

SOFTWARE EVALUATION

Software Title: **GCSE PHYSICS**

Publisher: **Aircom Education**

Year of Publication: **1998**

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Package Content

- 4 CD-ROMs: - Forces and Motion
- Electricity and Magnetism
 - Matter, The Earth, Stars and Planets
 - Waves and Optics

Cost

Single User copy costs £20

A Network Version costs £112

Hardware Requirements

Windows '95, '98 or NT 486-DX2, 66MHz
8Mb RAM
SVGA Monitor, high colour (16 bit)
CD-ROM drive (2 speed or better)
Sound Card and Speakers

INTRODUCTION

As a teacher of Junior Cert Science and Leaving Cert Physics I was interested in investigating a computer package, which might be useful in teaching these courses. There are very few, if any, Physics multimedia packages on the market that are produced specifically for the Irish Second Level Curriculum. I chose this package because it claims to be “suitable for the Irish Curriculum”. As the pack does not specify the level as Junior Cert. or Leaving Cert. standard I decided to investigate its suitability for both or either. As well as an evaluation of the quality and content of the package a technical evaluation is important, especially as many second level teachers are not ‘comfortable’ with using computers in the classroom situation. If software is to be successfully integrated into the learning environment it is essential that lack of familiarity with the technology does not discourage its use.

TYPE OF PACKAGE

This is a multimedia package as it includes text, audio, graphics, video and animations. It is basically a set of tutorials, in which the information is presented in discrete, stand-alone chapters. Within each chapter there are text descriptions supported by graphics, video and/or animations, where appropriate, interspersed with multiple-choice tests, comprehension tests and interactive exercises. Each CD has three simulated ‘laboratory’ experiments, which require interactivity with the user. In addition, there are six mock examinations, on each CD, based on the whole CD. Some of the animations are simulations of real situations. For example, the 'Nuclear Reactor' experiment allows the user to adjust the height of the control rods to determine a particular power output.

SUPPORTING DOCUMENTATION

There is no obvious supporting documentation except what was printed on the box. This is simply a list of the attributes of the package, the minimum system requirements needed and a list of the topics covered. The attributes of the CD-ROMS listed are as follows:

- Contain comprehensive teaching material to cover the National Curriculum Syllabus (U.K.).
- Are easy to install.
- Retain student interest with high quality animation and graphics.
- Stimulate learning through interactive exercises.
- Provide sample examination questions with model solutions.
- Support classroom teaching.
- Are useful for self-tuition and revision.
- Cover all U.K. examination board syllabuses.
- Are authored by practising teachers.
- Cater for all levels of ability with the inclusion of extension material.
- Are fully narrated with accompanying music, (both narration and music can be turned on or off).
- Contain a full course content index.
- Are supported by technical help phone lines.

However, once each CD is installed on the computer, accessible through Windows Explorer, there is a Word file called 'Summary', which provides a course summary sheet for the particular CD.

There is a copy of each of these in the Appendix. Included on the summary sheet for each CD is a general overview, a course material overview and an overview of the experiments.

There is also a file accessible through Windows Explorer, called 'Helpme'. This provides information on how to deal with problems encountered while running the CD-ROM – mainly how to change computer settings. A copy of this is also included in the Appendix.

METHODOLOGY FOR EVALUATION

Initially, I spent a number of hours using the package. I chose the CD called 'Waves and Optics', as I felt it might be the most suitable to test with various levels of my students – keeping in mind my teaching programs with each class to date. This gave me a general feel for the package without looking at any features in detail.

I then examined each topic on this CD in quite a lot of detail and formulated my own opinions about its suitability for Leaving Cert students and Junior Cert students. On the basis of these two preliminary investigations and the list of attributes about the package on the box, I composed two questionnaires – one for students and one for teachers.

As there are no computer facilities in the labs in school, I asked three of my Science teacher colleagues to choose one of the CDs from the pack and to take it home with the questionnaire to evaluate. Of these, one is a Leaving Cert Physics teacher and the other two are general Science teachers. Also, two are 'comfortable' using computers and the other is not.

I asked for student volunteers from Second, Fifth and Sixth Year to use the 'Waves and Optics' CD. One of the students is mildly dyslexic. They all worked individually. Each individual was given Part 1 of the Questionnaire at the start. Some students worked in the Computer Room and others took the CD home. On return of the CD, Parts 2 and 3 of the Questionnaire were given to the students to fill in. Most of the students also commented to me verbally after their session.

(Unfortunately, the Second Years did not get the opportunity to view the CD.) I would also have liked to record a group working through the program, but again this proved too difficult to organise.

PROGRAM INSTALLATION

Installation of the CD is very straightforward. Even the teacher who was not familiar with computers had little trouble, once installation was started. One of the students commented that it took too long to load. When the computer is switched on the CD auto loads. On-screen instructions are clear and easy to follow. However, a message just after installation, about the colour settings could have been explained.

“You are running in 256 colour mode. GCSE Physics requires your display to run in high colour (16-bit) mode. Do you wish to continue in 256-colour mode? Yes No “.

While the CD will still operate without changing the settings, a user not familiar with changing computer settings could be put off. If the settings are not changed the detail of some of the graphics is not visible. If the settings are changed the computer needs to be shut down and rebooted. When being run by a single user on a network the settings must be altered at the server. There is a network version available for use by multiple users on a network.

EASE OF USE, DESIGN AND NAVIGATION

Once installed, the first screen displays the title, (animated), accompanied by music and a button prompting the user to click for the main menu. This is brief but can be bypassed as the user can move to the main menu by clicking a button.

The **main menu** page has five graphics entitled –*CD Tour, GCSE School, Lab, Testing Centre, Exit* – and a button called Settings. Placing the cursor over each graphic causes a message to appear which indicates where clicking the graphic brings the user to. Clicking on the ‘Settings’ button brings the user to a screen, which allows the music, narration and/or menu animations to be switched on or off. Placing the cursor on each graphic on the menu causes it to become animated and produce a sound.

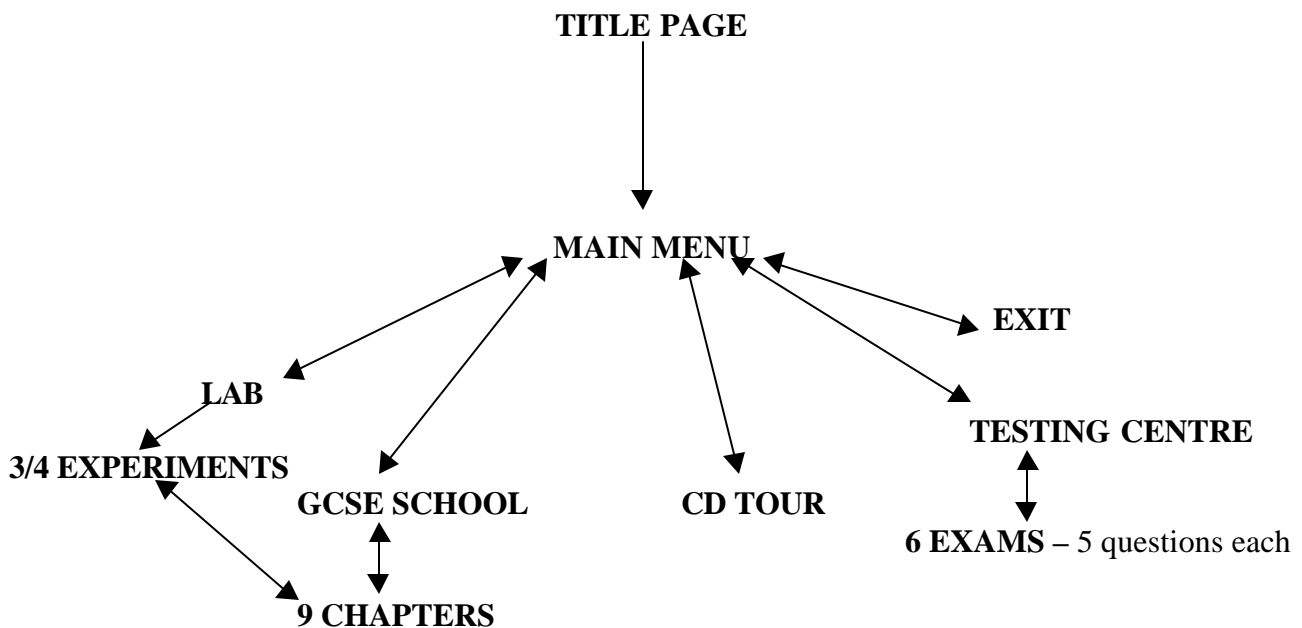
- Choosing the ‘**CD Tour**’ gives an introduction and overview of the CD. It explains the help buttons on each screen and how to navigate through the CD.
- Clicking on the ‘**GCSE School**’ graphic brings the user to the **main topics menu**. There are nine graphics, clicking on any one will bring the user to a particular chapter. For example, the ‘Waves and Optics’ CD has the following chapters: Colour and Light, Rectilinear Propagation, Ripple Tanks, Waves, Electromagnetic Spectrum, Energy Transfer, Expansion and Contraction, Earthquakes, Sound.
- Once in a particular chapter, navigation is very easy, as each page has eight **navigation buttons**, as follows: to 1st page of chapter, to last page of chapter, back a page, to last page of chapter, to next page, to topic menu, list of recent pages, text search. The last button mentioned allows the user to enter a word/phrase, it then searches and gives the page(s) on which the word/phrase occurs and allows a jump to that page. Therefore the user can determine alternative routes through the information and can also bookmark the pages to which they have been. One student noted that it is “*good the way you can go straight to any part within a topic*”, (i.e. chapter).

- Clicking on the **'Lab'** graphic brings the user to the experiments chapter. There are three or four experiments, each of which is represented on the menu by a graphic, which when clicked on will start the experiment.
- Choosing **'Testing Centre'** brings the user to the mock examination. There are six exams, each with five questions.
- Clicking on the **'Exit'** graphic allows the user to quit.

If the cursor is placed near the top of any page a toolbar appears. This always has 'File' and 'Settings', and only sometimes has 'Navigation' and 'Utilities'. 'File' gives the options of quitting or of printing out the page. 'Settings' gives the options of turning on or off, the music, narration and menu animations. 'Navigation' allows the user to move to a chosen topic, (chapter). 'Utilities' has a calculator. As can be seen from the results of the surveys, the calculator was not easily located, if at all. Only one of those tested found it, and then only by accident.

For a user familiar with general computer packages navigation around the CD is very easy. To other users, because of consistency throughout the CD, once they get started navigation is relatively straightforward, on-screen information, buttons and menus are very clear. The fact that the calculator could not generally be found is a very obvious negative for this package and generally made doing mathematical problems impossible without using an external calculator.

Each of the four CDs is designed in exactly the same way. The general sequence of menus is:



PROGRAM CONTENT

Topics covered:

○ **CD 1: Forces and Motion:**

- Velocity
- Acceleration
- Newton's Laws of Motion
- Projectiles
- Static Forces and Moments
- Pressure
- Graphical Methods
- Circular Motion
- Density and Flotation
- **Experiments:** (1) The Cannon
(2) The Car
(3) The Submarine
(4) The Air-Drop

○ **CD 2: Electricity and Magnetism:**

- Electric Circuits
- Ohm's Law
- Variable and Non-linear Resistors
- Power in Electric Circuits
- Electricity in the Home
- Electric Charge
- Magnets and Motors
- Transformers and the National Grid
- Structure of Atoms
- **Experiments:** (1) Bomb Disposal
(2) Series Circuits
(3) Electromagnet

○ **CD 3: Matter, The Earth, Stars and Planets:**

- The Sun and the Solar System
- Gravity
- The Earth and The Moon
- Comets, Meteors and Satellites
- Life Cycle of Stars
- Atomic Structure and Radioactivity
- Uses and Effects of Radioactivity
- Energy Sources
- Electron Beams
- **Experiments:** (1) Investigation of the penetrating power of radioactive emissions
(2) The Nuclear Reactor
(3) The Electron Beam

○ **CD 4: Waves and Optics :**

- Progressive Waves
- Sound
- Ripple Tanks
- Rectilinear Propagation
- Colour and Light
- The Electromagnetic Spectrum
- Energy Transfer
- Expansion
- Earthquakes
- **Experiments:** (1) Colour Mixing
(2) Earthquake
(3) Sound Interference Experiment

There are no teacher notes or pupil notes provided.

Currency And Accuracy

The information presented is factual, accurate and up to date. The software was published in 1998. This is the most recent version of this package available. However, one student felt that “*it was like a computer game from years ago*”, and that it could be updated.

Bias

There is no culture or gender bias, apart from the fact that the narrator is male with an English accent.

Instruction

Instruction makes use of various learning styles, for example, visual, aural, conceptual, problem solving and recall. The user can control the pace at which he/she moves through the CD, and also the path that is taken. However, the structure of the software is such that a student is more likely to work through a chapter, rather than move rapidly from one to another.

CURRICULUM RELEVANCE

The package claims to cover the GCSE Science Syllabus in Physics, and to be “superb support material”. As the GCSE Syllabus is not familiar to most teachers in Ireland, this has little meaning in the Irish Curriculum context.

Looking at the package from an Irish Curriculum perspective it is not suitable to cover either the Junior Cert. or Leaving Cert. curricula. Some of the topics are covered in too much depth and others in not enough depth. It could however, with teacher pre-selection of relevant topics, be useful to illustrate some of the course material, at both levels. For example, on CD 3, the “Life Cycle of the Stars”, “The Sun and the Solar System” and “The Earth and the Moon” chapters would be excellent support material for the Earth Science unit of the Junior Cert syllabus. On the other hand, on the same CD, the chapters on “Radioactivity” and “Electron Beams” would be very suitable support material for the Leaving Cert syllabus. Some chapters are not relevant to either curriculum, for example, Projectiles. While brighter students will probably choose topics relevant to their course,

without teacher guidance, less able students will 'get lost' and possibly end up more confused after using the package.

Some chapters have 'extension material'. This is intended to match the different levels that the GCSE Syllabus caters for, and has no direct relevance to the Irish Curriculum.

PRESENTATION

The narrated introduction at the beginning of each CD contain "explanations supported by animations and regular tests".

Stacy: " text, illustrations, animations and sound are appropriate and enhance the CD".

Screen Displays

The screen display does not fill the full monitor screen. This takes away from the impact of the package. The colours used are very dull. The title pages are on a black background. The text is white printed on a grey background. While the animations and video sequences are excellent, the whole screen appearance is very dull and unlikely to keep the attention of an unmotivated student.

Text

The text is printed clearly in a standard font. The size is relatively small. One of the teachers' felt it could be larger. Another thought that "*there is too much text to read through*" and that it "*is 'boringly' presented*". The colour and size of the text cannot be altered. The student with dyslexia found she had to reread the text a number of times, "*to make it clear in my mind*".

Audio

The text is narrated by a male voice, in a monotonous tone, which can become irritating. One student liked the voiceover as "*it made it easier to concentrate and understand*", while, another, found it "*annoying*". Also, the speed at which the text is narrated is much slower than the speed at which most of the targeted users read the text. Therefore, the facility available to turn off the narration is a very useful one.

Each of the main menu options is animated and has an associated sound, e.g. bell ringing with the 'GCSE School' or creaking doors with 'Exit'. These menu animations and sounds can also be turned off.

Graphics

The 3D animated illustrations in each chapter are of a high quality and provide excellent illustrations to support the text. This is especially true for concepts, which are difficult to visualise, e.g. the working of a motor or wave characteristics. As Rachel put it, "*some of the diagrams and footage were really good, it made some theories much clearer, you can see what is meant*".

Video

Where there are video clips there is a time delay while waiting for the video to play. One student found the video-clips unclear and hard to understand. (This may have been because of the colour settings).

On the whole the animations and video clips enhance instruction and stimulate student interest.

Information Presentation

The information is presented in a basically linear fashion, with the option to jump forward or backwards. Where an experiment might be relevant there is a link available to that experiment, or if a reference is made to another chapter a link allows a jump to it. However, in each case it is not

immediately obvious how to return to the original chapter. One of the students commented on the absence of a dictionary, to explain terms used.

PRACTICE/ASSESSMENT/FEEDBACK

The three main areas providing practice and feedback to the user are (a) interactive exercises in each chapter, (b) mock examinations and (c) experiments. The method of practice and feedback differ in each case. There is no feedback available for the teacher.

(a) Interactive exercises

These exercises occur in each chapter. They are varied including mathematical problems, multiple choice questions and virtual experiments. The user is given two chances to get the correct answer. Then a worked solution is given. The feedback given when the user gets a correct answer is a not very exciting message "Well done, that was the correct answer", in small print! Teachers commented that the exercises were "*complicated enough to follow*" and "*require prior knowledge*", but generally agreed that they stimulated learning.

(b) Mock Examinations

Each examination has five questions, each of which has a number of parts. The answer once entered cannot be changed until all five questions are completed. Then a 'Review' is possible, but all questions must be revisited and answers can be changed. 'Results' are given as a mark for each question and a total mark. There is no way of telling which parts of each question the user got wrong. Model solutions are available for each exam. Once the user has started an exam it is not possible to exit out of it until the all the questions in the exam have been attempted. This can be frustrating. Also, as mentioned earlier, the lack of an available calculator makes some of the questions impossible. The students who did an exam said it was "*easy*". One of the teachers commented that equations should have been provided.

(c) Experiments

These are not laboratory experiments in the normal sense. They are really animated sequences of simulated real-world experiences requiring interaction with the user. Visual feedback leaves the user in no doubt as to whether their input was correct or not. A text explanation is also provided. One teacher felt that the experiment result would be clearer if it was narrated.

In all three types of interactivity, affirmation of correct answers might have more impact if an audio message was given.

OVERVIEW OF TEACHING WITH THIS SOFTWARE

Level

The overall view of the teachers surveyed was that there were parts of the package that were suitable for Junior Cert Science, other parts for a Transition Year Science program, other sections for Leaving Cert Physics and some material did not fit into any of these categories.

Use

The documentation stated as an objective that it "*supports classroom teaching*". The students who were positive about the package would prefer to learn using teacher, book and CD. Similarly, the teachers all felt it could support classroom teaching, but not replace it. Both students and teachers agreed that it would be useful for revision, after class lessons on a topic, but not for self-tuition. It

certainly could be used to enhance the learning and teaching process when real-life/hands-on situations are not possible. It is suitable for use with the whole class, (network version), or with individuals or small groups. Pre-selection by the teacher is essential if used in a class situation.

Facilities

Printing: any page can be printed.

Calculator: this is available for interactive exercises in chapters, but not in mock examinations.

Book marking: one of the navigation buttons keeps a list of 'recent pages'.

AUDIENCE APPEAL

It is interesting to note that the student with dyslexia found that “*overall it, (the CD), annoyed and frustrated me*”. For her, this seemed to tie in with the amount, narration and presentation of text. The other students found it to be “*good*”, “*very good*” and “*really useful*”.

ADVANTAGES AND DISADVANTAGES OF THIS PACKAGE

Advantages:

- excellent animations
- good support material for a taught course
- information divided into chapters, each of which stands alone and enables a small amount of information to be studied at a time.....good for retaining a student's attention and concentration span
- user interactivity maintains interest
- good for illustrating abstract concepts
- very suitable for student revision of material previously covered. “*Being a CD it means you can go back over it again and again*”
- very little computer skills required, installation and navigation easy
- cheap
- music and narration can be disabled
- “*its not as boring as a book*”
- “*diagrams were really good*”
- “*its different*”
- “*nice for self assessment*”

Disadvantages:

- presentation colours too dull and uninteresting
- presentation screen too small
- not geared exactly to the JC or LC
- screen doesn't fill the monitor
- calculator not obvious
- some calculations too difficult to do onscreen
- some exercises not very useful, e.g. colour mixing with different % of each colour
- affirmation of students if they get a correct answer not good
- positive feedback not strong enough
- exams...feedback and recursion not very satisfactory

- maybe too much text to read
- no dictionary
- not specific to the Irish Curriculum
- *“you can’t beat doing the real experiment”*

CONCLUSION

In spite of its disadvantages, I would consider this package to be a very useful resource for the teaching of some topics at Leaving Cert and Junior Cert levels. It could also be useful in the development of a Transition Year Science Module, for example, in Astronomy. Its most positive attributes are the animated sequences, the low level of technical knowledge required to use it and its low cost. It is a pity that the presentation of text and general screen appearance is not more appealing. With teacher pre-selection of topics it would be very useful for reinforcement and revision of a taught topic. Overall, I would recommend a copy of this package for the library and as a resource in the lab from which selected animations could be integrated into teaching when appropriate.

BIBLIOGRAPHY

Junior Certificate Science Syllabus

Leaving Certificate Physics Syllabus

<http://www.becta.org.uk/technology/software/curriculum/evaluation1.html>

<http://www.becta.org.uk/index.cfm>

<http://www.so.cc.va.us/vccsit/softchek.htm>

<http://www.beaconlc.org/seval/princip.asp>

APPENDICES

STUDENT QUESTIONNAIRES

TEACHER SURVEYS

COURSE SUMMARY

SHEETS

‘HELPME’