

SELECTING EDUCATIONAL COMPUTER SOFTWARE
AND EVALUATING ITS USE, WITH
SPECIAL REFERENCE TO
BIOLOGY EDUCATION

by
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ABSTRACT

In the field of Biology there is a reasonable amount of software available for educational use but in the researcher's experience there are few teachers who take the computer into the classroom/laboratory. Teachers will make use of video machines and tape recorders quite happily, but a computer is a piece of apparatus which they are not prepared to use in the classroom/laboratory.

This thesis is an attempt to devise an educational package, consisting of a Selection Form and an Evaluation Form, which can be used by teachers to select and evaluate educational software in the field of Biology. The forms were designed specifically for teachers to use in preparation of a computer lesson. The evaluation package also provides the teacher with a means of identifying whether the lesson has achieved its objectives or not. The teacher may also be provided with feedback about the lesson. The data is gathered by means of a questionnaire which the pupils complete.

It would appear that teachers are uncertain as regards the purchase of software for their subject from the many catalogues that are available. The evaluation package implemented in this research can be regarded as the beginnings of a data base for the accumulation of information to assist teachers with details on which software to select.

Evidence is provided in this thesis for the practical application of the Selection and Evaluation Forms, using Biology software.

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I wish to dedicate this work to my wife Brenda.

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CHAPTER ONETHE EVALUATION OF EDUCATIONAL SOFTWARE1.1. INTRODUCTION

With the introduction of technology into everyday life, it is becoming essential that the use of this technology forms part of the school curriculum.

"Microtechnology has become such an integral part of our everyday lives in both work and leisure, that it is not enough to leave it to a band of dedicated enthusiasts to introduce our children to the important social, political and ethical issues raised by its use and abuse in society. A serious problem, therefore, is that if microtechnology in general, and the microcomputer in particular, are to become as integral part of school life and the curriculum as other tools and resources, then all teachers must become confident and competent users."

(Blease 1986:1)

Blease expresses a concern about the inclusion of microcomputers into the schools and the need for teachers to become computer literate. There is a need for the pupils to be computer literate and it is the duty of teachers to address this matter.

Over the past five to ten years there appears to have been an increase in the number of schools purchasing microcomputers in this country. Thousands of rands have been raised by parent bodies to be spent on equipping school computer rooms.

The absence of the use of computers in the classroom/ laboratory formed one of the underlying concerns of this

research. Even though many schools possess computers in a computer laboratory, the researcher's teaching experience in the Queenstown area is that computers are not being used as common teaching aids in the classroom/laboratory itself. One does, however, find many other forms of modern technology in the classroom/laboratory such as overhead projectors, video machines, and oscilloscopes. It is the experience of the researcher that computers are being used mostly for administrative duties, such as reports and the storing of pupil information rather than being used by teachers in the classroom/laboratory as teaching aids.

1.1.1. BACKGROUND TO THE PROBLEM UNDER INVESTIGATION

The research was not designed to investigate the reasons why there is an absence of computers in the classrooms. There may be reasons for their exclusion from the classrooms, such as the lack of electricity in rural areas, or financial stringency. Many schools cannot afford educational aids such as overhead projectors, tape recorders, and duplicating machines, let alone computers. Computers are seen by many schools to be a luxury which have a low priority status.

Evans discusses the lack of computers in the classroom/laboratory in Britain in 1986.

"In summary, secondary schools have the following problems:

- Change is happening on many fronts
- Teachers feel threatened by the impact of technology on their previously sacrosanct subjects
- Responsibility for the computers in the school has fallen to the computer specialist who is not always familiar with ideas of computers across the curriculum
- Computer use has often been limited to computer studies
- Many schools have tied down their machines to one room - a computer laboratory
- The computer is still an alien element in the classroom."

(Evans 1986:61)

There are likely to have been advances in Britain since 1986 but the researcher's perception is that change in South Africa is less apparent. A significant point for teachers to note is the last point made by Evans. It is the researcher's experience that many teachers are unwilling to introduce computers into the classroom / laboratory. In general it appears that the computer is not seen as a tool to be brought into the classroom/laboratory and used as a powerful teaching aid.

Another important factor when considering the role of the computer in the teaching of Biology is that :-

"Microcomputers should never be allowed to take over biology teaching. Biology is the study of living things, not machines. The microcomputer should be thought of only as an aid and not an all exclusive one."

(Rawlinson 1985 : 150)

A major problem with respect to any form of software in South Africa is the 'buying in the dark' syndrome. Overseas software has to be selected from catalogues which provide

limited information on which to make well considered decisions. Having ordered the software, one is forced to accept it even if it has limited use.

In Britain it is possible to purchase software for BBC computers on an approval basis. If the purchaser wishes to consider purchasing an item of software the school is sent the full package. If the software is approved by the purchaser it is retained and the purchaser is billed for it. If the purchaser is not satisfied the package is expected to be returned undamaged within a specified period of time. It is difficult for some of the software to be copied owing to sophisticated copy detection devices. If it is detected that the software has been copied, the purchaser is billed whether the school wants the software or not. The researcher is unaware of any such system operating in South Africa at present.

Another problem with respect to the software is that of applicability to the South African syllabus. The researcher has encountered very little software that has been written specifically for local needs. This means that software has to be purchased from abroad and then adapted wherever possible.

1.1.2. AIMS OF THE RESEARCH

This research was aimed at:-

- 1) developing an evaluation package to assist teachers to:
 - a) select educational software for Biology by:
 - i) identifying the strengths and weaknesses of the software, and
 - ii) identifying the aims of the software;
 - b) receive feedback from the pupils with respect to the teaching strategies adopted by the teacher in presenting the software;
- 2) making teachers more aware of the intricacies of the software by using the evaluation package mentioned above.

The package consists of a Selection Form and an accompanying Evaluation Form.

An underlying principle for the development of the Selection Form within the Evaluation Package was the fact that all software, even if it is rated as poor educational software, may still have some use. In the hands of some teachers, poor software may still be effective, even if the objectives are limited. If the software can be used to convey one good principle it is worth using provided that it can convey that principle more effectively than the teacher could have done

without using the software. If the software cannot convey the principles of the subject more effectively than the teacher, it would be unwise to utilize the software at all.

Having identified the aims and the strengths and weaknesses of the software, the teacher will be better prepared to present the lesson using the computer. The Evaluation Form provides the teacher with a tool to evaluate his/her teaching strategies in relation to the software. In this respect the pupils are used to provide response data related to the lesson. It is this data that will indicate whether the application of the software was successful or not.

By using both the Selection and the Evaluation Forms the teacher can be provided with information pertaining to a triangular relationship, namely the role of the pupil(s), the role of the teacher, and their interaction with the software in the lesson. With this information, the teacher will be in a better position to continue with the process of incorporating computer software into future lessons. The implications of the triangular relationship will be discussed in Chapter 6.

1.2. RESEARCH METHODOLOGY

The research methodology adopted for the purposes of this research was based on action research (Cohen and Manion :

1989). This type of research was employed because of the nature of the teacher's involvement in the research. In such an instance the teacher ...

"... will feel the need for some kind of change or improvement in teaching, learning or organisation, for example, and will be in a position to translate his ideas into action in his own classroom. He is, as it were, both practitioner and researcher in one and will integrate the practical and theoretical orientations within himself."

(Cohen and Manion 1989 : 220)

Another reason for the use of action research was to provide the teacher-researcher with a means of self evaluation in order to modify his/her own teaching practice. An Evaluation Package for the selection and evaluation of educational software, was developed for the purposes of this research so that the teacher-researcher would be able to evaluate his/her own teaching strategies with respect to the software selected for use in the classroom. It is the intention of the researcher to develop the Evaluation Package further so as to assist teachers to modify their teaching strategies with respect to the use of computers in the laboratory/classroom in an effective way.

"The principle justification for the use of action research in the context of the school is improvement of practice."

(Cohen and Manion 1989 : 224)

Conventional applied science methodology, as described by Cohen and Manion (Cohen and Manion 1989 : 218), is not applicable in such instances because these methods attempt to establish definite relationships with the view to

generalizations and testing of theories. Applied science also adopts a system of establishing controls in order to prove or disprove hypotheses. Action research on the other hand...

"interprets the scientific method much more loosely, chiefly because its focus is a specific problem in a specific setting. The emphasis is not so much on obtaining generalisable scientific knowledge as on precise knowledge for a particular situation and purpose. The conditions imposed on applied research, therefore, are normally relaxed with action research."

(Cohen and Manion 1989 : 218)

One of the advantages of action research in the educational context is that it can lead to self evaluation on the part of the teacher. In so doing the teacher-researcher can obtain valuable feedback about his/her teaching which can assist him/her to modify his/her own teaching strategies to achieve the aims of the lesson. The use of action research can also lead to the teacher-researcher obtaining precise knowledge for a particular situation and purpose (Cohen and Manion 1989 : 218), such as how pupils view the software selected, or how the pupils view the teaching ability of the teacher.

A disadvantage of action research as revealed by Cohen and Manion (1989) is that the teacher-researcher may not be objective in viewing the situation. The teacher-researcher does not attempt to control the variables in the educational context. It is not the aim of action research to establish a control group so that the results are scientifically justifiable. The results of action research are not

generalisable, they are restricted to the environment in which the research was conducted. In this piece of research an independent trialist was used in an attempt to reduce the subjectivity.

1.3. AN OVERVIEW OF THE CHAPTERS

Having established the aims of the research the following ideas will be discussed in the proceeding chapters. Chapter Two is concerned with establishing the theoretical basis for the research. In this chapter the question of the selection and evaluation of software will be discussed in detail. Reference will be made to the development of the Evaluation Package involving the Selection Form and the Evaluation Form, as a tool for the selection and effective use of educational software. Other selection forms will be considered briefly and their advantages and limitations will be discussed. It will be necessary to discuss the role of computers in schools, with special reference to Biology. Associated with computers are the issues relating to Computer Aided Learning, or CAL, and Computer Aided Instruction, or CAI. Although it must be pointed out that the research did not focus specifically on these issues, it is necessary to comment briefly on the implications of these two topics in the research. Reference will be made to the Taylor model (Adams 1988) of tutor, tool, tutee, which will serve as a framework

to discuss matters relating to computers in the classroom/
laboratory.

Chapters Three and Four give a detailed analysis of the Selection and the Evaluation Forms respectively. The forms are discussed extensively with an explanation of the reasons for the inclusion of each sub-section. It must be noted at this point, that the researcher does not view the Evaluation Package which was developed for this research, as being the ultimate package to be used to select and evaluate educational software in Biology. The Selection Form may, however, contain important criteria to be used to identify good educational software. Chapters Three and Four also deal specifically with the ways in which the Selection and Evaluation Forms were designed.

Chapter Five deals with the analysis of a set of results obtained using a program entitled "The Kidney" by Garland Computing Company. A complete set of Selection and Evaluation Forms used with this program will be found in Appendices 4 and 5. This chapter deals specifically with the interpretation of the results. The whole Evaluation Package, as the researcher hopes to demonstrate, will provide the teacher with information pertaining to the software and ways in which the teacher's strategies can be merged with the aims of the software in question. Reference will also be made to the comments by a colleague who trialled the instrument

independently.

Chapter Six deals with the discussion of the results and the role of the participants in the triangular relationship.

The concluding chapter will discuss the implications of the research and the possibilities for further investigations based on this research. The Evaluation Package will be analyzed critically, weighing up the advantages and disadvantages of its use.

CHAPTER TWO
COMPUTERS IN SCHOOLS

2.1. MODES OF USE

The role of the computer in Computer Aided Learning (CAL) and Computer Aided Instruction (CAI) is important to understand. Taylor (Adams 1988) views the role of the computer in three different ways.

Firstly, there is what is termed the 'Tutor Model', where:-

"The computer, programmed by experts, presents subject material to the subject and the student responds. ... The learning process is substantially in the hands of the program developer."

(Adams 1988:1)

Secondly, Taylor identifies a 'Tool Model':-

"... in which the computer has some practical utility in terms of saving time and preserving intellectual energy by transferring of routine tasks to the computer, or enhancing human creative skills."

(Adams 1988:3)

Finally, the 'Tutee Model' is suggested where the 'child teaches the computer' through the aid of a computer language, as in LOGO for example.

It can be argued that there is a place for the computer in the Biology classroom/laboratory, especially when one considers the tutor and tool models proposed by Taylor. The role of the computer as a tutee would be limited in such a field as Biology due to the fact that most of the pupils taking Biology may have little or no inclination to develop

programming skills. The discussion, therefore, will be limited largely to Taylor's tutor and tool models.

In terms of the tutor model most of the software encountered in this research is designed so that the pupils will follow a reasonably predetermined path through the software in order to achieve the objectives. Some software may include questions either at the end of certain stages or at the end of the program in order to test whether the user has achieved the objectives laid down. This type of software may be seen as a constructive teaching aid at the disposal of the teacher. The role of the computer in this model depends largely on the content of the software. The software may either be used in the presentation of a lesson, or to supplement a section of the work that has been taught.

The tool model has a different role to play. There is, for example, software available which can be used to analyze statistical data and present it in a meaningful way. The data that is presented can be displayed in terms of graphs, pie charts, or other mathematical relationships. Such programs as spreadsheets and databases can also be used to interpret data. It must be added that, in a sense, the computer could be used as a tutee in this model as the pupils will have to know how to 'program' the software in order to extract the information needed.

Serfontein explains the use of the terms CAL and CAI as follows:-

"These terms are generally regarded as being synonymous in describing teaching by means of computers. However some authors draw a distinction between them. CAI and CAL are described as follows:-

- Computer-assisted instruction (CAI) means that the instruction of a student in the didactic situation is controlled by the computerized lesson units.
- Computer-assisted learning (CAL) means that the student/pupil controls the didactic situation by implementing the computerized lesson units, learning all the while."
(Serfontein 1980:10)

It is necessary to consider the application of CAI and CAL in the field of Biology as explained by Hall.

"Biology has for far too long been regarded as the second-class science option in many schools. Those not bright enough or motivated enough, ... opt for or are persuaded to take biology ... rather than the so-called 'more difficult' options of physics and chemistry.

The physicists and chemists demand perhaps more than their fair share of laboratory time and biologists are often relegated to classrooms for a considerable portion of their lessons.

Modern biology syllabuses demand an experimental rather than a descriptive approach to the subject but such an approach may require the purchase and use of sophisticated and expensive apparatus. The experiments that can be carried out are limited by the time available and many phenomena are not investigated fully because experimental procedures may be very complicated, because procedures cannot be adequately replicated, because of insufficient control of variables, or because certain experiments involving living organisms conflict with our respect for life.

These problems of time, space, apparatus and skills may seriously restrict the amount of practical work that biologists can carry out in many schools, and

much work is often based on textbooks and note-taking, on diagrams and representations, on secondhand data and limited practical work. Computers can help to alleviate these problems if used correctly."

(Hall 1985:17)

Hall's comments refer to a greater emphasis on an experimental approach to the teaching of Biology as a scientific subject. The present Biology syllabus of the Cape Education Department does not advocate the same level of practical work. Nevertheless, practical work does form an integral component of the final matric examination and therefore needs to be seriously considered when teaching Biology.

The new standard six and seven syllabuses due to be implemented in 1992 and 1993 respectively make special reference to practical work and the handling of apparatus. When considering the use of the computer in the presentation of practical work it is important to remember that there is no substitute for hands-on practical work. The role of the computer should therefore be to supplement those aspects which are difficult or even dangerous to perform. An example of this would be in the use of radioactive isotopes or the synthesis of polypeptide chains. The computer can be used in such cases to enrich the pupil's knowledge and to present the concepts that are involved in the biological process.

Ayerst contributes ideas as to the way in which computers can be utilized in the classroom/laboratory but he spells out a

warning to all Biology teachers first.

"One of the most important things that every biologist must remember is that he is involved in the study of living organisms and their interactions. We must not allow ourselves to be seduced by the mathematicians or computer scientists into believing that the study of computer models are in any way a substitute. If we look at the programs on the market we see germinating seeds without reference to species, light requirement or temperature: predator - prey relationships with no species mentioned, etc. This must be bad biology and bad news for the biology teacher."

(Ayerst 1986:118)

It is important to remember that the computer is no substitute for the real thing and the use of the computer should therefore be to supplement teaching and not to replace the living subject which is being studied. Ayerst continues his article by indicating that:-

"...universities have used computers to carry out the complex arithmetic needed to analyse statistically the readings gathered in the field and also have used remote electronic sensors to gather data that is reliable. With the arrival of micros in schools we too can once again make the practical part of biology a worthwhile part of our work."

(Ayerst 1986:118)

Another very important use of computers is in the formation of hypotheses. Conducting of controlled experiments in the school classroom/laboratory is limited due to problems associated with time and facilities. Pupils are perhaps not exposed sufficiently to how hypotheses are formulated. Through the use of software that simulates experiments, such as "Transpiration" by Garland, it is possible to conduct a series of simulated controlled experiments after setting up a

potometer in the classroom. The practical work must be done first in order to identify the physical problems associated with the apparatus. It is also important to attempt to alter the external variables one at a time before attempting the simulation on the computer. The computer simulation can generate acceptable results, based on a biological model, within a short space of time so that a series of results can be produced. The data that is generated from the simulation can be provided for the pupils to interpret. Using this data the pupils are then able to postulate a hypothesis and test it using the simulation all within one teaching period.

Hall raises the following points:-

1. Computers can provide motivation.
2. Computers can offer different learning environments.
3. Computers can provide new learning opportunities.
4. Computers can extend learning possibilities.
(Hall 1985:17-18)

The most significant point to bear in mind with respect to CAI and CAL is the last point. It seems reasonable to assume that pupils' learning possibilities are restricted by the level of knowledge and academic qualifications of their teachers. Also, the degree of success of a teacher may be indicated by the pupil pass rate. In an experiment conducted by the University of the Western Cape in a programme called 'Operation Outreach' the limitations of a low standard of teachers' qualifications were eliminated to a certain extent.

The pupils were taught using computers in their own time as a form of supplementary education. The results of this exercise reported that there were significant increases in the number of candidates passing matric. (Computer Mail 1987:22)

It is the researcher's experience that many teachers show little inclination to broaden their academic interests by reading articles relating to their subject, or by studying further. With the implementation of the then new Biology syllabus in 1985-86, a new way of thinking was expected of teachers. The teachers were asked at various in-service teacher training courses held throughout the Cape Province to encourage their pupils to think more critically and be prepared to answer more questions based on 'data-response' type questions. Examples of this would include tables of figures or graphs and the pupils would be asked to extract information from the data. It was also envisaged that pupils might be given a series of diagrams and asked to predict what could be expected to happen next. From the researcher's experience, many teachers find it difficult to interpret and manipulate data, let alone teach their pupils how to do so. It is at this point that the computer could be utilized. The computer might prove to be a valuable tool to stimulate pupils to think. As Hall implies in his last point, the computer can extend the learning possibilities beyond the classroom/laboratory. Pupils may be confronted with experiments that cannot be conducted in the classroom/

laboratory. Large volumes of data can be generated, with the pupils being given the task of analyzing it. The data generated may be presented graphically on the computer. Calculations using, for example, the chi-squared test may be carried out when answering questions on genetics. There are many possibilities. The pupils would be left with more time to think and draw logical conclusions from the data accumulated rather than doing the time consuming work that can be done by computers.

2.2. A PLACE IN THE CURRICULUM

There is a place for the computer in the curriculum, especially in the Biology curriculum. The role of the computer can be to assist the teacher and the pupils to interpret data. The computer can also serve to simulate experiments that would otherwise not be possible in the school classroom/laboratory, especially when such experiments are considered to be too dangerous or too costly. Examples of this would be in the radioactive labelling of organic compounds to trace biochemical pathways, or studying the effects of high temperatures on the human body.

Naiman sees the introduction of software into the classroom/laboratory as follows:-

"It seems that as the computer finds its own voice, the software that best uses the computer has to ease into the classroom without upsetting the

curriculum or unsettling teachers."
(Naiman 1987:196)

The implications of this are far reaching in the field of education and specifically in Biology. With regard to Biology, the introduction of computers implies that teachers must become computer literate in order to use the software that is available. The types of software that are available include drill and practice programs, simulations and tutorials. Content-free software, such as spreadsheets and data bases may also be used by Biology teachers, and there are also statistical packages like "Statistics for Biologists" which cater specifically for the analysis of biological data.

Ediger sees the need for computers to be brought into the curriculum when he states that:

"... Computers are commonly used in the business world as well as at home. Schools and society should not be separated from each other. Rather, what is emphasized in society that is deemed worthwhile also has significance in developing the school curriculum."

(Ediger 1986:63)

In summing up the place of the computer in the curriculum the following are some of the important issues which Evans raises.:-

- "- The curriculum is undergoing change
- Any new curriculum must take into account the future needs of the pupils - this is a time of snowballing technological advancement
- The microcomputer not only helps in making that change work, it instigates it

- Planning for integration of the microcomputer into the curriculum is vital
- The computer changes the relationship between pupil and teacher when used appropriately
- Basic computer 'skills' are the fundamental requirements for the society of the future. We must ensure that they are properly taught."
(Evans 1986:81)

2.3. THE QUESTION OF EVALUATION - WHAT DOES IT MEAN?

Blease deals with software evaluation very effectively and differentiates between two concepts intimately related to the term 'evaluation'. On the one hand he refers to 'selection' and on the other he refers to 'evaluation'. The two processes go hand-in-hand and, for the successful utilization of educational software, they must be seen as forming an integral relationship. Blease has the following to say in connection with these two terms:-

"Faced with the ever-increasing mountain of so-called educational software, they [teachers] must choose those programs which might, in certain circumstances, be of use to them in the classroom.

... the term 'software evaluation' is rather misleading in this context since the very act of evaluation implies the testing of materials in real classrooms with real children. What is more, such evaluations require that the programs are judged against a set of well defined criteria. These criteria must be based upon the teacher's own curriculum model which in turn determines the specific aims and objectives for a series of lessons or particular topic to be taught.

What is more appropriate is to describe the process in two stages. Firstly, SOFTWARE SELECTION; a process undertaken outside the classroom by a teacher or group of teachers who are well informed

about the educational issues of computing. Decisions are made about the potential of the programs under scrutiny by critical reference to a whole series of commonly agreed criteria. These criteria might be said to constitute aspects of 'good practice' in the design and publication of educational software. Decisions must be made by individual teachers, however, according to the particular use they have in mind for the program to achieve their own specific lesson aims and objectives. What might work for one teacher in one situation might not work for another. Indeed, what might work for one teacher with one class may not work at all for the same teacher with a different class, having different interests, needs and abilities. All experienced teachers know that this is common to all forms of lesson planning, it is not unique to the world of educational computing.

Secondly, SOFTWARE EVALUATION, is a process performed in schools and classrooms, and can be extended over a considerable period of time. Careful planning is needed to integrate the use of the program into the overall plan and objectives of the scheme of work. This time the effectiveness of the program may be measured in terms of such things as learning outcomes, or its ability to maintain high levels of pupil motivation over time. However, whatever criteria are used for evaluation, they must relate directly to the aims and objectives of the teacher who is actually using the program. After all, what might appear to be a totally uninspiring program can end up as part of a most stimulating and creative lesson in the right hands."

(Blease 1986:4-5)

Some important issues with regard to this research emerge from the above. First of all, the emphasis is placed on the teacher who must choose the software that he/she is going to apply in his/her classroom/laboratory. The teacher should do the selection of the software for use in the classroom/laboratory against a set of well defined criteria. Many teachers do not have any suitable criteria against which to select and evaluate software, nor have they developed the skill to do an evaluation in the classroom/laboratory.

The aim of this research is to provide teachers with the tools to evaluate educational software, specifically in the field of Biology. As will be mentioned later on, the potential is there for the evaluation tool to be modified slightly to encompass all educational software, irrespective of subject.

The 'selection' of software will occur outside the classroom/laboratory. It should be conducted by teachers who are well informed about the potential benefits of computers in their teaching. The teacher should be able to make meaningful decisions based on this information and select the best possible software for his/her use. The aspect of selecting good educational software needs to be developed further in South Africa.

What must also be realized is the fact that teachers must be flexible in their approach to teaching with computers. As Blease (1986:130) states, that which works for one teacher may not work for another, and it may not work with a different class. Again the onus is placed on the teacher to see the educational variations that may occur in a given situation and be able to adjust to the circumstances in which he/she may find himself/herself.

Blease also raises the question of 'evaluation' of the

software that has been selected by the teacher. This is the process whereby the software is taken into the classroom/laboratory and actually evaluated on site. Again, Blease indirectly refers to the importance of the teacher in planning the lesson so that the use of a program is 'integrated' into the overall objectives of the scheme of work. Blease goes on to mention the fact that the program must be measured in terms of its 'educational outcomes' or its ability to 'maintain high levels of pupil motivation'. The important issue here is that the software must suit the objectives of the teacher. A good teacher may be able to utilize poor software by identifying certain useful objectives. On the other hand some teachers may not be able to utilize good software effectively if they are not thoroughly prepared.

Self discusses the issue of the aims of evaluation. An important point which he raises is the idea of making an evaluation:-

"... to provide decision-makers with information about the effectiveness of an educational programme or product..."

(Self 1985:147)

The researcher feels that the importance of this is that teachers should be evaluating educational software in order to inform other teachers as to the value of certain pieces of software. The aim of this research is to provide the teacher with a tool to 'select' educational software, and then to

'evaluate' the selected software in the classroom/laboratory. The final assessment will involve the circulation of the results of the classroom/laboratory research to other teachers so that they might benefit from this research.

The content of the tool for 'selection' was based on the concept of a modified 'checklist'. The reason for the use of a checklist type of form is to provide a basic framework for the use of various selection criteria.

"The important thing is to remember that these checklists have their limitations, but that, at the same time, they can provide an all important framework within which the software reviewer can work."

(Blease 1986:63)

Another author who has views on the use of checklists is Chambers. He sees the checklist as:-

"... a useful tool in ensuring that all issues are addressed and that multiple evaluations are somewhat comparable. The checklist is, however, only a tool, and the heart of the evaluation should be formed by the professional training and experience of the evaluator."

(Chambers 1983:71)

The selection tool is intended as a means by which all the important issues pertaining to 'good' software can be raised during the process of selection.

The Selection Form that emerged from this research is seen by the researcher as a means of preparing for a lesson using computer software. What is being advocated is that teachers utilize the form as a means of ensuring that most of the educational issues are addressed, when selecting or preparing

educational software for classroom/laboratory use.

The criteria used in the Selection Form arose from the different selection/evaluation forms that were encountered. These criteria were subjected to a process of research and development and were eventually either included, modified or rejected. The end result, the Selection Form, is thus the culmination of several drafts which have been refined through the research process.

2.4. OTHER SELECTION AND EVALUATION FORMS

A number of selection and evaluation forms were encountered during this research, which may be found in Appendix 1. As will be discussed below it was felt by the researcher that these forms were not adequate to provide an effective means to evaluate educational software both qualitatively and quantitatively. Many of these forms were merely 'checklists' on which the person evaluating the software had to make a cross or a tick in the relevant spaces. It must be stated that the types of selection and evaluation forms encountered can play a definite role in the evaluation of software.

Please does, however, indicate what these checklist really are.

"Many so called program 'evaluations' which we see printed in computer magazines are little more than program 'reviews', descriptions of what the

programs are about. These have their place, of course, but only in the sense that they draw to our attention those programs which might be worth looking at more critically. Some, however, do attempt to provide a more critical appraisal by awarding points or stars in an apparently objective sort of way. This approach creates problems of its own of course, especially since the criteria for awarding the points or stars are rarely adequately defined. So what appears, on the face of it, to be a convenient tool for standardised program evaluations, is nothing more than an invitation to make more subjective judgements." (Blease 1986:60)

A feature of most of the other published forms that were encountered by the researcher was the fact that there were very few or no instructions to the user on how the forms were to be completed, or how to implement the evaluation procedure. For this reason the Evaluation Package developed in this research included an instruction page for each subcriterion quoting an example in an attempt to simplify the completion of the forms.

Another feature of other checklists is that most of them make use of a rating system as the main means of capturing the impressions of the evaluator. Often, these ratings may be very subjective in nature. This is seen by the researcher to be a problem as the person reviewing the checklist may well be influenced by the figures displayed. The evaluator on the other hand has no means of justifying his/her point of view to the person reviewing the checklist.

"The most important issue in constructing a checklist is the degree to which it enhances the selection of courseware that will accomplish the predefined objectives. Checklists are therefore dynamic instruments that must be modified after

actual experience in the learning process with the courseware selected. A real danger in this regard, however, is that in an attempt to increase effectiveness (i.e., to guarantee success of the courseware selected), the checklist eliminates a large proportion of acceptable products. Where there is limited courseware in an area, a "qualified yes" might be more helpful."

(Chambers 1983:71)

Barker and Yeates also identify the subjective nature of evaluating software.

"One of the major problems often encountered during courseware evaluation is the subjective way in which many teachers/instructors approach the task. This situation is probably forced upon them because of the absence of any formal method of assessing the value of the courseware units. Obviously, what is needed in order to overcome this difficulty is some form of objective evaluation metric that can be applied in a standard way to each of the courseware items to be evaluated."

(Barker & Yeates 1985:86)

It must be stated, however, that the forms that were developed for the purposes of this research are also based on the concept of a checklist system. The forms are, however, comprehensive and deal with numerous aspects which the researcher, in conjunction with an independent trialist, regards as important criteria to be used for the selection and evaluation of educational software.

A common feature among the other selection and evaluation forms was the relatively short time taken to complete them which is in direct contrast with the Selection and Evaluation Forms developed in this research. The latter may be viewed by some as being too complex, too lengthy and time consuming

for the time conscious teacher. However, one cannot evaluate educational software effectively without giving it due consideration and if the software is to be evaluated extensively, then sufficient time must be at the evaluator's disposal to do so. The Selection and Evaluation Forms put forward in this research are seen by the researcher as a basis for future development. The forms can be tailored to suit the individual needs of teachers. An aspect to remember is that teachers are provided with an extensive basis on which to proceed in order to establish a better working document for the selection and evaluation of educational software. This working document can then be used for the purpose of assessing the software that has been chosen in order to achieve the best educational use out of it.

The Selection and Evaluation Forms which emerge from this research will attempt to avoid the pitfalls of the checklist approach mentioned above. The evaluator will need to have more time available to evaluate a piece of software. At the same time the evaluator will be forced to consider the criteria more deeply and to consider the possible ways in which the software can be implemented in the classroom/laboratory.

CHAPTER THREE
THE SOFTWARE SELECTION FORM

3.1. DESIGN OF THE SELECTION FORM

3.1.1. PROBLEMS ENCOUNTERED

There are numerous evaluation forms available such as those published in various magazines and journals, a sample of which may be found in Appendix 1.

The majority of the forms considered by the researcher had major drawbacks in terms of their successful application and presentation of information to the user wishing to utilize the results. As has been mentioned previously, most of the forms encountered were superficial and subjective, completed by placing in blocks, ticks or crosses based on an immediate impression. They did not provide the evaluator with instructions as to how they were to be completed and under what conditions to evaluate the software.

One of the biggest problems encountered in the development of the Evaluation Package was in the use of the term 'evaluation'. The term 'evaluation' is in fact a composite term which has two facets. Blease (1986) differentiates clearly between 'selection' on the one hand, and 'evaluation' on the other. It is necessary to stipulate precisely what one is referring to when one uses the term 'evaluation'. The term 'selection' will be used to refer to the selection

of the software 'off the shelf', together with those processes that are concerned with the preparation of the software for classroom/laboratory use. 'Evaluation' on the other hand will refer to the analysis of how the selected software stands up to its specified aims, in conjunction with the aims of the teacher who uses the software in the classroom/laboratory.

In the development of the evaluation tool for this research, two forms emerged. A Selection Form was developed in conjunction with an Evaluation Form. The two forms are intimately linked in such a way that any person referring to the forms may be provided with comprehensive information on the evaluation of the software at his/her disposal once the forms have been completed.

The bridge that was formed to span the gap between selection and evaluation, was based on a simple principle. The Selection Form was designed so as to provoke the teacher to consider the variables in a computer lesson in conjunction with the software prior to implementation in the classroom/laboratory. Related to this, the Evaluation Form would highlight two basic aspects of the lesson. Firstly, if the teacher had prepared thoroughly by using the Selection Form, he/she would be well versed in the strengths and weaknesses of the software and therefore be in a position to use the software effectively. Secondly, the Evaluation Form would

provide valuable feedback with regard to the effectiveness of the teacher in using the software, as well as information about the pupils' views of the software.

An assumption made is that in using a questionnaire designed primarily to provide feedback from the pupils, the pupils know what is best for them. Usually, as educators we strive to guide the pupils in the 'right direction'. We assume that we know what is best for them. Far too often, we do not listen to what the pupils have to say. The view of the researcher is that, when evaluating software the pupils' opinion is very valuable. It is an opinion also shared by Blease (1986).

The Selection and Evaluation Package is provided in such a way that the forms are simple enough to utilize effectively. The processing of the data may be time consuming but with the Evaluation Form a teacher may be able to interpret the result rapidly and effectively.

One of the spinoffs of the research is to enable teachers to do research in the classroom/laboratory. The forms provide teachers with information as to whether they are achieving their objectives or not.

Another problem that was encountered in the research was the selection of the criteria for the Selection and Evaluation

Forms. As has been mentioned before, the criteria were initially drawn from existing selection and evaluation forms together with contributions from Blease (1986). These criteria were grouped together and refined with the input from fellow colleagues and some of the staff of Rhodes University Education Department. The Evaluation Package was then trialled by an independent trialist and the final changes were then made to the list of criteria and the layout of the forms. The researcher does not advocate that this is the final set of criteria on which educational software must be evaluated. It is suggested that these criteria serve as a basis for further research and development.

The range of software which was researched also presented a problem. Due to limited finances it was not possible to sample software more extensively so as to achieve a wider range of results for the selection process. In order to prove that the Selection Form is capable of differentiating between different types of software, ranging from excellent to poor, it would be necessary to conduct further research using a wider range of software.

3.1.2. THE SELECTION FORM - CRITERIA FOR SELECTION AND THEIR USE

The establishment of the criteria necessary for the selection of software was not based on a random selection of criteria.

As mentioned previously the criteria from existing selection forms served as a basis for the Selection Form and this form went through several stages of refinement.

The Selection Form was intended for practicing teachers. It was felt that the emphasis should therefore be on a practical approach to the layout of the form. The aim of this was to compel the teacher to consider each criterion and its subdivisions in detail prior to implementing the software in the classroom/laboratory. This would in turn help in the preparation for the implementation of the software in the classroom/laboratory. Once the teacher had worked through the selection process, he/she would have a clearer idea of why and how he/she was going to implement that particular piece of software. Even though the Selection Form is time consuming to complete, if the teacher uses it as it was intended to be used, the process of implementing the software should be made easier and more effective. The converse of this would be inadequate preparation of the software and ultimately time lost on undesired outcomes of the lesson, and possibly wasting of a potentially valuable opportunity. Feedback from pupils after the lesson may indicate to the teacher the success of the lesson and whether the objectives of the lesson match the objectives of the software.

A total of seven criteria were finally selected for inclusion in the Selection Form. They included the following:-

- | |
|----------------------------|
| 1. DETAILS OF SOFTWARE |
| 2. EVALUATOR'S PARTICULARS |
| 3. HARDWARE REQUIRED |
| 4. SOFTWARE OBJECTIVES |
| 5. TECHNICAL DESIGN |
| 6. SUBJECT CONTENT |
| 7. DOCUMENTATION |

To this was added the following three points :-

- | |
|-----------------------------|
| 8. CONCLUSIONS OF SELECTION |
| 9. SUMMARY AND RATINGS |
| 10. RATING SCALE |

The researcher is not advocating that this is the ultimate set of criteria but that these criteria serve the function of highlighting important issues to teachers. These teachers may be intending to use the criteria to select and use software in the Biology classroom/laboratory. Alternatively they may use forms completed by other teachers to see what conclusions they have drawn. The latter would serve the function of a review, providing valuable insight into that particular piece of software.

What follows is a discussion of each of the main criteria and the reasons for their selection, with additional comments being made where necessary. It must also be noted at this point, that the instructions for the use of the Selection Form are included on the facing page of the Selection Form (See Appendix 2). The inclusion of these instructions was prompted by a lack of explicit instructions in all other selection and evaluation forms encountered. Many of the

subsections for the various criteria would appear to be straightforward, but by supplying simple examples in each case confusion may be reduced.

3.2. A DISCUSSION OF THE SELECTION FORM

3.2.1. INTRODUCTION AND INSTRUCTIONS

It is important that the person evaluating the software runs through the software at least three times, each time adopting a different approach. Each run must be executed with the following three people in mind :-

- 1) the teacher;
- 2) a 'bright' pupil; and
- 3) a 'weak' pupil.

This idea is shared by both Rogers (1985:25) and Doll (1987:51) who also suggest that the software is run through at least three times, each time adopting a different perspective. By doing this exercise one becomes very familiar with the software's potential and at the same time one becomes aware of how the software may relate to one's own pupils. Having prepared oneself with this information, one is now in a position to tackle the content of the Selection Form in a more meaningful manner.

3.2.2. DETAILS OF THE SOFTWARE

This section is largely self explanatory, yet it provides important information pertaining to the software. Information such as :-

- | |
|--|
| 1. DETAILS OF SOFTWARE |
| 1.1. TITLE |
| 1.2. CLAIMED CONTENT |
| 1.3. AUTHOR / PROGRAMMER |
| 1.4. COMPANY |
| 1.5. LOCAL SUPPLIERS |
| 1.6. LOCAL PRICE |
| 1.7. LOCAL AVAILABILITY |
| 1.8. FOREIGN PRICE |
| 1.9. COPYRIGHT |
| 1.10. RECOMMENDED LEVEL (STANDARD / AGE) |
| 1.11. TYPES OF SOFTWARE
[DRILL AND PRACTICE; TUTORIAL; SIMULATION;
GAME; MODEL; OTHER] |
| 1.12. RUNNING TIME |

This information can be used by a person reviewing the software with the aim of possibly purchasing that particular piece of software. It may also serve as a cross reference for the purpose of identifying software being used if two pieces of software possess the same title.

The question of copyright was not considered to be an important sub-criterion but it does have certain implications. A copyright is normally placed on a piece of software. In such a case the purchaser is not legally allowed to make backup copies of the software unless stated on the package. Teachers may have to make illegal backup copies for safe keeping. Sometimes sophisticated copy

protection devices prevent backup copies being made or only allow a single copy to be made. Doll also identifies copyright as a problem.

"Software producers and distributors may be reluctant to send a program to a school on approval because it is relatively easy for a knowledgeable person to copy a program, and producers seem to be concerned about this."

(Doll 1987:50)

Another aspect of the copyright issue which should be mentioned, is that there may be a few users who have the ability to alter the software to suit their own particular needs. Some software has no built-in copy protection device. In such a case it may be physically possible to alter the program to suit one's own needs. (A simple example of this would be an accounting package which is imported from Britain or America. The currency sign is not compatible with the Rand and therefore would present a problem to local users.)

3.2.3. EVALUATOR'S PARTICULARS

It was felt that it is important to know who the evaluator is, as well as his/her qualifications. This may serve an important function in the situation where a reviewer may wish to query the reasons for certain statements and ratings made by the evaluator. This will also place a greater responsibility on the evaluator to make more accurate judgements of the software and not base the assessment purely on subjective impressions. It is however difficult to

eliminate the subjectivity aspect of the assessment entirely. It is therefore important to read the evaluator's remarks carefully in conjunction with the ratings that have been given for each particular sub-criterion.

The following information is required of the evaluator:-

2. EVALUATOR'S PARTICULARS		
2.1.	NAME	
2.2.	HOME ADDRESS	PHONE
2.3.	WORK ADDRESS	PHONE
2.4.	OCCUPATION	
2.5.	PRESENT POSITION	
2.6.	ACADEMIC QUALIFICATIONS	

3.2.4. HARDWARE REQUIREMENTS

The hardware requirements serve as an indicator to the reviewer of the type of equipment that is required, if he/she intends to make use of that particular piece of software. Some programs, for example, operate using only the microcomputer, one floppy disk drive and the screen, while others require a printer or a plotter, dual disk drives or hard drives, etc. In some cases a teacher may purchase a particular piece of software only to discover that it is not compatible with his/her microcomputer or it requires certain pieces of hardware which are not at his/her disposal. If the package has been opened for any reason the supplier may not refund the purchaser's money. It was felt that the following points were significant when dealing with this subsection:-

3.	HARDWARE REQUIRED
3.1.	MICROCOMPUTER
3.1.1.	TYPE
3.1.2.	LANGUAGE
3.1.3.	MEMORY CAPACITY
3.1.4.	SOUND
3.2.	MONITOR
3.2.1.	COLOUR
3.2.2.	MONOCHROME
3.3.	STORAGE MEDIUM
3.3.1.	DISK DRIVE - SINGLE OR DUAL
3.3.2.	CASSETTE TAPE
3.4.	PRINTER
3.4.1.	PRINTER WIDTH
3.5.	PLOTTER
3.6.	OTHER COMMENTS

With reference to 3.6. 'Other Comments' the person evaluating the software may make further comments with respect to such aspects as installing programs onto hard drives, or networking.

This section of the Selection Form was not allocated any rating scale due to the fact that the software is being evaluated and not the computer itself. The evaluation of the hardware can involve complex tests which are beyond the capabilities of most classroom teachers.

3.2.5. SOFTWARE OBJECTIVES

The following points were selected under this criterion:-

- 4. SOFTWARE OBJECTIVES
 - 4.1. GENERAL OBJECTIVES AS STATED
 - 4.2. OBJECTIVES MUST SATISFY SOME OF THE FOLLOWING CRITERIA
 - 4.2.1. UNDERSTANDING OF BIOLOGICAL ISSUES
 - 4.2.2. AWARENESS OF INTER-RELATIONSHIPS
 - 4.2.3. FOCUS ON OBSERVATION
 - 4.2.4. LEADS TO MEANINGFUL RECORDINGS
 - 4.2.5. ALLOWS FOR ANALYSIS AND EVALUATION
 - 4.2.6. FORMATION OF HYPOTHESES
 - 4.2.7. TESTING OF HYPOTHESES
 - 4.2.8. FACILITATES EFFECTIVE COMMUNICATION
 - 4.2.9. ALLOWS FOR EXPRESSION OF IDEAS
 - 4.2.10. NURTURES A RESPECT FOR LIFE
 - 4.3. ARE THE SOFTWARE OBJECTIVES ACHIEVABLE?
 - 4.4. GENERAL COMMENTS

The selection of the objectives was based on those of the Biology Syllabus as found in the Senior Secondary Syllabus (Syllabus for Senior Secondary Course 1985: General Science 1984) of the Cape Education Department. It was noted that the objectives of the syllabus refer to standards 8 to 10. For this reason it was felt that the software objectives should match at least some of these objectives.

Much of the software available in South Africa is of foreign origin, being mainly from Britain and America. This software is therefore not designed for our local needs. The evaluator must therefore take into consideration what the software objectives are in comparison with those of the South African syllabus. The reviewer's attention must also be drawn to this fact if he/she intends to make use of the information contained in the Selection Form.

3.2.6. TECHNICAL DESIGN

This is a standard inclusion in most of the forms encountered which dealt with selection or evaluation of software. This section deals primarily with the structure and flow of the program. It includes the following aspects:-

5. TECHNICAL DESIGN
5.1. GRAPHICS
5.2. FLOW
5.3. INSTRUCTIONS
5.4. BUGS
5.5. DEGREE OF CONTROL
5.6. DEGREE OF FREEDOM
5.7. SELF CONTAINED
5.8. DOCUMENTATION DEPENDENCY
5.9. SCREENS EASY TO READ
5.10. EFFECTIVE USE OF SOUND
5.11. OTHER (state)
5.12. WHAT IMPROVEMENTS IF ANY
5.13. GENERAL COMMENTS

It is possible to become very involved in the technical details of the software and their associated implications. The influence of such factors as height of the characters on ease of reading, or the effectiveness of the use of sound, or the amount and rate of information presented per screen, may influence the effectiveness of the software. The form makes provision for comments on such factors. It was, however, decided to keep the subcriteria as simple as possible to facilitate ease of interpretation on the part of the evaluator.

3.2.7. SUBJECT CONTENT

Under this section for the selection of software, the following sub-criteria were selected:-

6. SUBJECT CONTENT
6.1. DEGREE OF ACCURACY
6.2. RELEVANCE OF TITLE
6.3. STIMULATING
6.4. DEGREE OF DIFFICULTY
6.5. ADDITIONAL INFORMATION GIVEN
6.6. UNNECESSARY DETAIL
6.7. WHAT IMPROVEMENTS IF ANY
6.8. OTHER (state)
6.9. PREREQUISITE KNOWLEDGE REQUIRED
6.10. APPLICABILITY TO THE PRESENT SOUTH AFRICAN SYLLABUS
6.11. APPLICATION OF SOFTWARE TO OTHER SUBJECT AREAS
6.12. GENERAL COMMENTS

The relative importance of this section cannot be over-emphasized in achieving the objectives of the software. The subject content of the software will relate directly to the objectives of the software and to the way these apply to the curriculum within which they are going to be used. This criterion will serve to emphasize the differences in the curriculum of the software's country of origin and that of South Africa.

The subject content of the software must not be questionable. It is here that the distinction between a professional programmer and a teacher-programmer must be made. Far too often the professional programmer only takes into

consideration the technical side of the software, ensuring that software will be technically perfect. He/she may however overlook the accuracy of the content, decreasing the acceptability of the software. On the other hand the teacher-programmer has the necessary subject knowledge. He/she may be able to present the information far more accurately, but the software may lack technical excellence. The abilities of the two types of programmers need to be merged to ensure the best results possible.

Another important area is that of prerequisite knowledge. The evaluator must consider what the pupils will need to know prior to the use of the software in the classroom/laboratory. The pupils must have the prerequisite knowledge present on which the new knowledge is to be built. It would be meaningless for a teacher to use a piece of software like "The Kidney" by Garland for example, if the pupils had no idea of the concepts of excretion, osmoregulation and homeostasis, together with the details of the internal structure of the kidney.

The software may also have an application in other subject areas. For example, the program entitled "Human Population Growth" may be applied in Biology as well as Geography. Other examples may include content free software, such as word processors, spreadsheets and data bases which can be used across the curriculum.

3.2.8. DOCUMENTATION

Documentation, in whatever form, plays a significant role in the implementation of the software for which it was designed. It is the author's way of communicating with the user, by providing instructions for the running of the software. The documentation should assume that the user has had no previous experience with computers or with that particular program. In many cases the documentation will provide background information to a program which will prove valuable to the successful implementation. Examples of this may be found in the programs "Expedition to Saqqara", "The Mary Rose", "Transpiration", and "Dieting". Often the documentation will provide other useful information like diagrams and references which will be of assistance to the pupils or the teacher. Some software provides general information, or information for the teacher only or for the pupil only.

The following criteria are included under this section:-

7.	DOCUMENTATION
7.1.	CONTENT
7.1.1.	LENGTH
7.1.2.	WORKSHEET(S)
7.1.3.	DIAGRAMS
7.1.4.	RELIABILITY
7.1.5.	ADDITIONAL INFORMATION
7.1.6.	GENERAL COMMENTS
7.2.	INSTRUCTIONS FOR USE
7.2.1.	INSTRUCTIONS FOR TEACHERS
7.2.2.	INSTRUCTIONS FOR PUPILS
7.2.3.	GENERALLY USEFUL
7.2.4.	OTHER (State)
7.3.	GENERAL COMMENTS

All software packages must include simple instructions on how to start up the programs from the time the microcomputer is switched on, as well as what to do throughout the program, even where on-screen instructions are provided.

There are some programs that require specific pupil orientated documentation for the program to be completed. In such cases accompanying worksheets may be provided. Examples of this would be "Circulation" and "Dieting" by Garland Company where specific worksheets and data tables are supplied for use with the program. There are, however, many programs that do not provide documentation for the pupils to use. In such cases, this criterion is give a '0' for the influence of the factor and the evaluator must make a comment to that effect.

3.2.9. CONCLUSIONS OF SELECTION

Under this section, the person doing the evaluation of the software is required to summarize how he/she views the software under seven headings:

8. CONCLUSIONS OF SELECTION

Use the information recorded in sections 1 - 7 to complete this section. Feel free to state the obvious as well as to be critical of the content and application of the software you are evaluating

CONTENT
OBJECTIVES
DOCUMENTATION
VALUE FOR MONEY
USABILITY
CLASSROOM MANAGEMENT
GENERAL

These seven points sum up all the criteria which the teacher will have used to select the software, but it must be noted that subjectivity may occur in this section. The evaluator's own personal views on the software may become evident as it is under this section that personal opinions may be expressed. For this reason it was decided not to allocate a scoring system to this section. The reviewer must therefore take into account all the comments made under this section and formulate his/her own opinion. At this stage the pupils' opinions are not considered as the teacher should now be ready to implement the software in the classroom.

What is important is that the reviewer needs to read through

the relevant comments made, taking note of what the evaluator has highlighted as the strengths and weaknesses of that particular piece of software. These points must be seen in conjunction with the individual sections. The reviewer must formulate an overall impression based on the accumulation of all the information given by referring back to all the different criteria.

3.2.10. SUMMARY AND RATINGS

This section is aimed specifically at the reviewer who wishes to briefly review the software when presented with the Selection Form. It provides a simple overview of the software, such as the title, type of program, type of classroom/laboratory management and whether the program is recommended or not. This section also gives the reviewer some indication as to what to expect from the comprehensive Selection Form.

The details of the Summary and Rating section of the Selection Form are as follows:-

```

+-----+
|          9. SUMMARY AND RATINGS          |
| Instructions: Place a CROSS (X) over the appropriate |
|           block which you think best applies to that |
|           particular topic                     |
|-----|
| 9.1. TITLE OF SOFTWARE                    |
|-----|
| 9.2. SOFTWARE OBJECTIVES                  |
|-----|
| 9.3. TYPE OF SOFTWARE                    |
| +-----++-----++-----++-----++-----+ |
| | DRILL AND PRACTICE | | TUTORIAL | | GAME | | SIMULATION | | MODEL | |
| +-----++-----++-----++-----++-----+ |
|-----|
| 9.4. SOFTWARE DESIGN (Technical).        |
| +-----++-----++-----++-----++-----+ |
| | UNACCEPTABLE | | POOR | | AVERAGE | | GOOD | | OUTSTANDING | |
| +-----++-----++-----++-----++-----+ |
|-----|
| 9.5. DOCUMENTATION...                    |
| +-----++-----++-----++-----++-----+ |
| | NONE | | LIMITED | | SUFFICIENT | | VERY GOOD | |
| +-----++-----++-----++-----++-----+ |
|-----|
| 9.6. RECOMMENDED CLASS MANAGEMENT...     |
| +-----++-----++-----++-----++-----+ |
| | INDIVIDUAL | | SMALL GROUPS | | LARGE GROUPS | | WHOLE CLASS | |
| +-----++-----++-----++-----++-----+ |
|-----|
| 9.7. VALUE FOR MONEY...                  |
| +-----++-----++-----++-----++-----+ |
| | ROBBERY | | POOR | | FAIR | | GOOD | | EXCELLENT | |
| +-----++-----++-----++-----++-----+ |
|-----|
| 9.8. RECOMMENDED...                      |
| +-----++-----++-----++-----++-----+ |
| | YES | | YES BUT WITH CERTAIN RESERVATIONS | | NO | |
| +-----++-----++-----++-----++-----+ |
+-----+

```

3.2.11. THE RATING SCALE

The reason for the inclusion of the rating scale in the Selection Form was that often teachers want more than just an indication of 'recommended' or 'not recommended'. The latter gives no indication of the value of the program. The rating

scale was intended to be used in a manner whereby a person reviewing the document may see at a glance how the evaluator had rated the particular piece of software.

The summary of the rating scale is seen as a valuable guide to a person reviewing the software. In this section a summary of all the rating scores is indicated out of a maximum possible score for each of the criteria. The effectiveness of the interpretation of the results lies in the reviewer being able to glance through all the values and identify those that are either highly rated or are poorly rated. All that is required on the part of the reviewer is to refer to the relevant section and the reasons for the ratings will become evident. It is here that the overall significance of the Selection Form lies. It provides more than the arithmetic average of a number of subjective ratings. The reviewer is provided with further information as to how the evaluator sees the software, how it can be utilized, the strengths and weaknesses, and information not provided by other forms or reviews. (See Appendix 1). The Selection Form was designed to fill the gap left by the usual checklist and/or review.

3.2.12. USE OF THE RATING SCALE

A simple rating scale of -2 to +2 was adopted to indicate the influence of a given factor on the Selection Form. Options vary from a 'very negative influence' with a rating of -2 to

a 'very positive influence' at the +2 end of the scale.

The rating scale is based on the influence of the individual subcriteria under the relevant headings. Where it was felt that the factor had no bearing on the overall rating of the software, as in the particulars of the evaluator, or the type of computer, no rating scale was offered. Only those subcriteria which would have an overall bearing on the final score were included. It must be noted that there was no weighting of general comments.

3.2.13. INTERPRETATION OF THE RATING SCALE

Initially the interpretation of the final score presented an obstacle. The final total achieved for a piece of software using the Selection Form cannot be regarded as an absolute value, but rather as a relative indicator of the overall value of the software in the classroom/ laboratory. It must also be seen as a single evaluator's view of the software. Once the Selection Form has been extensively utilized in the field on the same piece of software more conclusive results can be drawn.

Thus a person reviewing the software must proceed with caution when considering the final score. It must be interpreted against the relative scale provided :-

10. RATING SCALE			
Instructions: Fill in the relevant details using the ratings from the sections			
		RATING	OUT OF
1..	DETAILS OF SOFTWARE	_____	10
2..	EVALUATOR'S PARTICULARS	N/A	N/A
3..	HARDWARE REQUIRED	N/A	N/A
4..	SOFTWARE OBJECTIVES	_____	24
5..	TECHNICAL DESIGN	_____	24
6..	SUBJECT CONTENT	_____	22
7..	DOCUMENTATION	_____	20
TOTALS		_____	100
RATING SCALE			
0	-	20	NOT RECOMMENDED TO POOR
21	-	40	POOR TO AVERAGE
41	-	50	AVERAGE TO GOOD
51	-	75	GOOD TO VERY GOOD
76	-	100	VERY GOOD TO OUTSTANDING

An essential idea is that the reviewer must study the results for the individual sections and scrutinize their strengths and weaknesses. This can be done by referring to each section individually and reading the relevant comments made. The subtotals of the various criteria are possibly of greater significance than the overall rating score as it is here that the individual strengths and weaknesses are highlighted.

3.3. AN OVERVIEW OF THE SELECTION FORM

It is felt by the researcher that the Selection Form provides more information than other types of forms, examples of which may be found in Appendix 1. The researcher maintains that teachers need more information than simply 'recommended' or 'not recommended', or a single paged document with ticks

placed in appropriate blocks. These types of forms may be regarded as being mere reviews of the averages of a number of 'evaluators'. A short description or an advertising pamphlet (See Appendix 6) is insufficient to inform a person considering a piece of software.

The Selection Form could also quite easily be referred to as a teacher preparation form. By using the Selection Form, the teacher could also prepare himself/herself for a computer lesson. The teacher would be able to merge the objectives of the software with those of his/her own lessons. In so doing the learning outcomes of the lesson could possibly be enhanced further.

CHAPTER FOUR

THE SOFTWARE EVALUATION FORM

4.1. CRITERIA FOR EVALUATION

The basic aim of the Evaluation Form is to capture some of the information pertaining to:-

- a) the pupils,
- b) the lesson, which involves content, and the teacher who is presenting the lesson, and
- c) the software.

A computer lesson must be viewed as an integration of these three basic factors in the form of a triangle. The implications of this will be discussed more fully in Chapter 6. The Evaluation Form can be divided into two basic parts, namely, a Questionnaire for pupils to complete, and an Evaluation Grid for the teacher to use. (See Appendix 3 for details). The latter is used to easily capture and display data from the pupils in the Questionnaire.

4.1.1. THE INSTRUCTION SHEET

The instruction sheet at the start of the Evaluation Form is intended to provide the basis for the use of the form. There are instructions for the two parties involved in the evaluation, namely:-

- a) the pupils, and

- b) the teacher who will present the lesson content using the computer software.

An important point which emerges from the investigation is the fact that the pupils provide much of the data, for ultimately they are the ones that are directly involved in the interaction with the software. The pupils are thus regarded as 'co-researchers' in that they form part of the evaluation team. The input from the pupils occurs only in the evaluation phase when the software is taken into the classroom. The pupils' feedback may help to indicate to the teacher whether his/her teaching strategies are suitably matched to the aims of the software.

An assumption made with respect to the Evaluation Form is that the majority of teachers have had little or no research training or experience, which implies that any research conducted must be kept as low key as possible.

4.2. THE QUESTIONNAIRE

The Questionnaire is aimed specifically at the pupils as their comments form the basis for the capturing of the data related to the software. The Questionnaire is divided into five basic areas of interest, namely:-

- a) information about the pupils (4.2.1.)
- b) information about the lesson (4.2.2.)
- c) information about the program (or software) (4.2.3.)
- d) any accompanying documentation (4.2.4.), and
- e) an open section for general comments by the pupils (4.2.5.) which includes:-
 - i) enjoyment of the program
 - ii) what was learned from the lesson

It is important that the forms are completed as soon after the lesson as possible by all the parties concerned.

What follows is a short discussion of the various aspects of the Questionnaire labelled as above.

4.2.1. PUPIL INFORMATION

This section is designed to capture data relating to the pupils themselves. This includes how well they do in Biology, and some information regarding their opinions about computers in general. Below is an extract of what information the pupils must enter by placing crosses in the blocks provided:-

1. <u>YOUR DETAILS</u>
1.1. HOW WELL DO YOU DO IN BIOLOGY? below 50 __ 50-75 __ 75+ __
1.2. DO YOU LIKE WORKING WITH COMPUTERS? no __ maybe __ yes __
1.3. WOULD YOU LIKE MORE LESSONS USING COMPUTERS? no __ maybe __ yes __
1.4. DID YOU FIND THE COMPUTER EASY TO USE? no __ yes __

4.2.2. THE LESSON

The second part of the Questionnaire refers to the actual lesson presented by the teacher. In this section the intention is that the teacher is provided with information regarding the effectiveness of the lesson. It therefore has the potential for providing information pertaining to the teacher's performance in handling the lesson.

2. THE LESSON

- 2.1. DID YOU ENJOY THE LESSON WITH THE COMPUTER?
not at all|___|it was alright|___|very much|_!
- 2.2. DID YOUR TEACHER EXPLAIN HOW TO USE THE PROGRAM PROPERLY?
no|___|yes|___!
- 2.3. DID YOU HAVE TO CALL YOUR TEACHER AT ANY TIME TO EXPLAIN SOMETHING?
no|___|yes|___!
- 2.4. TO WHAT EXTENT WERE YOU KEPT BUSY WITH THE COMPUTER?
very little|___|for a while|___|very much|___!
- 2.5. WOULD YOU LIKE TO HAVE USED THE COMPUTER MORE IN THE LESSON?
no|___|yes|___!
- 2.6. DO YOU THINK THAT YOUR TEACHER COULD HAVE EXPLAINED THE LESSON BETTER IF THE TEACHER HAD NOT USED THE COMPUTER?
no|___|maybe|___|yes|___!

4.2.3. THE SOFTWARE

The third part of the Questionnaire focuses specifically on the software itself. Most pupils have had little or no computer experience and certainly very few pupils understand the intricacies of computer programming. The questions asked are therefore of a very general nature. The questions are concerned with the ease with which the pupils used the program.

This section includes the following questions to be answered by the pupils:-

3. <u>THE SOFTWARE</u>
3.1. DID YOU ENJOY THE PROGRAM CHOSEN BY THE TEACHER? not at all ___ it was alright ___ very much ___
3.2. DID YOU FOLLOW WHAT THE PROGRAM WAS ALL ABOUT? not at all ___ sometimes ___ all the time ___
3.3. WAS THERE ENOUGH TIME TO SEE EVERYTHING ON THE SCREEN BEFORE YOU CONTINUED? no ___ yes ___
3.4. DID YOU HAVE TO DISCUSS ANYTHING RELATED TO THE PROGRAM WITH YOUR FRIENDS? no ___ yes ___
3.5. WERE THE INSTRUCTIONS ON HOW TO USE THE PROGRAM EASY TO OPERATE WHILE YOU WERE USING THE PROGRAM? no ___ alright ___ yes ___
3.6. DID YOU HAVE TO REFER TO THE INSTRUCTIONS CONTINUALLY TO BE ABLE TO USE THE PROGRAM? no ___ yes ___

4.2.4. DOCUMENTATION

The fourth section of the Questionnaire is that dealing with documentation. The use of this section is expected to be limited due to the fact that some software does not contain any form of documentation. Many programs are designed to stand alone without there being any need for documentation for the pupils. On the other hand most educational software is accompanied by a document designed specifically for the teacher, so that the onus is on the teacher to instruct the pupils at the start of the lesson as to how to use the particular piece of software. Most of the software used for this research was of this nature. There are, however, a few

programs, for example, the content free packages, like "Statistics for Biologists", that will require the pupils to refer to documentation as they use the software. For the latter case it was decided to include questions on documentation in the Evaluation Form with the instruction that if there was no documentation the pupil was to continue to the following section.

```

+-----+
| 4. DOCUMENTATION                                     |
| WAS THERE ANY DOCUMENTATION?                          |
+-----+
| IF YES THEN GO TO 4.1.: IF NO THEN GO TO 5.1. |
+-----+
| 4.1. DID YOU FIND THE DOCUMENTATION EASY TO READ?    |
|       no|___|yes|___|                                  |
| 4.2. WAS THE DOCUMENTATION USEFUL TO YOU?            |
|       no|___|yes|___|                                  |
| 4.3. DID YOU HAVE TO READ THE DOCUMENTATION BEFORE   |
|       YOU USED THE PROGRAM?                          |
|       no|___|yes|___|                                  |
| 4.4. HOW OFTEN DID YOU HAVE TO REFER TO THE          |
|       DOCUMENTATION WHILE YOU WERE USING THE PROGRAM? |
|       never|___|sometimes|___|a lot|___|             |
+-----+

```

4.2.5. GENERAL COMMENTS

The final section was designed to be an open-ended section where the pupils are free to express their own opinions. There are three open-ended questions which revolve around two basic aspects, namely, the software chosen by the teacher and the lesson itself. With regard to the software the pupils have to state which aspects they enjoyed and which they did

not enjoy. The pupils also have to state what they learned from the lesson.

The forms were designed to provide the teacher with useful information regarding the lesson as a whole, involving the interactions of the teacher, the lesson content and the software.

As part of the instructions the pupils are told to be as critical as possible. All information is to be treated confidentially to allow them to express their own personal views. The Questionnaire is meant to provide the teacher with the basic information needed to analyze the lesson, identifying both the positive and negative feedback.

The questions include the following:-

- | |
|---|
| 5. <u>GENERAL COMMENTS</u> |
| 5.1. <u>WHAT ASPECTS OF THE LESSON DID YOU ENJOY?</u> |
| 5.2. <u>WHAT ASPECTS OF THE LESSON DID YOU NOT ENJOY?</u> |
| 5.3. <u>WHAT DID YOU LEARN FROM THE LESSON?</u> |

4.2.6. CODING OF THE SCORES

It is also necessary to comment briefly on the use of the

coding system which is located alongside the first four sections of the Questionnaire. In each case there are either two or three possible alternative places to answer. It is quite possible for the pupils to do the coding for the teacher if they are correctly instructed. Further instructions on the method of coding are included in the Evaluation Form found in Appendix 3. It must be emphasized that the completion of the forms must be done as soon after the lesson as possible by all parties concerned, as explained in the instruction sheet which accompanies the Evaluation Form.

The coding of the pupil responses on the results form is merely to establish frequency counts. No numeric values or weightings are assigned to responses.

4.3. ANALYSIS OF DATA

4.3.1. EVALUATION OF PUPILS' RESPONSES

It was intended that the use of the Evaluation Package would help to analyze the responses of the pupils in a meaningful way. By counting up the number of responses for each question on the questionnaire and calculating the percentage response it is possible to interpret the responses made by the higher, middle and lower ability groups as determined by the pupil responses to 1.1. of the questionnaire. These responses can be linked to the way each group views the software and the

lesson. It is designed so that the results are easily produced and can be recorded in a simple manner. These results can also be circulated to other teachers. They would be able to identify from the results what the software and the lesson was like and so formulate their own ideas. The results include the following:-

- a) results of the Selection Form,
- b) the comments from the Selection Form,
- c) the comments by the pupils after the lesson,

The person receiving this information will then be in a better position to select the software, rather than to select the software 'cold' from a catalogue of many titles. The idea is to better inform teachers and prevent them from buying relatively useless software.

4.3.2. FINAL SUMMARY AND COMMENTS

The summary sheet at the end of the Evaluation Form may be viewed as the culmination of the implementation of the Selection and Evaluation Forms. It is a useful reference sheet which can provide more than a subjective review of a piece of software. The person reviewing the forms may be able to identify the strengths and weaknesses of the software from the summary. If he/she wishes to investigate the software further, all the information pertaining to that particular piece of software may be found in the pages leading up to the

summary page.

4.4. AN OVERVIEW OF THE EVALUATION PACKAGE

The extent to which the Selection Form and Evaluation Form are put to use may be limited to a few teachers who may wish to tease out the complexities of the relationships which exist in the interactions between the computer software, the pupil and the teacher. It is to be expected that the majority of teachers will not be inclined to adopt these forms as a result of the time pressures from extra mural activities and lesson preparation. What then is the value of the Selection and Evaluation Forms? The true value of the forms lies in their use to identify those aspects that make good educational software. Further comments on this issue are given in section 6.1.3. The forms can also serve to prepare the teacher to present the software in the class by focusing attention on the key issues involved. Once the teacher has become sensitized to those factors that make good educational software, the need for the forms decreases as the teacher should now be equipped with the necessary insight to identify good educational software. Another benefit of the forms is that teachers who have evaluated software can pass the completed forms on to colleagues, with the aim of informing them as to its worth.

It is the opinion of the researcher that the use of the forms

will reveal information to the teacher who wishes to evaluate a lesson involving computers in his/her subject. The time spent in preparing a lesson using the Selection Form may be well worth the effort. The comments that emerge from the lesson may also help to identify the strong points of the lesson which relate to the teacher, such as, whether the pupils think that the teacher may have taught the lesson better without the computer or not. This will be highlighted by such questions as whether the teacher explained fully what to do when using the program. The teacher needs to accumulate all the remarks from the general comments and isolate two or three common statements from the pupils. In this way the teacher is provided with useful feedback.

CHAPTER FIVE

SELECTING EDUCATIONAL SOFTWARE AND EVALUATING ITS USE, WITH SPECIAL REFERENCE TO BIOLOGY

5.1. EMPIRICAL RESEARCH

This chapter is devoted to a discussion of using the Selection and Evaluation Forms. The research utilized these forms as tools to evaluate software in the subject area of Biology. At the same time the Evaluation Form served to identify whether the teaching strategies of the teacher-researcher realized the objectives of the software. The latter was achieved by the completion of questionnaires by the pupils.

In terms of the Taylor models (Adams 1988) of the role of the computer, the computer was used primarily as a 'Tutor'. The pupils had hands-on experience with the computer and were influenced by the programs used by the teacher-researcher.

The research was conducted with six different Biology classes (5 groups in 1988 and 1 group in 1991). Three classes contained only higher grade pupils (one class averaged 65-70% and the other two classes averaged 50-60% in Biology tests). Two classes contained both higher and standard grade pupils of mixed ability (average 50-55%), and one class contained only standard grade pupils (average

45-50%). The top higher grade class, one of the average higher grade classes, and the pure standard grade class were taught by the researcher, while the second higher grade group and the two mixed higher and standard grade classes were normally taught by one of the researcher's colleagues.

The methods of action research (Cohen and Manion) were utilized for the purposes of this research, as the nature of the situation demanded a 'small scale intervention'. (Cohen and Manion 1989:217). The empirical research conformed very much to the characteristics of action research namely:-

"... situational - it is concerned with diagnosing a problem in a specific context and attempting to solve it in that context;
...collaborative - teams of researchers and practitioners work together on the project;
...participatory - team members themselves take part directly or indirectly in implementing the research;
...self-evaluative - modifications are continuously evaluated within the ongoing situation, the ultimate objective being to improve practice in some way or other."

(Cohen and Manion 1989:217)

Worth noting is the last point made by Cohen and Manion above. The researcher intended to provide teachers with a tool to evaluate their own teaching practices with respect to computers in the Biology classroom/ laboratory. With the aid of the Selection and Evaluation Forms the teacher utilizing the Evaluation Package should be able to:-

"... translate his ideas into action in his own classroom. He is, as it were, both practitioner and researcher in one and will integrate the practical and theoretical orientations within himself."

(Cohen and Manion 1989:220)

In order to justify the use of the Evaluation Package the researcher needed to use an acceptable research strategy as a means of accumulating data from the flexible and complex environment of the classroom/laboratory.

Mc Niff justifies the use of action research in the classroom by highlighting why the more traditional methods of research are not suitable in the educational context.

"Both the empiricist and the interpretive traditions are grounded in subjects other than educational practice. They do not allow for such questions as 'How can I improve my class practice?' or 'How can I account for my own educational development?' - first, because it is not part of their methodological design to ask such practical, problem-based questions, and second, because it is not part of their conceptual repertoire to answer them. They can make predictions and give descriptions of the phenomena of social settings. They cannot give educational explanations for the events within those settings. For that, another sort of approach is needed, one that will tackle the practical issues of why things happen as they do, rather than as they might."

(McNiff 1988:18)

The method that McNiff advocates is that of action research with the teacher attempting to make sense of his/her own teaching practice with the view to self-evaluation.

The Evaluation Package developed for this research was the result of collaboration between the researcher and an independent trialist who was a colleague at the same school. The contents and format of the package were altered several times in response to inputs from discussions with the independent trialist, from a seminar held at Rhodes

University with the staff of the Education Department and with fellow M.Ed. students.

5.2. SOFTWARE USED

The software used for the research was not as diverse as was intended. Its range was determined by the limits imposed by availability and affordability. The software that was researched may be grouped into three basic categories, namely:-

- a) software for Biology
- b) software for Geography, and
- c) across-the-curriculum software.

With respect to a) above, the following pieces of software were used for the research purposes using the Selection and Evaluation Forms:-

	Rating /100
i) Dieting by Garland	46
ii) The Kidney by Garland	57
iii) Transpiration by Garland	51
iv) Blood Sugar by Garland	62

Other Biology software that was taken through the selection stage only included:-

	Rating /100
v) Photosynthesis by Garland	53
vi) DNA Structure and Replication by Garland	59
vii) Dieting by Cambridge	61

The use of the Evaluation Package helped to differentiate the software into two basic groups, namely 'average to good'

and 'good to very good', according to the pre-determined rating-scale.

From the above results the package only produced a spread of scores with a range of 16 points. The true capacity of the Evaluation Package needs to be tested across a wider range of software.

It must be pointed out that Geography and across-the-curriculum software was also analyzed using the Selection Form. This helped to illustrate the flexibility of the Selection Form. It was also found to be applicable in other subject areas. The only difference being that two sub-criteria had to be altered, namely:-

a) 4.1.2. - Understanding of Biological Issues

which could be changed to read:-

4.1.2. - Understanding of Related Issues, and

b) 4.2.5. - Nurtures a Respect For Life,

which could be changed to read:-

4.2.5. - Nurtures a Respect For The Subject

The other software used for selection purposes included the following titles :-

	Rating /100
a) Mapwork Skills by Ginn Software	55
b) Expedition to Saqqara by Ginn Software	56
c) Mary Rose by Ginn Software	66

5.3. A DISCUSSION OF A SAMPLE FORM - "THE KIDNEY" BY GARLAND

What follows is a brief look at a sample program entitled "The Kidney" using the Selection Form. Relevant extracts will be referred to in an attempt to highlight the value of the Selection and Evaluation Forms. (Refer to Appendices 4 and 5 for details of the completed Selection and Evaluation Forms based on the software.)

5.3.1. THE SELECTION FORM - A DISCUSSION OF THE RESULTS

Using the overall rating scale, the program emerged with a score of 57/100 i.e. in the range 51 - 75%, or in simple terms 'Good to Very Good'. This can be illustrated by an extract from the summary page which gives a review of all subtotals of the different criteria used.

10. RATING SCALE	
Instructions: Fill in the relevant details using the ratings from the sections	
1.. DETAILS OF SOFTWARE	RATING: <u>2</u> OUT OF <u>10</u>
2.. EVALUATOR'S PARTICULARS	<u>N/A</u> <u>N/A</u>
3.. HARDWARE REQUIRED	<u>N/A</u> <u>N/A</u>
4.. SOFTWARE OBJECTIVES	<u>18</u> <u>24</u>
5.. TECHNICAL DESIGN	<u>14</u> <u>24</u>
6.. SUBJECT CONTENT	<u>14</u> <u>22</u>
7.. DOCUMENTATION	<u>9</u> <u>20</u>
=====	
TOTALS	
	<u>57</u> <u>100</u>
RATING SCALE:-----	
0 - 20	NOT RECOMMENDED TO POOR
21 - 40	POOR TO AVERAGE
41 - 50	AVERAGE TO GOOD
51 - 75	GOOD TO VERY GOOD
76 - 100	VERY GOOD TO OUTSTANDING

Having reviewed the overall rating scale the individual sub-totals are of importance to the reviewer. By referring to various sub-totals, the reviewer is given an indication of the strengths and weaknesses of a particular program.

Another important issue that emerges from the summary sheet is that the software is rated above 50% for the 'Software Objectives', the 'Technical Design' and 'Subject Content' of the program. By referring to each of these sub-criteria the reviewer is made aware of why the evaluator rated these sections so highly. With reference to the former two sub-criteria, it can be seen from the following extract the type of information that was recorded, together with the ratings for the individual subsections.

INFLUENCE OF FACTOR
VERY NEGATIVE

4. SOFTWARE OBJECTIVES									
4.1.	GENERAL OBJECTIVES AS STATED ..Help you to learn the anatomy of the nephron of the ..kidney (part 1); Use of animated graphics to show how the kidney works in.....								
	..excretion and the control of water and salt.....	-2	-1	0	+1	+2			
4.2.	OBJECTIVES MUST SATISFY SOME OF THE FOLLOWING CRITERIA								
4.2.1.	UNDERSTANDING OF BIOLOGICAL ISSUES ..Excretion and homeostasis.....							+2	
4.2.2.	AWARENESS OF INTER-RELATIONSHIPS ..Well demonstrated; control of water.....							+2	
4.2.3.	FOCUS ON OBSERVATION ..Not a major factor.....			0					
4.2.4.	LEADS TO MEANINGFUL RECORDINGS ..Not a major factor for consideration.....			0					
4.2.5.	ALLOWS FOR ANALYSIS AND SELECTION ..Well demonstrated in part 2.....					+1			
4.2.6.	FORMATION OF HYPOTHESES ..Yes - especially in part 2 of the software.....							+2	
4.2.7.	TESTING OF HYPOTHESES ..Yes - especially in part 2.....							+2	
4.2.8.	FACILITATES EFFECTIVE COMMUNICATION ..can lead to productive discussions....							+2	
4.2.9.	ALLOWS FOR EXPRESSION OF IDEAS ..Can be linked to other related factors....					+1			
4.2.10.	NURTURES A RESPECT FOR LIFE ..If the program is used correctly.....							+2	
4.3.	ARE THE SOFTWARE OBJECTIVES ACHIEVABLE ...Yes.....							+2	
4.4.	GENERAL COMMENTS ..A very effective program which demonstrates both the structure.. ..and the function of the kidney from the point of view of excretion and homeo-.... ..stasis. The objectives of the software can be achieved for both the upper and... ..lower ability groups in the class. Simple graphics are used and the program..... ..can be separated into either structure or function separately.....								

				0	2	16	TOTAL	18	24

5. TECHNICAL DESIGN									
5.1.	GRAPHICS ..Very effective graphics are used to represent the nephron of the kidney.							+2	
5.2.	FLOW ..logical and effective.....					+1			
5.3.	INSTRUCTIONS ..On screen prompts are simple and effective.....							+2	
5.4.	BUGS ..No bugs encountered.....							+2	
5.5.	DEGREE OF CONTROL ..The user has a reasonably high degree of control.....							+2	
5.6.	DEGREE OF FREEDOM ..The freedom is primarily concerned with altering the conditions					+1			
5.7.	SELF CONTAINED ..Reasonably well contained but needs initial input from teacher....					+1			
5.8.	DOCUMENTATION DEPENDENCY ..Only in the initial stages.....							+2	
5.9.	SCREENS EASY TO READ ..Screens were uncluttered and easy to read.....							+2	
5.10.	EFFECTIVE USE OF SOUND ..The program makes no use of sound.....			0					
5.11.	OTHER (state) ..None.....			0					
5.12.	WHAT IMPROVEMENTS IF ANY ..The use of the randomly selected questions in the..... ..Tutorial could be altered to ensure that different questions are asked each time.								
			-1					
5.13.	GENERAL COMMENTS ..The use of the simple graphics is effective in conveying the.... ..structure of the nephron as well as the movement of the substances through the... ..nephron. Pupils' attention is drawn to what is happening by flashing arrowswhich means that their attention will be focused on the activity with an..... ..uncluttered screen display. The only problem is that the random selection..... ..of questions tends to select a few questions a bit too often which may cause the... ..pupils to lose interest in the program								

				-1	0	3	TOTAL	14	24

The above extract gives a detailed explanation of the way in which the evaluator views the program.

With reference to 'Subject Content' and 'Documentation' as sub-criteria, mentioned previously in this section, the following comments emerge from the general statements:

```
+-----+
| 6.12. GENERAL COMMENTS ..A very useful program. It
|       relates structure to function and visually
|       illustrates the concepts of homeostasis with
|       regard to the regulation of water by ADH and
|       the effects of salt and alcohol on the
|       production of ADH
+-----+
```

and:-

```
+-----+
| 7.3.  GENERAL COMMENTS..The documentation is
|       generally aimed at the teacher level but
|       the pupils may be in a position also to gain
|       something from it
+-----+
```

Selection Form (Appendix 4)

From these types of comments, the reviewer is in a better position to judge the software as he/she is provided with useful highlights. Comments that emerged were:

"Relates structure to function.."

"Visually illustrates the concepts of
homeostasis.."

"Documentation is generally aimed at the
teacher.."

The summary provides a comprehensive analysis of the software. This includes an all-round evaluation of what to expect from the software. It also includes details such as price, and type of computer used.

The issue here is that the reviewer, having being primed with the information from the Selection Form, is likely to be in a better position to make a more reliable decision, rather than spending money on unknown material. At the same time a teacher who utilizes the forms in preparing himself/herself for lessons involving computers and specific pieces of software, should be better prepared to achieve the software objectives and the objectives of that particular lesson. The teacher who makes use of the Selection Form should, in time, be better equipped to make professional judgments on the use of educational software.

5.4. THE EVALUATION FORM

The final test to see whether the selection process has been successful, is to take the software into the classroom/laboratory and evaluate it. The second part of the Evaluation Package was designed to be used as a tool for this purpose in the classroom/laboratory.

5.4.1. INFORMATION PRESENTED BY THE PUPILS - THE QUESTIONNAIRE

As mentioned previously, the design of the package described in this research is aimed specifically at those teachers who have had little or no experience with computers. The intention is to provide the teacher with a suitable method of monitoring the effectiveness of the teaching strategies

he/she is using in his/her classroom/laboratory when using computers.

The primary method of data capture is through the use of a questionnaire aimed specifically at the pupils. By analyzing the pupils' responses to the questionnaire it is possible to identify trends relating to how the various ability groups view the software as well as details pertaining to the software. The analysis of these responses will be discussed in the following section.

5.4.2. PUPILS' RESPONSES

This section is designed to provide the teacher with some basic details about the pupils themselves. It is necessary to highlight some of the important issues that emerged from the research.

The original research was conducted between April and May of 1988. Further modifications were made with an independent trialist who used the Evaluation Package. The results of a class of 29 higher grade pupils were used in research conducted in April 1991 as a sample to illustrate the use of the Evaluation Package. It must be noted that only two BBC computers were available for one lesson with 15 pupils around the one computer and 14 around the other. This must be borne in mind when considering the results.

The results of the pupils' responses to the questionnaire were as follows. Of the three ability groups, namely the higher, middle and lower ability groups, in the main all three groups reported that they enjoyed working with computers, though 9% of the pupils said that they did not enjoy working with computers, possibly due to the limited number of computers available.

More than 66% of all three groups wanted more lessons with computers. The lower and middle ability groups tended to have a more favourable response to the idea of more computer lessons than the upper ability group. Related to this was the fact that more than 87% of all three groups found the computers easy to use. This may have influenced whether they wanted more lessons with computers. No pupils claimed that they did not enjoy any lesson at all though there were mixed feelings as to the extent of their enjoyment. All three groups reported that the computer kept them busy for varying lengths of time. Those in the lower ability group all claimed to want to use the computer more in lessons. This tendency was also expressed by the middle ability group where 78% would like to have used the computer more, as opposed to 66% in the upper ability group.

The questionnaire also captured data with respect to the role of the teacher. More than 91% of all pupils claimed that the teacher explained how to use the computer properly. More than

60% of the pupils claimed that they did not have to call the teacher at any time to explain what to do. A major difference in opinion between the three groups emerged with reference to whether they thought that the teacher could have explained the lesson better without the computer. Of the upper ability group 66% said yes and 34% said that maybe the teacher could have explained the lesson better. The middle group reported 13% yes, 48% maybe and 39% no. The lower ability group reported 0% yes, 66% maybe and 34% no. The possible reason for this could be that the upper ability pupils are more aware of the teacher's capabilities than the other groups.

With reference to the program, the majority of the pupils claimed to have enjoyed it with no pupils claiming that they did not enjoy it. Related to this is the fact that 78% of the pupils claimed to have followed what the program was all about with the remaining 22% following some of the time. All of the upper ability group followed the program. All pupils reported that there was enough time to see everything on the screen which is a positive factor in favour of the program. All groups claimed to have had discussions with their friends during the lesson but there were no definite trends between the groups. Both the upper and lower ability groups claimed that the instructions were easy to follow, while 83% of the middle group said they were easy to follow with 4% claiming that the instructions were not easy to follow. The remaining 13% claimed that the instructions were alright to follow.

The results obtained in another five lessons using the same software showed very similar trends with slight variations in the percentages.

The aim of the research was to provide teachers with a tool to select and evaluate educational software. It was not considered appropriate to conduct pre- and post-testing to 'prove' that the software had achieved its objectives and produced meaningful learning. The action research approach adopted was considered more suitable.

5.4.3. COMMENTS BY THE PUPILS

A variety of comments emerged from the lessons. It is possible to detect several general themes emerging from the comments of the different classes. The manner in which the general themes became apparent was that all the comments from the pupils were recorded under their respective headings, and then examined for significant trends. Any recurring statements were then identified and noted down.

One such recurring comment that emerged from the lessons concerned the use of animated graphics. The pupils reported that they were able to relate more easily to the graphic depiction of the kidney. All groups of pupils, higher, mixed and lower ability, commented on the use of movement and graphics to convey the details. The following extracts of the

pupils' comments are used to support these statements:-

Higher Ability Group

"I enjoyed the way they used movement in the diagram to show us what was going on."

Mixed Ability Group

"The fact that we could actually see the blood and salt and water moving - it makes things easier to understand (seeing is believing)."

Lower Ability Group

"I enjoyed seeing how the pictures actually had blood and minerals moving through them. It made it clear how they functioned," and

"The visible aspect, i.e., being able to see the diagram on the computer and working out the labels helped me to remember the diagram more clearly."

The common element that emerged was that the use of animation made it easier to understand the process involved. This tends to support the ideas of Laxton who makes reference to computer graphics when he says:-

"One strong feature of much good computer-assisted learning material has been good graphics. With high resolution, colour, and rapid interaction with the user, computer graphics are a powerful element of CAL packages."

(Laxton 1985:189)

Another aspect that emerged as a common feature in each program was that of understanding the content. The comments that were made included:

"Explaining the kidney function diagrammatically made it seem much simpler." (from "The Kidney")

"Watching the process taking 'place' on the screen. This has been explained before but seems clearer now that I have seen it." (from "The Kidney")

"Very simple program but able to understand it immediately." (from "Dieting")

"Basically I got deeper insight into something I already knew. It helped me to understand it more easily." (from "Blood Sugar")

"The comments that came up on the screen when the fluid was moving through the nephron made it easier to understand." (from "The Kidney")

"The fact that what is shown on the screen may be used again, i.e. recalled. To be able to go over it again and again helped me to understand and remember it better than if I had just seen it in a text book." (from "Transpiration")

Any teaching aid which can enhance the understanding of the learning material should be considered to be of importance to a teacher. Arising from the comments it would suggest that some of the software helped to explain the material to the pupils more effectively. This does not mean to say that teachers must employ the computer in every aspect of learning. On the contrary, there are certain aspects of the syllabus that can best be taught by traditional means, whereas there are others that are well suited to computer aided instruction. The issue to remember is that the computer is not the teacher. The teacher and the computer must be seen as a team. This fact was identified by one of the pupil comments and highlights the importance of the use of computers in the classroom/laboratory.

"The lesson was easy to understand as the computer was there to show you and if you still didn't understand the teacher was there to explain."
(from "The Kidney")

There can be little doubt that the novelty value of the computer came to the fore. There were many pupils who reported that they enjoyed using the computer, or that the computer was intelligent, or that working with computers was easy and so on.

A feature to look for in the comments from the pupils is those aspects of the content that the pupils claim to have learned. This will give an indicator as to whether the software has achieved its objectives or not. Some appropriate comments were:-

"Dieting must be done sensibly according to weight, height and frame." (from "Dieting")

"I learned the labels on the diagram where substances are re-absorbed. How water, salt and alcohol affect the system." (from "The Kidney")

"Homeostatic relationships and how all the factors interact and where absorption takes place." (from "The Kidney")

"The diabetic people inject themselves with insulin, it was interesting to see the difference with shock in a normal person than that of a diabetic person." (from "Blood Sugar")

Another aspect which emerged from the empirical work was the computer skill gained in the Biology lesson. As one teacher sitting in on a computer lesson pointed out, "the pupils are gaining more than just the factual material, they are gaining computer literacy with hands-on experience. The benefits of exposure to computers can be of assistance to the pupils in later life". The resistance to use of computers can also be overcome, as was illustrated by the following statements:-

"I learned the diagram of the nephron and what the consumption of water, salt and alcohol can do to your urine - most of all I learned that computers aren't as difficult to operate once you know how, they're actually quite basic." (from "The Kidney")

"The fact that we did not only learn Biology helped us to learn about computers and how nice group work is if it is conducted in a calm and responsible atmosphere." (from "Dieting")

5.4.4. ANALYSIS OF THE RESULTS

The data presented in 5.4.2., namely Pupils' Responses was extracted using the results form (Appendix 3). By analyzing the different group's responses it is possible to identify the trends which occur between the various ability groups. It is this information that can provide valuable feedback to the teacher with respect to the pupils, the software and the teacher himself/herself.

5.4.5. THE OVERALL EVALUATION SUMMARY

The final summary page at the end of the Evaluation Package is a combination of the results of both the Selection Form and the Evaluation Form. It provides the reviewer with a comprehensive analysis of the program which was evaluated in the classroom/laboratory. This is a feature that none of the other 'evaluation' forms provided for, which reinforces the conception of the researcher, that other 'evaluation' forms displayed in Appendix 1, tend to be more of a simple review, rather than a true evaluation of a piece of software. As can be seen from the following extract from the evaluation of "The Kidney", the summary page provides the reviewer with detailed information pertaining to the software that was evaluated. This enables the reviewer to refer to any particular section in the Evaluation Package and to scrutinize the comments and ratings that the evaluator assigned to each of the criteria.

SUMMARY SHEET FOR OVERALL EVALUATION OF EDUCATIONAL SOFTWARE

1.1.	TITLE ..Kidney - Structure and Function.....		
1.2.	COMPANY ..Garland Education Software.....		
1.3.	GENERAL OBJECTIVES AS STATED ..Help you to learn the anatomy of a nephron; Use of.. ..animated graphics to show how the kidney works in excretion and homeostasis.....		
1.4.	EVALUATOR'S NAME ..Ron Beyers.....		
1.5.	RATING SCALES FOR SELECTION		
	Instructions: Fill in the relevant details using the ratings from the sections	(RATING)	(OUT OF)
1..	DETAILS OF SOFTWARE	2	10
2..	EVALUATOR'S PARTICULARS	N/A	N/A
3..	HARDWARE REQUIRED	N/A	N/A
4..	SOFTWARE OBJECTIVES	18	24
5..	TECHNICAL DESIGN	14	24
6..	SUBJECT CONTENT	14	22
7..	DOCUMENTATION	9	20
	TOTALS	57	100
1.6.	OVERALL RATING ON THE RATING SCALE OF [0 - 100]..57 'Good to very Good'.....		
2.	COMMENTS		
2.1.	OVERALL IMPRESSIONS OF PUPIL'S COMMENTS ..The general impression was that the..... ..pupils enjoyed using the program. They reported that the program helped to..... ..explain the structure of the nephron, as well as to display the concepts..... ..of homeostasis visually. Overall it helped them to learn the work better.....		
2.2.	OVERALL TEACHER'S COMMENTS ..The program is very useful in that it has both the facility for tutorial type.... ..of questioning aimed at the standard graders, as well as an animated diagram to.. ..show the functioning of the nephron. The final section deals very effectively.... ..with the concepts of homeostasis and the role that the kidney has to play..... ..in this respect.....		
2.3.	SOFTWARE'S STRONG POINTS ..The user is in complete control of the program at all times. The level of the.... ..content is of such a nature that it appeals to the pupils and does not confuse... ..them at all. It is a useful program to have and can be effectively implemented... ..in revision for individuals or for the whole class.....		
2.3.	SOFTWARE'S WEAK POINTS ..The random question generator does not eliminate questions that have been asked.. ..already and sometimes repeats the same question several times. There is nomethod of questioning the user again on those questions that were answeredincorrectly. The program does not keep a record of individual performances.....		

5.4.6. THE SIGNIFICANCE OF THE FORMS TO THE TEACHER

The value of the Evaluation Form lies in the analysis of the data provided by the pupils. An example of the type of data captured may be found in the question whether the pupils had enjoyed the lesson or not. If the reply had been that the majority of the pupils had not enjoyed the lesson, then the teacher would either have to look at the software that he/she had selected for the lesson, or he/she would have to look at how the lesson was presented. For the purposes of this research it was found that the level of interest in the computers was reasonably high for all the classes and the majority of the pupils enjoyed the lessons. This served as a good stimulus to continue using computer software in future lessons in Biology where possible and appropriate.

Another example of the type of data captured may be found in the question as to whether the teacher explained adequately the use of the program. If the pupils had said that the teacher had given insufficient explanation, then the teacher could interpret this to mean that he/she had not prepared himself/herself thoroughly for a lesson with that particular piece of software. The results of this research indicated that, for the six lessons evaluated, there was adequate explanation given by the teacher-researcher. It must be noted that, for all the programs evaluated, the teacher-

researcher used the Selection Form as a means of preparation for the lessons. This meant that the teacher-researcher was thoroughly prepared for the lessons, as was identified by the pupils using the Evaluation Questionnaire.

The potential of the Evaluation Form lies in long term research. By the accumulation of data on a number of lessons over a period of time, using different pieces of software, the teacher can build up a comprehensive picture of his/her own teaching strategies with respect to computers in his/her classroom/laboratory. This is likely to influence the future development of computers in education by providing teachers with positive feedback.

In the time that the research was conducted in the classroom/laboratory, some specific patterns emerged. At this stage the conclusions that can be drawn from the data accumulated are very tentative and may change as more information is accumulated and different teachers start to use the system.

However the following points emerged:-

- a) In the lower ability group all the pupils enjoyed using the computers while the upper and mixed ability groups had mixed feelings.
- b) The lower ability group stated that they found computers easy to use, but the other groups had mixed feelings.
- c) The majority of the pupils stated that the teacher

explained how to use the programs properly.

- d) Approximately half of the pupils stated that the teacher could not have taught the same lesson better without the computer, while approximately 40 percent stated that they were uncertain. The remaining 10 percent, primarily from the upper ability group, claimed that the teacher could have taught the same lesson better without the computer.
- e) More than 70 percent of the pupils claimed that they followed the lessons.
- f) More than 80 percent claimed that they had fruitful discussion during the lessons.
- g) More than 80 percent of the pupils found the instructions on the screen easy to follow.

It would appear that there were benefits in terms of motivation and cognitive understanding for all the ability groups. All pupils responded positively to the introduction of computers in the classroom/laboratory and the level of attention was very high. Once the pupils had gained confidence in using computers, many of them were proceeding to the point of making predictions before the software had completed that particular screen display.

It was observed that the lower ability pupils were looking to the computer to provide them with questions based more on the tutorial type of software. This was also evident in the higher ability pupils but they tended to interact more with

the software content rather than use the computer because of the novelty value involved. This was very evident with the program entitled "Blood Sugar" where the pupils had to supply the information with respect to whether the person was diabetic or normal, whether the person was to receive a shock or not and at what time. The results from this input were then plotted out simultaneously on four separate graphs relating to blood sugar levels, insulin levels, glucagon levels and adrenalin levels respectively. The amount of discussion that went on during the lesson was remarkable and it did not require much teacher input. All discussions centred around the topic presented by the software, and the pupils attempted to predict answers to questions of a "what if?" nature, followed by trying to simulate these conditions on the computer. All this focused on the topic of homeostasis, which the teacher-researcher previously has found difficult to explain effectively at this level and in this depth.

5.5. COMMENTS BY THE INDEPENDENT TRIALIST

An independent trialist tried out the Evaluation Package using the program called "The Kidney". Though the forms were not completed entirely due to ill health at the time of the evaluation, the independent trialist did provide valuable feedback.

Firstly, the length of the document was judged to be unwieldy for the time conscious teacher. The time taken to study the Evaluation Package initially is time consuming and it was felt that the length of the document needed to be shortened to a more manageable length. Several sections that were initially included in the package were either removed entirely or reduced to the essentials.

Secondly, the statistical correlations that were initially included in the package were complex and of no real value. The independent trialist felt that a lot of time would be spent in achieving very little real feedback. The correlation research aspect was therefore removed entirely and replaced with a simple grid which could be used to identify basic trends between upper, middle and lower ability pupils.

Thirdly, the independent trialist felt that it was important to know the conditions under which the software was evaluated, such as the number of computers and the number of pupils in the class. The results did reflect this problem as in the case of the class of 29 pupils and only 2 computers. Many of the pupils reported that there were too few computers. Provision was therefore made for comments on the conditions under which the software was tested as an item on the Evaluation Form, but it did not form part of the summary page.

Fourthly, the basic aim of the research was not indicated on

the original package. This problem was rectified together with several other minor changes which were made to improve the Evaluation Package as a whole.

The view of the independent trialist was that the Selection and Evaluation Forms did have a distinct role to play in the evaluation of educational software. The forms did focus the attention of the teacher on important evaluation criteria. The independent trialist was not familiar with the more loose interpretation of the scientific method which Cohen and Manion (1989:218) suggest is associated with action research. She did, however, agree that the Evaluation Package had a valuable role to play when a teacher, who was not familiar with computers in the classroom/laboratory, wanted to utilize the software at his/her disposal.

CHAPTER SIX

DISCUSSION OF THE RESULTS

6.1. THE TRIANGULAR RELATIONSHIP : TEACHER-PUPIL-COMPUTER

Having used the computer in the Biology classroom/laboratory the researcher suggests that the computer is a powerful tool for assisting the teacher in conveying concepts to pupils. It is a powerful teaching aid insofar that it can assist the teacher in achieving the aims of a lesson.

Evans (1986) sees the whole process primarily as a triangular relationship where the points of the triangle are formed by:-

- a) the teacher,
- b) the pupil, and
- c) the computer, together with the software being used.

This view is also strongly supported by the researcher. It is important to consider the roles played by the components of this triangular relationship.

The triangle formed must be viewed as being dynamic. This will depend on a number of factors, namely, the type of lesson that has been planned, the capabilities of the teacher, the ability level and composition of the class, and the piece of software being utilized. It must also be recognized that throughout the lesson the emphasis will also change depending on the type of activity that is called for by the software.

6.1.1. THE TEACHER

"As with any instructional material, the teacher must personally learn how to use the software first. Learning the software is always composed of two parts : learning the mechanics of the levels, choices, exit mechanisms, and help systems which allow one to move between the various components of the program ; and understanding the learning objectives of the program - what it is designed to teach? How can the teacher facilitate that learning? And what kind of questions should the teacher ask which will cause the students to actively develop the structures and insights this program is designed to encourage? This second component - the teaching component - is often totally neglected. This often occurs when teachers assume that software teaches. Teachers teach, and in order to effectively do so, they need to know where they are going or they're liable to end up somewhere else."

(Van Deusen & Donham 1986-87:32)

The role of the teacher in a computer lesson should be that of coordinator of the activities. In order to be able to achieve this the teacher must be fully acquainted with the finer intricacies of the software to be presented in the lesson. By being fully prepared, the teacher is then capable of being in full control of the lesson at all times. One thing that must be emphasized is that the teacher also needs to be prepared for the unexpected. A lesson with computers can be quite easily destroyed by unforeseen circumstances, in the form of a power failure, the corruption of a disk, or a hardware malfunction. In such cases the teacher must be prepared to adopt an alternative approach.

Before a teacher takes software into the classroom/laboratory it is important that the teacher is thoroughly prepared. One

of the aims of this preparation is to ensure that the teacher knows how the software operates, and how the teacher will interact with the software.

"In designing or assessing computer programs as elements in your teaching, it will help if you are aware of your role as a teacher."

(Nash 1983:19)

The importance of the teacher can be categorized into three main areas. Firstly, the teacher must have a sound knowledge of the subject. Secondly, the teacher must be fluent with the software for the lesson. In order to achieve this, the researcher advocates the use of the Selection Form. Thirdly, the teacher will have to know the potential of the pupils in order to adapt the teaching approach to their level. This means that the teacher must be able to focus the pupils' attention on different aspects of the software.

In connection with the third point mentioned above, Blease sees the role of the teacher as follows:-

"Judgements have to be made knowing the strengths and weaknesses of the class and the rate at which individuals are able to absorb new ideas. The teacher must decide which points of the work would best be handled by the computer, and which points might be necessary to intervene with other tasks away from the computer."

(Blease 1986:5)

The emphasis is on the teacher knowing the pupils' individual needs. It follows that the teacher's responsibility is to know when to use the computer and when not to.

"If the software is being used because it fulfils a particular need for a particular child or group of

children then it could be valuable. If, however, it is merely used to give children a turn at the computer then it is not really serving any useful purpose. The child's time could better be spent on another activity and the computer used in more useful applications."

(Blows and Wray 1989:157)

Perhaps the important thing to note is that the computer should be utilized only if it can be done so effectively.

Carney supports this view in the implementation of CAI in the classroom/laboratory and in a way the researcher sees as a fundamental issue in this research:-

"The critical factor influencing what cognitive skills students develop using CAI is not the software, but the teacher. The teacher can structure the learning environment with CAI as the vehicle for the students to develop goal setting, creative problem solving, analysis, evaluation and peer-interaction skills. CAI is compatible with this kind of environment and can be a powerful helpmate to a teacher trying to create this setting."

(Carney 1986:12)

As has been advocated throughout this thesis, the success of the computer in the classroom/laboratory rests very largely in the hands of the teacher. It is the teacher who has the potential to turn the software into a powerful teaching aid.

Govier makes the point that:-

"A computer cannot teach. It cannot even structure learning skills and concepts when they are of such complexity as those inherent in scientific activity. The competent and experienced teacher remains the only essential resource. In the microcomputer such teachers have a new and very powerful tool."

(Govier 1985:37)

To sum up the role of the teacher Terry has the following to say:

"Teachers are very versatile teaching devices. Their outstanding ability is their adaptability which even for a poor teacher potentially exceeds that of the best adaptive CAL package. A teacher is able to sense and probe a pupil's learning difficulties and then try a succession of different strategies, ..., in an attempt to overcome the problem. ...

However, while teachers are the most effective all round teaching devices they have some drawbacks to offset their many virtues... The teacher's ability to adjust his teaching to the needs of individual pupils, and hence his effectiveness, can be seriously diluted in large classes. The problem is compounded by the administrative load which inevitably falls on the teachers and reduces the time that they devote to their pupils. This may be alleviated by using the computer to assist with the management of learning. The second drawback is the teacher's limited presentation bandwidth. Although the teacher is very adaptable, by himself he can only impart information to his pupils by speech and gestures. This makes it difficult for him to explain visual phenomena or the functioning of dynamic systems, unless he makes use of other media to support these parts of the course."

(Terry 1984:39)

6.1.2. THE PUPIL

Pupils also have a distinct role to play in the triangular relationship. It is not recommended that they be left entirely on their own at the computer. It is also not recommended that the teacher sits at the computer with the pupils standing behind his/her back. The whole process must be viewed as a situation where the teacher and the pupils interact with the computer software. Each piece of software will have different requirements, and the pupils must be

assisted to adapt to these requirements in order to achieve the objectives of the software.

The key to a successful lesson using computers is involving the pupils as much as possible in the lesson. This is a fundamental teaching principle. Computers have an inherent attention-holding potential which is exemplified in the arcade-type game. The teacher should utilize this potential to achieve the aims of the lesson.

The role of the pupil is that of being in control of the learning process through active involvement. Most of the lessons in this research ended with spontaneous discussions between the pupils themselves. The benefit of this is that the pupils actively encourage and teach each other. As a result it is recommended that the software is not run on a one-to-one basis with one computer per pupil. It would be better to stimulate 'cross pollination' of ideas among peers through discussion. Pupils can learn through interaction with their peers. Bork also identified the interaction of peers when pupils worked with computers.

He states that:-

"The students interacted not only with the computer display but also with each other, often in a fashion that was highly directed towards the learning experience."

(Bork 1985:271)

The pupil should have control over his/her own learning pace. Teachers sometimes overlook the fact that pupils may not have

grasped the concepts of a lesson and as a consequence proceed with new material prematurely. A possible benefit of the computer is that the pupils will continue only once they are confident that they have mastered the information.

6.1.3. THE COMPUTER

The actual type of computer is of little importance to the triangular relationship though it does influence which software can be used in the classroom/laboratory. An example of this would be that software written for BBC computers cannot not be run on IBM, Commodore or Apple computers. The price of the hardware and the availability of the software may be influencing factors when it comes to the initial purchase.

It is the software that allows for the interaction between the pupils and the teacher. Depending on the type of software the teacher is provided with the means to direct the learning process as it occurs at the interface with the pupils. With most software the teacher has very limited control over the content being presented to the pupils, but the teacher needs to know the strengths and weaknesses of that particular piece of software in order to supplement it where necessary.

The objectives of the software may not necessarily match the objectives of the lesson. In order for the teacher's objectives to match completely those of the software for a

particular lesson, the teacher would have to write the software himself/herself. It is therefore important that the software objectives are clearly stated by the program designer so that the teacher can supplement these objectives if necessary. As mentioned previously, it is possible for poor educational software to be used effectively by a good teacher. On the other hand good software may not achieve the desired objectives if it is not used correctly.

The question as to what makes educational software good or bad is difficult to define in precise terms. In order to determine the answer to this question will involve a more precise study in itself and did not form part of this research. However, an overriding consideration as to what makes educational software good must centre around the objectives and the way in which these objectives are achieved. The way in which these objectives are coupled to the objectives of the lesson will certainly determine the outcome of the lesson as they must take into account the part played by the pupils and the teacher.

There is some software that will not require much influence from the teacher such as drill and practice type software. In such a case the software will focus purely on the interaction with the pupils. Some simulation programs such as "Blood Sugar" may be used without any teacher interference. In some cases it may be necessary for the teacher to control the

software directly, as in the case where there are is only one computer available per class. It may be possible for the computer to be linked up to a television screen for the whole class to watch the software. It is still possible to achieve the objectives of the software if the teacher directs the discussions during the lesson while he/she operates the computer.

An important point to note when dealing with computers in the classroom is that the teacher must be in control of the situation in order to achieve the objectives of the lesson. The teacher must use the computer as a teaching aid at his/her disposal to achieve these objectives by incorporating the objectives of the software into the lesson.

6.2. IMPLICATIONS OF THE TRIANGULAR RELATIONSHIP

The implications of the triangular relationship are simple. The onus is placed on the teacher to prepare himself/herself in the use of a particular piece of software in order to achieve a given objective or objectives. This process can be made easier by the use of the Selection Form which alternatively could be called the "Preparation Form". The pupils can also contribute to the relationship by being permitted to determine their own pace while having hands-on experience. If the teacher is sitting at the computer, there is little chance that he/she can observe what each pupil is doing. Ideally, the teacher should move freely between the

pupils and the computers. It may be necessary to highlight certain features on the video display unit by pointing to them. It is also advisable that the teacher instructs the pupils in terms of keyboard input rather than physically doing the input himself/herself.

Full familiarity with the software on the part of the teacher is essential. If the teacher is not prepared for what is to appear on the screen next, it could lead to an embarrassing situation and the confidence of the pupils might be lost.

In this discussion the importance of recognizing and exploiting the triangular relationship has been emphasized. The success of a lesson may depend upon how this relationship is nurtured.

6.3. LIMITATIONS OF THE RESEARCH

The research was conducted on a small scale using six different classes. The results could be significant but it is not possible to generalize from the data. The choice of the type of research, namely action research, was appropriate in that it provided a viable framework for the evaluation of educational software in the Biology classroom/laboratory. The research was aimed at improving the teaching of Biology through the use of the evaluation package. In this situation the teacher acted as both teacher and researcher, which in

itself is a limitation. Because the teacher is actively involved, he/she may not be able to be objective in his/her evaluation of the software. The use of an independent trialist, however, gave another perspective to the research and hopefully, increased the level of objectivity of the findings.

There is another limitation to this research. The Evaluation Package is a lengthy document which does take a long time to complete. This may be viewed by some as a major disadvantage. The importance, however, of evaluating a piece of educational software thoroughly must not be underestimated. The real value of a piece of software can only be revealed through thorough investigation. The researcher advocates, therefore, that educational software be evaluated in fine detail by using an Evaluation Package such as the one developed for this purpose in this research.

The Evaluation Package is neither complete nor closed. A recommendation for further research is that the package be developed further. This can be achieved by extending the range of Biology software for testing, as well as extending the testing to other subject areas. Different teachers should also assess the package and modify it for their own individual uses, as mentioned in Appendix 3, page 9 (1). This may ultimately result in a more useful working document.

CHAPTER SEVEN
IMPLICATIONS OF THE RESEARCH

The level of the research was aimed specifically at the average teacher who has had little or no computer experience. It is helpful for teachers to be provided with a tool to assist them in the task of selecting and evaluating good educational software. By using a tool, such as the one developed and tested in this research, the teacher is able to identify the strengths and weaknesses of software. The researcher has shown that the Evaluation Package can be used effectively in Biology lessons for the selection and evaluation of Biology software. The package is, however, sufficiently adaptable for it to be applied to other subjects as well.

The package was designed for the teacher who is willing to teach with the aid of computers. By addressing the various issues surrounding the use of educational software, the teacher is likely to be better equipped to select and use good educational software in the future. By using the Evaluation Package the teacher should have a firm foundation on which to base the selection and evaluation of software. Jacobs also sees the situation in a similar light by providing what he believes is a set of criteria by which a person can become a 'Computer Education Specialist':-

"For microcomputers to positively impact education,

educational leaders must recognize that the implementation of computer education programs cannot be left to well-meaning but already overburdened classroom teachers. A specialist who can provide leadership and guidance is needed. This proposed set of competencies for such a computer education specialist separates computer education from the realms of computer science. It places the focus on educator and not on computer, giving more teachers a viable role in using computers in the instructional settings."

(Jacobs 1985:18)

The philosophy of Jacobs is simple. What is needed is 'Computer Educators' and not 'Computer Science Educators'. No doubt there is a place for the computer scientist in the subject field of computer studies. In order to help Biology teachers to become 'Computer Educators', however, they must be provided with the means to do so. One possible way to achieve this lies through the use of the Evaluation Package.

The researcher has shown that the Evaluation Package can be successfully applied to Biology software. The Evaluation Package can be adapted as further research by more Biology teachers into this subject is conducted. The package provides a basis for future research. There is a need for the Evaluation Package to be expanded and developed for other teachers to use, in Biology as well as other subjects.

By developing the forms further and utilizing the services of other teachers, an extensive data base could be established for all Biology software. This data could be stored on computer diskettes which could be circulated amongst teachers providing them with detailed information pertaining to

software that has been evaluated elsewhere.

What is needed now is for the concepts embodied in this research to be spread to practicing Biology teachers and teachers of other subjects further afield in South Africa.

"-We need to appraise the role of the computer in the whole range of secondary subjects.

-We must consider the computer as a tool to be used in any way that is appropriate.

-We need to educate teachers in the use of the computer using sensible strategies that relate more to classroom experience."

(Evans 1986:62)

The opinions of teachers are very important in the evaluation of educational software.

"... the opinion of a competent, experienced colleague carries considerably more weight than data-laden jargonistic descriptions by "experts" from outside the classroom."

(Hofmeister 1984 : 7-19)

In conclusion, the following references express the future hope of this research:-

"It is therefore very important that teachers get together to exchange ideas and information, preferably on a local basis, in order to keep up to date with this rapidly advancing area of education."

(Hall 1985:26)

"Talk to others who use computers; attend workshops and conferences; and read reviews in general computer magazines, publications devoted specifically to computers in education, or other periodicals for educators and parents. Check software catalogues from educational suppliers,... Most important, when you find a program that helps strengthen a child's mind, spread the word - there are lots of us out here."

(Kleiman 1985:61)

It is hoped that the results of this research will not lie bound up in this thesis but that they will be disseminated to the many 'unconverted' and those 'sitting on the fence'. The true value of the Selection and Evaluation Forms will lie in their implementation by teachers who are prepared to take the bold step of entering the computer age. It is hoped that by using the forms, they will be making that step less traumatic and the end products will speak for themselves.

LIST OF REFERENCES

- Adams, T. (1988). Computers in Learning : A Coat of Many Colours. Computer Education, 12. (1) 1-6
- Ayerst, J.M. The use of microcomputers in field and laboratory work. In Smith C.J. (Ed) Exploring Biology with Microcomputers. London : Council for Educational Technology. 118-123
- Barker, P. & Yeates, H. (1985). Introducing Computer Assisted Learning. United Kingdom: Prentice-Hall
- Blease, D. (1986). Evaluating Educational Software. New Hampshire : Croom Helm
- Blows, M. & Wray, D. (1989). Using computers effectively. Warwickshire, Great Britain : Scholastic Publications
- Bork, A. (1985). Children and Interactive Learning Environments. In Milton, C. (Ed) Children and Microcomputers. California: Sage 267-275
- Carney, C.C. (1986 March). Teacher + Computer = More Learning. The Computing Teacher . 12-15
- Chambers, J.A. (1983). Computer-Assisted Instruction. New Jersey : Prentice-Hall
- Cohen, L. & Manion, L., (1989). Research Methods in Education. Kent : Mackays
- Computer Mail (1987 September 25). Supplement to the Financial Mail. 19-25
- Department of Education. (1985) Senior Secondary Course Syllabus for General Science (Ordinary Grade). Provincial Administration of the Cape of Good Hope.
- Doll, C.A. (1987) Evaluating Educational Software. Chicago and London : American Library Association
- Ediger, M. (1986 October). Microcomputers in the Science Curriculum. Spectrum. 62-64
- Evans, N. (1986). The Future of Microcomputers in Schools. Hampshire : Mac Millan Education

- Govier, H. (1985). The Potential of Simulations for Teaching Primary Science. In Stewart, J. (Ed) Exploring Primary Science and Technology with Microcomputer. London : Council for Educational Technology. 31-37
- Hall, C. (1985). Aspects of computer-assisted learning in biology. In Smith C.J. (Ed) Exploring Biology with Microcomputers. London : Council for Educational Technology. 16-30
- Hofmeister, A. (1984). Microcomputer Applications in the Classroom. New York : CBS College Publishing
- Jacobs, J.E. (1985 August/September) Let's Prepare Computers Educators - NOT Computer Science Educators. The Computing Teacher. 17-18
- Kleiman, G.M. (1985 Fall/Winter) The Electronic Classroom. What to look for in Education. Compute. 59-61
- Laxton, A.W. (1985). Training institutions and the 'new technology'. In Smith, C.J. (Ed) Exploring Biology with Microcomputers. London : Council for Educational Technology. 183-191
- McNiff, J. (1988) Action Research: Principles and Practice. London : MacMillan Education.
- Naiman, A. (1987 February) A Hard Look at Educational Software. Byte. 193-200
- Nash, A. (1983). An introduction to microcomputers in teaching. London : Hutchinson & Co.
- Rawlinson, A. (1985). The use of microcomputers in analysing and presenting results. In Smith C.J. (Ed) Exploring Biology with Microcomputers. London : Council for Educational Technology. 139-150
- Rogers, G. In Hall, C. (1985). Aspects of computer-assisted learning in biology. In Smith C.J. (Ed) Exploring Biology with Microcomputers. London : Council for Educational Technology. 16-30
- Self, J. (1985). Microcomputers in Education. Sussex : The Harvester Press

- Serfontein, C.P. (1980). Computers-Assisted Instruction: Remedial Mathematics Instruction in Absolute Values. Pretoria : HSRC
- Terry, C. (1984). Using Microcomputers in Schools. Kent : Croom Helm
- Van Deusen, R.M. & Donham, J. (1986-1987, December/ January). The Teacher's Role in Using the Computer to Teach Thinking Skills. Compute. 32-34

Appendix Page 1

Appendix 1.1.

OTHER SELECTION AND EVALUATION FORMS

Reference : Burt, C. (1985 May). Software in the Classroom -
A form for teacher use. The Computing
Teacher. 16-19

EDUCATIONAL SOFTWARE—CLASSROOM USE ANALYSIS

DATE _____
SIGNATURE _____

1. CLASSIFICATION

NAME OF PROGRAM _____
PUBLISHER _____
AVAILABLE FROM _____ FOR _____
SPECIAL EQUIPMENT _____

2. SPECIFICATION

SUBJECT AREA _____ GRADE LEVEL _____
SPECIFIED TOPIC _____

TYPE:

- DRILL & PRACTICE
- TUTORIAL
- SIMULATION
- GAME
- PROBLEM SOLVING
- SKILL BUILDER
- OTHER _____

MENU: (title and mnemonic)

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____

MANAGEMENT _____
RECORDKEEPING _____

COMMENTS: _____

3. LESSON/UNIT INVOLVEMENT

USAGE:

- REMEDIATION
- STANDARD INSTRUCTION
- ENRICHMENT

PURPOSE:

- INTRODUCE
- REVIEW
- MOTIVATE
- REINFORCE
- TEST

UNIT: _____

LESSON: _____

CLASSROOM MANAGEMENT:

- MUST DISK REMAIN IN DRIVE TO USE? YES NO
- INDIVIDUAL GROUP CLASS
- SIGN-UP SHEET ASSIGNMENT

TIME ALLOTMENT PER RUN _____

TOTAL TIME ALLOTTED _____

4. TEACHER INVOLVEMENT

PREPARATION: _____

USAGE: _____

SUMMARY: _____

5. STUDENT INVOLVEMENT

PREPARATION: _____

USAGE: _____

SUMMARY: _____

Appendix Page 2

Appendix 1.2.

OTHER SELECTION AND EVALUATION FORMS

Reference : Chambers, J.A. (1983). Computer Assisted Instruction. New Jersey :
Prentice Hall, 75-77

TABLE 5-1.
 COURSEWARE REVIEW CHECKLIST
 SECTION I: COURSEWARE OBJECTIVE(S)—NEEDS TO BE MET

TABLE 5-1. (Continued)

SECTION II: DEMOGRAPHICS

DATE: _____ REVIEWER: _____

PRODUCT: _____

SECTION III: SCREENING CRITERIA

- | | | |
|--|---|---|
| 1. Is the courseware applicable to the objectives? | Y | N |
| 2. Is the required microcomputer available? | Y | N |
| 3. Are the computer language and operating system available? | Y | N |
| 4. Is the cost within budgetary limits? | Y | N |
| 5. Are the required peripherals available? | Y | N |
| 6. Is the instructional design appropriate? | Y | N |
| *****RECOMMENDED FOR REVIEW? | Y | N |

SECTION IV: INSTRUCTOR-RELATED ITEMS

DATE: _____ INSTRUCTOR: _____

- | | Poor | Good |
|---|---------|------|
| A. Administrative Issues | | |
| 1. Backup availability and cost | 1 2 3 4 | |
| 2. Defect guarantees and quantity discounts | 1 2 3 4 | |
| 3. Learning environment | 1 2 3 4 | |
| 4. Documentation | 1 2 3 4 | |
| B. Content Issues | | |
| 1. Instructor-controlled parameters | 1 2 3 4 | |
| 2. Accuracy | 1 2 3 4 | |
| 3. Environment | 1 2 3 4 | |
| 4. Pedagogy | 1 2 3 4 | |
| 5. Answer judging | 1 2 3 4 | |
| 6. Branching | 1 2 3 4 | |
| 7. Learning theory | 1 2 3 4 | |
| 8. Time allowances | 1 2 3 4 | |
| 9. Progress reporting | 1 2 3 4 | |
| 10. Professionalism | 1 2 3 4 | |
| C. Technical Issues | | |
| 1. User friendliness | 1 2 3 4 | |
| 2. Error trapping | 1 2 3 4 | |
| 3. Color dependency | 1 2 3 4 | |
| 4. Speed of execution | 1 2 3 4 | |
| 5. Appearance | 1 2 3 4 | |

SECTION V: STUDENT-ORIENTED REVIEW

- | | Poor | Good |
|----------------------------|---------|------|
| 1. Results | 1 2 3 4 | |
| 2. Student Control | 1 2 3 4 | |
| 3. Freedom from Technology | 1 2 3 4 | |
| 4. Motor Skills | 1 2 3 4 | |
| 5. Motivational Value | 1 2 3 4 | |

TABLE 5-1. (Continued)

SECTION VI: OVERALL RATING AND COMMENTS

*****OVERALL RATING (Note: We recommend only courseware rated 3 or higher be considered for acquisition.)

Comments: (Attach additional pages if extra space is needed.)

SECTION VII: POSTIMPLEMENTATION COMMENTS (Attach additional pages if extra space is needed.)

Appendix 1.3.

OTHER SELECTION AND EVALUATION FORMS

Reference : Sales, G. Carrier, C & Glen, A. (1986 May)
Evaluating Lessons that use
Computers. The Computing
Teacher. 46-47

Lesson Evaluation Tool

Part I. Overall lesson including both computer and non-computer components.

Directions:

1. Circle a number on the scale next to each instructional event indicating how closely you believe the success of your lesson correlates with the statement provided.
2. As you consider each event, note any suggestion that may occur to you for modifying the lesson.

Lesson title _____

Lesson objective(s) _____

Instructional Events	Event Rating Scale					Modifications Needed
	low				high	
Gaining Attention	1	2	3	4	5	This activity encouraged students to focus on the task.
Informing Students of Objectives	1	2	3	4	5	This activity helped students form expectations about the need to master the content to be presented.
Stimulating Recall of Prerequisite Knowledge	1	2	3	4	5	This activity helped to refresh students' memories of related information.
Presenting Content	1	2	3	4	5	The content presentation was clear and accurate.
Providing Learning Guidance	1	2	3	4	5	This activity provided effective instructional support for the students.
Eliciting Performance	1	2	3	4	5	The practice or application activities reinforced new knowledge.

Part II. Computer-related activities.

Directions:

1. Using the scale below as a reference, circle a number indicating your response to each of the following statements.
2. Where appropriate, add suggestions for improvements and comments.

Activity Title _____

SCALE	STATEMENT	SUGGESTION
low	high	
	INSTRUCTIONAL	
1 2 3 4 5	The computer component helped students to achieve the lesson objectives.	
1 2 3 4 5	The software used accommodated the range of student abilities.	
1 2 3 4 5	Students were interested in the computer activity.	
1 2 3 4 5	The software proved to be a valuable component of the lesson.	
	CLASSROOM MANAGEMENT	
1 2 3 4 5	The grouping arrangement used was successful.	
1 2 3 4 5	The time required for the computer-related portion of the lesson was appropriate.	
1 2 3 4 5	The technique used for monitoring student progress was effective.	
1 2 3 4 5	Students were able to operate the hardware.	
	SOFTWARE	
1 2 3 4 5	A sufficient quantity of the software was available to meet lesson needs.	
1 2 3 4 5	The software ran without any problems.	
1 2 3 4 5	The software made effective use of the computer as an instructional medium.	
	HARDWARE	
1 2 3 4 5	A sufficient quantity of hardware was available.	
1 2 3 4 5	All the appropriate hardware was available.	

Appendix Page 4

Appendix 1.4.

OTHER SELECTION AND EVALUATION FORMS

Reference : Signer, B. (1983 October) How do Teacher and
Student Evaluations of CAI Software
compare? The Computing Teacher. 34-36

Figure 1.
Signer Student Software Questionnaire
(Write author for additional validation data
and permission to reproduce forms.)

This will not be graded. Your comment will simply be used to improve your instruction. Your help in evaluating the instruction is invaluable.

Date _____ Evaluator's Name _____

Program Name _____

Chapter _____ Section _____

T _____ F _____ 1. I enjoyed the microcomputer program.
 (Comments)

T _____ F _____ 2. Working with the screen became boring.
 (Comments)

T _____ F _____ 3. I found myself just watching the screen,
 rather than trying to learn.
 (Comments)

T _____ F _____ 4. I feel satisfied with what I learned.
 (Comments)

5. The pace of the instruction using the microcomputer was:
 _____ Just right _____ Too fast _____ Too slow
 (Comments)

6. The amount of material covered during the lesson was:
 _____ Just right _____ Too much _____ Not enough
 (Comments)

7. I feel that the material presented was:
 _____ Too difficult for me
 _____ Just normal for me
 _____ Perfect. I really learned quicker with the microcomputer
 _____ Mostly a review since I already knew it
 (Comments)

8. What would you change to make this lesson better for you?

9. What did you really like about this lesson?

Figure 2.
Signer Teacher Software Evaluation Checklist

Program _____ Microcomputer _____
 Lesson Topic _____ Ch _____ Sec. _____
 Teacher _____ Program Author _____
 Times Presented _____

1. Was the pace appropriate for your instruction? (Why or why not?)

2. What would you like to see altered?

3. What suggestions do you have for teachers using it for the first time?

4. Was outside preparation required?

a. How much time?

b. Preparation of additional materials?

5. Compare this lesson using the microcomputer program to your past teaching of the topic.

a. Student behavior

b. Facilitation of material to be learned

6. General comments (hardware, classroom management, etc.).

7. Program use: Introductory? Drill practice? Review?

a. Your use

b. Suggested use

END ■

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Appendix Page 5

Appendix 1.5.

OTHER SELECTION AND EVALUATION FORMS

Reference : Hofmeister, A. (1984) Microcomputer Applications
in the Classroom. Holt : CBS
College Publishing

COURSEWARE EVALUATION FORM

PROGRAM
NAME: _____

PUBLISHER: _____

PRICE: _____

	SUPERIOR	VERY GOOD	GOOD	FAIR	POOR
CONTENT					
INSTRUCTIONAL DESIGN					
RECORD KEEPING/ MANAGEMENT					
EASE OF USE					

I. PACKAGE CONTENTS

II. HARDWARE REQUIREMENTS

Figure 7.1

COURSEWARE EVALUATION FORM 2

Content

	EXCELLENT	SATISFACTORY	UNSATISFACTORY	NOT APPLICABLE
Objectives are fully and clearly defined.				
Target audience is clearly defined.				
Outside activities are appropriate and effective.				
Prerequisite skills are clearly defined.				
Content is presented clearly and logically.				
Content is transferable and generalizable.				
Content is consistent with objectives.				
Vocabulary level is appropriate for subject area and learner level.				

Figure 7.2

COURSEWARE EVALUATION FORM 3

Instructional Design

	EXCELLENT	SATISFACTORY	UNSATISFACTORY	NOT APPLICABLE
Learner controls rate and sequence of instruction.				
Program can be used independently.				
Learner interacts only with appropriate segments.				
Program utilizes a variety of display and response modes.				
Program minimizes necessary typing.				
Program handles a wide range of student responses appropriately.				
New material is presented in context and is related to previous material.				
Summaries and reviews are provided, important concepts are restated.				
Program can be adjusted by user for local needs.				
Appropriate use of graphics/color/sound.				
Feedback is useful and appropriate.				
Instruction is active rather than passive.				
Learner expectancies are established.				
Program has consistent display rate.				
Displays are clear, understandable and effective.				

Figure 7.3

COURSEWARE EVALUATION FORM 4

Record Keeping & Management

	EXCELLENT	SATISFACTORY	UNSATISFACTORY	NOT APPLICABLE
Program keeps accurate records of student response.				
Program keeps ongoing student records.				
Program includes diagnostic/evaluative testing.				
Program generates further assignments.				
Program graphically depicts student progress.				
Program provides statistical information on student progress.				
Program allows printout and screen display of student records.				

Ease of Use

	EXCELLENT	SATISFACTORY	UNSATISFACTORY	NOT APPLICABLE
Support materials provided are comprehensive and effective.				
Program is reliable in normal use.				
"HELP" procedures are available.				
Program can be exited by student or automatically when appropriate				

Figure 7.4

COURSEWARE EVALUATION FORM 5

Program Strengths and Weaknesses

Validation

PROGRAM TESTED

From _____ To _____

_____ In house

_____ Independent

_____ Controlled

_____ Uncontrolled

POPULATION(S) TESTED _____

ASSESSMENT INSTRUMENT(S) _____

EVALUATION SITE(S) _____

RESULTS _____

CONTACT PERSON _____

ADDITIONAL INFORMATION _____

EVALUATED BY _____

DATE _____

Figure 7.5

Appendix 1.6.

OTHER SELECTION AND EVALUATION FORMS

Reference : Doll, C.A. (1987) Evaluating Educational Software.
Chicago and London : American Library
Association

Evaluation Checklist

- I. When you receive an educational microcomputer software program to evaluate or preview, supply the following information as accurately and completely as possible.

A. Program title: _____

Series title (if applicable): _____

Local vendor: _____

Cost: _____ Copyright date: _____

- B. Hardware specifications and compatibility:

Make/model microcomputer: _____

Memory required: _____

Program language: _____

DOS: _____

Required peripherals:

_____ second disk drive _____ color monitor

_____ graphics capabilities _____ printer

_____ game paddles _____ other (specify):

Input device:

_____ floppy disk _____ cassette

_____ cartridge

Evaluation Checklist

C. Subject/curriculum area: _____
 Age/grade level: _____

II. When considering a piece of instructional microcomputer software for purchase, answer the following questions.

- | | Yes | No |
|---|-------|-------|
| 1. Will this program run on my model of microcomputer? | _____ | _____ |
| 2. Does my microcomputer have enough memory capacity to run this program? | _____ | _____ |
| 3. Do I already have all the necessary extras to make this program run (e.g., second disk drive, printer, game paddles, color monitor)? | _____ | _____ |
| 4. Is this program written in a language my microcomputer "speaks"? | _____ | _____ |
| 5. Is the input device compatible with my equipment? | _____ | _____ |
| 6. Is a backup copy of this program readily available? | _____ | _____ |
| 7. Will this program be used in my school or library, instead of sitting on the shelf? | _____ | _____ |
| 8. Are there mistakes in this program? (This includes spelling, grammatical, content, and/or programming errors.) | _____ | _____ |
| 9. Will good vendor support be available after the program is purchased? | _____ | _____ |

A negative response to any of the above should cause the reviewer or reviewers to seriously consider *not* purchasing the program.

III. Now run the program on the microcomputer and respond to the following statements. Try to run the program normally, without any deliberate mistakes. Then see how it responds to errors. While working with the program, indicate how much you agree with the following statements. Skip those statements which do not apply to the program being evaluated.

A. Presentation of Content

- | | Strongly
Agree | Agree | Disagree | Strongly
Disagree |
|--|-------------------|-------|----------|----------------------|
| 1. Program content is accurate. | _____ | _____ | _____ | _____ |
| 2. Program is up to date or current. | _____ | _____ | _____ | _____ |
| 3. Program is unbiased and free of stereotyping. | _____ | _____ | _____ | _____ |

Evaluation Checklist

- | | Strongly
Agree | Agree | Disagree | Strongly
Disagree |
|--|-------------------|-------|----------|----------------------|
| 4. Information is presented on computer screen in nonconfusing manner. | _____ | _____ | _____ | _____ |
| 5. Program is compatible with texts and other materials. | _____ | _____ | _____ | _____ |

B. Educational Quality

- | | Strongly
Agree | Agree | Disagree | Strongly
Disagree |
|---|-------------------|-------|----------|----------------------|
| 1. Authors have background or training in education. | _____ | _____ | _____ | _____ |
| 2. Program was pretested and revised. | _____ | _____ | _____ | _____ |
| 3. Possible to identify program goal(s) and objectives. | _____ | _____ | _____ | _____ |
| 4. Program enhances, supports, and supplements school objectives. | _____ | _____ | _____ | _____ |
| 5. Material organized in small, well-sequenced units. | _____ | _____ | _____ | _____ |
| 6. Information or skill presented more than once. | _____ | _____ | _____ | _____ |
| 7. Builds from familiar to the new or unknown. | _____ | _____ | _____ | _____ |
| 8. Required user response matches program objectives and/or desired type of learning. | _____ | _____ | _____ | _____ |
| 9. Required response matches skills of target audience. | _____ | _____ | _____ | _____ |
| 10. Program requirements match target audience. | _____ | _____ | _____ | _____ |
| 11. Reading level of program and its instructions match target audience. | _____ | _____ | _____ | _____ |
| 12. Prerequisite skills match both program and target audience. | _____ | _____ | _____ | _____ |
| 13. Where appropriate, computer screen is adapted for young users. | _____ | _____ | _____ | _____ |

Evaluation Checklist

	Strongly Agree	Agree	Disagree	Strongly Disagree
14. Neither content nor documentation is offensive or condescending to users.	_____	_____	_____	_____
15. Program is suitable for type and amount of anticipated use.	_____	_____	_____	_____
16. Intended user can work with program independently.	_____	_____	_____	_____
C. Documentation and Support Materials				
1. Manual well constructed and understandable.	_____	_____	_____	_____
2. Manual discusses advantages, disadvantages, and unique features of program.	_____	_____	_____	_____
3. Manual uses good organizational aids.	_____	_____	_____	_____
4. Manual gives clear directions on access to and use of instructional management portions of program.	_____	_____	_____	_____
5. Program can be used by following only directions which appear on computer screen.	_____	_____	_____	_____
6. On-screen instructions are clear, concise, and easy to follow.	_____	_____	_____	_____
7. Experienced users can bypass on-screen beginners' instructions.	_____	_____	_____	_____
8. Support materials do more than duplicate program content.	_____	_____	_____	_____
9. Support materials are educationally sound.	_____	_____	_____	_____
10. Program and accompanying materials are self-contained.	_____	_____	_____	_____

Evaluation Checklist

	Strongly Agree	Agree	Disagree	Strongly Disagree
D. User Interaction with Program and Operating Interaction				
1. User controls pace of program and, where appropriate, its direction.	_____	_____	_____	_____
2. Frequent opportunities for user interaction.	_____	_____	_____	_____
3. Function assigned particular key is consistent throughout program.	_____	_____	_____	_____
4. User can correct mistakes while entering information.	_____	_____	_____	_____
Response to Correct Answers				
5. Program acknowledges and/or rewards correct answers.	_____	_____	_____	_____
6. Variety in rewards for correct answers.	_____	_____	_____	_____
Response to Content Errors				
7. Program gives users second chance and/or repeats pertinent part of program.	_____	_____	_____	_____
8. Program does not simply indicate answer is wrong and then continues.	_____	_____	_____	_____
9. Program does not respond to wrong answers with insulting or derogatory messages.	_____	_____	_____	_____
10. Program does not use flashy, elaborate response to wrong answers.	_____	_____	_____	_____
11. No audible response to wrong answers.	_____	_____	_____	_____
Response to Format Errors				
12. Program prompts user when incorrect command is given.	_____	_____	_____	_____
13. Program prompts user when answer does not match required format or given list.	_____	_____	_____	_____

Evaluation Checklist

	Strongly Agree	Agree	Disagree	Strongly Disagree
14. Program accepts minor misspellings, where appropriate.	_____	_____	_____	_____
E. Utilization of Microcomputer Strengths				
1. Program branches; i.e., user response determines subsequent questions or information.	_____	_____	_____	_____
2. Program is more than computerized workbook.	_____	_____	_____	_____
3. Program gives immediate feedback.	_____	_____	_____	_____
4. Problems presented in random order.	_____	_____	_____	_____
5. Screen display well designed and uncluttered.	_____	_____	_____	_____
6. Graphics are distinct, understandable, and well designed.	_____	_____	_____	_____
7. Graphics highlight or emphasize key points.	_____	_____	_____	_____
8. Color or shading is used effectively.	_____	_____	_____	_____
9. Sound is used appropriately (e.g., to reward correct answer, enhance instruction, give directions).	_____	_____	_____	_____
10. It is easy to turn off sound.	_____	_____	_____	_____
F. Instructional Management				
1. Program records responses of individual users.	_____	_____	_____	_____
2. Program can store scores of more than one user.	_____	_____	_____	_____
3. Program differentiates between right answers on first, second, third try, etc.	_____	_____	_____	_____

Evaluation Checklist

	Strongly Agree	Agree	Disagree	Strongly Disagree
4. Program identifies type(s) of problems that gives a student difficulty.	_____	_____	_____	_____
5. Program gives initial diagnosis of student strengths and weaknesses.	_____	_____	_____	_____
6. Instructional management section is easy to use.	_____	_____	_____	_____
7. Possible for teacher or librarian to tailor program to users.	_____	_____	_____	_____
8. Possible to print out information in instructional management section.	_____	_____	_____	_____
9. Instructional management section has procedures to protect its information.	_____	_____	_____	_____
IV. In addition to the general statements in Section III, there are considerations which pertain to specific formats. Respond to statements in the following categories appropriate to the program being evaluated. Skip sections or statements which do not apply.				
	Strongly Agree	Agree	Disagree	Strongly Disagree
A. Drill and Practice Programs				
1. Program is repetitious.	_____	_____	_____	_____
2. Program has progressive levels of difficulty.	_____	_____	_____	_____
B. Tutorial Programs				
1. Assume some of the task of instruction.	_____	_____	_____	_____
2. Frequently assess user performance.	_____	_____	_____	_____
C. Problem-solving Programs				
1. User input influences situation presented.	_____	_____	_____	_____

	Strongly Agree	Agree	Disagree	Strongly Disagree
2. Program reacts to each user action.	_____	_____	_____	_____
3. Program contains all relevant details.	_____	_____	_____	_____
4. Program responds to wide variety of user actions.	_____	_____	_____	_____

D. Games/Simulations

1. Program has varying and progressive levels of difficulty.	_____	_____	_____	_____
2. User responses, not chance alone, determine results of program.	_____	_____	_____	_____
3. User can stop and return to program later without penalty.	_____	_____	_____	_____
4. Games are fun to play.	_____	_____	_____	_____
5. Simulations include all essential elements of real situation and interrelationships among these elements are accurate.	_____	_____	_____	_____

E. Shell Programs

1. Program has simple procedure for changing content.	_____	_____	_____	_____
2. Program accepts both letters and numbers.	_____	_____	_____	_____

V. The next step is to obtain an overall rating for the program being evaluated. To do this, count the total number of statements you *strongly agree* with, the number you *agree* with, the number you *disagree* with, and the number you *strongly disagree* with; and fill in the blanks below.

Strongly Agree	Agree	Disagree	Strongly Disagree
_____	_____	_____	_____

The sum of the numbers in the first two blanks (*strongly agree* and *agree*) is the total number of criteria on which the program was marked favorably or on which it performed well. The sum of the last

two numbers (*disagree* and *strongly disagree*) indicates the total number of evaluative criteria where the program does not perform well. These two figures summarize your reaction to the program and represent the number of its strengths (*strongly agree* and *agree*) and the number of its weaknesses (*disagree* and *strongly disagree*).

The numbers which result from this method should not be used as absolute guidelines. Instead, they provide a quick summary of your reaction and can help you come to a final decision. It is possible for a useful program to have a few more weaknesses than strengths, and you may wish to use or purchase such a program. It is also possible for a program to have a few more strengths than weaknesses, but the identified weaknesses may be more important than the strengths. In this case, the decision may be not to purchase or use the program.

VI. The last step is to make a final decision. Remember that no program is perfect. Then, based on the information gathered, use your professional judgment to determine whether or not to recommend this program.

- ___ 1. I recommend this program for purchase or use.
- ___ 2. I recommend this program with reservations or stipulations. (Please specify.)

- ___ 3. I do not recommend this program for either purchase or use.

Program Title: _____

Evaluator's Name: _____

Date: _____

Appendix 1.7.

OTHER SELECTION AND EVALUATION FORMS

Reference : McCormick, S. (1985). The development of Computer-Assisted Learning Materials : The Computers in the Curriculum Model. In Smith C.J. (Ed) Exploring Biology with Microcomputers. London : Council for Educational Technology. 31-43.

Appendix B. Formative evaluation checklist (Computers in the Curriculum Project)

FORMATIVE EVALUATION CHECKLIST

Below is a checklist of points helpful in assessing how well a CAL unit has been designed and written. Your reactions to these points are important to authors in editing a unit prior to publication.

The answers to questions such as those in the checklist are in fact very important to us but what would also be extremely valuable would be suggestions for alternative ways of expressing a particular idea so that, for example, in question S3, the identification of current shortcomings and proposals for alternatives would be most valuable.

PLEASE MAKE COMMENTS ON THIS FORM AND ON A COPY OF THE UNIT

BACKGROUND DATA (where appropriate)

- B1 Unit used by students - number
- age
- sex/other course.
- B2 Average time devoted to the unit by a student.
- B3 It would be helpful if we could identify you. If you have no objection please give your name.

STUDENT MATERIAL

- S1 Do the questions provide an adequate framework for student's activities not involving the program?
- S2 Do the questions provide an adequate framework for student's use of the program?
- S3 Is the prerequisite knowledge of the questions adequately covered:
- In the printed material itself
- deducible from the program
- otherwise?
- S4 Is the language used appropriate to the age/ability of target student?
- S5 Are the illustrations adequate?
- S6 Could the layout be improved?
- S7 Are there particular points of difficulty/confusion?

TEACHERS' MATERIAL - DOES THIS ADEQUATELY PROVIDE:

- T1 a statement of objectives?
- T2 a statement of the level and prerequisite knowledge?
- T3 a statement of the rationale for the unit, its scope and limitations?
- T4 useful suggestions re use of material in class, classroom organization, etc?
- T5 warnings of places likely to give student difficulty?
- T6 warnings about program limitations?
- T7 a statement of the computer model and assumptions made?
- T8 references to other sources, etc?
- T9 hints or comments on questions in the student material?
- T10 suggestions for extensions or increased flexibility?

PROGRAM

- P1 What, if any, failures occurred?
- P2 Are there unhelpful/misleading messages?
- P3 Does the program have a structure which makes it easy/convenient to use?
- P4 Are students puzzled by the display or uncertain what is expected of them?
- P5 Could the display of information be improved?
- P6 Is essential information lost from the display at any time?
- P7 Do changes in the display happen too quickly or too slowly?
- P8 Was the program used by students or as a class demonstration?

GENERAL

Your free-ranging comments on the value of the unit would be valuable. Why would you use it again (or not)? Also, it would be valuable to know of any data you may have on students' performance linked to their use of the material. Anecdotal evidence, eg, students' comments, your own observations, are always valuable.

PLEASE RETURN THIS FORM WITH AN ANNOTATED COPY OF THE UNIT - THANK YOU

Appendix 1.8.

OTHER SELECTION AND EVALUATION FORMS

Reference : Alexander, K & Blanchard, D. (1985) Educational Software : A Creator's Handbook.
Tecmedia : Loughborough 234 - 235

Software Evaluation Checklist

INSTRUCTIONAL CRITERIA

- A. What is the objective? _____
- B. Does the software objective match your curriculum objectives?
- C. Is the application appropriate for the type of learning outcome specified in the objective?
- D. Does the program use an instructional strategy appropriate to the application and learning outcome?

PRESENTATION CRITERIA

Screen format

- A. Liberal use of blank space
- B. Avoids busy, cluttered screen
- C. Avoids cryptic abbreviations and codes (uses another screen if necessary)
- D. Screen elements take advantage of natural eye movement
- E. Uses correct spelling and grammar
- F. Flashing text and other forms of highlighting used sparingly

Paging

- A. Avoids scrolling when paging to new material
- B. Uses a slight pause when erasing and redisplaying the same section of the screen
- C. Does not require the student to attend to two different things on the screen simultaneously
- D. Requires student response before proceeding to a new page. Avoids display time-outs
- E. Allows the student to page forward and backward through several pages of text

Ease of Use

- A. Provides menus and/or special commands that enable the student to go easily from one part of the program to another.
 - 1. Keys used to implement a command are mnemonically related to the purpose of the command
 - 2. All possible alternative commands are made clear
 - 3. A minimum of keystrokes is required to execute any command
 - 4. Keys used to execute commands are consistent throughout the program
- B. Instructions are clear, simple, and concise
 - 1. Instructions are available both on-line and off-line
 - 2. The student has the option to skip lengthy instructions
 - 3. The student is prompted what to do next at critical points in the

- C. Minimal time is required to generate title page
- D. Messages are provided to inform the student of noticeable pauses in a program
- E. Pauses are masked, where possible

Interaction

- A. Interactive capabilities of the computer have been well used
- B. The student is prompted on the nature of the expected response
- C. The student is allowed to correct typing mistakes by requiring the pressing of the ENTER key to signal the end of a response
- D. Error traps test the appropriateness of students' response
- E. Correct feedback is provided when students enter the incorrect answer to questions or problems
- F. Sarcastic feedback is avoided
- G. The number of times students must iterate through try-again loops is minimized

Curriculum

- This program fits our current curriculum or can be modified to our curriculum

Appendix Page 9

Appendix 2

A BLANK SELECTION FORM

Software

Selection

Form

INFLUENCE OF FACTOR
 VERY NEGATIVE
 SLIGHTLY NEGATIVE
 NONE
 SLIGHTLY POSITIVE
 VERY POSITIVE
 -2 -1 0 +1 +2

6. SUBJECT CONTENT		-2	-1	0	+1	+2
6.1. DEGREE OF ACCURACY						
6.2. RELEVANCE OF TITLE						
6.3. STIMULATING						
6.4. DEGREE OF DIFFICULTY						
6.5. ADDITIONAL INFORMATION GIVEN						
6.6. UNNECESSARY DETAIL						
6.7. WHAT IMPROVEMENTS IF ANY						
.....						
.....						
6.8. OTHER (state).....						
.....						
6.9. PREREQUISITE KNOWLEDGE REQUIRED						
.....						
6.10. APPLICABILITY TO THE PRESENT SOUTH AFRICAN SYLLABUS						
.....						
6.11. APPLICATION OF SOFTWARE TO OTHER SUBJECT AREAS						
.....						
6.12. GENERAL COMMENTS						
.....						
.....						
						TOTAL

22

7. DOCUMENTATION		-2	-1	0	+1	+2
7.1. CONTENT						
7.1.1. LENGTH						
7.1.2. WORKSHEET(S)						
7.1.3. DIAGRAMS						
7.1.4. RELIABILITY						
7.1.5. ADDITIONAL INFORMATION						
7.1.6. GENERAL COMMENTS						
.....						
7.2. INSTRUCTIONS FOR USE						
7.2.1. INSTRUCTIONS FOR TEACHERS						
7.2.2. INSTRUCTIONS FOR PUPILS						
7.2.3. GENERALLY USEFUL						
7.2.4. OTHER (State)						
.....						
7.3. GENERAL COMMENTS.....						
.....						
.....						
						TOTAL

20

8. CONCLUSIONS OF SELECTION

Use the information recorded in sections 1 - 7 to complete this section. Feel free to state the obvious as well as to be critical of the content and application of the software you are evaluating

CONTENT

OBJECTIVES

DOCUMENTATION

VALUE FOR MONEY

USABILITY

CLASSROOM MANAGEMENT

GENERAL

9. SUMMARY AND RATINGS

Instructions: Place a CROSS (X) over the appropriate block which you think best applies to that particular topic

9.1. TITLE OF SOFTWARE

9.2. SOFTWARE OBJECTIVES

9.3. TYPE OF SOFTWARE DRILL AND PRACTICE TUTORIAL GAME SIMULATION MODEL

9.4. SOFTWARE DESIGN (Technical). UNACCEPTABLE POOR AVERAGE GOOD OUTSTANDING

9.5. DOCUMENTATION... NONE LIMITED SUFFICIENT VERY GOOD

9.6. RECOMMENDED CLASS MANAGEMENT... INDIVIDUAL SMALL GROUPS LARGE GROUPS WHOLE CLASS

9.7. VALUE FOR MONEY... ROBBERY POOR FAIR GOOD EXCELLENT

9.8. RECOMMENDED... YES YES BUT WITH CERTAIN RESERVATIONS NO

10. RATING SCALE

Instructions: Fill in the relevant details using the ratings from the sections

	RATING	OUT OF
1.. DETAILS OF SOFTWARE		10
2.. EVALUATOR'S PARTICULARS	N/A	N/A
3.. HARDWARE REQUIRED	N/A	N/A
4.. SOFTWARE OBJECTIVES		24
5.. TECHNICAL DESIGN		24
6.. SUBJECT CONTENT		22
7.. DOCUMENTATION		20
TOTALS		100

RATING SCALE

0 - 20	NOT RECOMMENDED TO POOR
21 - 40	POOR TO AVERAGE
41 - 50	AVERAGE TO GOOD
51 - 75	GOOD TO VERY GOOD
76 - 100	VERY GOOD TO OUTSTANDING

PLEASE NOTE: These scores are relative scores and that further information may be obtained by studying the individual strengths and weaknesses as reflected in the table above.

FOR FURTHER INFORMATION CONTACT :-
RON BEYERS
(Queenstown Girls' High 0451-4160)

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Appendix 3

A BLANK EVALUATION FORM

Software



Evaluation



Form



ANALYSIS OF THE EDUCATION SOFTWAREINSTRUCTIONS TO PUPILS

- 1) Please inform the pupils that this is not a test.
- 2) Ask the pupils to be as critical as possible when completing the questionnaire as all information will be treated as confidential.

SOME NOTES TO THE TEACHER

- 1) It is advisable that the Evaluation Form is completed as soon after the lesson as possible by the pupils, the teacher, and the non-participant observer.
- 2) The scores for each question are allocated a number according to their position, i.e.

All responses on the *LEFT* are assigned a score = 1
 All responses in the *MIDDLE* are assigned a score = 2
 All responses on the *RIGHT* are assigned a score = 3

Examples no!_X_'yes!_; SCORE = 1

no!_;;maybe!_X_'yes!_; SCORE = 2

not at all!_;;it was alright!_;;very much!_X_' SCORE = 3

- 3) Once all the questionnaires have been coded, enter each pupil's individual scores on the MASTER EVALUATION RESULTS FORM. Complete the arithmetic calculation to determine the correlation between the parties concerned.
- 4) Read through the comments that were recorded on the Evaluation Form noting down those comments that occur more frequently.
- 5) The forms were designed to give you a chance to correlate how the pupils view the computer lesson that you present to them. The primary goal is to evaluate the software.
- 6) Please note that it is not possible to make substantial generalizations from the data as the forms were not intended to do so.
- 7) It may be advisable for you to ask a colleague in your department to sit in on the lesson to act as an independent non-participant. They may provide you a slightly different perspective on the lesson.
- 8) It is important to record the information as accurately as possible. The forms were designed for easy use. The time spent on analyzing the results may well reveal worthwhile information pertaining to the software as well as your role in the lesson.
- 9) The form was designed for teachers to use. If you feel that any aspect of the forms do not comply with your requirements, please feel free to alter the forms wherever necessary.
- 10) If you wish to receive further information pertaining to the Selection And Evaluation of Software, or you wish to make any suggestions, please feel free to write to :-

Ron Beyers
 Queenstown Girls' High
 P.O.Box 95
 Queenstown
 5320
 Phone ; 0451 - 416011

COMPUTER LESSON EVALUATION FORM

NAME	DATE	CLASS
LESSON TITLE	GRADE	

Place a CROSS (X) in the appropriate box
 i.e. no! yes!
 or fill in the relevant information i.e. 16 years old

1. YOUR DETAILS

- 1.1. HOW WELL DO YOU DO IN BIOLOGY? below 50! 50-75! 75+!
- 1.2. DO YOU LIKE WORKING WITH COMPUTERS? no! maybe! yes!
- 1.3. WOULD YOU LIKE MORE LESSONS USING COMPUTERS? no! maybe! yes!
- 1.4. DID YOU FIND THE COMPUTER EASY TO USE? no! yes!

2. THE LESSON

- 2.1. DID YOU ENJOY THE LESSON WITH THE COMPUTER? not at all! it was alright! very much!
- 2.2. DID YOUR TEACHER EXPLAIN HOW TO USE THE PROGRAM PROPERLY? no! yes!
- 2.3. DID YOU HAVE TO CALL YOUR TEACHER AT ANY TIME TO EXPLAIN SOMETHING? no! yes!
- 2.4. TO WHAT EXTENT WERE YOU KEPT BUSY WITH THE COMPUTER very little! for a while! very much!
- 2.5. WOULD YOU LIKE TO HAVE USED THE COMPUTER MORE IN THE LESSON? no! yes!
- 2.6. DO YOU THINK THAT YOUR TEACHER COULD HAVE EXPLAINED THE LESSON BETTER IF THE TEACHER HAD NOT USED THE COMPUTER? no! maybe! yes!

CODE FOR OFFICIAL USE
1. <input type="checkbox"/>
2. <input type="checkbox"/>
3. <input type="checkbox"/>
4. <input type="checkbox"/>
5. <input type="checkbox"/>
6. <input type="checkbox"/>
7. <input type="checkbox"/>
8. <input type="checkbox"/>
9. <input type="checkbox"/>
10. <input type="checkbox"/>

3. THE SOFTWARE

CODE FOR
OFFICIAL USE

- | | | |
|--|---|---------|
| 3.1. DID YOU ENJOY THE PROGRAM CHOSEN BY THE TEACHER? | not at all!__!it was alright!__!very much!__! | 11.!__! |
| 3.2. DID YOU FOLLOW WHAT THE PROGRAM WAS ALL ABOUT? | not at all!__!sometimes!__!all the time!__! | 12.!__! |
| 3.3. WAS THERE ENOUGH TIME TO SEE EVERYTHING ON THE SCREEN BEFORE YOU CONTINUED? | no!__!yes!__! | 13.!__! |
| 3.4. DID YOU HAVE TO DISCUSS ANYTHING RELATED TO THE PROGRAM WITH YOUR FRIENDS? | no!__!yes!__! | 14.!__! |
| 3.5. WERE THE INSTRUCTIONS ON HOW TO USE THE PROGRAM EASY TO OPERATE WHILE YOU WERE USING THE PROGRAM? | no!__!alright!__!yes!__! | 15.!__! |
| 3.6. DID YOU HAVE TO REFER TO THE INSTRUCTIONS CONTINUALLY TO BE ABLE TO USE THE PROGRAM? | no!__!yes!__! | 16.!__! |

4. DOCUMENTATION

WAS THERE ANY DOCUMENTATION? IF YES THEN GO TO 4.1.: IF NO THEN GO TO 5.1.

- | | | |
|---|---------------------------------|---------|
| 4.1. DID YOU FIND THE DOCUMENTATION EASY TO READ? | no!__!yes!__! | 17.!__! |
| 4.2. WAS THE DOCUMENTATION USEFUL TO YOU? | no!__!yes!__! | 18.!__! |
| 4.3. DID YOU HAVE TO READ THE DOCUMENTATION BEFORE YOU USED THE PROGRAM? | no!__!yes!__! | 19.!__! |
| 4.4. HOW OFTEN DID YOU HAVE TO REFER TO THE DOCUMENTATION WHILE YOU WERE USING THE PROGRAM? | never!__!sometimes!__!a lot!__! | 20.!__! |

5. GENERAL COMMENTS

5.1. WHAT ASPECTS OF THE SOFTWARE DID YOU ENJOY?

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

5.2. WHAT ASPECTS OF THE SOFTWARE DID YOU NOT ENJOY?

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

5.3. WHAT DID YOU LEARN FROM THE LESSON?

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

Please note
ALL INFORMATION WILL BE TREATED AS CONFIDENTIAL
Thank you for your time and effort

EDUCATIONAL SOFTWARE - CLASSROOM EVALUATION AND ANALYSIS

EVALUATOR

DATE

1. CLASSIFICATION

Name of program

Publisher

2. SPECIFICATIONS

Subject Area Standard

Type of Program

3. LESSON INVOLVEMENT

How was the program used? (Remedial, instructional, enrichment, etc.,)

How many pupils were there in the class at the time of evaluation?

How many computers were there available for the lesson?

4. CLASSROOM MANAGEMENT

Teachers's preparation

.....

Teacher activity during the Lesson

.....

Other Teacher Comments

.....

.....

.....

Pupil activity

.....

Summary of pupil comments.....

.....

.....

.....

.....

.....

.....

Appendix Page 11

Appendix 4

A COMPLETED SELECTION FORM

"THE KIDNEY" - BY GARLAND

Software

Selection

Form

The Kidney

INFLUENCE OF FACTOR
 VERY NEGATIVE
 SLIGHTLY NEGATIVE
 NONE
 SLIGHTLY POSITIVE
 VERY POSITIVE
 -2 -1 0 +1 +2

1. DETAILS OF SOFTWARE

1.1. TITLE ..Kidney - Structure and Function.....

1.2. CLAIMED CONTENT ..Help you to learn the anatomy of the Nephron of a Kidney (part 1)
 ..Use of animated graphics to illustrate the process of excretion (part 2).....

1.3. AUTHOR / PROGRAMMER ..Val Garland and David Garland.....

1.4. COMPANY ..Garland Education Software.....

1.5. LOCAL SUPPLIERS ..Computers for Africa and Allen's Associates.....

1.6. LOCAL PRICE ..R350.....

1.7. LOCAL AVAILABILITY ...Difficult to have the software imported through local agents.....

1.8. FOREIGN PRICE ..unavailable.....

1.9. COPYRIGHT ..A copyright is placed on the software.....

1.10. RECOMMENDED LEVEL (STANDARD / AGE) ..14 +.....

1.11. TYPES OF SOFTWARE [DRILL AND PRACTICE; TUTORIAL; SIMULATION; GAME; MODEL; OTHER]
 ..Simulation and tutorial.....

1.12. RUNNING TIME ..30 - 40 minutes.....

|_ | | | +1 | |
 -2 -1 | | | | |
 |_-1_| | | | |
 |_-2_| | | | | +2_|
 |_-2_| -1_| | | | 4_| TOTAL 2
 10

2. EVALUATOR'S PARTICULARS

2.1. NAME ..Mr Ron Beyers.....

2.2. HOME ADDRESS ..36 Haig Avenue..... PHONE ..0451-6970.....
 ..Queenstown.....

2.3. WORK ADDRESS ..Queenstown Girls' High..... PHONE ..0451-4160.....
 ..P.O.Box 95 Queenstown.....

2.4. OCCUPATION ..Senior Science and Biology Teacher.....

2.5. PRESENT POSITION ..Head Of Department.....

2.6. ACADEMIC QUALIFICATIONS ..B.Sc, H.E.D., B.Ed.....

3. HARDWARE REQUIRED

3.1. MICROCOMPUTER

3.1.1. TYPE ..BBC or BBC Master.....

3.1.2. LANGUAGE ..Basic.....

3.1.3. MEMORY CAPACITY ..32K Minimum.....

3.1.4. SOUND ..None used.....

3.2. MONITOR

3.2.1. COLOUR ..Designed for colour monitors.....

3.2.2. MONOCHROME ..The software is not adversely affected by using a monochrome...

3.3. STORAGE MEDIUM

3.3.1. DISK DRIVE - SINGLE OR DUAL ..Single disk drive needed.....

3.3.2. CASSETTE TAPE ..Cassette version available.....

3.4. PRINTER ..Not required.....

3.4.1. PRINTER WIDTH ..Not applicable.....

3.5. PLOTTER ..Not applicable.....

3.6. OTHER COMMENTS ..The program is only suitable for BBC computers and is only...
 ...available on disk which can be transferred to a hard drive if available.....

INFLUENCE OF FACTOR
 VERY NEGATIVE
 SLIGHTLY NEGATIVE
 NONE
 SLIGHTLY POSITIVE
 VERY POSITIVE

-2 -1 0 +1 +2
 [] [] [] [] []

4. SOFTWARE OBJECTIVES

4.1. GENERAL OBJECTIVES AS STATED ..Help you to learn the anatomy of the nephron of the ..kidney (part 1); Use of animated graphics to show how the kidney works in..... ..excretion and the control of water and salt.....

4.2. OBJECTIVES MUST SATISFY SOME OF THE FOLLOWING CRITERIA

4.2.1. UNDERSTANDING OF BIOLOGICAL ISSUES ..Excretion and homeostasis.....

4.2.2. AWARENESS OF INTER-RELATIONSHIPS ..Well demonstrated: control of water.....

4.2.3. FOCUS ON OBSERVATION ..Not a major factor.....

4.2.4. LEADS TO MEANINGFUL RECORDINGS ..Not a major factor for consideration.....

4.2.5. ALLOWS FOR ANALYSIS AND SELECTION ..Well demonstrated in part 2.....

4.2.6. FORMATION OF HYPOTHESES ..Yes - especially in part 2 of the software.....

4.2.7. TESTING OF HYPOTHESES ..Yes - especially in part 2.....

4.2.8. FACILITATES EFFECTIVE COMMUNICATION ..can lead to productive discussions....

4.2.9. ALLOWS FOR EXPRESSION OF IDEAS ..Can be linked to other related factors....

4.2.10. NURTURES A RESPECT FOR LIFE ..If the program is used correctly.....

4.3. ARE THE SOFTWARE OBJECTIVES ACHIEVABLE? ..Yes.....

4.4. GENERAL COMMENTS ..A very effective program which demonstrates both the structure.. ..and the function of the kidney from the point of view of excretion and homeo-.... ..stasis. The objectives of the software can be achieved for both the upper and... ..lower ability groups in the class. Simple graphics are used and the program..... ..can be separated into either structure or function separately.....

[] [] [] [] [] +2
 [] [] [] [] [] +2
 [] [] [] [] [] 0
 [] [] [] [] [] 0
 [] [] [] [] [] +1
 [] [] [] [] [] +2
 [] [] [] [] [] +2
 [] [] [] [] [] +2
 [] [] [] [] [] +2
 [] [] [] [] [] +2
 [] [] [] [] [] +2
 [] [] [] [] [] +2
 [] [] [] [] [] +2
 [] [] [] [] [] +2
 [] [] [] [] [] 0 [] [] [] [] [] 2 [] [] [] [] [] 16 TOTAL 18
 24

5. TECHNICAL DESIGN

5.1. GRAPHICS ..Very effective graphics are used to represent the nephron of the kidney.

5.2. FLOW ..logical and effective.....

5.3. INSTRUCTIONS ..On screen prompts are simple and effective.....

5.4. BUGS ..No bugs encountered.....

5.5. DEGREE OF CONTROL ..The user has a reasonably high degree of control.....

5.6. DEGREE OF FREEDOM ..The freedom is primarily concerned with altering the conditions

5.7. SELF CONTAINED ..Reasonably well contained but needs initial input from teacher....

5.8. DOCUMENTATION DEPENDENCY ..Only in the initial stages.....

5.9. SCREENS EASY TO READ ..Screens were uncluttered and easy to read.....

5.10. EFFECTIVE USE OF SOUND ..The program makes no use of sound.....

5.11. OTHER (state) ..None.....

5.12. WHAT IMPROVEMENTS IF ANY ..The use of the randomly selected questions in the..... ..Tutorial could be altered to ensure that different questions are asked each time.

5.13. GENERAL COMMENTS ..The use of the simple graphics is effective in conveying the.... ..structure of the nephron as well as the movement of the substances through the... ..nephron. Pupils' attention is drawn to what is happening by flashing arrowswhich means that their attention will be focused on the activity with an..... ..uncluttered screen display. The only problem is that the random selection..... ..of questions tends to select a few questions a bit too often which may cause the... ..pupils to lose interest in the program

[] [] [] [] [] +2
 [] [] [] [] [] +1
 [] [] [] [] [] +2
 [] [] [] [] [] +2
 [] [] [] [] [] +2
 [] [] [] [] [] +1
 [] [] [] [] [] +1
 [] [] [] [] [] +2
 [] [] [] [] [] +2
 [] [] [] [] [] 0
 [] [] [] [] [] 0
 [] [] [] [] [] -1
 [] [] [] [] [] -1 [] [] [] [] [] 0 [] [] [] [] [] 3 [] [] [] [] [] 12 TOTAL 14
 24

INFLUENCE OF FACTOR
 VERY NEGATIVE
 SLIGHTLY NEGATIVE
 NONE
 SLIGHTLY POSITIVE
 VERY POSITIVE
 -2 -1 0 +1 +2

6. SUBJECT CONTENT	
6.1. DEGREE OF ACCURACY ..The subject material is covered accurately.....	_____+2_
6.2. RELEVANCE OF TITLE ..Relevant.....	_____+2_
6.3. STIMULATING ..A useful and stimulating program.....	_____+2_
6.4. DEGREE OF DIFFICULTY ..May be used for both Standard and Higher Grade.....	_____+2_
6.5. ADDITIONAL INFORMATION GIVEN ..The documentation does provide some additional info.	_____+1_
6.6. UNNECESSARY DETAIL ..No unnecessary details encountered.....	_____+2_
6.7. WHAT IMPROVEMENTS IF ANY ..None.....	_____0_
6.8. OTHER (state) ..None.....	_____0_
6.9. PREREQUISITE KNOWLEDGE REQUIRED ..It is advisable that the pupils do already have.. ..the theoretical knowledge of the structure and function of the kidney . The..... ..program can be used to revise and reinforce the concepts of excretion.....	_____+1_
6.10. APPLICABILITY TO THE PRESENT SOUTH AFRICAN SYLLABUS ..Eminently suitable, but..... ..only for the standard 10 syllabus.....	_____+2_
6.11. APPLICATION OF SOFTWARE TO OTHER SUBJECT AREAS ..Only to Biology and specifically.. ..excretion and homeostasis.....	_____0_
6.12. GENERAL COMMENTS ..A very useful program. It relates structure to function and..... ..visually illustrates the concepts of homeostasis with regard to the regulation of ..water by ADH and the effects of salt and alcohol on the production of ADH.....	_____0_

_____0_2_12 TOTAL 14
22

7. DOCUMENTATION	
7.1. CONTENT	
7.1.1. LENGTH ..Two pages.....	_____+1_
7.1.2. WORKSHEET(S) ..No worksheets are provided.....	_____0_
7.1.3. DIAGRAMS ...None provided.....	_____0_
7.1.4. RELIABILITY ...Generally good.....	_____+1_
7.1.5. ADDITIONAL INFORMATION ...some additional information is provided.....	_____+1_
7.1.6. GENERAL COMMENTS ..The documentation that accompanies the software is..... ..brief but it is felt that the software is reasonably well self-contained.	_____+2_
7.2. INSTRUCTIONS FOR USE	
7.2.1. INSTRUCTIONS FOR TEACHERS ..No distinction is made between teacher or pupil	_____+2_
7.2.2. INSTRUCTIONS FOR PUPILS ..No documentation provided for pupil use.....	_____0_
7.2.3. GENERALLY USEFUL ...Yes.....	_____+2_
7.2.4. OTHER (State)	_____0_
7.3. GENERAL COMMENTS..The documentation is generally aimed at the teacher level but.... ..the pupils may be in a position also to gain something from it.....	_____3_6_

_____3_6_ TOTAL 9
20

8. CONCLUSIONS OF SELECTION

Use the information recorded in sections 1 - 7 to complete this section. Feel free to state the obvious as well as to be critical of the content and application of the software you are evaluating

CONTENT ..The content of the software is sound but limited to the nephron of the.....
..kidney. It does not deal with the macro-structure of the kidney which a pupil...
..will have to find in a text book. This does help to focus the attention of the...
..user on the actual unit of filtration as the program deals with the function of..
..the nephron as well as homeostasis.....

DOCUMENTATION ..The documentation is adequate, providing the user with brief.....
..details of how to operate the program. The essential details of the structure....
..as well as the background to the concepts behind homeostasis are also provided...
..The documentation does include short notes on the effects of various substances..
..such as water, salts and alcohol on the production of ADH.....

VALUE FOR MONEY One is forced to use the software solely for the section on the kidney.
..This in terms of the South African syllabus is limited to Std. 10 only. This.....
..makes the software restricted in its general use throughout the standards.....
..In terms of the direct value for money it is reasonable as it does illustrate....
..the structure of the kidney as well as simulate the functioning and homeostasis..

USABILITY ..The software is restricted in terms of its usability across the standards..
..The only place where it can be used is in standard 10 under the section of
..Excretion. Even then it only represents a small portion of the syllabus. It does..
..on the other hand convey the concept of excretion and homeostasis very
..effectively which some teachers may find difficult to convey to their pupils.....

CLASSROOM MANAGEMENT ..A major factor to consider is the number of computers available..
..as the larger classes will not see the screen displays that clearly. The pupils..
..may then lose interest and become bored. The computer allows the pupils to
..interact effectively with the program by asking them questions followed by.....
..a simulation of excretion and a simulation of the effects of water, salt and.....
..alcohol on ADH.....

GENERAL ..The software is simple but very effective in conveying the details of.....
..the nephron to the user in part 1. The user also has the option of being asked...
..some questions by the computer based on the structure of the nephron which he/she
..have just viewed. The problem is that the questions that are randomly selected...
..tend to be repeated too often which may cause the pupils to want to continue to..
..the next section. In part 2 of the program the user is taken through the.....
..process of excretion by an effective moving simulation of the process of.....
..excretion, followed by the homeostatic control. The effects of water, salt and...
..alcohol are simulated. In this section the user has complete control of the.....
..input by increasing one of the factors. This could lead to effective.....
..classroom discussions.....

.....
.....
.....
.....

9. SUMMARY AND RATINGS

Instructions: Place a CROSS (X) over the appropriate block which you think best applies to that particular topic

- 9.1. TITLE OF SOFTWARE ..Kidney - Structure and Function.....
- 9.2. SOFTWARE OBJECTIVES
- 9.3. TYPE OF SOFTWARE DRILL AND PRACTICE TUTORIAL GAME SIMULATION MODEL
- 9.4. SOFTWARE DESIGN (Technical). UNACCEPTABLE POOR AVERAGE GOOD OUTSTANDING
- 9.5. DOCUMENTATION... NONE LIMITED SUFFICIENT VERY GOOD
- 9.6. RECOMMENDED CLASS MANAGEMENT... INDIVIDUAL SMALL GROUPS LARGE GROUPS WHOLE CLASS
- 9.7. VALUE FOR MONEY... ROBBERY POOR FAIR GOOD EXCELLENT
- 9.8. RECOMMENDED... YES YES BUT WITH CERTAIN RESERVATIONS NO

10. RATING SCALE

Instructions: Fill in the relevant details using the ratings from the sections

	RATING OUT OF	
1.. DETAILS OF SOFTWARE	2	10
2.. EVALUATOR'S PARTICULARS	N/A	N/A
3.. HARDWARE REQUIRED	N/A	N/A
4.. SOFTWARE OBJECTIVES	18	24
5.. TECHNICAL DESIGN	14	24
6.. SUBJECT CONTENT	14	22
7.. DOCUMENTATION	9	20
TOTALS		
	57	100

RATING SCALE :-----

0 - 20	NOT RECOMMENDED TO POOR
21 - 40	POOR TO AVERAGE
41 - 50	AVERAGE TO GOOD
51 - 75	GOOD TO VERY GOOD
76 - 100	VERY GOOD TO OUTSTANDING

PLEASE NOTE: These scores are relative scores and that further information may be obtained by studying the individual strengths and weaknesses as reflected in the table above.

FOR FURTHER INFORMATION CONTACT :-
RON BEYERS
(Queenstown Girls' High 0451-4160)

Appendix Page 12

Appendix 5

A COMPLETED EVALUATION FORM

"THE KIDNEY" - BY GARLAND

Software



Evaluation



Form



The Kidney

COMPUTER LESSON EVALUATION FORM

NAME	DATE	CLASS
LESSON TITLE		GRADE

Place a CROSS (X) in the appropriate box
 i.e. no! ;yes! !
 or fill in the relevant information i.e. 16 years old

1. YOUR DETAILS

- 1.1. HOW WELL DO YOU DO IN BIOLOGY? below 50! ;50-75! ;75+! !
- 1.2. DO YOU LIKE WORKING WITH COMPUTERS? no! ;maybe! ;yes! !
- 1.3. WOULD YOU LIKE MORE LESSONS USING COMPUTERS? no! ;maybe! ;yes! !
- 1.4. DID YOU FIND THE COMPUTER EASY TO USE? no! ;yes! !

2. THE LESSON

- 2.1. DID YOU ENJOY THE LESSON WITH THE COMPUTER? not at all! ;it was alright! ;very much! !
- 2.2. DID YOUR TEACHER EXPLAIN HOW TO USE THE PROGRAM PROPERLY? no! ;yes! !
- 2.3. DID YOU HAVE TO CALL YOUR TEACHER AT ANY TIME TO EXPLAIN SOMETHING? no! ;yes! !
- 2.4. TO WHAT EXTENT WERE YOU KEPT BUSY WITH THE COMPUTER very little! ;for a while! ;very much! !
- 2.5. WOULD YOU LIKE TO HAVE USED THE COMPUTER MORE IN THE LESSON? no! ;yes! !
- 2.6. DO YOU THINK THAT YOUR TEACHER COULD HAVE EXPLAINED THE LESSON BETTER IF THE TEACHER HAD NOT USED THE COMPUTER? no! ;maybe! ;yes! !

CODE FOR OFFICIAL USE
1. <input type="checkbox"/> !
2. <input type="checkbox"/> !
3. <input type="checkbox"/> !
4. <input type="checkbox"/> !
5. <input type="checkbox"/> !
6. <input type="checkbox"/> !
7. <input type="checkbox"/> !
8. <input type="checkbox"/> !
9. <input type="checkbox"/> !
10. <input type="checkbox"/> !

3. THE SOFTWARE

CODE FOR
OFFICIAL USE

- | | | |
|--|---|------------|
| 3.1. DID YOU ENJOY THE PROGRAM CHOSEN BY THE TEACHER? | not at all! ___! it was alright! ___! very much! ___! | 11. ! ___! |
| 3.2. DID YOU FOLLOW WHAT THE PROGRAM WAS ALL ABOUT? | not at all! ___! sometimes! ___! all the time! ___! | 12. ! ___! |
| 3.3. WAS THERE ENOUGH TIME TO SEE EVERYTHING ON THE SCREEN BEFORE YOU CONTINUED? | no! ___! yes! ___! | 13. ! ___! |
| 3.4. DID YOU HAVE TO DISCUSS ANYTHING RELATED TO THE PROGRAM WITH YOUR FRIENDS? | no! ___! yes! ___! | 14. ! ___! |
| 3.5. WERE THE INSTRUCTIONS ON HOW TO USE THE PROGRAM EASY TO OPERATE WHILE YOU WERE USING THE PROGRAM? | no! ___! alright! ___! yes! ___! | 15. ! ___! |
| 3.6. DID YOU HAVE TO REFER TO THE INSTRUCTIONS CONTINUALLY TO BE ABLE TO USE THE PROGRAM? | no! ___! yes! ___! | 16. ! ___! |

4. DOCUMENTATION

WAS THERE ANY DOCUMENTATION? IF YES THEN GO TO 4.1.; IF NO THEN GO TO 5.1.

- | | | |
|---|---|------------|
| 4.1. DID YOU FIND THE DOCUMENTATION EASY TO READ? | no! ___! yes! ___! | 17. ! ___! |
| 4.2. WAS THE DOCUMENTATION USEFUL TO YOU? | no! ___! yes! ___! | 18. ! ___! |
| 4.3. DID YOU HAVE TO READ THE DOCUMENTATION BEFORE YOU USED THE PROGRAM? | no! ___! yes! ___! | 19. ! ___! |
| 4.4. HOW OFTEN DID YOU HAVE TO REFER TO THE DOCUMENTATION WHILE YOU WERE USING THE PROGRAM? | never! ___! sometimes! ___! a lot! ___! | 20. ! ___! |

5. GENERAL COMMENTS5.1. What aspect of the lesson did you enjoy?

1. The graph which moved, it showed an immediate reaction which made it easy to comprehend. The diagrams of the kidney tubule were clear and easy to understand 2. Being asked questions so that you could check yourself, the graphs as they were new and interesting, following movement. 3. Compacted lesson, showing all aspects of excretion with minimum time spent. Easy to follow and clear instructions. Concentrate on own weaknesses and on the work at your own pace. The syllabus could be complete quicker by pupils working at leisure understanding is stressed more than piles of notes out of the classroom situation 4. The diagram shows reabsorption and the graph which shows the effect of concentration of various substances 5. Being able to watch the path through the nephron. The graphs were very interesting 6. Enjoyed part 2 especially. Interesting and clearly seen how the levels rise and fall. Enjoyed the discussions concerning the above 7. How different substances taken in affect the kidney. The quiz at the end of each diagram. Discussion afterwards. 8. The discussion of various questions relating to the kidney. Also the part of the program about water, salt and alcohol intake - it gave me a clearly understanding about how the kidney works. The diagrams also illustrated the function of the kidney very well 9. I enjoyed the diagrams and explanations; as well as the label test. The graphs were also useful 10. Following the pattern of flow through the kidney gave a better understanding 11. The quiz part when it was required to know the diagrams of the structure. The part when we saw how different aspects affect the kidney 12. It was a new idea which kept you interested throughout the lesson. It explained exactly how everything worked, showing you movements that take place. You were kept active during the lesson, not letting you take off into another world. 13. The simulation was good in that you could see reabsorption, ultrafiltration and the actual order it goes in. Graphs were good and gave me a better understanding of how ADH, UC (urine concentration) and UV (urine volume) work together. 14. It was clearly set out before us and easy to understand, would be excellent to revise / study with for the exams, esp if we had a program for each chapter. It helped us to learn a lot in a short period of time. 15. The labelling of the nephron was useful and especially the testing thereof afterwards. The cursor that simulated the path that the fluid would follow was also easy to follow and understand. The graph which showed an increase in alcohol, salt and ADH was also useful in helping me to understand a bit better 16. The graphs and flow of blood and the "dot" through the kidney 17. The graph and concentration of substances. The diagram of reabsorption 18. The accurate diagrams and information that was given. It was easy to read and to follow by all and I found that I had a much clearer and better understanding of what usually takes place in the kidney. I also enjoyed the part where it was illustrated how the blood flow and how the sodium pump came into action, and the effect of salt, water and alcohol 19. Having the process displayed visually. This gives me a very clear picture in my mind 20. I enjoyed the part of the program where we had to label the drawing of the kidney by ourselves. We were actually learning without realizing it. 21. I enjoyed the program as it showed it detail how the kidney works. There were also questions to answer. 22. It was a different sort of lesson compared to our normal lessons which made a nice change. It was easy to understand and practical 23. I enjoyed see clear well labelled pictures. The way in which the blood and nitrogenous waste moved on the screen showing us exactly how the system works was enjoyable 24. I enjoyed the part where they gave us the diagram and we had to choose the correct label from a given list. How alcohol affects the kidney is also very interesting. 25. The questions to revise the work help with learning and their repetitiveness helps too 26. It was nice to have a lesson on the computer - different - made one think when we reached the part of how ADH, volume and concentration of urine effect kidney functioning. Working computers kept one interested. Nice to discuss with people that is when you learn. 27. It is enjoyable to sometimes have a change in the lesson instead of sitting in class the whole time. I found the program interesting and it was easy to understand 28. A person was able to see the effects of various substances on the kidney whereas with a textbook this would not have been possible 29. The graphs related to homeostasis. ADH level, Urine volume, Urine concentration.

5.2. What aspect of the lesson did you not enjoy?

1. Not enough information given by the diagram 2. The repetition of the same questions on the labels. Following the dot as it really travelled a bit slowly and you felt distanced from the work as bit as there were too many crowded around the computer 3. Too many pupils were not involved due to the limited number of computers 4. - 5. None 6. In the part showing the filtrate going through the vessels, the labels weren't as detailed and as exact as our textbook. (But it wasn't that bad) (Still quite helpful) 7. Sometimes the questions were repeated too often 8. When others were discussing things that I didn't follow, which confused me for a while. I also got a little bit bored with the lesson after about 20 minutes 9. - 10. The graph could have been better drawn therefore easier to understand 11. The computer room was too crowded - difficult to see 12. It was too crowded, more information could have been given 13. Too many people to a computer 14. None, perhaps if it had been longer we would've been able to learn more 15. - 16. Labelling the kidney parts 17. - 18. I cannot mention anything that I did not enjoy. It was interesting and gave me a better understanding. It was not too long either. 19. Repetition of questions already asked 20. I did not enjoy the part where the waste products (white thing) was moving through the kidney because I did not know what was going on 21. I would have liked the program to have been longer 22. - 23. There were too many in the class and we were unable to take part fully in the lesson 24. I didn't really grasp the waste products moving up the tubes - explanation was needed there 25. none 26. Too many people to 2 computers, otherwise the lesson was great. Would have been nice however if we could have been given more information 27. There was nothing that I really didn't enjoy 28. - 29. The labelling of the kidney

5.3. What did you Learn from the lesson?

1. It was revision but if it had been the first time it would have been a good grounding, more explanation is necessary 2. All the stuff to do with the graphs (ADH levels, etc.) 3. Nothing we really didnt know 4. The effect of substances in your body 5. Nothing that was not learnt in class except for the graphs which were not known before 6. Thought about how to answer questions in the exams on levels (with salt and ADH). Clarified the whole section in my mind. Stimulating and insight into the kidney 7. The path of all substances once entering filtrate 8. More about how the kidney works with various substances and how it reacts in various ways 9. I realised what the kidney did, and how it worked. 10. The flow pattern through the kidney 11. More about excretion in the kidney 12. How salt, water affect different things 13. We had learnt all about this before - except for the graphs which were new 14. A great deal. I now understand the kidney fully 15. The lesson was a good summary of the nephron and also clarified some aspects 16. What alcohol, salt and water can do to the body 17. The main idea of the circulated process of the excretion in the kidney 18. The function and importance of the kidney 19. Label names. How and where things take place. How various substances affect you kidneys 20. I learned the parts of the kidney and how they function 21. I was actually able to see the waster travel in the kidney structure 22. The way the kidney works when affected by certain substances, eg. salt, water and alcohol; the structure of the kidney 23. I learned the importance and functions of the kidney. Also how we use it in every day life 24. I learnt the parts of the kidney and how they function 25. The labels of the diagrams and the way the system works 26. How salt, water and alcohol affect different things. Learnt quite a bit. Labels made me learn them (asking labels) 27. The effects of different substances have were shown clearly on the graphs and it was interesting 28. I learned about the various effects of different substances on the kidney. 29. About homeostatic control of the kidney

Please note
ALL INFORMATION WILL BE TREATED AS CONFIDENTIAL
Thank you for your time and effort

MASTER EVALUATION RESULTS FORM

1. Arrange the pupil questionnaires according to the pupil's ability / grades.
2. Number the pupil's questionnaires.
3. Score the individual responses as stated on page 1.
4. Record the scores on this form in TABLE A below.
5. Calculate the totals for each of the different responses in TABLE B below.
6. Calculate the percentage responses for each of the different responses in TABLE C below.

Question No.

TABLE A

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	
Pupil No. 1	3	3	2	2	2	2	1	3	1	2	2	3	2	1	3	1					1.
2	3	3	3	2	2	2	1	2	2	3	2	3	2	2	3	1					2.
3	3	3	3	2	2	2	1	2	2	3	2	3	2	1	3	1					3.
4	2	3	3	2	2	2	2	2	2	3	2	2	2	1	3	1					4.
5	2	2	3	2	3	2	2	2	2	3	2	3	2	2	3	1					5.
6	2	2	3	2	3	2	2	2	2	1	2	3	2	2	3	1					6.
7	2	2	3	2	2	2	1	2	2	2	2	3	2	2	2	1					7.
8	2	2	3	1	3	2	2	2	2	2	2	2	2	2	2	1					8.
9	2	2	3	2	3	2	2	2	2	2	3	3	2	2	3	1					9.
10	2	3	3	2	2	2	2	2	2	1	2	3	2	2	3	1					10.
11	2	3	3	2	2	2	2	2	2	2	2	3	2	2	3	1					11.
12	1	3	3	2	3	2	1	2	2	2	2	2	2	2	3	1					12.
13	2	1	2	1	2	2	2	2	1	2	2	3	2	2	3	1					13.
14	2	3	3	2	3	2	1	3	2	2	3	3	2	1	3	1					14.
15	2	3	3	2	3	2	2	3	2	2	3	3	2	1	3	1					15.
16	2	3	3	2	3	2	1	2	2	2	3	3	2	1	3	1					16.
17	2	3	3	2	2	1	1	2	2	1	2	2	2	2	2	1					17.
18	2	3	3	2	3	2	2	3	2	1	3	3	2	1	3	1					18.
19	2	3	3	2	2	2	1	2	2	1	2	3	2	1	3	1					19.
20	2	2	3	2	3	2	2	3	1	1	3	3	2	1	3	1					20.
21	2	2	3	2	3	2	1	3	1	1	3	3	2	1	3	1					21.
22	2	3	3	2	3	2	1	3	2	1	3	3	2	1	3	1					22.
23	2	3	3	2	3	2	2	2	2	2	3	2	2	1	3	1					23.
24	2	3	3	2	2	2	2	3	1	2	3	2	2	1	3	1					24.
25	2	3	3	2	3	2	1	3	2	2	3	3	2	2	3	1					25.
26	1	3	3	2	3	2	1	2	2	2	3	2	2	2	3	1					26.
27	1	2	3	2	3	2	1	3	2	1	3	3	2	2	3	1					27.
28	2	2	3	2	3	2	1	3	1	1	3	3	2	1	3	1					28.
29	2	1	2	1	3	1	2	2	2	3	3	3	2	1	1	1					29.
30																					30.

Number of pupils scoring

TABLE B

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	
1.	3	0	0	3	0	2	15	0	6	10	0	0	0	15	1	29					1.
2.	23	18	3	26	11	27	14	11	23	14	14	7	29	14	3	0					2.
3.	3	9	26	18			18		5	15	22			25							3.

Percentage breakdown for pupil responses

TABLE C

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	
1.	10	7	0	10	0	7	52	0	21	34	0	0	0	52	3	100					1.
2.	79	62	10	90	38	93	48	38	79	48	48	24	100	48	10	0					2.
3.	10	31	90	62			62		17	52	76			86							3.

EDUCATIONAL SOFTWARE - CLASSROOM EVALUATION AND ANALYSIS

EVALUATOR ..Mr Ron Beyers.....

DATE ..April 1988..

1. CLASSIFICATION

Name of program ..The Kidney - Structure and Function.....

Publisher ..Garland Computing.....

2. SPECIFICATIONS

Subject Area ..Biology - Excretion and Homeostasis..... Standard ..Ten.....

Type of Program ..Tutorial and Simulation.....

3. LESSON INVOLVEMENT

How was the program used? (Remedial, instructional, enrichment, etc.) ..Revision and Enrichment.....

How many pupils were there in the class at the time of evaluation? ...29 Pupils of mixed ability.....

How many computers were there available for the lesson? ...Only 2 BBC B monochrome Computers were available.....

4. CLASSROOM MANAGEMENT

Teachers' preparation ..An essential component using the Selection Form as a means of preparation for the lesson.....

Teacher activity during the Lesson ..Advisory capacity - providing the instructions to the pupils to continue with.....
the program ..

Other Teacher Comments ..It is essential the teacher allows the pupils to experiment by themselves. At the same.....
time it is important for the teacher to direct their attention to specific points in the program.....

Pupil activity ..Hands-on experience with discussions during the lesson.....

Summary of Pupil Comments ..The use of animated graphics helped to explain the function of the kidney as well as to.....
explain the role of the kidney in homeostasis.....

SUMMARY SHEET FOR OVERALL EVALUATION OF EDUCATIONAL SOFTWARE

- 1.1. TITLE ..Kidney - Structure and Function.....
- 1.2. COMPANY ..Garland Education Software.....
- 1.3. GENERAL OBJECTIVES AS STATED ..Help you to learn the anatomy of a nephron; Use of..
..animated graphics to show how the kidney works in excretion and homeostasis.....
- 1.4. EVALUATOR'S NAME ..Ron Beyers.....
- 1.5. RATING SCALES FOR SELECTION

Instructions: Fill in the relevant details using
the ratings from the sections

	RATING	OUT OF
1.. DETAILS OF SOFTWARE	2	10
2.. EVALUATOR'S PARTICULARS	N/A	N/A
3.. HARDWARE REQUIRED	N/A	N/A
4.. SOFTWARE OBJECTIVES	18	24
5.. TECHNICAL DESIGN	14	24
6.. SUBJECT CONTENT	14	22
7.. DOCUMENTATION	9	20
TOTALS		57 100

1.6. OVERALL RATING ON THE RATING SCALE OF [0 - 100]...57 'Good to very Good'.....

2. COMMENTS

2.1. OVERALL IMPRESSIONS OF PUPIL'S COMMENTS ..The general impression was that the.....
..pupils enjoyed using the program. They reported that the program helped to.....
..explain the structure of the nephron, as well as to display the concepts.....
..of homeostasis visually. Overall it helped them to learn the work better.....

2.2. OVERALL TEACHER'S COMMENTS

..The program is very useful in that it has both the facility for tutorial type....
..of questioning aimed at the standard graders, as well as an animated diagram to..
..show the functioning of the nephron. The final section deals very effectively....
..with the concepts of homeostasis and the role that the kidney has to play.....
..in this respect.....

2.3. SOFTWARE'S STRONG POINTS

..The user is in complete control of the program at all times. The level of the....
..content is of such a nature that it appeals to the pupils and does not confuse...
..them at all. It is a useful program to have and can be effectively implemented...
..in revision for individuals or for the whole class.....

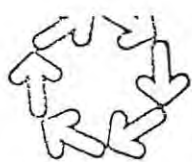
2.3. SOFTWARE'S WEAK POINTS

..The random question generator does not eliminate questions that have been asked..
..already and sometimes repeats the same question several times. There is no
..method of questioning the user again on those questions that were answered
..incorrectly. The program does not keep a record of individual performances.....

Appendix Page 13

Appendix 6

A SAMPLE OF ADVERTISING PAMPHLETS



Educational software from

**GARLAND
COMPUTING**

Biology

**THE HUMAN SKELETON, JOINTS
AND MUSCLES Human Biology Collection 3**

This collection of programs about the human body, will be useful in CSE and 'O' Level biology courses, physical education, nursing and physiotherapy courses, and for those studying First Aid.

THE HUMAN SKELETON contains three sections leading to an understanding of the naming and arrangement of the bones of the human body and information about the properties, structure and functions of bone and cartilage. The third section shows 11 types of fracture, and question/answer sequences test recognition of these. Animated sequences show fracture repair.

AP10: BBC 40-track disc £14.50/80-track disc £14.50

JOINTS contains three main sections describing the fibrous, cartilaginous and synovial joints. The synovial joints section is further divided into options showing general structure and action of the various types of joint, and explanation of the theory of levers as applied to their action. There is also a section on injury and diseases of joints.

AP11: BBC 40-track disc £14.50/80-track disc £14.50

MUSCLES contains three main sections dealing with the function of muscles, the structure of visceral, cardiac and skeletal muscle, and muscle movement. The movement option includes animations and explanation of the sliding filament action, the biochemistry of muscle action and fatigue and how muscles act together to produce movement.

AP12: BBC 40-track disc £14.50/80-track disc £14.50

TEETH and Dental Care

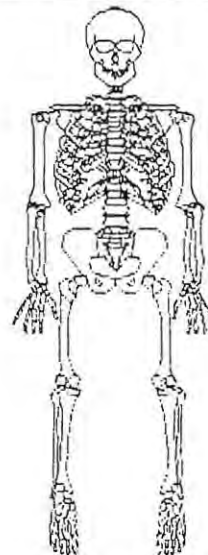
Published by the General Dental Council in association with Garland Computing. This program is intended for use by children aged about 10 years and above, although younger children could certainly use the program with extra guidance from the teacher. The aims of the program are to help children learn about the types of teeth and their structure, and the importance of diet and dental hygiene in preventing tooth decay and gum disease. The program uses animated graphics and sound-effects to increase the appeal of the program to children, with a variety of options chosen from a menu as required. A simple and enjoyable quiz at the end of the program tests whether the pupil has learnt the main 'messages' of dental care. The program can be used by individual pupils or in small groups, or by a teacher in demonstration mode.

HE1: BBC 40-track disc £14.50/80-track disc £14.50

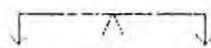
"Garland Computing can now be considered the foremost BBC Micro software company in the field of Science and Maths" A&B Computing

- 1..Skull
- 2..Backbone
- 3..Rib cage
- 4..Arm
- 5..Leg
- 6..Return to Main menu

Type in a number



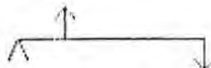
- 1..First order lever
eg Head lifting on neck



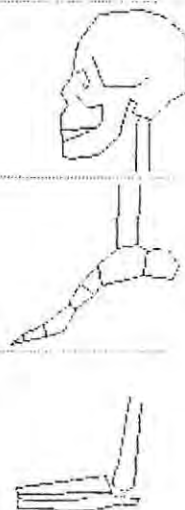
- 2..Second order lever
eg Rising on toes



- 3..Third order lever
eg Bending Elbow



Type 1, 2, 3 or E



"very thorough coverage indeed, and I couldn't think of anything which had been missed out" - Personal Computing Today

- Enamel
- Dentine
- Pulp



The dentist has put in a small filling. If you had come for your checkup you might have had no fillings.

Press Space-bar

"... a novel and interesting approach to dental health education ... the program will stimulate thought and discussion"
- British Dental Journal

A collection of programs written by Val and David Garland which can be used as interactive visual aids or by individual pupils for self-tuition. For Biology and Nursing courses (age 14+).

ACTION OF THE HEART contains three programs. HEART1 uses a diagram and questions to help learn the anatomy of the heart. HEART2 and HEART3 use animated graphics to show how the mechanical and electrical events of the heart cycle are co-ordinated. **KIDNEY STRUCTURE and FUNCTION** contains two programs. KIDNEY1 uses a diagram and questions to help learn anatomy of the kidney tubule. KIDNEY2 uses animated graphics to show filtration and illustrates homeostatic control.
 UB1: BBC cassette £11.26/40-track disc £11.74/80-track disc £11.74

FEMALE REPRODUCTIVE CYCLE/FERTILIZATION contains two programs. FEMREP contains a diagrammatic illustration of the ovarian and uterine cycles, showing the relationship between hormones. FERTIL shows step-by-step the events occurring during fertilization, implantation and early pregnancy.

AP3/6: BBC cassette £10.00/40-track disc £11.75/80-track disc £11.75

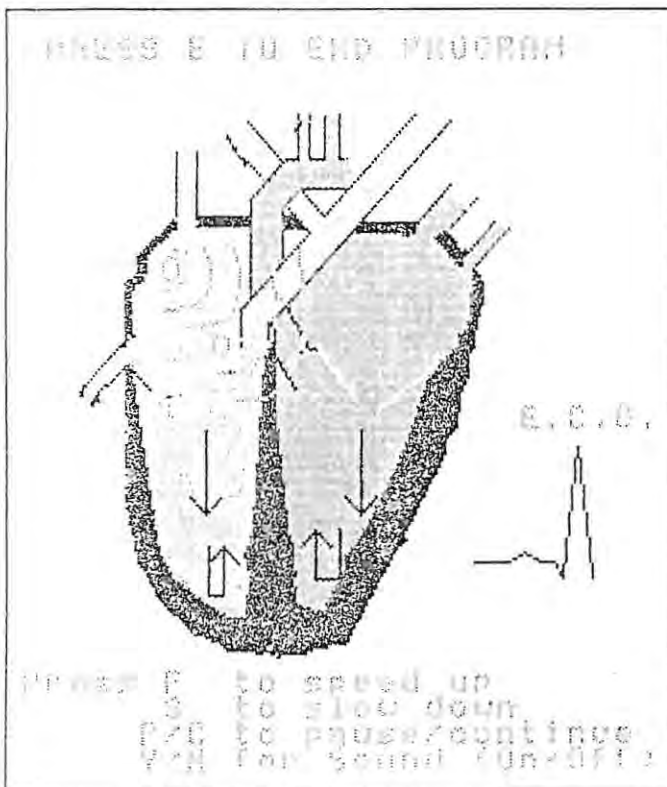
HUMAN BLOOD GROUPS is an effective simulation of the slide agglutination technique used for determining the ABO groups in human blood. The user can perform simulated experiment on blood of known and unknown types.

AP8: BBC cassette £10.00/40-track disc £11.75/80-track disc £11.75

HUMAN BIOLOGY DISC 1 a collection of the above three packages on disc.

HBD1: BBC 40-track disc £31.75/80-track disc £31.75

"programs which we could enthusiastically recommend" — Nursing Mirror



A collection of programs with integrated worksheets written by Glyn Rogers and Susan Devereux using a novel approach which provides a stimulating way for students to work, and allows a single computer to be used by a class of 24 pupils. The computer poses problems for individual pupils who must complete worksheets and check their answers. The teacher may check the progress of individual pupils. For age 13+.

BLOOD CIRCULATION MAZE is a revision exercise in which the pupils learn the names of the major blood vessels by finding their way around the body on routes set by the computer.

AP4: BBC cassette £10.00/40-track disc £11.75/80-track disc £11.75

DIETING helps understand concepts of energy intakes for different subjects. The pupils must choose a diet that provides the required energy intake for a specific subject.

AP5: BBC cassette £10.00/40-track disc £11.75/80-track disc £11.75

BODY PROCESSES and THE FATE OF PROTEIN uses the events in protein digestion and excretion of nitrogenous compounds to show the inter-relationship of body processes. The program is written as a game — a 'jigsaw puzzle' in which the pupils must arrange the 'pieces' in the correct order.

AP9: BBC cassette £10.00/40-track disc £11.75/80-track disc £11.75

HUMAN BIOLOGY DISC 2 a collection of the above three titles on disc.

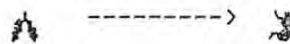
HBD2: BBC 40-track disc £30.00/80-track disc £30.00

"... simple and straightforward to use ... it is most encouraging to see a program designed to help overcome the problems of class management" — J. Biological Education

You are lost in the maze, DAVE

To find your way out you must find the shortest route from —

(2) LUNGS to (4) STOMACH



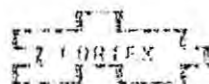
When you have done that, come back and I will tell you if you are out of the maze

Press any key to continue.

Each piece of the puzzle consists of FIVE stages.

Each stage is given a number and these numbers must be sorted into the correct order to form the piece e.g.

Name of piece.	Stages.
B CORTEX	3 Bowman's Capsule 11 Arteriole. 19 Renal Artery. 27 Pressure Filtration. 35 Glomerulus.



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and Master Compact Software

Educational Software Directory for the BBC Micro

RML, Sinclair Spectrum, Acorn Electron,
Amstrad and Commodore 64.



Title/Publisher	Program Content	Order Ref.	Format	Price
THE HUMAN SKELETON Garland Computing Age: 13 years + Colour M	Contains three sections leading to an understanding of the naming and arrangement of the bones of the human body and information about the properties, structure and functions of bone and cartilage. The third section shows 11 types of fracture, and question/answer sequences test recognition of these. Animated sequences show fracture repair.	Q0959 Q0960 Q0961 Q0962	BBC 40-track disc BBC 80-track disc Econet 40-track disc Econet 80-track disc	£14.50 £14.50 £29.50 £29.50
JOINTS Garland Computing Age: 13 years + Colour/Sound M	Contains three main sections describing the fibrous, cartilaginous and synovial joints. The synovial joints section is further divided into options showing general structure and action of the various types of joint, and explanation of the theory of levers as applied to their action. There is also a section on injury and diseases of joints.	Q0963 Q0964 Q0965 Q0966	BBC 40-track disc BBC 80-track disc Econet 40-track disc Econet 80-track disc	£14.50 £14.50 £29.50 £29.50
MUSCLES Garland Computing Age: 13 years + Colour/Sound M	Contains three main sections dealing with the function of muscles, the structure of visceral, cardiac and skeletal muscle, and muscle movement. The movement option includes animations and explanation of the sliding filament action, the biochemistry of muscle action and fatigue and how muscles act together to produce movement.	Q0967 Q0968 Q0969 Q0970	BBC 40-track disc BBC 80-track disc Econet 40-track disc Econet 80-track disc	£14.50 £14.50 £29.50 £29.50
HUMAN ENERGY EXPENDITURE Longman Age: 13-16 years Colour	The activities which people undertake effect the amount of energy that they use. A study of human energy expenditure inevitably involves a large amount of calculation if more than a very limited range of activities are to be investigated. This unit allows students to explore energy requirements in relation to activity, sex and mass without doing any calculation, and to compare them with the energy they obtain from the food they eat.	Q6068 Q6069 Q6070 Q6071	BBC 40-track disc RML380/480Z disc RML480Z network Apple disc	£18.50 £18.50 £29.50 £18.50
RELATIONSHIPS BBC Publications Age: 13-17 years Colour	This program is based on data from the World Health Organisation. A sophisticated simulation puts you in the role of medical control officer for an African village with the task of reducing the level of malarial infection. Control measures must be selected carefully to keep within budget, and sudden unexpected events can undo all your good work. Help is available from the data-base of information about the methods used by medical officers in other villages. 24 page illustrated manual and converter program for 80-track disc included.	Q2406	BBC 40-track disc	£14.95
PHYSIOLOGICAL SIMULATION Five Ways/Heinemann Age: 13-18 years Colour M	In this simulation of an active human, the user, representing the brain, has to keep its body (the computer) alive while performing a series of physical activities. Once the sex, age, vital capacity, obesity, and blood volume have been set, the brain can vary the rate of breathing, the breath volume, and the sweating rate while the human performs up to ten activities. The program highlights the effect of altering a single variable in a complex system, reinforces the interrelationship of the physical variables, and allows comparison of two humans with different statistics who are performing the same activities.	Q4542 Q4543 Q4605 Q4606 Q4607 Q4608	BBC 40-track disc BBC 80-track disc Econet 40-track disc Econet 80-track disc RML 480Z disc RML 480Z network	£18.50 £18.50 £28.50 £28.50 £18.50 £28.50
HEART AND KIDNEY Garland Computing Age: 14+ years Colour/Sound M	Five full length programs for use in self-tuition and revision by students age 14+, especially those studying for O-level or A-level Biology or for nursing examinations. ACTION OF THE HEART contains three programs. HEART 1 uses a diagram and questions to help learn the anatomy of the heart. HEART 2 and HEART 3 use animated graphics to show how the mechanical and electrical events of the heart cycle are co-ordinated. KIDNEY STRUCTURE and FUNCTION contains two programs. KIDNEY 1 uses a diagram and questions to help learn anatomy of the kidney tubule. KIDNEY 2 uses animated graphics to show filtration and illustrates homeostatic control.	Q0885 Q0886 Q0887 Q5237 Q5238	BBC cassette* BBC 40-track disc BBC 80-track disc Econet 40-track disc Econet 80-track disc *or Electron	£11.26 £11.74 £11.74 £26.75 £26.75
FEMALE REPRODUCTIVE CYCLE/FERTILIZATION Garland Computing Age: 14+ years Colour M	This package contains two programs. FEMREP contains a diagrammatic illustration on the ovarian and uterine cycles, showing the relationship between hormones. FERTIL shows step-by-step the events occurring during fertilization, implantation and early pregnancy.	Q0888 Q0889 Q0890 Q5239 Q5240	BBC cassette* BBC 40-track disc BBC 80-track disc Econet 40-track disc Econet 80-track disc *or Electron	£10.00 £11.75 £11.75 £26.75 £26.75
HUMAN BLOOD GROUPS Garland Computing Age: 14+ years Colour M	This program is an effective simulation of the slide agglutination technique used for determining the ABO groups in human blood. The user can perform simulated experiments on blood of known and unknown types. Of particular use in nursing and technician courses where practical problems rule out laboratory work on blood specimens.	Q0891 Q0892 Q0893 Q5241 Q5242	BBC cassette* BBC 40-track disc BBC 80-track disc Econet 40-track disc Econet 80-track disc *or Electron	£10.00 £11.75 £11.75 £26.75 £26.75
HUMAN BIOLOGY COLLECTION 1 Garland Computing M	Action of the heart/kidney structure and function; Female reproductive cycle/fertilisation and human blood groups combined on one disc.	Q0894 Q0895	BBC 40-track disc BBC 80-track disc	£31.75 £31.75
HEART & DIGESTION AVP Computing Age: 14+ years Colour M	By using annotated diagrams and testing sections this collection of programs is useful for teaching and revising work on the heart and digestive system. With the main program on the digestive system the operator works at his own pace building up a diagram on the screen and studying the functions and processes occurring at each stage. The testing section incorporates interesting animated graphics and the times as well as the scores are given. In all programs the user's results are displayed in tabular form to enable comparisons.	Q3769 Q3770 Q3771	BBC cassette BBC 40-track disc BBC 80-track disc	£15.00 £15.00 £15.00
MICRO DIET Longman Age: 14-19 years Colour	Microdiet contains a database of over 500 foods with details of up to 29 nutrients for each food. It is designed so that users can investigate and analyse foods in four ways. Table 1 shows the amounts of the 29 nutrients in each food chosen; Table 2 provides the cost of certain nutrients supplied by a given food, making it possible to find out, for instance, the cheapest source of protein; Table 3 compares actual nutrient-intakes from a given list of foods with the recommended daily intake as suggested by the DHSS in 1981; and Table 4 allows the user to select a particular nutrient and find out how much is in any given food. Microdiet is fully supported with Teachers' guide, students' handbook and input preparation sheets.	Q6080 Q6081 Q6082 Q6083 Q6084	BBC 40-track disc Econet 80-track disc RML380Z disc* RML480Z disc RML480Z network *380Z requires 56K of memory or 32K + HRG	£29.50 £39.95 £29.50 £29.50 £39.95
THE EYE Garland Computing Age: 14 years + Colour M	This is an interactive collection of eleven programs designed to assist in understanding the structure of the human eye and how it works. The topics are (1) labelling the eye (2) working of the iris (3) accommodation of the lens (4) long-sight and its correction (5) short-sight and its correction. This package has much clearer diagrams and is easier to use than existing programs on this topic.	Q0983 Q0984 Q0985 Q0986	BBC 40-track disc BBC 80-track disc Econet 40-track disc Econet 80-track disc	£11.75 £11.75 £26.75 £26.75



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TITLE: CHEMICALS OF LIFE I: THE STRUCTURE OF MATTER

GRADE: STD 5 TO MATRIC

APPROPRIATE FOR SCHOOL USE

DESCRIPTION: Discusses the study of molecules, models of atoms, ions and charges, and ionic and covalent bonding. Upon completion of this program student should be able to determine the number of atoms in a compound, calculate the total electrical charge of an atom and explain ion formation oxidation states, stable octets, use the periodic table and describe bonding. Requires IBM PC colour display or equivalent.

CODE: IBM (IBM01PC)

TITLE: CHEMICALS OF LIFE II:
WATER, CARBOHYDRATES AND LIPIDS

GRADE: STD 5 TO MATRIC

APPROPRIATE FOR SCHOOL USE

DESCRIPTION: Describes the role of water and inorganic chemical in physiology, how lipids and carbohydrates are formed and used by cells, and the difference between dehydration synthesis and hydrolysis. Also shows how a starch is digested, explains the difference between saturated and unsaturated fats, and the function of ADP and ATP in cellular respiration. Requires IBM PC colour display or equivalent.

CODE: IBM (IBM02PC)

TITLE: CHEMICALS OF LIFE III:
PROTEIN AND NUCLEIC ACIDS

GRADE: STD 5 TO MATRIC

APPROPRIATE FOR SCHOOL USE

DESCRIPTION: Demonstrates the role of nucleic acids and proteins and how they are formed, the function of enzymes, and the difference between dehydration synthesis and hydrolysis. The program also describes the factors that affect enzyme rate of reaction such as pH, temperature and substrate, and explains the role of amino acids in building proteins. Requires IBM PC colour display or equivalent.

CODE: IBM (IBM03PC)

TITLE: CYTOLOGY AND HISTOLOGY: CELLS AND TISSUES

GRADE: STD 5 TO MATRIC

APPROPRIATE FOR SCHOOL USE

DESCRIPTION: Discusses cell theory, the function of various organelles of the cell, cell diversity, and tissue types and their function. Upon completion of this program, students should be able to describe how cells form tissues, the function of cellular parts and differences in cell types. Requires IBM PC colour display or equivalent.

CODE: IBM (IBM07PC)

TITLE: THE ENVIRONMENT I: HABITATS AND ECOSYSTEMS

GRADE: STD 5 TO MATRIC

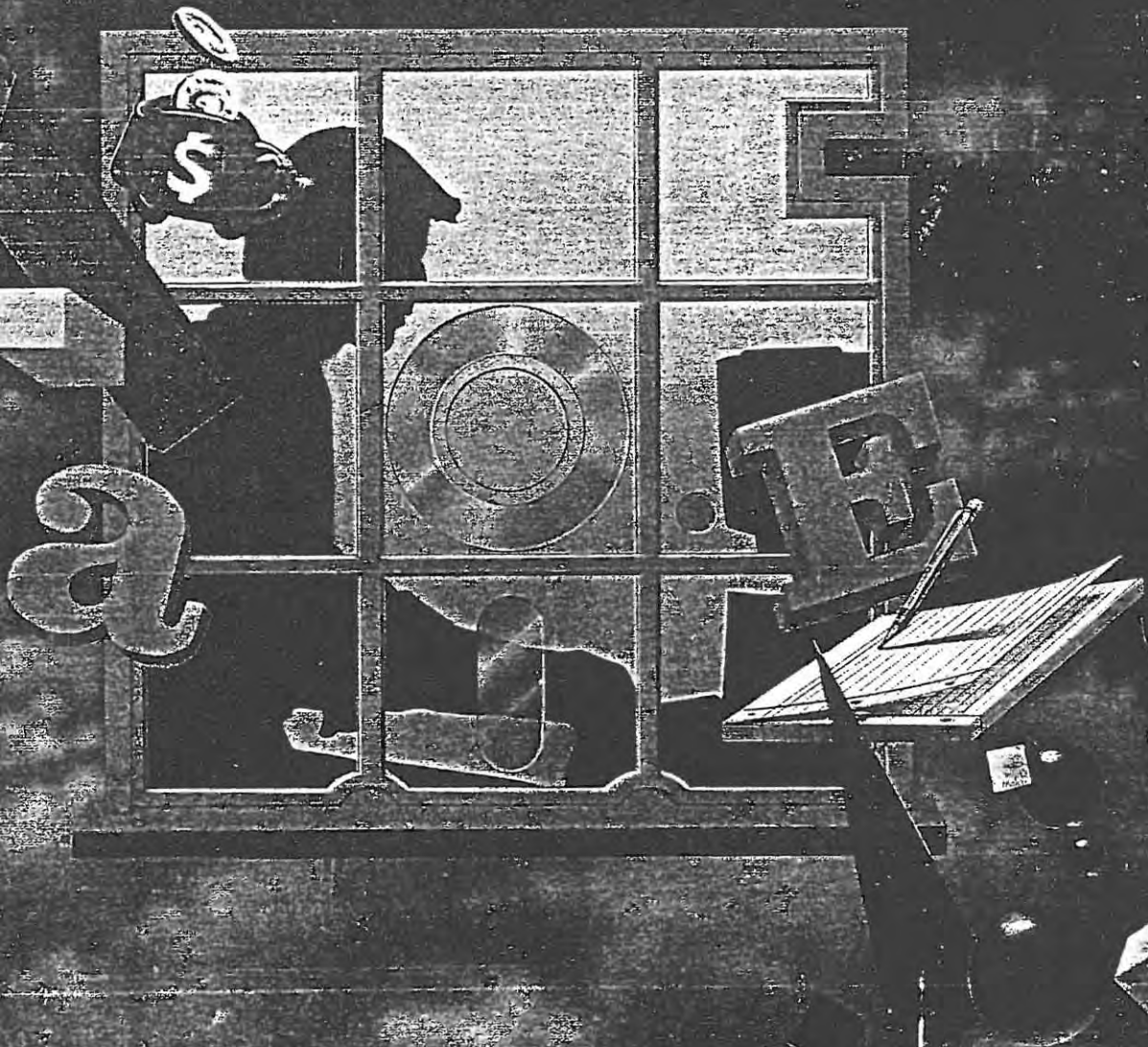
APPROPRIATE FOR SCHOOL USE

DESCRIPTION: Examines the effects of abiotic and biotic factors on the environment, plant succession, major geographic biomes, and the relation of populations and communities to an ecosystem. The program describes the composition of ecosystems, how organisms interact with their environment, and concepts like predation, symbiosis and populations. Requires IBM PC colour display or equivalent.

CODE: IBM (IBM19PC)

EDUCATIONAL AND HOME SOFTWARE

CATALOG



MARINE LIFE: INVERTEBRATES

Grade Level: 7th to Adult
Appropriate for School Use



Presents information on animals from the Phylums Porifera (sponge), Mollusca (sea anemone), Coelenterata (clam), and Echinodermata (starfish). Lessons present informational text and color graphics. Probe reviews anatomical parts and functions. Games involve identification and vocabulary. The Quiz generates multiple choice questions. Includes teacher's guide with reproducible worksheets.

■ Apple (VE113AP).....\$ 49.95

MARINE LIFE: SEA LAMPREY

Grade Level: 7th to Adult
Appropriate for School Use



Presents information on the life cycle and anatomy of a sea lamprey. Lessons present information with text and color graphics. Probe reviews information on anatomical parts and functions. Games involve identification and spelling. The Quiz generates multiple choice questions. Includes teacher's guide with reproducible worksheets.

■ Apple (VE118AP).....\$ 49.95

PLANT AND ANIMAL CELLS

Grade Level: 7th to Adult
Appropriate for School Use



Presents information on the general structure of plant cells, photosynthesis, the general structure of animal cells and mitosis. The Lessons present informational text and color graphics; the probe reviews structural parts and functions; the Games use vocabulary from the lessons; and the Quiz generates questions based on the lessons. Includes teacher's guide with reproducible worksheets.

■ Apple (VE117AP).....\$ 49.95

THE PLANT: NATURE'S FOOD FACTORY

Grade Level: 7th and Up
Appropriate for School Use



"Plants" includes five tutorials: the cell, the flower, the leaf, the stem, the root. Four experiments: light and photosynthesis, light, water and growth, wavelengths, genetics. Three quizzes: true/false, multiple choice, knowledge quiz; and a glossary.

■ Apple (VE111AP).....\$ 69.95

PROTOZOA

Grade Level: 6th to 9th
Appropriate for School Use



Presents data on four representative organisms in the Protozoa phylum. Identifying and spelling the microstructures with Amoeba, Euglena, Paramecium and Plasmodium. Includes a database describing the cellular parts of their functions. A special Microscope Study Unit is also included. Lab Pack contains instructional manual and 5 program disks.

■ Apple (VE105AP).....\$ 39.95

Lab Pack

■ Apple (VE15AP).....\$ 79.95

SENSES

Grade Level: 7th and Up
Appropriate for School Use



Identifies the names of the parts of the sense organs. Player learns to identify and spell the names of the basic parts of the eye, ear, tongue, nose and skin. Offers interesting facts about the function of the parts presented. Lab Pack contains instructional manual and 5 program disks.

■ Apple (VE103AP).....\$ 39.95

Lab Pack

■ Apple (VE13AP).....\$ 79.95

VISIFROG

Grade Level: 6th to Adult
Appropriate for School Use



The anatomy of the frog is displayed in computer graphics. Practice identifying and spelling the names of the musculature, digestive, cardiovascular and nervous systems and skeleton of the frog. A database is included describing the systems and their functions. Lab Pack contains instructional manual and 5 program disks.

■ Apple (VE106AP).....\$ 39.95

Lab Pack

■ Apple (VE16AP).....\$ 79.95

THE WORM

Grade Level: 7th and Up
Appropriate for School Use



No science teacher or student should be without this colorful, interactive learning system. Learn the digestive, nervous, circulatory, reproductive and locomotive systems of the common earth worm while playing the Identification Game. Access detailed information with the Data Retrieval Utility and practice matching structures and functions with the Quiz Machine. Lab Pack contains instructional manual and 5 program disks.

■ Apple (VE108AP).....\$ 39.95

Lab Pack

■ Apple (VE18AP).....\$ 79.95

WORLD BOOK DISCOVERY

HOW THINGS WORK

Grade Level: 1st to 6th
For Home and School Use



A series of graphic simulations to help a child understand primary principles of science. In learning how simple machines (lever, pulley, etc.) work, the player learns to apply the correct machine to solve problems.

■ Apple (WB60AP).....\$ 39.95

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LAC OPERON

Lewis J. Kleinsmith, *University of Michigan*

An interactive simulation in which computer graphics and animation are used to illustrate the molecular interactions and changes which occur during the regulation of the Lac Operon. Contains three programs: Animation of the Lac Operon with explanatory text, animation without text (excellent for student review or as a classroom lecture aid), and an interactive test on the steps of the process.

\$50 S T D (0-88720-283-7)

Apple II series, 48K

LabPack - \$110.

\$50 S T D (0-88720-296-9)

IBM PC, 128K, CGA and monitor.

LabPack - \$110.

Apple/IBM

MITOSIS AND MEIOSIS

Lewis J. Kleinsmith, *University of Michigan*

Using a format similar to *Lac Operon*, this simulation presents the molecular interactions involved in mitosis and meiosis. Three programs are included: Animations with an accompanying explanation, animations without the text, and an interactive test on the steps of the process.

\$50 S T D (0-88720-371-X)

Apple II series, 48K

LabPack - \$110.

\$50 S T D (0-88720-372-8)

IBM PC, 128K, CGA and monitor.

LabPack - \$110.

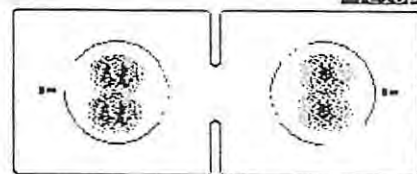
This enzyme, β -galactosidase, is in turn encoded by a gene that is a member of a group of genes called the lac operon:



Bacteria also make a protein, called the lac repressor, which binds to the DNA of the lac operon and blocks its transcription by RNA polymerase.

Press **space bar** to continue

This display is taken from the animation with text portion of the Lac Operon simulation. It may also be viewed without the text.



As the nuclear envelope is forming, the chromosomes uncoil back into chromatin fibers. At the same time, the plasma membrane folds inward and divides the cell in half. This latter process is called cytokinesis.

Using graphics and animation, this program shows students the molecular interactions involved in mitosis and meiosis. Here, process of cytokinesis is explained.



This first tRNA binds to its corresponding amino acid and carries it to the ribosome.

CYS
amino acids

Students can explore the interactions and movements of the various components involved in the flow of information from DNA to messenger RNA to protein.