

- How many users will be interested in this site?
- Where are they located and do they work from different places?
- Will all the people interested using the program the same way and if not, how will it differ?
- Is there a specific teaching problem in the current environment with specific students and can the development of the web site accommodate it?
- What is the computer literacy of the general target population?
- What hardware is available to the user?

It is on the other hand worthwhile to design for a larger audience in the long term. There should be either an opportunity to gain the appropriate skills or the interaction must be simplified to meet the competency of the audience.

2.4 Communication issues

Important matters concerning communication as an issue to design and develop this web site successfully, are discussed under the following headings:

2.4.1 Effective communication

For the communication facility to be effective, certain components should be kept in mind such as

♦ learning;
♦ general information transmission, and
♦ social communication.

2.4.1.1 Essential learning communication

Broholm & Aust (1994) believe that the essential learning process of interaction and feedback can only occur through supplementing a form of computer-mediated-communication (CMC). The presentation of an electronic mail (e-mail) communication or a dedicated e-mail mailing list can accommodate the essential feedback and interaction.

Computer-mediated-communication (CMC) offers the opportunity of **student to student** and **student to lecturer** contact. It also opens up the path to learning material by experts. This global interconnectivity results in an increased collaboration that extends the institutional and national boundaries. (Harasim, 1996)
Active learning is promoted by CMC because the learner can use his own time to give thought to a matter and return to the topic in a tutorial presented by a- synchronous text-based medium. (Laurillard, 1996)

Dede (1989) detected that the introvert as a less assertive learner, gains far more by the CMC method than the traditional face-to-face class communication. For the simple reason not to compete with the confident learner.

2.4.1.2 General information communication

According to Clarke (1998:14), sufficient provision should be made for course and learning issues. These include the relevant resources, technology, terminology and how to interpret it. It should

also identify the help sources and explain the means of assessment of work and projects completed.

Research has shown that the predominant communication is of a more social and other wise course management orientated nature, than it is focussed on content matters. CMC accommodates all learners at once and provides all the information concerning administration and other course requirements, while a face-to-face situation can waste a considerable amount of time. (Draper, 1997)

Wilson (1996) is of opinion that the "most basic level of interactivity is by means of hypertext links, blue underlined clickable words which take you to the underlying information."
He also advises a search tool for an information-rich web site in order to cut the time in search of what the reader is looking for. This search tool is indeed interactive. The reader types in a word and a selection of matching document titles are made.

2.4.1.3 <u>Social communication</u>

To create a social atmosphere and cohesion in a study environment, the necessary communication channels are essential. This requires a specific method. A class-mailing list for asynchronous social communication and synchronous electronic "chat" channels are the possibilities for this need. (Clarke, 1998:14)

Of all the possible CMC methods, e-mail has been the most popular amongst students. (Holden and Wedman, 1993) Wilson (1996) believes that the need for social communication (interaction) is very high on the list when planning a web site. He states: "Customers want to be treated as individuals, and all but nerds enjoy conversation. This means our web sites must glow with humanity and flexibility: our e-mail is answered promptly, our writing style is personal and chatty."

According to Wilson (1996), the most popular feature of a server is the real-time **chat** groups and then again it is the preference of the customer and not the designer or developer of the site.

An inexpensive tool makes **"chat"** between groups possible on the web without any special plug-ins. What you want to avoid on your Web site is an empty chat room that people only enter to ask, "Is anybody here?" The Internet is the ultimate global forum for interacting with customers and potential customers. Wilson advises that it is therefor wise to take advantage of everything available for information retrieval and social interaction.

2.4.2   Limitations of computer communication

Computer-mediated-communication has several limitations. It is said that CMC is only suitable for instrumental relationships rather than social supportive ones. The lack of visual and social presence is another limitation. CMC is a suitable method of conveying information, opinion and suggestions, but it would not accommodate agreement or disagreement. When dealing with social-emotional tasks, CMC is also not the answer. (Hiltz and Wellman, 1997)

In cases where the students are too busy to log on regularly, they tend to fall behind and result in missing deadlines for assessment etc. If the communication tools do not provide adequate management of the information, it can result in information overload.

2.4.3   Traditional vs. Electronic communication

Greller and Barnes (1993) believe that communication by means of computer facilitates interaction similar to that of contact communication in a classroom, but with the difference of a combination of the printed word with verbal patterns of speech.

An advantage of the electronic communication is the storage and recording of messages for later use.

2.4.3.1   Bulletin boards

In real world, a bulletin board is a device to which you can staple announcements, appointments, etc. Alessi & Trollip (2001) describe a web-based bulletin board as a web site to which Web users can post items such as text, pictures or complete multimedia programs.

A bulletin board must be visited periodically to browse its contents unlike e-mail, which is delivered to your computer.

Bulletin boards provide asynchronous communication because each user accesses the bulletin board at his own convenience.

A freeware/shareware bulletin board program can be used to support a learner. Any question or comment from a learner causes an automatic copy to be sent to the bulletin board owner. The e-mail response can then be posted directly to the board. The bulletin board owner can also re-arrange the questions and answers into the meaningful categories and sequences.
(Wilson, 1996)

2.4.3.2   E-mail

Wilson (1996) discusses hyperlinked e-mail addresses ("mail-to" links) as a facility to provide a quick way for users to contact each other. Provide a simple form with information like name, e-mail address, topic, and phone number and by doing that the reaction is quick and precise. Interaction is all about answering e-mail promptly and in a helpful manner. A successful web site should provide an essential communication channel, such as the e-mail facility.

2.5 Structural issues

Aspects, which affect the structural design and development of the planned web site, are discussed under the following headings:

2.5.1 Navigation

The most important thing about navigation is that it must be very clear. (Sachs and Stair, 1997) They see image maps as a wonderful and colorful navigation tool, but advise to have a default URL specified. The images should also have defined borders and not a fuzzy look around them.

Sachs and Stair (1997:175) suggest that an image or icon link should be near to a text hyperlink, for the simple reason that many people will admire them, but will eventually go to the familiar text hyperlinks. They stress the fact that the same words or phrases must be used for icon, image and text hyperlinks.

2.5.1.1 Linear, Hierarchical and Mixed- hierarchical

All the above schemes follow naturally from an objectivist approach to educational design and according to Laurillard (1994) there is a serious shortcoming in these book-like structures, analyzed in terms of the ideal teaching/learning process. There is very little user control, other than going to different topics at will. The viewer still has to use the material as the designer dictates and the usual menu encourages the user to start at the beginning and keep going.

2.5.1.2 Concentric

Phillips (1997:66) describes a concentric structure as a knowledge base with a number of reference topics where the information is divided into different categories. A wheel represents each topic. The user moves between topics along the axis to investigate the different categories of information at the rim of the wheels. This is quite a quick method of finding information for especially knowledge bases and the user has control over what information to look at.

Kennedy and Taylor (1994) think that this model can create a constructivist environment because it avoids the directionality of the linear and hierarchical structures. The user can start anywhere.

2.5.1.3   Hypermedia

Because the computer is not restricted to two-dimensionality, which is the case with traditional media, any links can be made between pieces of content. These links on the information network are known as 'hyperlinks' and the general structure is known as 'hypermedia'

The hypermedia structure can be based on hierarchical structures with links moving side-ways between the arms of the hierarchy. Hypermedia structure offers an advantage to educational programs because it facilitates a constructivist approach. This structure enables the student to build knowledge according to personal preference.

Phillips (1997:70), on the other hand, mentions that in some programs difficulties arise because of unstructured access to all information. The user can thus be sidetracked to follow interesting information to its end and in the absence of adequate navigational tools, the user might get lost in "hyperspace". This is a real concern in the design of IMM.

A further problem is the inadequacy of research skills to be able to construct from the knowledge network. It is thus necessary to provide a guideline for the students in discovering the knowledge, other wise they won't make any sense of the hyperlinks.

The dilemma regarding hypermedia is that the student must have the necessary research skills and computer-based cognitive tools to make sense of the environment. The World Wide Web is a good example of the hypermedia structure. In the current form however, it has not been applied to the advantage of education. It is not enough to have information resources to guarantee learning. The student needs guidance to build pieces of the information into a mental structure.
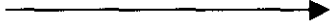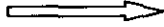
Phillips (1997:72) is of opinion that the successes in CBT projects often have a mixture of hierarchical and hypermedia structures.

2.5.1.4 Explicit structures

A traditional way of implementing navigation schemes is by menus made up of buttons. This metaphor means an explicit structure on the content, because in the Western world we are used to start in the top left corner and continue until we are finished. With the menu a 'start here' linearity is implied. Menus lead to a typical linear sequence of screens which is commonly accessed by navigational buttons e.g. **back, next, previous, continue.** Icons may also be added to the navigation. For moving up the hierarchy, buttons such as main menu, topic, contents, previous menu etc. are often used to guide the user. Graphics are also sometimes used. (Phillips, 1997)

2.5.1.5 Implicit structure

Table 2.5 Description of the Implicit structure

Use content to navigate	⟶	1.Parts of subject material 2.Click on 'hotwords'
Start from the end	⟹	Use result of the structured argument

Start with the result of the structured argument represented in a visual form. The student can then investigate any aspect of content to a depth of his desire, restricting the scope to only one key concept. Investigating leads to other information.

It is not yet known whether this approach is widely applicable and it might be limited to concepts with simple visualizations. (Phillips, 1997)

2.5.1.5 Navigation headings

Important facts concerning the success of the navigation of a web site is the following:

♦ It is advised to add headings to chapters in order to link back to the beginning of that document.

♦ For pages in a chapter, add a sub-heading in order to go back to the beginning of the chapter.

- Pages longer than one- and-a-half screens need duplication of the navigational links to save readers from scrolling up and down the pages.

- Avoid **"back"** and **"return** to" buttons and links. Rather use a more descriptive link such as **"ahead to Chapter 5: Evaluation"**

- A navigational scheme for a number of topics is even better.

- Avoid a palette of graphic navigational buttons. Try not to confuse the user and rather make it easy to decode your navigational symbols.

- If graphic navigation buttons must be used, add text labels to them.

- It is a good idea to add a short list of content to a long page. Two reasons for doing this are for first time readers to see what to expect from that section and returning readers to find the information they are looking for even quicker.

- A title header on each page would be of great navigational value-small but recognizable as a title.

- Choose a title that accurately summarizes the content of the page. Meaningful titles save the reader time and avoid frustration.

- Provide a search service and clearly state the scope of the collection being searched. (Levine, 1999)

According to Merle (1999), navigation bars must be a simple set of buttons or text and should be repeated on each page. It shows best at the top, left, or bottom. Consistency is of utmost importance.

She also advises that if a scroll bar is used for more than 1½, add simple text navigation at the very bottom to avoid scrolling back in order to make another selection.

Merle (1999) adds that it is a good idea to let the user know where he /she is at a given moment. For this reason you can alter that page button slightly e.g. dim, highlight or another colour.
The navigation bars should include a home page button and contact information. If the site is large, it is necessary to add an index page or site map. The site map must show a complete outline of the site.

Merle (1999) suggests that, search capabilities are also a good idea in order to allow the user to conduct a one or two word search to receive a possible list of relevant pages.

Merle (1999) emphasises that consistency is very important and that one must keep in mind that the web site as a whole is well organised. She recommends no fancy backgrounds etc. but rather concentrate on the organisation of content in a simple and easy-to-follow format.

Most interactions with web pages include navigating hypertext links between documents. The most frequent problem is the feeling of being lost on a site. Clear and consistent icons, graphic identity schemes, and graphic or text overview can give the user confidence to find what they are looking for. To be able to return to the home page is very important as well as to other major navigation points in the local site. It is a set of basic buttons, often graphics that appear on every page of the site to navigate and create the graphic identity that reminds the visitor that he is still on the site.

There should be no dead-end pages, meaning that there is no link to any other local page, including the home page. If a user that go directly to a subsection of the site, it is fatal if there is no link back to the home page or to a local menu page. Those readers will have no further access to the site. (Merle 1999)

2.5.2 Storyboard

Initially a site will consist of screens with certain topics but with no content. The storyboard defines all the resources required for each screen.

Vaughan (1998:468) describes a storyboard as an essential part of the planning phase. This is where each screen is sequentially organized and the necessary design notes as well as sketches accompany the planned project.

During the development phase the storyboard is reviewed many times and production work starts as soon as the content has been finalized.

Schwier & Misanchuk (1993:294) have found that storyboards are useful for an overall idea on the multimedia product. This method gives you a clear communication of the specific compositions within the multimedia production.

2.5.3 Hardware

According to Phillips (1997:50) it is an important consideration when building a software program, to decide which type of platform or hardware to use. The use of relevant and suitable software is also of primary importance. For instance, a colour program for end users with black and white model is of little value.

On the other hand, the development of the computer industry is so fast moving that the upgrading of the user's computer is often quicker than the completion of the final product.

2.5.4 Software

Phillips (1997:52) stresses that it is as important as the choice of hardware. The choice of the software package can determine the use of hardware. For example, if a cross-platform program is developed with *Apple Media Tool*, you will need a Macintosh while the *Asymetrix Toolbook* works with IBM. Packages like *Authorware* forces students to follow certain paths through the material. In an educational program specifically, it restricts the student to go to any part of a module or unit at any time.

The second software issue is that of responsiveness. In general most IMM packages are slow because of the amount of mixed media used. The issue however is, to determine the speed of the program on the delivery platform.

Phillips (1997:52) gathered information about programs used on specific delivery platforms, which are displayed in Table 2.4.

Table 2.6 Comparison between combinations of different software and hardware

Delivery platform	Program/software
Macintosh	Use *Authorware* for delivery under windows
IBM	Exposed problems with *Authorware*. Resolutions were lost on transfer and transitions took longer than 20 seconds.
Spinnaker Plus	Faster than *Authorware* but to slow for effective student use.
Asymetrix Toolbox	Windows machines had to be used for development.

2.5.5 Delivery Platform

Different aspects can influence the choice of a proper platform. Personal preference, budget restrictions and the delivery requirements of the project are examples of such aspects. From the start the **Macintosh** has been defined as the "multimedia computer" for the simple reason that it has good built-in audio. (Vaughan, 1998:57) He believes however that the "newest, fastest, and most flexible computer" is still the best production station.

The **multimedia PC** is described as a standard and not a computer. It includes the minimum specifications to turn it into a multimedia computer.

Because of the fact that 80% of a developer's target market may be Windows platforms (multimedia PC's), it is of utmost importance that the designer/ developer makes use of tools, which make transfer, across platforms easier. (Vaughan, 1998)

For delivering a program on the web, it is without a doubt a requirement to have reasonable knowledge of the language (format) used to present structured text mixed with inline images. This format is known as HyperText Markup Language (HTML). (Vaughan, 1998:421)

Virtual Reality Modeling Language (VRML), a specifically designed environment which accommodates high-performance 3-D worlds, will be discussed as a possible web feature which can enhance the design industry as far as the collaboration on product designs, photorealistic 3-D graphics etc.

2.5.5.1   Virtual Reality Modeling Language and Hyper Text Markup Language

Virtual Reality Modeling Language (VRML) is a 3-D navigation specification. It enables the creation of 3-D sites e.g. chat rooms.

HyperText Markup Language (HTML) is the specification for page oriented Web navigation. Vacca states that the construction industry has already made use of VRML to explore exact representations of architectural drawings and models before even start building. (Vacca, 1996:1)

Laurillard (1993:122) describes hypertext as a controllable element by the user and as a medium with great strength. Iconic forms and options support the indexing, referencing, searching and editing tasks very well. A mouse click and pull down menus 'makes accessing and displaying an item of information very convenient' and the flexibility makes it customizable for the user. Another advantage of hypertext is the accessibility of the structure's topic. If the structure doesn't suit the user's way of thinking, it can easily be changed to suit their purposes better. Laurillard (1993:130) concludes that no form of hypermedia succeeds in supporting all the activities to complete the learning process.

Vacca (1996:7-11) indicates that the use of Virtual Reality modeling Language (VRML) balances the principle of simplicity and flexibility. Certain software products which can 'speak' VRML allow users to browse in 3-D before they start building.

According to Vacca (1996:15), VRML creates a much richer interaction than HTML. In 2-D home pages it is possible to jump from page to page and view images from a fixed, pre-determined perspective. The world of VRML however has no limitations and it is inexpensive to build. It can become bigger than the earth and the objects can defy the laws of gravity. VRML can change a 2-D home page into a 3-D home world.

2.5.5.2 Band width for VRML

Vacca (1996:17) reveals that images are loaded in chunks for greater accessibility. This has made a graphic-intensive web site more accessible for the average modem user. The user can now start reading text before the images have been off loaded completely.

VRML files are usually very compact and good VRML tools can access and save 3-D spaces in chunks. Even large files can be broken into many small files and loaded incrementally. It is actually more effective than 2-D.

2.5.5.3 Application of VRML

Vacca (1996:21) recommends VRML for any web site especially to engage visitors and keep them returning. Vacca stresses however that one must consider the user group carefully and should still keep the bandwidth in mind to avoid producing an attractive VRML site that is painfully slow to navigate. The lack of a language barrier makes the site even more attractive for a broader general audience. Vacca (1996) states that the intention of VRML is to become the standard language for interactive simulation within the web.

2.6 Design issues

Cottrell and Eisenberg (1997) state that "web page creation is becoming commonplace".

They added that writing HTML becomes easier but creating valuable web pages is not that easy. As desktop publishing software led to different combinations of styles which did not work, the ease of web page creation has resulted in some web pages of dubious design and questionable value. Cottrell therefore states that people are paying more attention to development of well-designed pages.

Aspects like minimising download time, avoiding flashing text, insufficient colour contrast and short page lengths with the important content near the top, have become the primary factors. A well- designed page must focus on the need of the target audience.

Cottrell also implies that the general audience approaches a web page in an information- seeking or problem-solving mode. Therefore they developed a model for information problem-solving and techniques for applying the model to web page design.

> "The heart of design is communication: defining a problem and creating a solution that balances pure information with an aesthetic that gives the message voice. The tension between form and function is the starting point for our exploration of Web design."
> (Veen, 1998)

Veen (1998) formulates a design philosophy as web sites lined up on a continuum between a library and a gallery. He explains this as the intent of a library to take inquisitive people to the information they are looking for. On the other hand, the gallery provides similar information but through a more experimental path.

Veen (1998) concludes this design approach by stating that form must follow function for a web design to be considered successful.

2.6.1 Importance of the design process

Phillips (1997:59) states that an important factor as part of the incremental prototyping model, is the design process, apart from the production process. It is best to complete the whole user interface before starting production. All aspects of the content should also be finalized.

First phase of the design is the requirements specification. The structure is not clear until the design process is almost complete. The success of the specific design strategy is uncertain until an advanced stage of the development. The purpose of the requirement specification is to define the functionality and scope of the project. This is inter-linked with the feasibility study.

Evaluation of the prototype exposes problems in the design, which leads to changes in the requirements specification. The final requirements specification as the first stage of the project is a difficult task but it is essential to create the process because it documents the design.

This phase provides a clear understanding of the project and an overview of the content. To ensure a well-structured content, teamwork is essential from the start, as all members of the team should be familiar with the content.

According to Phillips (1997:61) it is important to understand the scope of the content (brainstorming). All ideas are discussed and then only can a consensus be reached about the basic structure of the project. The design should be signed off after a consensus about the basic structure has been reached. No further changes should be made to the general design.

2.6.2 General design principles

In any multimedia program it is of importance to gain and hold attention. According to Schwier & Misanchuk (1993:213) it occurs quite often that the developer creates a distraction rather than attracts the user's attention. Too many colours, graphics and styles affect the quality of communication. The use of basic principles is after all, the most powerful concept in screen design.

2.6.2.1   Simplicity

According to Schwier & Misanchuk (1993:213) a minimalist approach is always effective. It should be a challenge to use as little text and graphics as possible in order to keep the program "lean", but effective and appropriate. Schwier and Misanchuk assure that formative evaluation

will reveal a program, which tends to be too simple. On the other hand, a too extravagant program will never show through evaluation but will waste time and disc space.

According to Schwier & Misanchuk (1993) the bottom line is to keep away from the "siren song of multimedia" and keep it simple and straightforward.

Veen (1998) stresses that simplicity is the essence of good web design. He stresses the importance on taking control of the content and keeping it down to the very essence. The main purpose of the web is to communicate a message.

According to Veen (1998), the user needs simplicity in every aspect. Elements should be familiar to the user e.g. underlined words, which refers to hyperlinks, a colour strip on the left hand side of the pages which indicates the navigation vocabulary.

2.6.2.2   Consistency

Unexpected elements must be limited to the minimum. Schwier & Misanchuk (1993) indicate that it upsets the user. When the unexpected is used to generate excitement or a special reaction, it is accepted, but always in an expected context. Consistency implies:

- ♦ style of presentation from one section to another;
- ♦ placements of various items e.g. navigation devices, student input, feedback;
- ♦ use of colour;
- ♦ access structure e.g. use of headings;
- ♦ use of cues e.g. font, italics, bolding, colour;
- ♦ screen density and white space;
- ♦ terminology (directions, menus and help screens);
- ♦ names of commands and manner of evoking them; and
- ♦ interactive behaviour in similar situations (e.g. click of the button in all multiple-choice questions).

2.6.2.3   Clarity

Schwier & Misanchuk (1993:214) refer to clarity as the process of stipulating what to teach or communicate. That refers to the different analyses, e.g. task analysis, content analysis etc.

To ensure that the clarity of the multimedia product is good, Schwier & Misanchuk (1993) divide content into three categories:

- ◆ Things the learner must know.
- ◆ Things which is nice to know.
- ◆ Things the learner doesn't need to know.

Schwier & Misanchuk (1993) state that the language level must suit the target population. They provide the following guidelines to ensure the clarity regarding language:

- ◆ compatible language;
- ◆ short sentences;
- ◆ avoid jargon;
- ◆ keep your prose lean;
- ◆ use bulleted lists;
- ◆ use active voice;
- ◆ keep away from negative statements;
- ◆ informal language is more accepted than journal style;
- ◆ use personal pronouns;
- ◆ use lots of familiar examples; and
- ◆ use inclusive language, meaning non-racial and non-sexist.

Veen (1998) advises that clarity should be a primary concern in building a web site. Thus, avoid confusion and make use of a rough 10-15 seconds to impress your reader, spark his interest and navigate him clearly into your site.

Veen (1998) mentions an effective strategy of matching words and pictures together, creating an eyeful of information that will easily guide your user.

2.6.2.4   Aesthetic Considerations

Schwier & Misanchuk (1993:215) reject the approach of aesthetics that over rule instructional considerations. Only if the instructional considerations have been applied satisfactory, can aesthetic considerations be added without affecting the other. These are the important considerations to bear in mind:

- ◆ Balance in screen design creates a feeling of stability.
- ◆ Harmony is using similar text fonts and colour within a screen display.

◆ Unity refers to the wholeness of a display and is the result of a well-balanced and harmonious screen.

2.6.2.5   White Space

White space has the function of bringing ideas together or separating them. It creates a lighter screen and can illustrate relationships. Therefore Schwier & Misanchuk (1993) state that the content must be chunked together to make sense instructionally.

Schwier & Misanchuk (1993:223) refer to Frase and Schwartz, who applied "segmentation" as a technique to divide text into meaningful segments. This resulted in an increased response time of 14-18%.

2.6.2.6   Interface layout and design

User interfaces have changed many people's lives. Schneiderman (1998:5) states that it is clearly visible in the effectiveness of learning. It is however important to remember that a certain amount of frustration, fear and failure occurs when the terminology, layout or level of complexity is not met by the user.

In designing a hypertext learning site, there is no control over the way in which the learner arrives at the site, the order in which the learner navigates the site, how much time spent at the site and where he exits the site. The learner gets involved in a jungle of information, which is spread across a number of sites. This situation differs significantly from the traditional topic of information presented in a single written article or book. It is therefore very important to guide the learner with regards to the navigation and the overall design and layout of the web site. (Clarke, 1998:23)

The user interface created the possibility for people to control their computers directly. They expect a level of design sophistication from all graphic interfaces, including web pages. The actual goal is to prevent putting any obstacles in the user's path.

Experienced as well as inexperienced users should be accommodated. Feedback from the users should be an objective indication of the success of the design ideas.

"An effective web site, is yet another powertool to help achieve the goals of the enterprise. The enterprise can be a business, a school, a government agency, or an individual."

They stress the fact that the objective of your enterprise should be the first and foremost issue. To follow on that is the objective of the web site. The web site should thus coordinate with the activities and goals of the enterprise.

2.7 Building blocks

2.7.1 Text

"More than any other element, body text can whisper or shout, look old or new, relax the reader, startle the reader, or send the reader away after two paragraphs, never to return..."
(Misanchuk, 1992:137)

"Typeface may be the single most important decision of your entire publication... and it can make or break your design."
(Lichty 1989:25)

According to Vaughan (1998:181) text is still one of the most powerful components of communication. Advertising companies and media wizards can change the meaning of a sentence into a single powerful logo or tagline. Multimedia authors blend a variety of components and add text to create integrated tools and interfaces for displaying messages on computers.

To create the correct atmosphere and feel to a specific text or screen, it is of utmost importance to use the appropriate word. According to this principle, the design of labels for title screens menus and buttons need using words with power to express.

Vaughan (1998:184) advises to rather use text for titles, headlines, menus, navigation and content than sound or other building blocks. It is tiring to listen to a sound or spoken voice to get where you want to be.

A balance of the amount of text on a page is equally important. Too little text on a page results in much more page turning and can annoy the learner. On the other hand, too much text on a page is restless, overcrowded and unpleasant. (Vaughan, 1998:186)

2.7.2 Text attributes

♦ Fonts and Faces

According to Vaughan (1998:182) and Schwier & Misanchuk (1993:239) a group of graphic characters is known as a typeface and the moment they appear in the same size and style, it is known as a font. Font styles include boldface and italic. Underlining and outlining can be added by the software of your computer.

♦ Print size

When using a substantial amount of text on screen, a small size of font makes sense as long as it is legible. Vaughan stresses that some fonts may actually look to busy in small size (9-point size) and it tires the readers eyes. Opposed to small body text, a larger font for titles and headlines can look elegant and catches the eye to get the specific message across more efficiently.

Schwier & Misanchuk (1993) state that the font size is partly affected by the screen definition and with a higher definition, a small font can be read much easier. They emphasise however, that a smaller font than 12 points should only be used in highly necessary situations.

Misanchuk (1992:128) agrees that a 9-12 point font is suitable for the body text, while anything bigger than that is appropriate for display, which includes headings, titles etc.

Eventually the print size, which looks well on your screen, is of importance. That may well not be the same as for material printed out on paper. Schwier & Misanchuk (1993:240) add that the main issue is that reading must be comfortable and a 14-point text seems to suit most people's preference.

♦ Type styles

Schwier & Misanchuk (1993:241) found that the use of unusual type styles should be strictly limited and only used when it can serve a specific purpose e.g. technical terminology, titles of books, periodicals and films.

The use of *Italics* merely for emphasis or for foreign words is not accepted. This originates from the fact that research has shown that it appears harder to read on paper and Schwier & Misanchuk (1993:242) adopted this finding to the use on CRT text as well.

Misanchuk (1992:128) adds that a decorative typeface can be used for an eye-catching effect, as long as it is used in very limited amounts, if at all in instructional materials.

Bold type is a good way of emphasising, providing it is used in moderation so that it can still be unusual and effective. (Misanchuk, 1992:242)

♦ Cases

According to Vaughan (1998:184) a mixture of upper- and lowercase words and sentences are easier to read than all in uppercase. If the lower-case letters have true descenders, the reading is definitely more comfortable. (Isaacs, 1987; Misanchuk 1993)

♦ Serif and Sans Serif

These terms refer to the type's mechanical and historical properties. It is the easiest way to categorise a typeface. It either has a little flag at the end of a letter stroke (serif) or it does not (sans serif).

According to Vaughan, the use of sans serif is far more attractive and legible on screen than serif font. The opposite is true for the print world. The reason for this assumption is purely because of the difference between the world of standard in computers and of printers. The research has also shown that user preference may include other things than just legibility, but there is enough discrepancy between the findings of print-based and CTR-based text to accept the generalizability of print-based research to CRT-based text. (Schwier & Misanchuck, 1993:241; Garner 1991;Vaughan, 1998:185)

Other authors have found that there is no final finding about the use of either serif or sans serif for better legibility. (Misanchuk, 1992:141; Lang, 1987:167; Tinker, 1963; White, 1983:58)

Serif font is widely recommended by some authors for the body text and sans serif for headings and other special uses. (Misanchuk, 1992:130)

Smaller size sans serif is however more legible than serifs. Thus the reason to believe that sans serif is a better choice for short bodies of text e.g. reference works etc. (Misanchuk, 1992; Collier & Cotton, 1989)

The important aspect in the end is still that typography gives a page a certain personality and an overall feeling.

Text, which is **"pleasant to look at"**, may have positive transfer to learning even if it is minimal in measuring. As long as **"the pleasant to look at"** does not hamper the learning, it would be a good idea to consider the learner's preference. (Misanschuk, 1992:14)

According to Schwier & Misanchuck (1993) there should be no more than two font types used on a single screen display. Style variation may however be applied through using **bold,** *Italics* etc. to create the necessary differentiation.

Suggestions and reasons for a suitable font according to Vaughan (1998) are set out in Table 2.5.

Table 2.7   Suggestions for a suitable font

Suggestion	Reason for suggestion
Small font	Most legible available
Different faces	As few as possible Vary weight and size e.g. italics/bold
Text blocks	Adjust leading for best line spacing
Vary the size of a font	Emphasise the importance of a message
Large size headlines	Adjust the spacing between letters
To make the type stand out	♦ Use different colours ♦ Various backgrounds ♦ Use reverse type
Anti-aliased text	To blend titles and headlines with background
Centered type in a text block	Keep to minimum lines
Drop shadows	Much more legible and greater impact
Headlines	Surround with lots of white space
Pick the right font	♦ The font that works for you ♦ The one which gets your message across

2.7.3   Screen grids

A concept transferred from designing on paper to the design on screen. Although invisible, Schwier & Misanchuck (1993:232) believe that it organises each display and establish certain areas of the screen for certain kinds of information. That is why the orientation, the navigation information, the instructions, the learner responses, the feedback and the error messages, and all other options should always appear in a consistent manner. The main function of the screen grid is to keep the user clearly navigated and without confusion.

2.7.4   Line length

Conflicting advice for print materials as to what the ideal line length should be varies between 35-75 characters. Research however, has shown that readers tend to dislike long as well as to short line lengths.

In computer-based instruction, authorities such as Bork (1984) and Heines (1984) recommend short lines. They also note that a CRT's width doesn't necessarily mean that the line length correspond to the full width.
In general longer lines are preferred to very short lines with 26 characters (Grabinger, 1985). Garner (1991:234) advises lines of 40-60 characters or double columns of 30-35 characters.

Not enough research has been done about this issue and Hannafin and Hooper (1989) state that text is read more efficiently when presented in a dense manner.

2.7.5   Colour combinations

Schwier & Misanchuk (1993:244) found that it is not safe to assume that colours are seen the same by all users of a CBI program, while users are exposed to a wide variety of colour representations on different colour monitors. It is thus better to go without colour unless there is a good reason to use colour.

Research up to 1991 concluded that all colours are superior to monochrome materials for emphasis and cueing. (Schwier & Misanchuk, 1993; Berry, 1991)

Colour should not become over-used and confuse learners instead of cueing them. (Glynn, Britton & Tillman, 1985; Schwier & Misanchuk, 1993)

To conclude, Schwier & Misanchuk (1993:244) state that the attractive colour display is due to the reduction of saturation (intensity) and the restriction of the number of colours (hues) used. Thus the use of pastels can be friendlier to the eye than the default colours provided. Using the same basic colour in different shades can also result in attractive colour displays.

Shneiderman (1998:398) adds that colour has powerful attractions and it is wise to keep to a set of guide lines to create a effective interface:

- ◆ Use colour conservatively.
- ◆ Limit the number of colour.
- ◆ Recognise the power of colour as coding technique.

♦ See that colour coding needs minimal user effort.

With a background texture and/or colour, Wilson (1996) assures that an attention-grabbing effect will be enhanced. Plain gray is the entry-level colour scheme and all browsers can display it but advisable. With the right code the background can easily be changed to any colour and the text can then be the contrasting colour.

Textured and coloured backgrounds are a common use on the web nowadays. It can however make the site pretty and something special when applied correctly. As soon as it affects the readability of the text, it should be excluded and plain white can be a better option.
(Wilson, 1996).

2.7.6 Images, graphics and animation

Research by Schwier & Misanchuk (1993:246) has indicated that graphics can add substantially to learning from text. Schwier & Misanchuk stress the fact that the graphic must still support the message of the text. Graphics used for the mere reason of decoration only distracts the learner's attention from the communication.

Hannafin and Hooper (1989:157) are of the opinion that the use of graphics should be avoided unless high redundancy exists between the information

Graphic elements like lines, icons and boxes should only be used to organise text presentation, (Schwier & Misanchuk, 1993:247).

Phillips (1997:107) states that the content and the look and feel of the web site should co-ordinate. This implicates that specific ideas should be consistent, e.g. colours scheme, the style of illustrations and the ideas for animation. The **"index"** or **"home page"** needs a graphic to look inviting. Think about it as the sign over your storefront that beckons your customer inside. Wilson (1996) is of the opinion that no graphics, is the easy way out but definitely to dull. When applying clip art, he stresses that one must make sure that the images used are copyright free and then convert it to a GIF image because of the smaller size compared to JPEG.

JPEG compresses better and thus more suitable for photograph graphics and it has a shorter loading time.

Wilson (1996) advises to utilize a scanned-in graphic when the logo is already available. Even this should then be converted to a GIF image. GIF works best when used with other images created in a graphics program.

Tips for successful graphics:

♦ Try to keep your images under 40K, or your customer may lose interest.
♦ Not all your viewers have 256-color capability, but only 16 colours. Test the graphics with 16 colours.
♦ The best combination is a single sparkling graphic combined with text.
♦ The overall look of your **"home page"** needs to be graphically balanced, pleasing, informative.
♦ The **"index"** or **"home page"** needs to entice the customer in the door to look at the rest of what you have to offer.

Sachs and Stair (1997:25) state that it is better to use GIF images because all graphic browsers can read them.

According to Wilson (1996) a small graphic at the top of each page helps to unify the web pages. It is also acceptable to use a smaller version of the main **"index page"** graphic.

Wilson (1996) and Sachs & Stair (1997:27), suggest that thumbnail images are a useful application to test the interest of the reader. The image size is a relevant information and the reader can decide whether he wants to open the image or not.

2.7.7   Buttons

As these represent areas on the screen, which should constitute a response and cause a certain action when clicked upon with the mouse, it is important that these buttons work effectively. The placement of the buttons needs careful planning. (Schwier & Misanchuk, 1993: 253)

Bullets are available as an HTML option to set of lists. Coloured balls arrows and pointers can be applied, but it should be used appropriately. (Wilson 1996)

2.8   Summary of Review

The review is focussed on the use of the computer as a communication tool. The researcher differentiates between communication with students, lecturers, and other design principles. The different facilities available through the Internet and the World Wide Web are discussed e.g. e-mail, a bulletin board and a listserv.

The collection of information from all over the world is made possible through the rapid development of technology. This thought brings the researcher to the issue of the WWW, the relevant search tools for specific information searches and the aspects related to the Internet.

All of the above aspects are considered in the development of the web site. Relevant building blocks and the applicable design principles should lead to an effective product. The final product should therefore accommodate all the needs of the target population, ensure a safe learning environment and add value to the educational institution.