

CHAPTER 1

INTRODUCTION AND BACKGROUND

This thesis reports on a study that investigated the suitability of a multimedia resource in the teaching of histology. Many of the Medical University of Southern Africa (MEDUNSA) learners come from disadvantaged communities. The schools in these communities often have teachers that are under qualified and limited facilities. Many learners also have to attend school in their second language. These factors prevent learners from fulfilling their true potential at school. At MEDUNSA learners with a Swedish rating scale (SRS) value of 10 are allowed into the MBChB class. This means that a learner with a D for mathematics and a D for science is given a chance to study medicine. Few, if any, other university in South Africa would allow learners like this to study medicine. The results from this study will determine if learners like we have at MEDUNSA can be taught effectively using a special developed multimedia resource. The study will also determine to what extent multimedia can be used to improve or replace aspects of the old histology course for second year medical and dental learners.

Many teachers have used the new technology which has emerged over the last years to develop teaching material. I soon also realized that the new technology could be used to great advantage in the teaching of histology which relies heavily on two dimensional images and drawings to explain the morphology of tissues and cells. A computer screen is highly suitable for displaying these graphics.

E-learning in the field of medicine is rare. The emphasis, in most medical disciplines, is on practical work. At MEDUNSA the only E-learning course is a post graduate course in Public health.

The utilization of new technology in teaching at MEDUNSA is limited to a few lecturers lecturing with the aid of a notebook computer and a data projector. Most lecturers are not interested in, or are ignorant or sceptical about the possibilities of new technology in teaching.

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Much has been done by teachers world wide to support the teaching of histology with computers. There is no doubt that new technology should be used to teach histology to our learners so the question arises: What would be the most efficient and also the most acceptable way to utilise new technology in the teaching of histology for the type of learner that we have at MEDUNSA.

Before the implementation of a new way of teaching could be contemplated, the traditional way of teaching should be investigated to see whether there are shortcomings and also to see if any of the traditional ways are effective and should therefore be retained. The traditional way of presenting a histology course includes lectures and practicals where a microscope is used. A textbook is prescribed and notes are supplied.

For this study developmental research was done. The study can be divided into a developmental section and a research section. For the developmental section multimedia teaching material were developed consisting of a video and multimedia computer presentations. For the research section two instruments were used to gather information on the traditional course and the use of the multimedia material that was developed. Many aspects relating to the development and use of multimedia were investigated. Issues like the learner's perceptions of multimedia, lectures and practicals and the video were investigated. The study will also indicate how *PowerPoint* can be used as an authoring tool to create standalone computer presentations for the teaching of histology.

This study was conducted in four parts. Firstly a literature study was conducted to determine what information was available regarding the development and use of multimedia. Secondly the multimedia computer programs were developed and implemented as they were completed. Thirdly information was gathered through a questionnaire and by drawing learner's records. From this the relationships between selection criteria, the use of multimedia and performance could be investigated, statistically analysed and written up.

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The dental and medical courses at MEDUNSA are changing into outcome-based courses. This is in line with what is happening throughout South African medical schools. The dental course changed in the beginning of 2003 and the medical course will change with effect from 2004.

The results of this research will be used to determine how and if E-learning could be incorporated into the new course. Possible changes include changing the histology course into a full E-learning course or partial E-learning partial conventional course. The status and future use of the microscope in histology teaching will also be evaluated.

Vaughan (1998) defines multimedia as:

“Any combination of text, graphic art, sound, animations and video delivered to you by computer or other electronic means”.

The thesis will be divided into five chapters, namely:

Chapter 1: Introduction and background;

Chapter 2: Literature survey;

Chapter 3: Development and collection of data;

Chapter 4: Results;

Chapter 5: Discussion and recommendations.

The structure of this, and all the subsequent chapters, will be presented graphically by way of a matrix. The main headings are numbered while the subsequent headings are bulleted. The headings are in colour boxes. The colour of the box corresponds with the colours of the matrix in the beginning of the chapter. The matrix for this chapter is divided into three columns. In the first column are the two main topics of the chapter, namely the background of the project and a description of the project. Under background, there is a description of the subject, information on how the course is

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presented, how tests and exams are conducted, the learners that are taught at MEDUNSA and a discussion of what we want to achieve by changing the histology course. Under the project, the history of the project, what the literature says about the project, what the practical and academic limitations of the project are, the value of the research, what makes this study unique, and lastly the two types of questions, developmental and research questions are dealt with.

Table 1.1: Layout of Chapter 1

Background	Histology	
	How is histology taught?	
	Histology tests and exams	
	The learners at MEDUNSA	
	What problems do we want to solve by changing the histology course?	
The project	History of the project	
	Literature on similar projects	
	Value of the research	
	What makes this study unique	
	Limitations and boundaries of the project	Practical limitations
		Research limitations
	Myths surrounding multimedia and computer based learning	
The Questions	Developmental questions	
	Research question	

1.1 Background

In this section the significance of histology and what the subject is about will be explained. The way in which histology is currently taught, the way in which tests and exams are conducted, the type of learner we are teaching and what we hope to achieve with this project will be explained in this chapter.

1.1.2 Histology

The second year Bachelor of Medicine and Surgery (MBCbB) and Bachelor of Dental Science (BDS) courses include anatomy as a subject. Anatomy is subdivided into gross anatomy, neuroanatomy, embryology and histology. A third of the anatomy time and marks are allocated to histology.

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Histology is a subject that deals with the cells and tissues of the human body. It encompasses terminology, descriptions of morphology, pictures and drawings that have to be memorized. Histology only deals with a few processes like tooth and bone development which are of a higher cognitive order.

In histology cross sections through tissues and cells are studied by examining microscope slides and electron micrographs. The surface of cells or tissues is studied by examining scanning electron micrographs. All three - micrographs, electron, micrographs and scanning-electron micrographs are in the form of two-dimensional images. These modes of studying make it very difficult for the learner to compile a clear picture of exactly what the tissue or cells look like in three dimensions, therefore drawings are used extensively in histology to explain the morphology, especially the three dimensional morphology of cells and tissues. Physiology deals mainly with the functions of the tissues and cells. To understand the function of tissues and cells one has to understand the morphology.

1.1.2 How is histology taught?

The traditional way of presenting histology is in the form of lectures and practicals. The lectures are given using overhead transparencies and photographic slides. The transparencies are used to display drawings and text. The photographic slides are photographs (called micrographs) of cross sections through tissues and cells.

The histology lectures at MEDUNSA are not compulsory, since the lecture hall that is used for histology lectures can take only 300 learners and there are 345 learners in the class. During the histology lectures that were presented as part of this study the hall was never full. A large number of learners did not attend the lectures that were part of this study. Another habit that many learners have is to leave the lecture before the end. Many learners also tend not to pay attention in class, and one is often aware of learners taking a nap.

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During the lectures there is very little interaction between the lecturer and the learners. This may be due to the fact that few learners have the confidence to stand up in front of a large class and ask a question. The time allocated for each histology lecture is one and a half hours. Most of the lectures that formed part of this study were completed within an hour.

During practical sessions learners view microscope slides (cross sections through tissues) under a light microscope. Certain cells and tissues then have to be identified. This is done with the help of a histology atlas and presentations that are shown to them on overhead monitors.

Five years ago I started to display images on overhead monitors. Using this method the teacher is sure that the learner sees a good example of a specific tissue and that the correct structures are seen and identified by the learners.

A histology textbook is prescribed. For the purpose of this study a three hour video covering the practical aspects of histology was developed as well as multimedia computer presentations covering some of the topics of the course.

1.1.3 Histology tests and exams

At the end of each block a test is conducted. The test consists of a practical and theoretical section. The written section of the test counts out of 150 with 50 marks allocated for histology. The practical histology test consists of a first test out of 30 marks and a second test out of 40 marks.

Second year medical and dental learners do not have to qualify for the exam. Learners automatically qualify for the exam when they register. Neither lectures nor tests are compulsory. During the study the year mark that a learner obtained was only considered when it was to the learner's benefit. Learners could get exemption if they passed all their tests and got a year mark of 60%.

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These rules changed in 2001. In future the year mark that a learner accumulates will either secure exemption if it is above 60% and no tests were failed or it will count 60% towards his or her final mark with the exam mark making up the rest.

1.1.4 The learners at MEDUNSA

MEDUNSA learners are mainly black. A quota system is used for admitting learners into the medical class. Black learners make up 77% of the selected learners, Indian learners 3%, white learners 11%, brown learners 8% and others (foreigners) 1%. The Swedish rating scale (SRS) system for the selection of learners is used at MEDUNSA. Only mathematics and physical science marks are taken into account.

Table 1.2: Swedish rating system

SRS system	
Distinction	8
B symbol	7
C symbol	6
D symbol	5

Additional credits are also given for passed subjects from other courses and for degrees obtained. The lowest rating on which a learner will be admitted directly into the MBChB course after metric is 10. Learners with lower SRS ratings are also allowed but only if they have additional credits.

1.1.5 What problems do we want to solve by changing the histology course?

Traditionally histology used to teach learners to use the microscope and to identify normal tissues so that they would be able to diagnose pathology with the aid of a microscope in their third year. However anatomical pathology has changed to a more

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macroscopically orientated course including very little or no microscopy. It is therefore no longer necessary for second year histology learners to do a thorough course in the use of the microscope.

Micrographs and electron micrographs viewed on a computer screen look exactly the same as when viewed under a light or electron microscope. This makes the computer ideally suited as a teaching tool for histology. This teaching tool should therefore be investigated and utilized to the fullest.

A number of learners are admitted late every year because of administrative problems. These learners start their course when a number of lectures and practicals have already been completed. Most of these learners have problems catching up. Allowing learners to register and start a course late places a responsibility on the university to help learners to catch up the work that they have missed. Providing the learners with multimedia study material may be a way of dealing with this problem.

Admitting learners with poor academic backgrounds also places a responsibility on the university to help learners to adapt to the high standard expected at a university. Providing multimedia resources that are designed to address learner's needs may help to achieve this.

The anatomy course for medical learners is changing to an outcome-based course in 2004. It has already been implemented for the BDS (Bachelor of Dental Science) learners in 2003. In addition, many anatomy departments in South Africa have already changed to outcome-based courses. This means a reduced number of contact hours for lectures as well as for practicals. The amount of information conveyed to the learners will therefore have to be reduced unless a way is found to convey the information outside of formal lecture or practical time. Multimedia computer presentations and videos supported by a website containing additional information as well as assignments could be the solution. Using this way of teaching could make it possible to maintain the standard of the course in spite of the reduced allocated time. Learners could do much of

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the course in their own time. The practical could be replaced by a tutorial presentation during which the best possible slides are shown to the learners instead of a learner sitting at a microscope wasting time looking for structures that may not even be on the slide. E-learning would not only give learners an opportunity to catch up missed lectures but also make it possible to revise lectures that were attended months ago.

A multimedia course that could replace the lectures and practicals or some lectures and practicals would take a huge burden off the teaching staff and may even bring about a saving in personnel. An E-learning course in histology does not have to be attended at the university but could be studied anywhere as long as the right hardware is available. Learners with concentration problems could go through the work at their own pace, repeating sections not well understood and take a break whenever they lost concentration. The lecture time could then be used for the higher level cognitive sections of the course. For an E-learning course to be acceptable it does not have to be better, although better is preferred, but simply needs to be just as good or the same as the traditional way of teaching histology.

1.2 The project

The topics in this section begin with the history of the project. The value of the research is discussed as well as the limitations and boundaries of the project. The latter is subdivided into practical and academic limitations. The reasons that make this study unique and lastly the developmental and research questions are also discussed.

1.2.1 History of the project

Over the years certain problems regarding the histology practicals have existed but have not been addressed.

The following problems occur when doing histology practicals in the traditional way using a light microscope, microscope slides and a histology atlas.

- The microscope slides available to the learners are not all equally good.

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- We only have a few examples of some of the slides like *olfactory epithelium* and the *pineal gland*.
- Of some of the other microscope sides we only have a few good examples like the *developing tooth*.
- Learners often waste a lot of time trying to find structures, which may even be absent in a specific slide.
- Learners often identify structures incorrectly without their or the lecturer's awareness.
- Theory and practicals are often dealt with as two separate subjects whereas the practical is supposed to support the theory.

Over the years the number of learners admitted to the MBChB course has steadily been increased. The increased numbers has meant that the number of practicals had to be increased because the histology laboratory where the practicals are done only has 110 microscopes. Currently we have to repeat the same practical four times to accommodate all the learners.

Much of the learning material in histology consists of facts that learners have to memorize. Because of this, lectures can easily change into sessions where the lecturer stands in front of the class and disseminates facts. Learners may feel that in stead of attending a lecture where the lecturer quotes facts from the textbook, they can read the textbook in their own time. Thus many learners do not attend lectures or leave lectures before the end.

Outcome-based histology will however have to demonstrate the clinical relevance of histology to link the histology to the clinical subjects taught in the dental or medical courses. At other institutions that have changed to outcome-based courses in anatomy, the contact hours for histology have been drastically reduced.

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To solve the problem of having to repeat the same practical four times, I started to videotape the microscope slides and the commentary that were shown on the overhead monitors during the first practical; this ensured that the practical was presented in exactly the same way to the 2nd, 3rd and 4th groups. In this way learners are all exposed to the best examples the lecturer could find. Slides of which only one or a few examples exist could be included. This has ensured that learners know exactly what they are looking at.

Because of requests from learners, these videos were put together on videotape and made available to them. However the way in which these videos were made resulted in a very unprofessional product, and the need arose to produce something more professional.

When the first 486 PC came out with the ability to display pictures and to play sound, the potential of this device as a teaching tool was immediately clear. When *Visual Dbase* came out with the ability to display graphics and to play sound I started to experiment with this program because I had experience in programming in *Dbase*. In *Visual Dbase* a database could be opened with sound and graphic (bitmap) files in it. These files could then be displayed in a form. On a 100Mhz Pentium computer this was a very slow process and became ever slower as more files were added to the database. Writing a program that displayed forms one after the other solved this problem. Each form displayed a number of text files, a graphic file and played a sound file. Making these forms was a very time consuming process. Arrows had to be put into the pictures permanently by using a graphics-editing program.

These programs were first compiled to help the learners during the practicals, replacing the videos that were originally made. The programs were shown to learners on overhead monitors during the practicals. A video converter was used to change the Super VGA signal into a video signal.

I also started to compile tests in the same way. The test consisted of a graphic image on part of the screen, a question on something in the image and five or six multiple choice

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answers from which to choose one. The test was answered on a multiple choice question (MCQ) form.

With the use of the video converter the signal could also be videotaped. The new presentations were then modified and video taped and made available to the learners, replacing the earlier made videos that were made directly from the video camera. Making videos in this way was a big improvement from making them directly from the video camera. When a video is made from a video camera and something needs to be changed the whole video has to be redone, otherwise one ends up with supplying a third generation video tape to the learners. If one makes the video from a computer, one can edit the presentation and simply copy the whole presentation again onto a master tape from which second-generation copies can be made for use by the learners.

The next step forward occurred when I was introduced to *PowerPoint*. *PowerPoint* could do everything that my own *Visual Dbase* program could do and more. Everything became much easier. Removable and changeable arrows and other indicators could be used. I started to remake all my presentations and MCQ practical tests in *PowerPoint*. The ideal situation would have been to make the presentations available on CD for the learners but because so few learners have access to computers the presentations were video taped as a master copy. Second generation copies were made from the master copy and made available to the learners. Videotapes were also placed in the library where there are facilities for watching videos.

Before tests and exams learners used to request to do revision using the microscopes. This could only be allowed with supervision, because microscopes had been stolen in the past during revision sessions without supervision. When the videotapes became available to the learners there were no more requests for using the histology laboratory for revision purposes.

When video taping slide shows from a computer there is a noticeable loss of graphic quality due to the reduced number of lines on a television monitor. The use of text on a

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video is limited to large fonts only. The interactivity is also limited to rewinding and fast forwarding. Presentations on a computer screen are much better than video due to the higher resolution of the super VGA screen and the fact that one can navigate through the program and the computer can react to learner's answers in response to questions.

1.2.2 Literature on similar projects

The literature reports on a number of studies done on computers in the teaching of histology. Mars and McLean (1996) developed a program and tested it on learners. Moga (S.A., Online) suggested that electronic means can be used to make more images available to learners. Richards et al (2000) found that learners would prefer a multimedia approach to histology. According to Meyer (1999), computers enhance the effectiveness of teaching and learning histology and can make the microscope obsolete. David A Begg from the University of Alberta (S.A., Online) anticipate that computers will reduce the cost of teaching histology and can make it possible to change histology in a distance learning program.

A new development in the teaching of histology is the virtual microscope where numerous micrographs are taken of a histology slide and compiled into a montage. The individual micrographs are then linked to the montage through a zoom in function. According to the Microbrightfield company (S.A., Online), this invention can replace the microscope as a teaching tool.

1.2.3 Value of the research

This study may prove useful in convincing the university to invest in facilities, convincing lecturers to develop teaching material like multimedia computer programs and videos and helping to decide whether we should retain the microscopes in the new computer centre.

According to the policies of the department of health, 80% of medical learners in South Africa will in future be from disadvantaged communities. This would mean that other universities with high selection criteria will be forced to admit more learners with poorer

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academic backgrounds. Universities are adopting more progressive recruitment strategies admitting learners on other criteria rather than school performance, admitting many under prepared learners (Multimedia Research Group, University of Natal Durban, S.A., Online). If a resource exists that is an effective tool for teaching disadvantaged learners, other universities that are also allowing disadvantaged learners into their programs can make use of this resource.

There is much pressure on Afrikaans universities to present courses like medicine in Afrikaans and in English, placing a burden on lecturers to give the same lecture twice. To prevent this, some universities have started to make use of interpreters to translate lectures while in progress. Multimedia programs can be presented to a learner in his or her language of preference.

1.2.4 What makes this study unique?

Previous studies dealt with learner perceptions and whether they prefer computer-based learning or not. This study investigates various aspects of teaching in histology. A large section of the course (just more than 40% of the lectures) was made available to the learners as multimedia computer presentations. Revision of all the practical work was made available as a video. This study not only investigates the possibility of changing the histology course into a multimedia course but also looks at the traditional way of teaching and testing histology. Learner profiles are compared to the different perceptions and also to the test results. Learner perceptions and learner likes and dislikes were investigated.

1.2.5 Limitations and boundaries of the project

A number of limitations were experienced in this project. These limitations could be divided into practical and research limitations. Practical limitations are limitations that limited the development, implementation and use of the multimedia and the information gathered by the instruments. Research limitations limit the accuracy and interpretation of the findings.

1.2.5.1 Practical limitations

The biggest practical limitation was the fact that not enough facilities existed to allow all the learners to use the multimedia computer presentations. This included facilities at MEDUNSA as well as facilities at home. Only 15 computers could be assigned for this project. The multimedia computer presentations were also available on the computers at MEDUNSA's computer centre but most of these computers did not have sound cards and to obtain a booking on one of them was difficult. Learners also had to pay to use these computers. The lack of facilities also prevented learners from using the multimedia computer presentations as much as they would have preferred to do. Not many learners (19% of respondents) had computers at home.

The multimedia computer presentations could also not be made as the author would have liked them to be. The only program available was *PowerPoint* which is not the ideal authoring program for a task like this. The limitations of *PowerPoint* also limited the features of the multimedia computer presentations. It was however felt that *PowerPoint* was good enough for a project like this as this was a study testing the possibilities of multimedia and not a final product for commercial distribution.

Another limitation was that no artist was available to make the many drawings that were used in the presentations, thus scanned images from books had to be used in many instances. The sound was also not nearly as good as I would have liked it to be as no proper sound studio was available for the development of the multimedia. *Windows'* sound recorder was used for the sound recordings.

1.2.5.2 Research limitations

This project was not additional, but was conducted as part of the academic program. Learners that volunteered were given permission to use the multimedia instead of attending classes and practicals. Because the project covered almost half the histology course there was no time to repeat any topic if the multimedia turned out to be unsatisfactory. Therefore the learners could not be forced to use the multimedia only as this could be used as an excuse if they did not do well in the test. Learners that used the

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multimedia could still attend classes and practicals. Learners could also not be prevented from using the multimedia as this could be seen as preventing them from improving their chances to do well in the test.

The questionnaire also had some limitations. Because the names of the respondents were required to link the responses of the questionnaire with the records, learners may not have been honest when answering some of the questions for fear of victimization (for example the rating of the lectures' questions). Many learners did not give their names. This prevented many responses from being linked to the records.

The tests that were written were not compulsory; therefore some learners may not have taken the tests as seriously as they should have.

The fact that no interviews were conducted with the learners may be viewed as a limitation but it was felt that sufficient evidence was gathered by the questionnaire. Some of the information would have been difficult and inaccurate had it been acquired from the learners during an interview. Learners may not have been honest in an interview when asked how they rate the lecturer or how they rate the multimedia.

The study was conducted at a single university, MEDUNSA with a unique student body. If the same study was conducted at another university with different learners, the results may have been different. Repeating the study with a different group of learners at a later stage may also give different results because every new group of learners that arrives at university differs from the previous group. More and more of the learners that arrive at university are computer literate. In each new group there are more learners that have used a computer as a study aid.

The findings of this study are all my interpretations. Another researcher may have interpreted the same information differently.

1.2.6 The myths surrounding multimedia and computer based learning.

Before the development could start a number of issues had to be clarified. Many claims are made regarding the value of multimedia and computer-based learning. The first issue that was investigated was “What are the myths surrounding multimedia and computer- based learning?”

1.2.7 The questions

The literature was reviewed for answers to the questions asked in this study. Obviously, answers to all the questions were not found in the literature. Some of the questions asked in this study will be answered by either the literature or the field study or by both. This is a study in developmental research and can therefore be divided into a developmental section and a research section. A set of questions were compiled for each section.

1.2.7.1 Developmental questions

The developmental questions deal with the development of the multimedia, namely the video and the computer presentations as well as with the development of the tests. The first two questions are about the value of multimedia, namely: “What are the advantages and disadvantages of multimedia in learning?”

When multimedia is used for learning purposes, pedagogical issues should be taken into consideration during development. What these issues are is the next question. The pedagogical considerations comprise constructivism, learning objectives and evaluation of the learners and the multimedia.

The next three questions deal with how multimedia should be delivered, designed and implemented. The question on delivery deals with the best format to deliver the multimedia in, looking at specific circumstances. The question on the design of multimedia looks into issues like the interface and the components of the interface such

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as images, text, colours and sound. Implementation looks at how the multimedia is made available to the learners.

The last developmental question is what the issues around tests are? The answer to this question will indicate how tests in this field are conducted.

1.2.7.2 Research questions

The research questions are divided into three main questions. The first question deals with the two instruments that were used (questionnaire and the records), the second question is: "What is the profile of a MEDUNSA learner?" The third question asks: "How should an E-learning course in histology be presented?"

The first consideration of the first main question deals with how a questionnaire should be designed, what the purpose of the questionnaire is, what types of questions can be asked in a questionnaire and what the arrangement of the questions should be. The answers to these questions will help to draw up the questionnaire. The last consideration is what the motivation for each question is.

The first question that was asked in the questionnaire was about the learner's subject preferences. The questionnaire enquired about what subsection of anatomy the learners prefer and why. The hypothesis is that learners do not like histology. The study will test this hypothesis.

The next question is about facilities. Questions are asked about video and computer facilities that learners have at home and whether they can afford a computer. These answers will also give insight into the financial situation of our learners.

A number of questions are asked about learning. The questions on learning are divided into tutored learning, self learning, favourite ways of studying and how learners would like their course.

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Under tutored learning the learners were first asked to rate the lectures. Secondly, a number of questions were asked about lectures, namely: why do learners not attend lectures, why do learners leave a lecture, do learners concentrate during lectures, are there too many lectures, are certain lectures more important than other lectures and which is the best way, from a learner's perspective, of presenting a lecture.

Another way of tutored learning is to attend practicals. Learners were asked why they did not attend practicals or left practicals.

The questions on self learning deal with the prescribed book, the internet, multimedia computer presentations and the video. The first four questions query the extent to which the four ways of self study were used. The following questions deal with the different issues concerning the multimedia computer presentations, namely: why they were not used, why learners used only some of the presentations, how much time learners spent using the presentations, whether the presentations were enjoyable to use, whether learners spent more time on histology because of the presentations, and whether learners helped one another when they encountered problems with the presentations. Respondents were also asked to evaluate the interface and if they found any technical problems or navigational errors. Questions were also asked on the perceptions that learners have about the multimedia computer presentations, namely: do respondents feel that the multimedia computer presentations improve recollection, do learners feel that their marks improved because of the presentations, is a computer presentation better than a lecture and did the presentations change the learners' attitude towards histology.

The questions on the video included a question on the number of times the learner watched the video as well as a question on the problems, if any, the learner encountered with the video.

A question was also asked about the learner's favourite way of studying histology.

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An important section of the questionnaire deals with the question on how learners would like their histology course to be structured. In this section the learners were asked whether they think multimedia can replace the traditional course and replace the microscope. Learners were also asked if they prefer watching the video or using the multimedia computer presentations.

Regarding tests, the learners were asked whether they feel that they will do well in histology if they work hard.

From the responses the following two questions, namely how successful were the multimedia computer presentations and how successful was the video, could be answered.

The research was conducted during the first two anatomy blocks. After each of these blocks tests were written by the learners. The last questions are: how did the learners perform in the tests and are there any relationships between the marks obtained and other parameters like selection criteria, the use of the multimedia computer presentations, the number of times the respondent watched the video and whether the respondent favours histology.

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Table 1.3: Issues investigated

Summary of the issues investigated.	
D E V E L O P M E N T	Advantages of computer- based learning
	Disadvantages of computer-based learning
	Pedagogical considerations
	Delivering multimedia
	Designing multimedia
	Implementation of multimedia
	Issues surrounding tests
R E S E A R C H	Subject preferences of learners
	Facilities at Medunsa
	Issues regarding lectures
	Issues regarding practicals
	Issues regarding video and multimedia computer presentations
	The use of the prescribed book
	Learner suggestions
	Learner profiles
	Suggestions for the presentation of an E-learning course