# EXPLOITATION OF POSSIBLE TYPES OF COMPUTER SOFTWARE TO ENHANCE THE LEARNING AND TEACHING QUALITIES

Seng Yong Ho, P. M. Nobar and Ah Meng Ng, Ngee Ann Polytechnic, Singapore

*The conventional system has achieved a level of productivity beyond which it cannot proceed any further. In this paper we review the latest computer oriented education and contrast it with the traditional method. In order to observe how computers can help teaching and learning activities in statistics, the state of CBL software has been reviewed and their shortcomings have been pointed out. The major rules of screen layout have been discussed and we have discovered that at present there are a very limited number of software in the market which are effective for teaching and learning. Hence, we have decided to use the commercial computational software in our teaching activities. Finally, an example of our teaching activities has been set out.*

## INTRODUCTION

If we expect a significant increase in productivity and quality of education under the current financial constraints and social changes we must call upon advanced technology to assist in the task of revamping the educational system. For further details see Bunderson (1981). The evolved system of learning and teaching environment must be: time independent, location independent, independent of learners knowledge, inclusion of all methods, open to public scrutiny, life long learning, and information processing capabilities.

## TRADITIONAL VERSUS MODERN OBJECTIVES

The conflict between the traditional models of teaching and instructional design models is that the former is characterised as saying: *"I teach and if you do not learn, so be it"* while the latter is characterised by a student centred orientation and is characterised by: *"Analyse the student's needs and the learning outcomes and revise the teaching activities to fit the situation".* A primary goal for educational programs must be to improve the effectiveness and efficiency of learning compared with traditional education. In other words students must learn: more in the same time, the same in less time, deeper in the same time and the same with less resources.

## COMPUTER BASED LEARNING MATERIAL

A CBL material may not be as good as the one to one course with a good instructor on a good day, the computer is consistent and always one to one. However, good instructors get old, some lose interest and some get promoted. The standardised lesson development has been due to the development in the area of courseware authoring languages making instructional courseware production rather easy and possible. A number of educational experts have addressed the problem of courseware material produced by novice instructors. Hall (1983) is concerned with the lack of attention to appropriate use of questioning and the lack of intellectual engagement between the student and the CBL material. Gagne (1979) analyses the typical CBL courseware material developed using an authoring language that depends upon standard prompts consisting of the following basic components: text, question, feedback, remediation and test. Gagne acknowledges the use of such systems in developing educational software but shows concern about the absence of internal learning processes and external instructional events. For this Gagne tabulates these special processes and events as well as a description of the types of learning outcome as shown in Table 1.

Table 1

| | |
|---|---|
| Alertness | Gaining attention |
| Expectancy | Informing learner of lesson objectives |
| Retrieval to working memory | Stimulating recall of prior learning |
| Selective perception | Presenting stimuli with distinctive features |
| Semantic encoding | Guiding learning |
| Retrieval and responding | Eliciting performance |
| Reinforcement | Providing informative feedback |
| Cueing retrieval | Assessing performance |
| Generalising | Enhancing retention and learning transfer |

To increase the effectiveness of the CBL materials Roblyer (1981) advocates a systematic design process which can be characterised as:

a the use of a theory based model,

b emphasis on written documentation,

c a team approach,

d a provision for evaluation.

## INTERFACE DESIGN

A large number of CBL software has been developed with little adherence to any principles of screen design. The following is a succinct summary of the major discoveries in the area of interface design:

*Screen format*

The screen must be divided into different sections and different sections should be allocated for menus, headings, objectives, test, graphics, questions, etc. Moreover, at least 50% of the screen must remain unused.

*Learning material*

The learning material should be divided into small sections.

*Representation of text*

The choice of text is an important issue and must follow certain guidelines:

- Unless highlighting is used, text should be predominantly lower case.
- Create symbols to replace text which is to appear on every frame.
- Present the learners with all the instructions necessary for them to make a response before presenting them with a prompt.
- Use overlays to add a bit of information at a time. A timed pause between the erasure of the old material will ensure that the learners know that new information has been added.

*Spacing*

Usually eyes move in an arc from the upper left corner to the lower right corner. Thus the main instructional medium either text or graphics should be placed in the upper left corner and the final instruction must appear on the bottom right corner.

*Justification*

The eyes respond more effectively to a line of text which is left justified than to text that is right and left justified.

*Colour*

Colour is one of objective aspect of screen design. However, the latest research shows that certain colours should be used on the same screen and the number of colours should not exceed 4.

*Background colour*

Use a neutral colour for background and use it throughout the whole CBL software.

*Colour of different objects*

Select different colours or different intensities of the same colour for each of the objects: headings, text, borders and instructions.

*Colour for reinforcement*

Use colour to reinforce the learning. For example on a multiple choice question

*Highlighting*

The following can be used for highlighting: boxing, underlining, italizing, boldfacing, capitalising and reversing the background colour. Blinking can be used on many displays. Its use should be restricted because it is distracting and may become annoying. For further details see Khtta.

*Common form*

Information should be presented as customarily seen by a user. For example, in USA days of the week are on the horizontal line whereas in Europe they often appear vertically.

*Animation*

Animation improve understanding and observation of different phenomena. Animation can be obtained with different techniques, each one showing different types of interaction: continuous animation, discrete animation, persistence of images and step by step animation.

*Freedom*

Leave the user in control. That is, do not force the user into unwanted situation'.

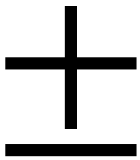
*Consistency*

The software must produce the same response to the same user action.

*Shortcuts*

The program must offer shortcuts to the experienced users.

*Screen overload*

The software must not overload the screen with information. The capacity of the short term memory is 7  2 items.

*Help*

The program must be able to provide quick and sensible information when requested.

*Messages*

The messages provided by the software must be specific, precise and constructive. The phrases must be user centred orientated and messages must appear in multiple level guiding the user.

*Input facilities*

If a program requires a large number of data, then there must be extra facilities for entering the data. Moreover, the software should be able to read a data set which has been produced outside.

## STATISTICS AND COMPUTERS

Statistical analysis did not show much progress until 1960s. Since then the development of computers statistical science has been changing in character and direction. The calculation power of computers has increased the range of statistical calculations as well as the category of users. The new statistical methods and new approaches in data analysis have inevitable influence in teaching statistics. The most influential changes are:

*Simulation*

The present usage of the term simulation often includes methods which previously had been classed as Monte Carlo methods, a term used by Metropolis (1949). Queuing theory is another field of statistics greatly affected by simulation methods.

*Numerical analysis*

Initially the enormous increase in computation speed stimulated the execution of extensive statistical calculations. The desirability of large scale statistical calculations gave rise to the consideration of computing efficiency, numerical accuracy and storage efficiency.

*Graphical Display*

Many statisticians have already accepted that the graphical representations are essential tools in statistical analysis of data.

## CBL SOFTWARE FOR STATISTICS

There are a very limited number of software which consider the guidelines described above and there teaching capabilities are very limited. Therefore, we have tried to use the commercial computational software in our teaching activities. As an example, in the teaching confidence interval of mean, we obtain ten samples of fixed sample size 30 (i.e. R1,R2,R3, R4,R5,R6,R7,R8,R9 and R10) are generated from a normal distribution with $\mu = 100$ and $\sigma = 20$. The 90% confidence intervals for the true mean are obtained for the ten sample using STATGRAHICS.

## TABLES

## CONCLUSION

Computer application in teaching and learning can be very valuable. Although we

have a set of guidelines for developing CBL software at the moment a very limited number of good software available. Therefore, we have used the commercial computational software successfully in our teaching activities.

## REFERENCES

Bunderson, C. V. (1981). Courseware: conception and definitions. In O'Neil, H. F.(Ed). Computer Based Instruction: a state of the art assessment. New York: Academic Press, Inc.

Gagne, R. and Briggs, L. (1979). Principles of Instructional Design, (2nd Ed.), New York: Holt, Rinehart and Winston.

Hall, K. A. (1983). Content structuring and question asking for computer based education. *Journal of Computer Based Instruction, 10(1).*

Kanata High Tech Training Association (Khtta), Observations based on a major CAL development project.

Metropolis, N. and Ulam, S. (1949). The Monte Carlo methods. *J. Amer. Stat. Assoc. 44,* No.247.

Roblyer, M. D. (1981). Instructional Design versus authoring of courseware: some crucial differences. *Association for Educational Data Systems Journal, 14(4).*