

USE OF COMMERCIAL COMPUTER SOFTWARE
IN HIGHER EDUCATION INSTITUTIONS WITH SPECIAL
REFERENCE TO STATISTICAL SOFTWARE

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It is now over 3 decades since computers are being used in improving teaching standards in higher education institutions. During this period a large number of packages either in commercial or public sectors have been developed to facilitate the learning process. In general, because of the complex nature of learning and the way human beings learn, only a limited number of developed software have really been useful. In parallel a number of commercial packages have also been developed to perform the basic statistical calculations. These packages have been used in tutorial sessions, in preparation of projects and by the researchers in higher education institutions. In this paper the authors will illustrate how these packages can be used in teaching some theoretical concepts of statistic effectively and efficiently.

INTRODUCTION

To get a broader view of the role of computers in education, it is useful to establish where computers are used in higher education institutions. Five main uses can be identified:

Computers in research

The new scientific problems encountered by researchers created the demand for digital computers. Today much research depends upon the existence of digital computers and they have become the most important tool of the 20th century. At present, the computers are also used in the social sciences and humanities as well as art and business studies.

Computers for teaching computing

The computers are used for teaching courses in computer science. Nearly all students at higher education institutions are taught a computer programming language.

Computers for administration

Computers are increasingly performing administrative tasks. At present almost all higher education institutions use computers for keeping student records, payroll, budgetary control, timetabling and so on. The other main use of computers are in libraries, where a number of tasks from catalogue production to book purchase are being automated.

Computers for learning management

The most extensive use is marking tests and processing examination results. Other tasks include prescription of specific teaching materials on the basis of learners' previous performance.

Computers as a learning resource

If the teaching material in a given course is stored inside the computer then the term Computer Based Learning (CBL) is appropriate. The use of CBL can be divided into two major parts:

- (i) Computer Assisted Instruction CAI, where computers instructs a student by going through different modes such as tutorials, simulations etc.; The learner receives and reacts to instructional material presented by the computer.
- (ii) In Computer Assisted Learning CAL, a student uses a computer as an aid to learning.

CBL AND STUDENTS

The computers allow students:

1. To tackle more realistic problems in research or industry, the practical skills acquired by the students will often be very useful in their later career.
2. To explore numerical and symbolic approaches to problem solving, thus complementing traditional manual analytical procedures.
3. To construct more realistic models which are more complex than those used in the traditional "chalk and talk" classrooms.
4. To close the gap between theory and practice by enabling them to try out the theoretical concepts.
5. To develop problem solving skills particularly with regard to decision making.
6. To perform simulation.

CBL AND MANAGEMENT

From management point of views three objectives are stated in support of innovation:

1. CBL will save time and effort and hence enable the staff to teach or train more students
2. The staff with the assistance of the computer can improve the quality of their teaching and their students' learning.

3. It will provide an intellectual challenge to the instructors with possibilities for evaluating courses more thoroughly and providing opportunities for a critical appraisal of their students' learning.

ADVANTAGES OF USING CBL

The overall advantages of using CBL software can be summarised as follows:

1. The software is almost always used to enrich existing teaching to supplement it rather than replace it. It seldom reduces staff student contact time.
2. The software is used in interactive mode. The student must remain alert to take some action, otherwise the display remains unchanged.
3. The software provides a student with experience in handling knowledge, i.e., solving a problem, applying a theorem rather than transmit knowledge.
4. The software promotes the restructuring of already acquired knowledge, that is, it makes a student to think more.
5. The software is used for high level learning. For a summary of levels of learning see Bloom (1956).

MULTIMEDIA INTERFACE

In the last decade multimedia systems have been developed capable of video display, graphics input components, slide projector interface and audio facilities.

BASIC OUTLINE OF THE DESIGN

It is necessary to see clearly the educational strategy to be adopted when considering the initial design. Certain questions related to the topic being examined can assist:

- how is the topic taught at present?
- what difficulties do students encounter?
- what do students actually do?
- how is it envisaged that the new material will overcome student difficulties?
- in what way is the computer performing a unique function?

Note that an instructor of the topic can only answer these questions, hence there is a need for the CBL materials being designed by subject specialists.

CLASSIFICATION OF CBL SOFTWARE

Among the several possible frameworks, the one proposed by Kismmis (1977) will be discussed. According to this classification the CBL software is divided into four groups:

The instructional paradigm

This is based upon breaking down the learning task into many small tasks. The students would be rewarded to reinforce their learning each time they demonstrate that they have mastered these tasks and would then be allowed to progress to the next task. Drill and Practice (DP) software falls within this category.

Revelatory paradigm

In this category, the CBL software guides a student through a process of learning by discovery in which the subject matter and the underlying theory are progressively revealed. In general as a student interacts with the model implemented in the software s(he) develops a feeling for its behaviour under various circumstances and so is led to discover the rules which govern it.

The conjectural paradigm

In this category computers are used to assist students in their manipulation and testing ideas and hypotheses. The idea is based upon the concept that knowledge can be generated through the students' experiences and the emphasis is mainly on students' exploration of information on a particular topic.

The emancipatory paradigm

This category concerns the use of computers as a means of reducing the amount of labour experienced by a student. For example, if calculations are not a valued part of a learning process, then computers can be used to perform the tedious calculations in order to obtain the valuable final result.

STATISTICS AT NGEE ANN POLYTECHNIC

Statistics is a major unit of the diploma courses at Ngee Ann Polytechnic. It is based on a combination of lecture courses and practical laboratory work which ranges from simple tutorial exercises to comprehensive assignments. This degree of activity is essential if students are intended to tackle realistic problems in industry. At present the commercial software STATGRAPHICS, SPSS, SAS and EXCEL has been licenced to support the students. The advantages of using a well known commercial software are:

- a They provide the student with a state of art as practised in industry.

- b They can improve the quality of their work by offering rigorous methods which cannot be found in locally developed software.

There are also some disadvantages in using commercial software:

- a The lack of detailed information on the structure of the program and the algorithms used.
- b The colossal time required for students and staff to become familiar with the software if full use is made of all the facilities.

USE OF COMMERCIAL SOFTWARE AS CBL

The authors believe that a commercial software such as EXCEL can also be used as a CBL software, that is, the software can be used:

1. to teach students theories covered within the course;
2. to facilitate the investigation process regarding the effects of different assumptions made in the development of the theoretical work;
3. to perform a sensitivity analysis to discover the effects of change in certain data groups or parameters.

To illustrate the use of EXCEL package, we consider the statistical analysis of the completely randomized design or one way classification. That is, it will be assumed that the experimenter has available the results of k independent random samples, each of size n from k different populations and the problem is to test the hypothesis that the means of these k populations are all equal. The method of analysis can be found in any standard textbook in the use of statistics. In Derivation of the basic method it has been assumed that:

- a the populations have normal distributions
- b the population have equal variances.

Although there exists methods for testing reasonableness of these assumptions they are outside the scope of the elementary course conducted at the Ngee Ann Polytechnic. Hence they cannot be used in checking the above assumptions. However it has been claimed that the conventional methods developed based on the above assumptions are fairly robust, that is they are relatively insensitive to violation of the assumptions of normality as well as the assumption of equal variances. The aim of using EXCEL is to investigate experiment-ally the effects of relaxing these assumptions. Appendix-I illustrates the results of relaxing the first and second assumptions. For further details see Mood (1973).

CONCLUSION

It has been shown that there are a large number of research work to use computers more effectively in education. At present because of high cost of development there are a limited number of effective CBL software in the market. However, there are a number of high quality software for professional use. In this paper the authors have shown that the commercial packages such as EXCEL can be used effectively in teaching statistics.

REFERENCES

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Mood, A. M., Graybill, F. A., Boes, D. C. (1973). Introduction to the theory of Statistics. 3rd ed. New York: McGraw-Hill Book Company.

APPENDIX-I

$$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$$

H_1 : At least one μ is different.

1 - All populations have normal distribution with $\mu = 210$ and $\sigma = 10$.