Undergraduate teaching in geriatric medicine using computer-aided learning improves student performance in examinations

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Abstract

Background: computer-aided learning (CAL) is increasingly used to deliver teaching, but few studies have evaluated its impact on learning within geriatric medicine. We developed and implemented CAL packages on falls and continence, and evaluated their effect on student performance in two medical schools.

Methods: traditional ward based and didactic teaching was replaced by blended learning (CAL package combined with traditional teaching methods). Examination scores were compared for cohorts of medical students receiving traditional learning and those receiving blended learning. Control questions were included to provide data on cohort differences.

Results: in both medical schools, there was a trend towards improved scores following blended learning, with a smaller number of students achieving low scores (P < 0.01). Feedback from students about the CAL packages was positive.

Discussion: blended learning was associated with improvement in student examination performance, regardless of the setting or the methods adopted, and without increasing teaching time. Our findings support the use of CAL in teaching geriatric medicine, and this method has been adopted for teaching other topics in the undergraduate curriculum.

Keywords: CAL, computer, learning, students, education

Introduction

Computer-aided learning (CAL) describes any use of computer technology to enhance knowledge. It is well received by students, particularly when used alongside traditional teaching methods [1–5]. This is sometimes called blended learning.

Modern undergraduate curricula are challenged by the need to teach an ever-expanding body of medical knowledge within a fixed time period. Given these pressures, teachers in geriatric medicine can struggle to find space to teach necessary theory whilst ensuring adequate consideration is also given to complex clinical issues like ethics and communication [6–9]. CAL packages provide an effective way of teaching fact-heavy topics [1, 10, 11], allowing face-to-face teaching to focus on more complex clinical issues, without increasing the total teacher contact time [9, 12].

Despite increased availability of online educational resources in geriatric medicine, there have been relatively few studies evaluating CAL as a means of delivering teaching in the speciality.

We designed and implemented CAL packages in continence and falls as part of an e-learning suite in geriatric medicine developed and delivered to undergraduates at the Universities of Nottingham and Leicester. This study aimed to establish their effect on learning, as evidenced by student examination performance.

Methods

Development of CAL packages

The CAL packages were developed using the Xerte open access platform. Learning outcomes were derived from the
British Geriatrics Society recommended undergraduate curriculum [13]. Storyboards were developed with input from specialists in continence and falls. The final product was hosted on an open-access website (http://bit.ly/T5kl4t).

Implementation into the curriculum and analysis of effects on student performance

The two medical schools had differently structured curricula and, as a consequence, CAL was implemented differently at each.

Nottingham

During their fourth year, Nottingham students undertook a 4-week attachment in geriatric medicine on a rotational basis. Didactic lectures on falls and urinary incontinence were replaced by compulsory CAL packages followed by a face-to-face case-based interactive teaching session—a blended learning approach. Cohorts in the same academic year, taught immediately before and after the change to teaching (December 2010 and May 2011, respectively), were assessed for knowledge of these topics as part of their end of course examination. Six questions related to falls and continence were included in the examination and were repeated for each group’s examination. These consisted of 3 true/false (1 mark each), 3 best of five questions (1 mark each) and 1 extended matching question (5 marks total). A question about stroke, a topic not taught using blended learning, was also repeated across both cohorts to provide some control. Scores were compared for traditional and blended learning.

Leicester

Leicester students undertook an 8-week attachment in geriatric medicine in their fourth or fifth years on a rotational basis. Six cohorts of students were recruited from December 2010 to July 2011. The first three cohorts of students (2006/07 intake) were allocated to receive traditional teaching. The following three cohorts of students (2007/08 intake) were given a link to the falls CAL website as a supplement to traditional teaching.

Students were assessed by means of a purpose-designed examination that assessed learning outcomes in falls and continence but did not contribute to their final grades. To provide additional control data, students were consented for disclosure of their Intermediate Professional Examination (IPE) results—a final year written and clinical examination in a range of specialties.

The examination included a total of 17 questions of varying format: 10 best of 5 questions (1 mark each), 3 true/false (1 mark each) and 4 short answer questions (3 marks each). Three questions on capacity assessment and stroke were also included as control questions.

Data were analysed using the Mann–Whitney U-test for the falls and continence questions, and chi squared for the control questions.

Results

Nottingham

In Nottingham 168 students received traditional learning and 162 students received blended learning. The maximum possible score was 11 for the falls and continence questions, and a single best-of-five question on stroke received a maximum possible score of 1.

The median score for traditional and blended learning cohorts was the same, but the distribution of scores was better post-intervention with ranges of 2–11 and 5–11, respectively (P < 0.01) (see Figure 1).

No statistically significant cohort effect was demonstrated. The scores for the control question in the traditional and blended learning cohorts, respectively, were 143/168 (85%) correct and 149/162 (92%) correct (P = 0.051).

Leicester

In the Leicester traditional learning cohort, 71 students out of a possible 107 volunteered and 67 consented to disclose IPE results. In the blended learning cohort, 100 students out of a possible 125 volunteered and 92 consented to IPE disclosure. Forty-nine per cent of students (49/100) accessed the CAL package on falls. Those who did not access the software were excluded from further analysis.

The median scores for the traditional learning group were 13 (IQR 4, range 0–19) and for those in the blended learning group 16 (IQR 3, range 8–19, P < 0.01) (see Figure 2).

There was no significant difference between the scores for the control questions between the traditional and blended learning groups (median 2, P = 0.752). However analysis of the IPE scores suggested some cohort effect,
with a significant difference in scores favouring the blended learning group with a median of 190 (range 150–225) versus the traditional group with a median of 186 (range 144–222, \( P = 0.04 \)).

Feedback from students at both Universities was positive. Ninety per cent of respondents rated the packages as very good or excellent.

**Discussion**

This study reports implementation of two CAL packages in geriatric medicine as part of a blended learning strategy across two medical schools with differing curricula. The main finding was that student performance improved following implementation; regardless of setting, how CALs were implemented, and the blended learning methods adopted. This was achieved predominantly by a change in the distribution of scores, with fewer students performing poorly.

In Leicester, where uptake was voluntary, only 49% of the students accessed the CAL packages. Those students who did so had significantly higher IPE scores than those who did not. This may reflect a more proactive and motivated group. Research has shown CAL appeals to students who are older and more driven [11, 14]. This is particularly relevant to those on graduate programmes. Data on uptake rates were not recorded in Nottingham, where an assumption was made that students would access material they knew would be examined.

These findings match the assertion in the broader literature that CAL is at least as effective as traditional teaching methods [1, 15–17] and that greater improvement in the performance is seen in weaker students following CAL implementation [18].

Although the total instruction time in falls and continence increased as a consequence of CAL, this was without an increase in scheduled teaching time and therefore added no pressure to staff resources. Although a considerable number of staff hours were involved in developing these packages, they are now relatively low maintenance. The more institutions that adopt them for use, the greater will be the collective efficiency saving.

The major strength of the study is that it describes real-world implementation of CAL, demonstrating feasibility of implementation and how performance was affected. Measures were taken to control for cohort effect. The main limitation of the analysis is that each medical school had to implement and analyse the effect of the CALs differently. The results are also limited to questions of knowledge, without considering skills or attitudes, which the introduction of CAL may have affected [19].

To conclude, blended learning incorporating CAL led to improvements in student performance in examinations in geriatric medicine, largely by improving the performance in weaker students. CAL can help with some of the time and resource issues facing teachers within geriatric medicine. Work has begun on creating packages in other core topics. These packages are free to access and maintained by the University of Nottingham. We invite colleagues to make use of them.

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**Conflicts of interest**

None declared.

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**References**


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