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An Investigation of Differences in Mature and Younger Students' Use of a Computer Based Learning Package

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Abstract

Older or "mature" students are becoming a larger proportion of the student population in tertiary education. This study looked at the difference between mature and younger students' use of, and attitudes towards, a Computer Based Learning (CBL) package used in a first year Economics class. Surveys, interviews and automatic recording of package use were used to gather data. It was found that the mature students made significantly more use of the package than the younger students. Other interesting results included the pattern of use and the way the two groups viewed the package. The results have implications for the provision of CBL material for both groups.

Introduction

Many studies have shown that Computer Based Learning (CBL) can have positive outcomes for students, such as an enhanced attitude and commitment to learning, a sense of reward, and improved learner confidence (eg Rachal, 1984 & 1993; Kulik *et al*, 1986). Some studies have looked at CBL use by different groups, eg male versus female, adult versus child. However, few have explored the differences in CBL use and attitudes between older and younger students in tertiary education.

Many institutions have experienced an increase in the number of older, so called "mature" students. Various studies define a "mature student" in different ways, eg by age (Trueman & Hartley, 1996) or by a break in formal education (Lowden *et al*, 1990). Age definitions usually classify those under 21 as "non-mature" but often create two or more mature categories (eg "mature" and "borderline mature").

Mature students often face a number of problems in furthering their education. Many have other commitments, such as jobs and family, which impinge on their ability to study. Mature students are also often concerned about their lack of background preparation and may be anxious about their performance (Munn *et al*, 1992; Knight and MacDonald, 1982). While these problems can affect any student, they are particularly likely to be encountered by mature students.

Despite these problems, mature students can be successful in an academic context. Richardson (1994, 1995) found that mature students were more likely to adopt desirable approaches to learning, such as a meaning orientation rather than simply reproducing facts. Trueman and Hartley (1996) found that mature students have better time-management skills. Mature students also often display a higher motivation and can bring a wider range of experience to their education.

It is possible that having CBL packages available could be an effective way to support mature students learning. Indeed, the convenience and learner control offered by CBL could be very attractive to this group. Maclay & Askov (1987) attributed increased participation in an adult education program to CBL use.

However, older individuals generally have less computer experience and have been characterised as "computerphobic" (Zeffane & Check, 1993). They may experience performance anxiety and lack of self-confidence when faced with computers (Saputo & Frieman 1984). These problems could reduce the positive advantages of CBL for this group.

This study had two objectives: to examine the differences in use of a CBL package (Economics in Action) between mature and younger students, and to determine the reasons for any differences found. The subjects for the study were students in a first year Economics class (ECON101) at Lincoln University in 1995. This paper is an overview of the study, the results found and conclusions reached.

Background

Economics in Action (EA) is a CBL package designed to be used with the first year textbook "Economics" (McTaggart, Findlay & Parkin, 1992). In 1995, EA was a DOS program. A key feature of EA is the use of "interactive graphs" which students are encouraged to manipulate. There are a number of modules covering different textbook topics. In each module, students can work through a tutorial, take a quiz or experiment with the graphs in "free mode". EA allows the learner full control over topic choice, sequence and repetition of material.

ECON101 is an introductory Economics class taught at Lincoln University in New Zealand. Lincoln is a small institution (approximately 4000 students at the time of this study) offering a range of degrees (Commerce, Agricultural Science, Resource Studies, Applied Computing, etc). ECON101 is required for a number of degrees and is generally taken in the first semester of study. In 1995, there were approximately 550 students enrolled in ECON101.

ECON101 was taught over 14 weeks with a two-week break in the middle of the semester. Assessment was by tests, written assignments, EA "assignments" and an exam. The EA assignments counted for 5% of the final grade, and were used as an incentive for students to use the package. However, the assignments simply involved running an EA quiz; student answers were not checked for correctness.

EA was installed on the University's computer network and available in all computer labs on campus. Students could also purchase a copy of EA to use at home.

Method

Classification of Students

Table 1 shows the criteria used to classify students as mature or non-mature for this study.

Table 1: Classification of Students

Age	**Group Classification**
Under 21	Non-mature
21 up to 25	Mature if one or more of the following were true: • had at least a two-year break from formal education • had one or more dependent children • had to take time off from regular employment to attend university Otherwise non-mature
25 and over	Mature

Class Surveys

Three surveys were carried out during the study: in the second week of the semester, mid-way through the semester, and in the following semester, after final grades for ECON101 had been distributed. The final survey is referred to in this report as the "post-semester survey". The first survey was used to classify students as mature or non-mature and gather demographic information. The second and third surveys contained questions about the how often students used EA, their reasons for using it, and their perceptions of it as a learning tool. The second and third surveys were carried out on random samples from the class.

Log of EA usage

Students' on-campus use of the EA package was automatically recorded for the entire semester. Information recorded included student's username, date and time of session, length of session, and the number of mouse clicks and key presses generated. Usage of EA on home computers could not be recorded.

Interviews

Selected students from the second and third surveys were interviewed at length in order to gain further insight into their use and attitude toward EA and CBL in general. The interviews used open-ended questions.

Analysis

The usage and survey data were summarised using graphs and tables. Statistical analyses were performed where appropriate. Only results with *p* values less than 0.05 are described as statistically significant in this paper. The interview data was simply categorised.

Initial Survey - Results and Discussion

Classification of Students

Table 2 shows a breakdown of the ECON101 class by age. Note that students who were under 21 or 25 and over were automatically classified as mature and non-mature respectively. The age distribution of the class was reasonably representative of all first year Lincoln students that year, with 10% of both groups aged 25 or over.

Table 2: Age by Group

	Mature		**Non-mature**		**Total**	
Age	**N**	**%**	**N**	**%**	**N**	**%**
Under 21	0	0%	340	84%	340	67%
21 up to 25	51	49%	64	16%	115	23%
25 and over	53	51%	0	0%	53	10%
Total	104		404		508	

Students aged 21 to 25 required at least one additional characteristic to be classified as mature. Table 3 shows the percentage of each group with each characteristic.

Table 3: Characteristics for Group Classification

Characteristic	**Mature**	**Non-mature**
Two-year break in education	95%	2%
Dependent children	14%	0%
Regular employment	12%	2%

It is obvious that the two groups were largely delineated by whether they had had at least a two-year break in education. This single characteristic seems to capture the meaning of "mature" as used in many studies, ie having significant life experience outside of formal education. It could be well be used to determine "mature-ness" in future studies.

Other demographic data

Table 4 shows the breakdown of each group by gender. Although there is a clear difference in the gender distribution between the groups, the usage data did not show a significant difference in EA usage between males and females (this is discussed below).

Table 4: Gender by Group

	Mature		**Non-mature**		**Total**	
Gender	**N**	**%**	**N**	**%**	**N**	**%**
Male	75	72%	233	58%	308	61%
Female	29	28%	171	42%	200	39%
Total	104		404		508	

Other interesting characteristics of the two groups were as follows (chi-squared tests were used to test for significance).

- There was no difference in the proportion of students studying full-time (98% for both groups). This is counter to expectations about the other commitments that mature students face, such as work and family.

- There was a significant difference in computer experience between the groups. Sixteen percent of the mature group had never used a computer before versus 4% of non-mature students. However, fewer than 10% of both groups reported being very experienced computer users. This highlights the wider disparity in computing background of mature students.

- A significantly higher proportion of mature students (60% versus 10%) had attempted or completed a non-university tertiary qualification (eg a Polytechnic diploma).

- A higher proportion of non-mature students had attended primary school in New Zealand (90% versus 74%).

Expectations of EA

Significantly more mature students intended to use EA "a lot" (44% versus 27%) while more non-mature students intended to use it "only to gain marks" or not at all (23% versus 14%). There was no significant difference in the intention to buy EA for home use (about 20% in each group).

The difference in expected use is interesting as it could be assumed that, since the mature students had less computer experience, they would be more reluctant to use a computer package. On the other hand, the result is consistent with claims that mature students are more anxious about their performance and "work harder".

Usage Data - Results and Discussion

Data from all on-campus EA sessions was automatically recorded in a log file. This data was filtered to remove short sessions (less than one minute) and those with little interaction (fewer than 10 mouse clicks and 10 key presses). This left a total of 5,685 student sessions that were analysed in a number of ways.

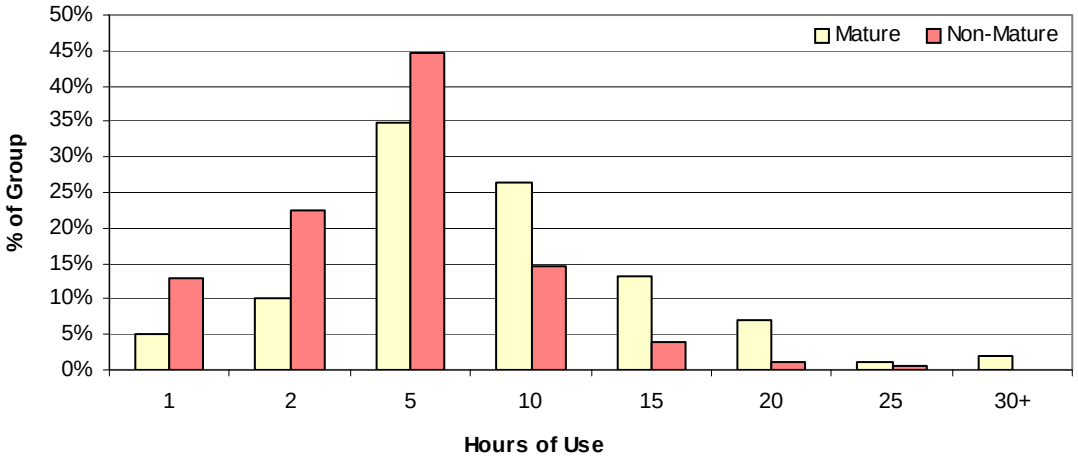
Differences in Usage

Table 5 shows the average number of hours and sessions of EA use per student. Figure 1 shows the distribution of the average time spent per student. While most students used EA for less than five hours, a few spent more than 20 hours using it.

Table 5: Average EA Use per Student by Group

		Mature	Non-mature	Overall
Hours	Mean	7.2	3.6	4.3
	Std Dev	6.7	3.3	4.4
Sessions	Mean	15.7	10.6	11.6
	Std Dev	10.9	6.6	7.9
N		98	390	488

Figure 1: Distribution of Total EA Use for Semester by Group



It can be seen from the high standard deviations and the graph that both distributions have large tails. To compensate for this, *t*-tests were performed on the log values of the hours and sessions data. These showed a very significant difference ($p < .001$) in the means for both hours and sessions between the groups.

Use of EA by students at home was not captured by the logging procedure. However, since a much higher proportion of mature students purchased EA (as discussed later), it is likely that the difference between the groups would have been similar or greater if home use had been included.

Gender Differences

While this study was not specifically looking at gender differences, it was important to see whether gender had an effect on the results. Table 6 shows a breakdown of the average hours of use by gender for the two groups.

Table 6: Average Hours of EA Use By Gender

Gender	Total Hours	Mature	Non-mature	Overall
Male	Mean	7.4	3.6	4.6
	N	71	209	280
Female	Mean	6.7	3.5	4.0
	N	27	181	208

There appears to be a difference between males and females for the mature group. However, when *t*-tests were performed on the log values of these data, no significant difference was found between the genders for either the mature or non-mature group. This indicates that conclusions drawn from the usage data are more likely to be due to differences in maturity level and are unlikely to be heavily influenced by gender differences. This does not imply that research into gender differences in mature and non-mature students is unwarranted.

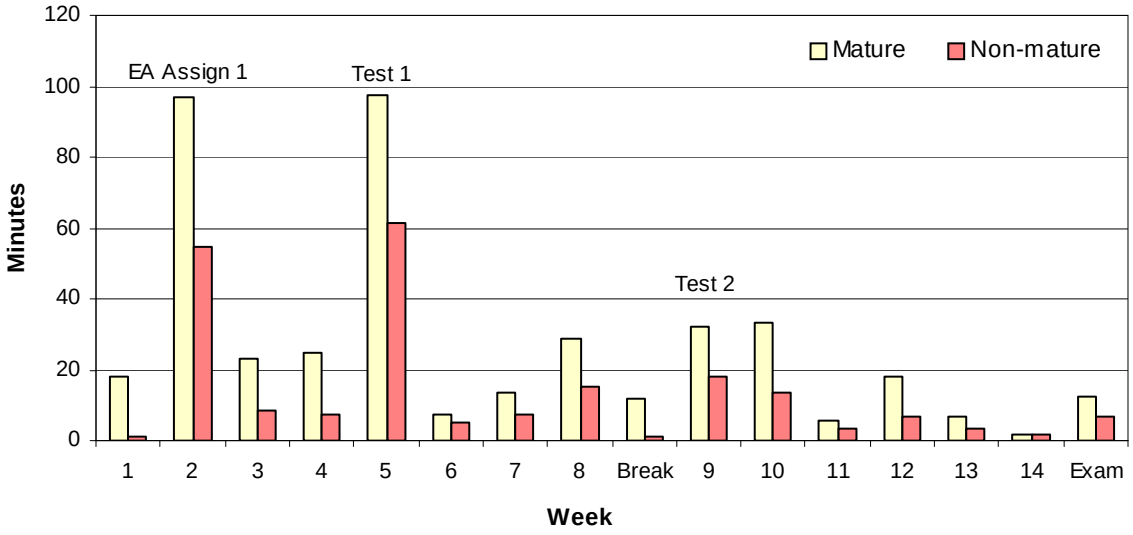
Usage Over the Semester

Analysing the data over time showed a very interesting pattern of use. Figure 2 shows the hours of EA use per student for each week of the semester (the break and exam period were each two weeks long). The consistently higher usage by mature students is also apparent in this graph, including over the mid-semester break when classes were not in session.

The "damped oscillation" effect can be partially explained by the placement of class assessments. The weeks affected by preparation for some of the assessments are noted on the graph. It appears that students in both groups were very concerned about the first of several EA assignments. In addition, these were first year students and the assignment was one of their first pieces of university assessment. In fact, all the EA assignments simply required running an EA quiz; no record of the number of correct answers was made. This minimal requirement may have contributed to the lower level of use for later EA assignments (weeks 5, 8, 10, 12).

The other major peak of EA use was in preparation for first test and there is a corresponding but smaller peak before the second test. There were only small increases for the written assignments (weeks 3, 6, 9, 11).

Figure 2: Average Time Spent per Student by Week by Group



Mid-semester and Post-semester Surveys - Results and Discussion

Each of the two later surveys used a different random sample of students. Table 7 shows the number of students who participated.

Table 7: Sample Size of Each Group

Survey	Mature	Non-mature
Mid-semester	31	32
Post-semester	32	36

Both surveys asked about how students used EA and how they felt it contributed to their learning. The post-semester survey contained more questions, including ones about students' overall perceptions of the class. Chi-squared analyses were used to test for differences in responses by the groups. There were few statistically significant differences found. The results discussed below are based on the post-semester survey except as noted.

Impact of EA

Table 8 shows the percentage of students who used EA to study for the tests and the exam. This result is consistent with the usage data, which showed a much larger use of EA before the first and second tests than before the exam (refer Figure 2).

Table 8: Use of EA for Study by Group

EA used to study for	Mature	Non-mature
Test 1	78%	75%
Test 2	62%	53%
Exam	28%	31%

Note that the question only asked whether the package had been used and not for an amount of use. This could account for the similar responses by the two groups despite the significant difference in recorded usage.

More than 80% of all the students felt they had received a final grade that was equal to or higher than expected. Over half of the students felt that EA had contributed "a little" to their grade and a quarter or more felt it had contributed "a lot". Students were also asked whether EA had helped improve their test/exam results and whether more use of EA would have improved their results further (see Table 9).

Table 9: Perception of Impact of EA by Group

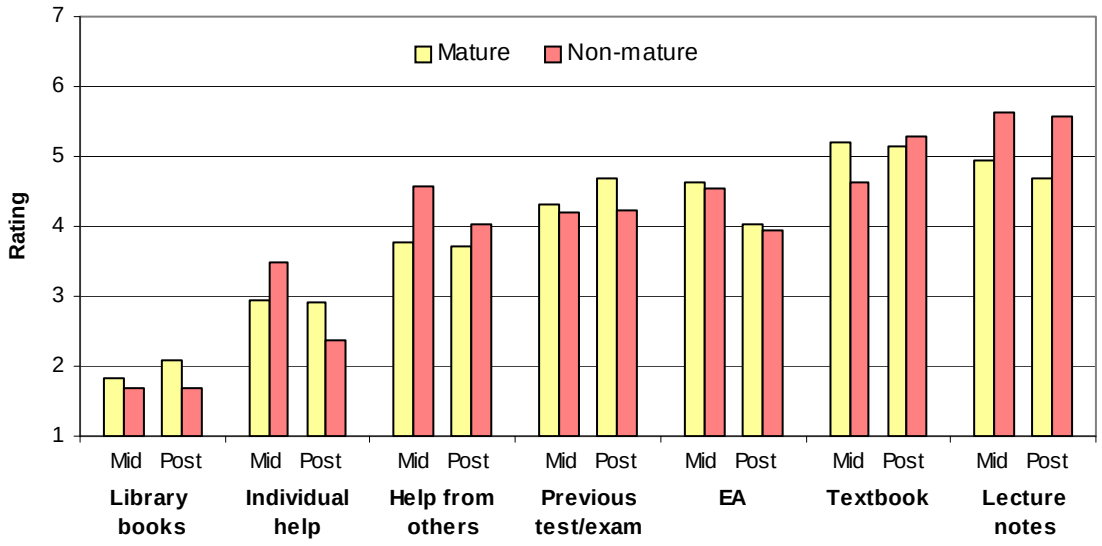
	Did improve my result		More use could have improved my result	
Assessment	**Mature**	**Non-mature**	**Mature**	**Non-mature**
Tests	72%	69%	53%	78%
Exam	48%	39%	44%	67%

The lower perceived contribution of EA to the exam might be due to the differences in style and content of the tests and the exam. There is a significant difference between the groups in the potential improvement that more EA use could have brought. This difference is not surprising given that the mature group used EA much more. They may well have felt that they had already received most of the benefit from it.

Helpfulness of Learning Resources

Students were asked to rate the helpfulness of the various learning resources available (*Lecture notes*, the *Textbook*, *EA*, *Individual help* from tutors, *Previous test and exam papers*, *Help from others* and *Library books*) on a continuous scale from 1 (lowest) to 7 (highest). Figure 3 shows the average rating for each resource for both groups and for both the mid-semester and post-semester surveys. Overall, there was a low correlation between the ratings for each resource. This indicates that students may have viewed each resource as quite independent.

Figure 3: Helpfulness of Learning Resources



These data were analysed using a general linear model. The variance ratios of the accumulated analysis of variance showed a significant effect of resource ($p < .001$) and a significant interaction between group and resource ($p < .015$). The difference between surveys was not significant, although the interaction between survey and resource was suggestive ($p = 0.06$).

The resources were grouped as shown in Figure 3 based on the predicted means and standard errors from the analysis. Both groups rated *Lecture notes* and *Textbook* higher than *EA*, with the non-mature students putting *Lecture notes* first. *EA* was rated similarly *to Previous tests and exams* by both groups and to *Help from others* by the non-mature students. *Individual help* and *Library books* were rated lower than *EA* by both groups.

The main difference between the surveys was a decrease in *EA* rating (which is consistent with usage data and survey responses) and a drop in the rating for *Individual help* for the non-mature group (possibly due to students being off campus during the exam period).

Other Survey Results

- There was a significant difference in the proportion of mature students purchasing EA for home use (20% versus 3% in the mid-semester survey). This is consistent with the higher recorded use of EA by mature students.

- EA quizzes were considered the most helpful by about half of both groups with tutorial mode the second most helpful.

- Both groups used the interactive graphs feature "most of the time" or "all of the time" (a rating of 2.7 out of a 1 - 4 scale).

- 80% or more of both groups said they would like a similar type of CBL package to be available in other subjects.

Interviews - Results and Discussion

Students from the mid- and post-semester surveys were invited to participate in interviews. The interviews were used to gain a better understanding of the differences between the groups and of their impressions of EA. Approximately 10 students from each group in each survey were interviewed. Open-ended questions were used. The results were summarised but no statistical analysis was performed since the students were self-selected.

Overall the interview comments generally supported the survey results. The main points are summarised below:

- The mature students tended to have a more positive view of EA in both sets of interviews. At the mid-semester point, the non-mature group's comments were mainly about problems using EA. However, their comments were more positive (even enthusiastic) in the post-semester interviews.

- Some of the problem areas mentioned by both groups were: the difficulties of computer access (there was no reserved computer time for the class), the lack of an initial tutorial on EA, and only 5% of the grade being based on EA use.

- It appears that a CBL package used in an accounting class had a negative impact on EA use. The accounting students were required to complete computer modules and tests. Several students said this took a lot of time and that they were "fed up with CBL". However, both groups felt that having packages similar in style to EA available in other classes (especially in the sciences) would be useful.

- Both groups indicated that they initially used EA just for the 5% it contributed toward their grade but this changed as the semester went on. Both groups said they used EA for test revision but the mature students also commented about how EA improved their understanding and learning overall. Several mentioned that they preferred using EA to the textbook.

- The mature group appreciated the control that using EA gave them. They commented on the ability to work at their own pace and in their own time, and to choose the method of use (eg graphs, quizzes, etc).

- The non-mature students were more satisfied with their final grades. This could be because mature students have higher expectations and/or difficulties returning to study.

Conclusions

Overall, the use of the EA package was not high by either group of students in this study. However, the majority of students believed that using EA had positive effects on their performance, despite limited computer access and a lack of initial training. This certainly supports the view that CBL can be a very effective learning resource. A useful idea for future research would be to compare the time spent using, and the perceived benefit of, all the learning resources available to a class.

The mature students in this study used EA more, and rated its benefits more highly, despite starting with less computer experience. The reasons for this are not completely clear. It is likely to be due to a combination of attitudes toward learning and the convenience and flexibility offered by CBL. Further study of mature students and their attitudes towards CBL is important if institutions are to cater for the increasing numbers of these students.

It is a common belief that the use of computers is the province of the young. This study shows that, far from being intimidated by computers, mature students can enthusiastically embrace their use.

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