

# CHANGING COMPUTER LITERACY AND ITS EFFECT ON ENGINEERING EDUCATION

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**Abstract** *For the past six years all new entrants to two first year electronic engineering courses have been questioned on their use and awareness of basic computer literacy. This includes their ownership of personal computers, what they do with them, how they use them to study and their knowledge of different types of software, such as word processing, databases and spreadsheets. The original syllabuses for both courses assumed little pre-knowledge of computer usage. Now this assumption is incorrect and the syllabuses have been rewritten to take into account this change. This is especially significant as one of the courses studied was a studio-based course that did assume a higher level of computer literacy than that initially shown by most students, which is now not true. The paper presents the results of the survey and discusses the changes made to accommodate the increased computer literacy of the students. It also raises questions about how this affects engineering courses in general, and whether online or web-based courses are the correct answer.*

**Index Terms** *Computer literacy, syllabus, electronic engineering*

## INTRODUCTION

The Department of Electronic Engineering (EE) at City University of Hong Kong runs four courses in Basic Electronics for first year students taking the Mechatronic Engineering (BEMTE) and Manufacturing Engineering (BEME) programmes offered by the Department of Manufacturing Engineering and Engineering Management (MEEM).

In the first week of Semester A, before the course starts each student is given a multiple choice questionnaire, which is in two parts. The first contains questions concerning the students' attitudes and competence in computer literacy, the second part contains questions relating to the students' knowledge of the course subject matter [1].

This paper evaluates the students' responses to the various questions on the first part of the pre-course questionnaire, and attempts to draw some conclusions as to how their competence and skills in computer literacy have changed over the six years that the study has taken place.

## THE QUESTIONNAIRE

The questionnaire consisted of 22 questions (although the 96-97 cohort were only presented with 12, consequently some of the analyses and graphs will start with the 97-98 cohort). The first question asked about computer ownership, and the second about the student's comfortability with using the computer. The next group of 4 questions asked about knowledge of the internet, word processing, spreadsheets and databases. The next group asked about attitudes to using computers. Finally, the remaining questions asked about pre-knowledge of the course, how much the students were prepared to use computers and the web in their studies, and the language of instruction.

## THE RESULTS

The first question asked whether the student had used a computer before. The results are shown in Figure 1.

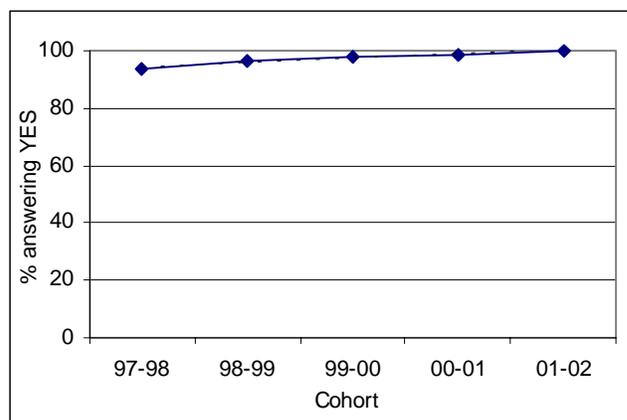


FIGURE 1

PERCENTAGE OF STUDENTS HAVING USED COMPUTERS BEFORE ENTERING THE UNIVERSITY.

As can be seen, and expected, the number of students having used a computer has now reached 100%. What is surprising is that just 5 years ago 6% of students had not used a computer before entering an engineering programme.

Question 2 asked whether the student felt comfortable us-

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ing a computer. Although the response to this question was predicated on the interpretation of 'comfortable', it was never the less one of a number of questions, which when combined together, gave a good indication of the student's attitude. The results are shown in Figure 2.

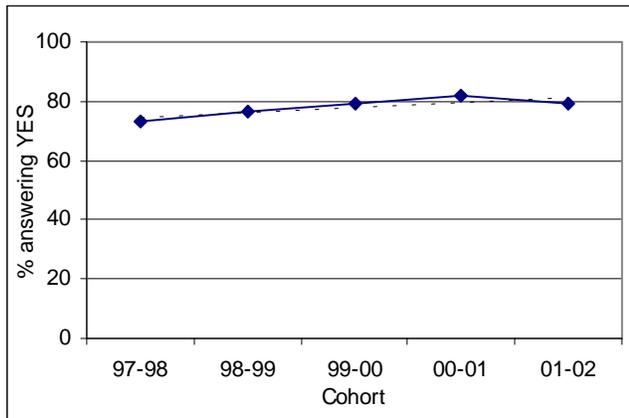


FIGURE 2

PERCENTAGE OF STUDENTS FEELING 'COMFORTABLE' USING A COMPUTER

It can be seen that the response has peaked, but at only 80%. Again, this is surprising considering that these are engineering students who will be spending considerable time using computers, not only in their courses, but also in their eventual jobs.

The next questions considered the students' technical skills at using, or at least being familiar with, the most common computer applications. Question 3 concerned the use of the Internet/WWW. The responses are shown in Figure 3.

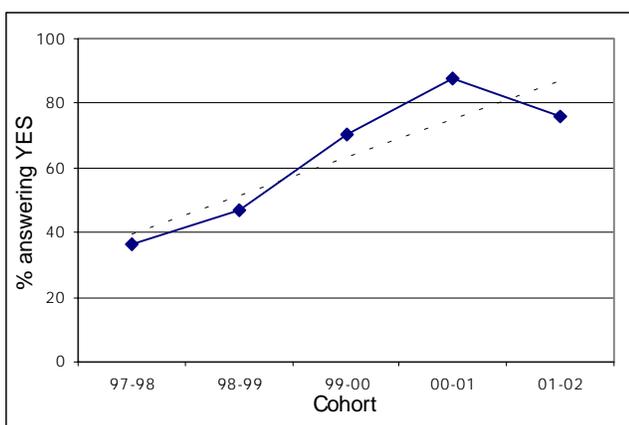


FIGURE 3

PERCENTAGE OF STUDENTS BEING FAMILIAR WITH THE INTERNET/WWW

The trendline shows that over the past 5 years familiarity

with the web has risen substantially, although the 01-02 cohort shows a drop-off that is not expected.

Figure 4 shows the aggregated results of all the questions concerning what might be called 'IT skills'. These questions asked about knowledge or experience of using word processors, spreadsheets and databases, and also includes the results of the question above concerning the Internet/WWW. A slight bias has been introduced to weight the results towards the more familiar applications, such as word processing, and against more uncommon ones, like databases. The results are shown in Figure 4. 100% would approximate to a good familiarity with all the common applications.

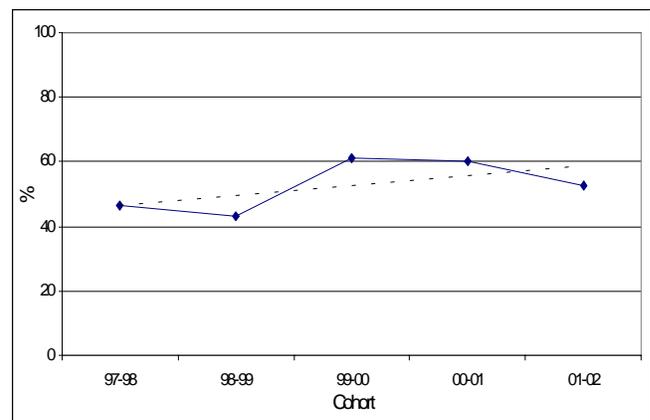


FIGURE 4

IT SKILLS

Again, a saturation point seems to have been reached, with students averaging around 60% skill level on entry compared to those who would be considered adequately skilled.

Figure 5 shows those responding positively to a question

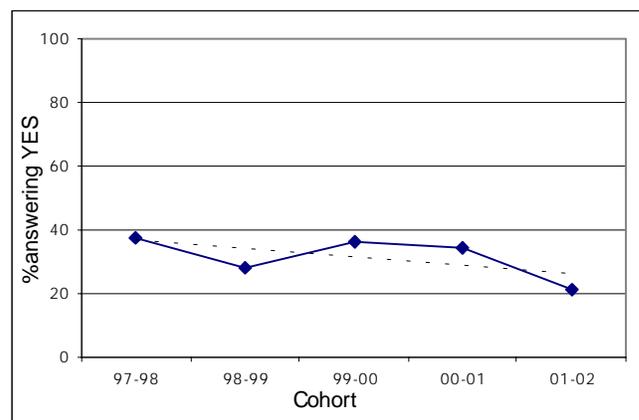


FIGURE 5

PERCENTAGE OF STUDENTS WHO USE A COMPUTER TO DO THEIR HOMEWORK

that asked of they use a computer to do their homework. Surprisingly, the trend has been falling, with around 20% using computers for homework in 01-02. However, as will be seen below, over 95% of students owned a computer by that time.

The next set of questions focused on the students' reactions to computer use. Figure 6 shows the percentage of those who felt that using computers help them learn, and Figure 7, the percentage of those who enjoyed using computers.

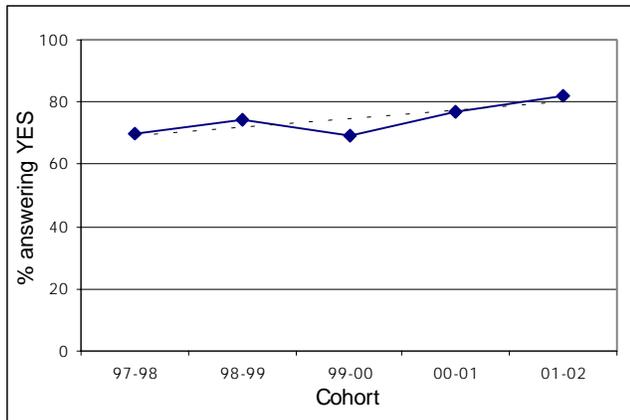


FIGURE 6

PERCENTAGE OF STUDENTS WHO FELT THAT COMPUTERS HELPED THEM LEARN

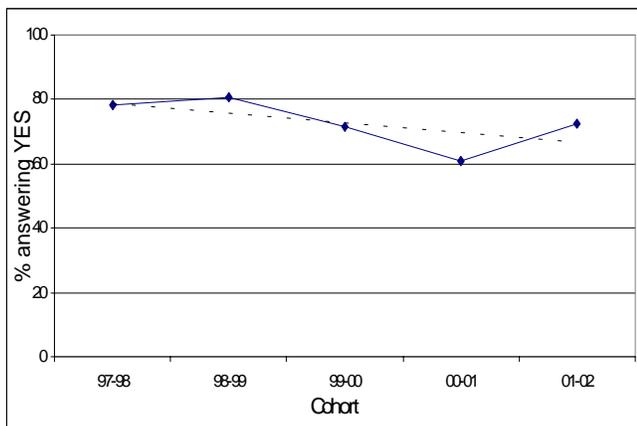


FIGURE 7

PERCENTAGE OF STUDENTS WHO ENJOYED USING COMPUTERS

The answers to these two questions seem to indicate that whilst most students considered computers a useful learning tool they didn't really like using them for doing so, and this seems confirmed by the responses to the question on homework, Figure 5, where a small minority, around 20%, actually used them for such a purpose.

However, it is interesting to see the responses to a ques-

tion concerning the number of hours that they use computers each week. As can be seen from figure 8, that has been increasing over the years of the study. Although the original study requested detailed information about the number of hours, Figure 8 shows those who use the computer for more than 10 hours a week, a median point derived from the original survey.

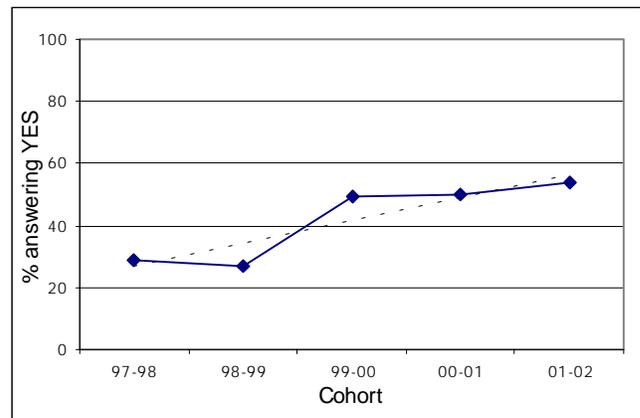


FIGURE 8

PERCENTAGE OF STUDENTS USING A COMPUTER FOR MORE THAN 10 HOURS/WEEK

A related survey, taken in the middle of the semester, showed that most of the time spent on the computer was used for game playing, surfing the web and chat rooms. Educationally related usage was a distant 4th in the list. [2]

The responses to the questions relating to computer usage and the students' feelings were aggregated into a single response. This is shown in Figure 9. 100% would be a rough measure of someone feeling happy, competent and at ease when using a computer. The percentage is the class average of this very rough and ready measure.

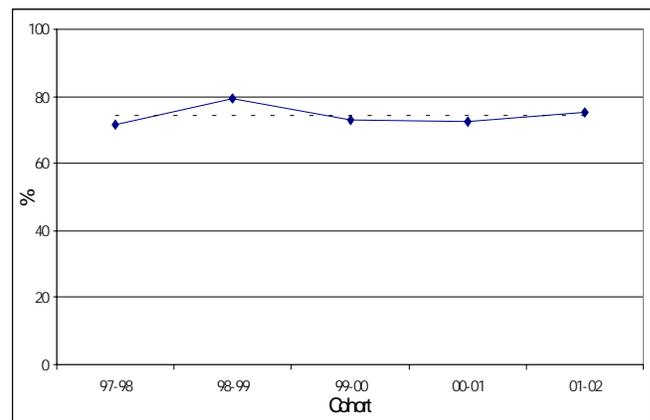


FIGURE 9

FEELINGS TOWARDS USING COMPUTERS. 100% WOULD INDICATE A FEELING OF COMPETENCE AND EASE. CLASS AVERAGE.

It can be seen that the feelings towards using computers have been fairly constant over the period of the survey.

The next three questions were related to the ownership of computers and the technical details. Figure 10 shows the percentage of students owning a computer, Figure 11 the percentage of these having a CDROM capability, and Figure 12 the percentage having a modem. These questions were considered important as much of the course material was placed on the web over the period of the survey and it was possible to access the university network from home via the web. At the same time, some of the coursework was also made available in CDROM format.

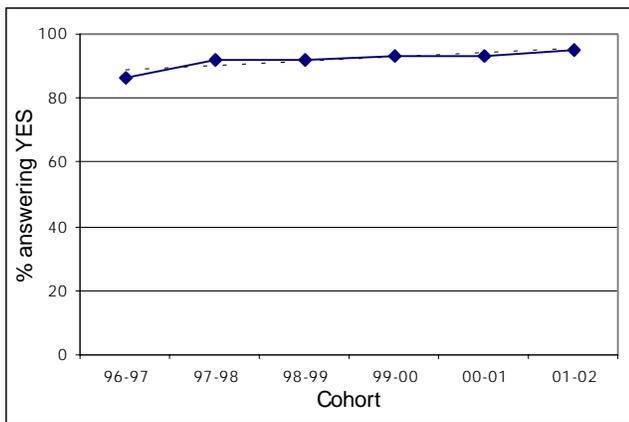


FIGURE 10

PERCENTAGE OF STUDENTS OWNING A COMPUTER

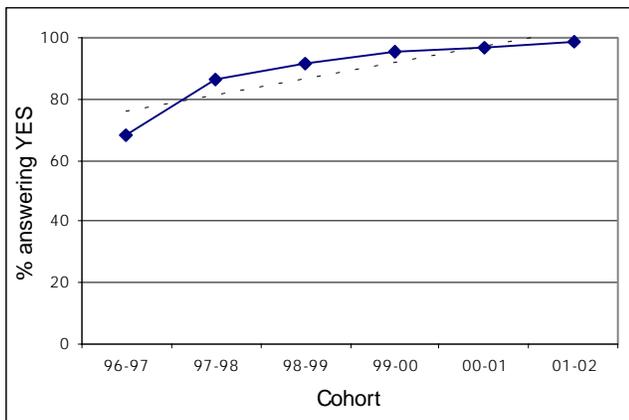


FIGURE 11

PERCENTAGE OF COMPUTERS OWNED WITH CDROM CAPABILITY

As was to be expected the responses followed very closely the development of technological progress. It can now be safely assumed that only a small minority of students do not own a

computer, and this is probably because of financial problems. During the past two years the university has allowed students to borrow laptop computers which have wireless LAN capability for use on campus, and circumstantial evidence shows that those not owning a computer themselves now have access to one for most of their study time.

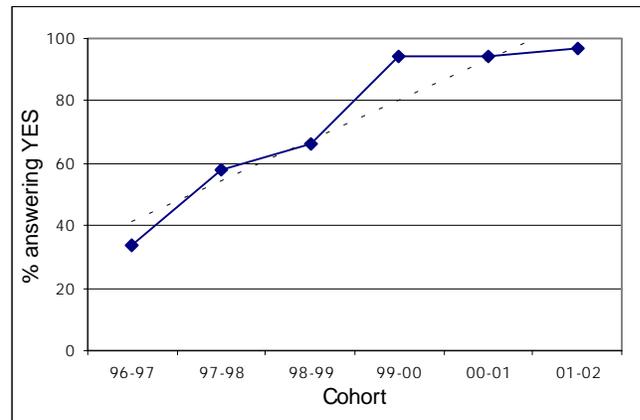


FIGURE 12

PERCENTAGE OF COMPUTERS OWNED WITH A MODEM CAPABILITY

Two final questions related to the students' thoughts about how the courses should be presented. As the courses became more web based and interactive, it became possible to allow them to study in a self-learning mode, and not attend classes. No student took up this option. In fact, the responses to a question asking if they would consider using this mode of learning, shown in Figure 13, indicate a trend away from doing so.

A related question asked if, owning a modem, they would

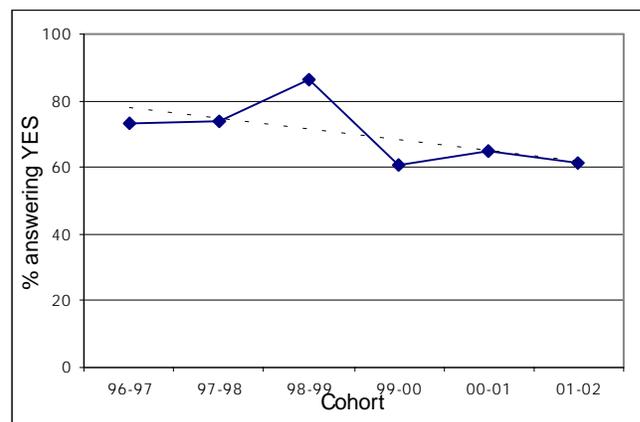


FIGURE 13

PERCENTAGE OF STUDENT WHO WOULD CONSIDER USING SELF-LEARNING MODE OF INSTRUCTION

consider doing some study work at home online. The responses are given in Figure 14.

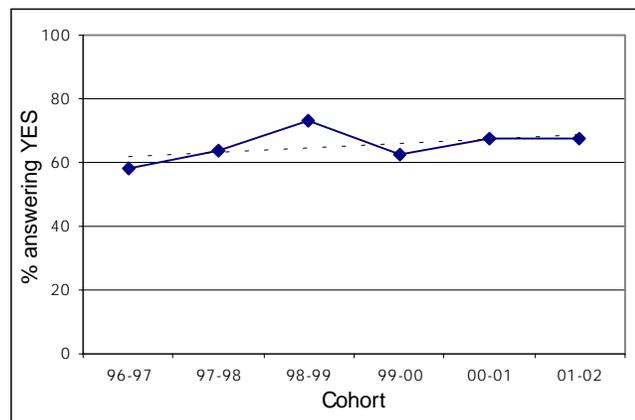


FIGURE 14

PERCENTAGE OF STUDENTS PREPARED TO DO SOME STUDY RELATED WORK AT HOME VIA A MODEM. RESPONSES FROM THOSE OWNING A MODEM ONLY.

This percentage has remained remarkably steady over the period of the study even though modem ownership has increased from 25% to near 100% over that time.

### DISCUSSION

Many courses established over the past five years or so have made basic assumptions concerning the level of computer literacy of the students, and this is especially true of engineering courses. There has also been a very substantial move away from the more traditional pedagogies of engineering education to those which are more student-centred and interactive.

The long running survey reported in this paper seems to confirm certain aspects of these assumptions but contradicts some others. If engineering courses are to make full use of the technology available then the course designers and teachers must be aware of these contradictions.

Admittedly, the two bachelor's degree programmes studied at City University of Hong Kong do not reflect the situation on a wider basis - they just reflect the unique conditions of the Hong Kong educational system that is currently in transition from a pedagogy formally based on rote learning to one more oriented towards more investigative pedagogies. The students studied in the survey reported here were products of a system in transition and their attitudes towards learning showed this, in their classroom behaviour as well as their general knowledge of the subjects they elected to study. A related paper [1] shows that the actual aptitudes of the students had dropped over the period of the study even though their entrance grades

had improved. This dichotomy also seems to have been seen in the results of the study reported here.

For example, although their ownership, use of computers, and computer skills had risen steadily, their willingness to use computers as part of their course has decreased. This probably would not be true for a computer programming or engineering design course that was simulation intensive. However, the two courses studied were consistent in their responses [2] which indicated that this feeling was prevalent independent of the programme.

One explanation could be that at the beginning of the survey period ownership of computers was low, although not significantly so, whereas web access, for example, has increased significantly. The decrease in willingness to use the computer/web/internet for studying seems to have dropped by about the same amount as the increase in ownership, indicating that at the beginning of the survey those using computers were more willing to use them. As ownership has increased as well as access to the web, the change in use has also affected the students attitudes. It now seems that the computer has become more of a social tool than one for study. It is therefore not possible to correlate the increase in computer ownership with an increase in the desire to use computers for learning. This belief, which seems to be erroneous based on the work reported here, has been a foundation of the move towards more web base interactive learning pedagogies. Vast investments have been made in designing and evaluating these new pedagogies, many of which have not taken into account the changing nature of student attitudes towards computers.

### CONCLUSIONS

From the survey reported here a number of clear trends can be discerned as far as Hong Kong is concerned. They may or may not have relevance to other countries. First, ownership of computers by first year engineering students is nearly 100%, and these computers are equipped with CDROM and modem capabilities. 100% of students are able to make use of computer applications, although these are heavily weighted towards web/internet access and word processing but not spreadsheets and/or databases. There are a substantial minority - about 20% - of students who do not feel comfortable using computers, although over half those reporting used the computer for more than 10 hours a week.

Around 60% of students should be considered computer literate with respect to their knowledge of basic applications. The majority of students - around 80% - think that using computers helps them learn, but a decreasing number - now around 60% - would be prepared to use computer-based self-learning

pedagogies. In fact, the percentage of students that use a computer to do their (school) homework is only around 20% and dropping.

Clearly, these attitudes towards computer-based or computer assisted learning are of concern to those academics who are involved with developing such courses, and this surely has implications for such areas as distance learning which are becoming more and more dependent on internet- and based-learning pedagogies.

### ACKNOWLEDGEMENTS

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