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Full Length Research Paper

Evaluating the impact of video-based versus traditional lectures on student learning

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Although, computer assisted learning and multimedia programs have emerged into higher education institutions, there is no clear evidence that such a movement can improve student learning. This study was conducted to provide an objective assessment of the impact of lectures with the use of video clips on student learning over traditional teaching methods. Five university students participated and experimental control was achieved using an alternating-treatments design. Overall, students experienced sixteen 5-minute lectures, half on kinesiology and half on psychological issues for children, delivered by either traditional or video-based methods. Results showed that teaching material based on video clips was at least as equally effective as standard teaching lectures. Similar data were collected during 1-, 2-, and 3-week follow-up measures. These results come in agreement with the current literature reinforcing the suggestion that the use of videos in education may hold great promises.

Keywords: Higher education, video-based lectures, learning, single-case research methodology, teaching.

INTRODUCTION

Current advances in information and communication technologies (ICT) have spurred the need to incorporate higher levels of technology into university classrooms. Educators use technological advances as powerful pedagogical tools not only to present a plethora of information on a specific topic, but also to incorporate material that is not available in print or that require synthesis from multiple resources (Marshall, 2002; Wofford et al., 2001). Hence, computer-assisted learning has become popular in educational settings, having revolutionised the higher education sector (Selwyn, 2007).

Computer-assisted learning (CAL) can be defined as any form of instruction that uses the computer to present information with ultimate goal to enhance student learning (Devitt and Palmer, 1999; Karakas, 2008). It consists of text, whereas multimedia within CAL combines the use of text, audio, video, and graphic images (Cooper, 2007). Although, thorough evaluation of the utility of CAL in enhancing student learning can be difficult (Hudson, 2004) and more rigorous research is still needed (e.g., Bloomfield et al., 2008), several researchers have made important efforts to compare CAL with textbook material (e.g., Santer et al., 1995); computer-based lectures with traditional lectures (Guy and Frisby, 1992; Jeffries, 2001; Sestini et al., 1995); even, entire e-learning courses with lecture-based courses (Hadley et al., 2010; Smart and Cappel, 2006). In general, CAL may create a rich environment for active learning which could be equally effective or even superior to traditional teaching methods (Hudson, 2004; Kaveevivitchai et al., 2009).

The impact of CAL on students' attitudes towards learning has also been favourably evaluated as a supportive means to address their educational needs (e.g., Hosny et al., 2008). The prospect that CAL plays a diverse role in students' learning has largely influenced

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their position. They recognise that the presentation of visual texts (e.g., video clips, pictures) in computer-based lectures can become a significant support (Bracher et al., 2005; Hartley, 1994). This is potentially because complex skills can be easily broken down into their simpler components and presented visually, enhancing students' comprehension and retention (Choi and Johnson, 2005). Thus, students who may have limited prior knowledge might benefit more from information presented in the multiple-symbol system of video technology (Salomon, 1994).

More specifically, the use of video, video streams or video-web communication has spanned the educational curriculum in a range of fields such as mathematics (e.g., Seago, 2004); science (e.g., Constantinou and Papadouris, 2004); language (Jauregi and Banados, 2008; Wagener, 2006) and others (Goldman et al., 2004). Even from the students' perspective, studies have shown that video can be a more effective medium than text to enhance their satisfaction and motivation during the learning process (e.g., Choi and Johnson, 2007; Shyu, 2000). The issue of adding video components to computer-based lectures, however, has not been studied systematically (Spickard et al., 2002). There are some studies examining the ways that students make use of digitised videotapes of lectures, but the results are rather mixed (e.g., Berner and Adams, 2004; Davies et al., 2005; Herder et al., 2002; Homer et al., 2008; Romanov and Nevgi, 2007).

The inclination of using videos or videotaped lectures in the university classrooms, however, appears to be indicative of a larger problem in education research. There has been rather limited effort for an objective evaluation of educational innovations. With a few exceptions (i.e., Balsev et al., 2005; Ford et al., 2005; Hilton and Christensen, 2002; Kamin et al., 2003), where the use of videos was mainly evaluated in combination with other multimedia CAL material, most studies have been exploratory in nature and base their results on students' subjective views through questionnaires or self-report providing limited empirical evidence on how videos can improve their learning (e.g., Ballantyne and Knowles, 2007; de Leng et al., 2007; Palmer 2007; White et al., 2005). While their importance should not be underestimated, such evaluations are still subjective and hence, they cannot fully reflect educational outcomes. An objective evaluation can be a multifaceted and difficult task as it involves not only the provision of technological advancements, but also the human aspects of critical content, effective pedagogy, attractive presentation, efficient evaluation, and extensive dissemination (Bransford et al., 2000). One possible strategy would be to break down this multifaceted task into its constituent elements and then to evaluate each of these elements individually. Once effective properties of these elements are identified then the task of reconstructing this multiple task into an effective pedagogical strategy could begin. Given that current evidence is still inconclusive, such an approach may shed some more light on the impact that videos might have on student learning.

Accordingly, this study was designed to objectively assess one element of this task: the impact of lectures with the use of video clips on student learning over traditional teaching methods.

METHOD

Experimental design

An alternating-treatments design was employed for all students (e.g., Barlow et al., 2008). The decision of using a single-case research design for the current study was made in an effort to meet current demands for an objective and in-depth evaluation of educational innovations. This particular design is a useful technique to examine the effectiveness of two or more treatments, when these are conducted within the same intervention condition with the same individual but separated in time and presented alternatively (Wolery et al., 2010).

Participants

Five postgraduate students (1 male, 4 females) in business studies aged 24 - 44 years old participated. Students with limited (if any) knowledge on the teaching topics of this study (i.e., health-related) were preferred as this would facilitate the integrity of the research methodology. These students came from diverse ethnic and cultural backgrounds, but all were fluent in English.

Following a complete description of the study and its objectives, formal written consents were obtained from all students. An ethical approval had already been granted by the institution of the authors.

Stimulus materials

Overall sixteen 5-min lectures were designed and used. In relation to the content, these lectures were classified into two different categories: a) eight which were focused on aspects of kinesiology covering the topics of elbow flexion, forearm supination, shoulder extension, and wrist extension and b) eight lectures focused on psychological issues for children such as depression in children, Attention Deficit Hyperactivity Disorder (ADHD), suicide in adolescence, and learning disabilities.

In each category, half lectures were designed following the traditional teaching methods while the remaining contained specifically created video clips. Thus, collectively there were eight traditional and eight video-based lectures. The content of each traditional lecture corresponded precisely to the content of the respective video-based one. Hence, the objectives of the lectures, whether traditional or video-based, were identical. In that way, the only difference between the two types of lectures was the delivery means; either traditional or video-based (e.g., Aly et al., 2004). In fact, traditional lectures were created from the video-based lectures to ensure that both the content and the presentation sequence were

very similar for the two different ways of presenting the teaching material. This was important in order to avoid confounding content with presentation method in order to assess the impact of the video-based lectures on learning.

All lectures were presented and built up as a series of PowerPoint® slides. Text and pictures were depicted on the slides designed for the traditional-based lectures as opposed to some text and mainly videos for the video-based ones. The videos presented either a couple of people getting involved in interview-like discussions on the subject, or vignettes of real life situations (e.g., a child with ADHD behaving at school), or demonstrations of different client and therapist positions for assessing functional range of motions (e.g., elbow flexion, forearm supination etc). It is worth mentioning that despite the fact that the production of such video-based lectures can be expensive and time-consuming, cost was kept minimal as both authors contributed to the educational design and content of them.

Outcome measures

The effectiveness of any educational innovation/teaching method in an objective way would be assessed if measurable data for that innovation could be collected. Therefore, the impact of either teaching method (i.e., traditional and video-based) on students' learning was measured by scoring on particularly designed quizzes for ensuring the reliability of data collection across all delivered lectures. They were developed by both authors and each of them contained 5 to 8 questions; 3-4 multiple-choice, 1-2 true-false, and 1-2 fill-in the missing word. The questions reflected upon the learning objectives of each lecture. Data on the correct and incorrect responses to the questions were collected. Collectively, 24 quizzes were filled in by each student while overall 120 quizzes were filled in by all students.

Procedure

Baseline

During baseline sessions there was no prior delivery of any teaching material. Instead, students were required to fill in eight quizzes which reflected on the subsequent lectures, either traditional or video-based. They were informed that they would not be penalized in any way for incorrect or blank answers. The purpose of this contingency was to control for the effects of motivation on performance. Also, students were not told the correct answers until the completion of the entire study (i.e., after follow-up). This was done for eliminating affects of testing of the same quizzes in both baseline and follow-up.

Intervention

In each session during this condition, each student firstly attended a block of 2-3 lectures. Both authors delivered one or two lectures, either traditional or video-based and in either topic (i.e., kinesiology and psychological issues for children) to counterbalance for any *presenter effects*. Following each lecture, students were required to fill in the respective quizzes as in baseline. Despite 16 overall lectures had been prepared, each student experienced only eight of them. In this way, none of the students attended the same sequence in terms of either the content (e.g., elbow flexion, depression etc) or the mode (traditional and video-based) or the lecturer to counterbalance for any potential order effects. Students were randomly assigned to the order of the lectures.

Follow-up

Follow-up measures were obtained one, two and three weeks after the delivery of the respective lectures had been taken. The procedures were identical to those during baseline, and a total of eight assessments were conducted for each student.

Inter-rater reliability

Inter-rater reliability is typically measured for assessing the quality of the obtained data (e.g., Alberto and Troutman, 2005). In the current study, the two authors and an independent rater (another healthcare university lecturer) scored 55% of the quizzes from each of the experimental conditions (i.e., baseline, intervention, and follow-up). The independent rater was naive to the experimental conditions and to the assignment of the students across traditional or video-based lectures. They all scored the answers from each quiz on a separate data sheet to ensure independent scoring. Total average reliability was 100% across all questions of the quizzes.

Social validity

Single-case research methodology requires the collection of "consumer satisfaction data" through, for example, opinion surveys, questionnaires or interviews. These data provide information about the social validity of a study, an assessment which refers to assessing whether treatment objectives, procedures, and effects are important and acceptable to the "consumers" of treatment. That is, "consumers" have to validate the social significance of the goals, the social appropriateness of the procedures, and the social importance of the effects of any intervention (e.g., Martin and Pear, 2006). These social validity data tend to be of secondary importance and they should be used to supplement primary data collected through direct measures of behaviour (Gast, 2010).

Therefore, at the conclusion of the study, all students were requested to fill in a short 5-point Likert-type questionnaire (1 = completely disagree, 5 = completely agree), designed by the authors, for measuring the social validity of the video-based lectures. Specifically, students had to respond to the following five questions: (1) lectures were interesting because of the incorporated video clips; (2) the video clips in the lecture provided a good introduction to real patient situation; (3) the video clips can help students understand a topic rather than simply memorising it; (4) the video clips used did not relate to the topic; and (5) the video clips distracted me from the main points being presented. Finally, space was also allocated on the questionnaire for any further comments.

RESULTS

Collectively, the primary findings for each student are depicted in Figure 1. In general, the performances of all students were rather variable across all conditions. However, all of the students' responding was higher

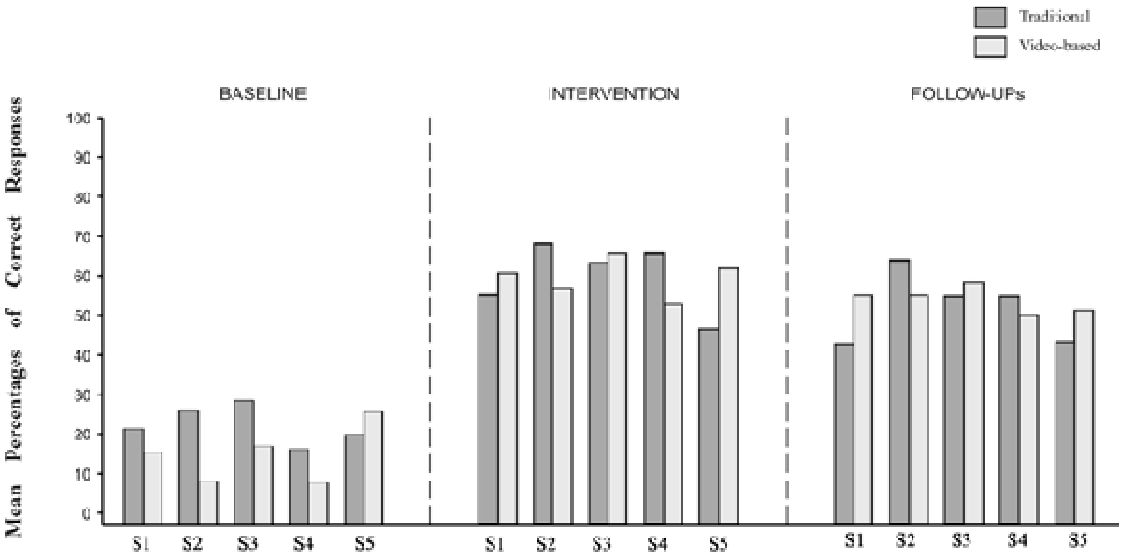

Figure 1. Mean percentages of correct responses for all students (S1, S2, S3, S4, & S5) across the video-based and traditional lectures during the baseline, intervention and follow-up conditions.

during intervention and follow-up conditions demonstrating that video-based lectures were at least as equally effective as standard teaching lectures. Nevertheless, average performances of all students demonstrated a slight superiority of video-based lectures over traditional ones.

As it is the case with all single-case research designs, visual inspection of the data informs the researcher whether one treatment is consistently more effective than the other in producing changes in the target behaviour. Hence, Figure 2 provides a detailed graphical display of the data for each student across all conditions. Specifically, the percentage of correct responses to the quizzes for student 1 during baseline was at an average of 21% (range, 0% - 50%) per session, irrespectively of the subject; kinesiology or psychological issues for children. During intervention, percentages of correct responses increased to an average of 54.5% (range, 42.8% - 75%) per session and dropped slightly to an average of 42% (range, 10% - 75%) per session during all follow-up measures. A remarkable increase of correct responses from an average of 15.5% (range, 0% - 22.2%) during baseline to an average of 60% (range, 35.7% - 94.4%) during intervention was recorded for the quizzes that video-based lectures were designed for, irrespectively of the topic. Similar results, an average of 56% (range, 35.7% - 72.2%) per session, were obtained during all follow-ups.

For student 2, percentages of correct responses increased during intervention from a level of 25.4% (range, 0% - 40%) per session to an average of 68.7% (range, 50% - 80%) per session on the quizzes related to the traditional lectures. Similar performance was maintained during follow-up. As for the quizzes related to video-based lectures, increase of the percentages during intervention was even more substantial showing a difference of 47.9% from the percentages during baseline. Percentages were alike during follow-up.

Data for students 3, 4, and 5 were similar to those of student 2. That is, the differences between the mean percentages for the quizzes related to video-based lectures in baseline from those in intervention were at a level of 47.5%, 52.5%, and 35.1%, respectively. On the contrary, the increase of the mean percentages for the quizzes related to traditional lectures during intervention was of 33.4%, 52.1%, and 26.4%, respectively. Similar percentages with those during intervention across each student were noted during follow-up.

DISCUSSION

Overall, data from the current study provided an objective illustration that short video-based lectures can be at least as much effective as the standard teaching methods, which come in agreement with the current literature. Also, the five postgraduate students reported that the use of videos improved their attention to the topic of the lecture and also that videos had a positive impact on their motivation as well as concentration levels.

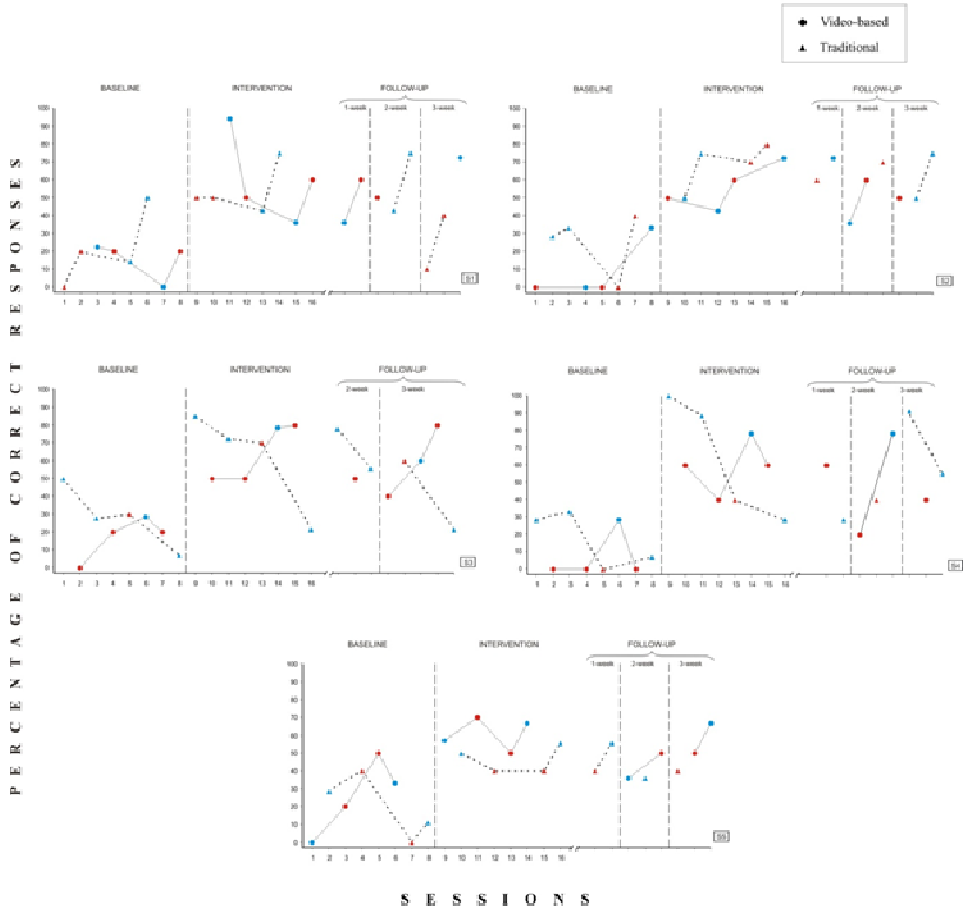

Figure 2. Percentages of correct responses for all students (S1, S2, S3, S4, & S5) across the video-based and traditional lectures during the baseline, intervention and follow-up conditions. Lectures on kinesiology are indicated by red data points whilst those on psychological issues for children by blue data points.

Replication is the essence of believability in research. Data from this experiment come in agreement with other studies wherein different quantitative research methodologies were employed, adding to the evidence of the effective use of videos in learning (e.g., Chen et al., 1998; Ford et al., 2005; Kline et al., 1986; Ricks et al., 2008). Carefully constructed videos can be an efficient supplement to current practices releasing the classroom time for even more exciting and interactive engagements. They can become a cost effective teaching method in that video-based libraries can be created and be used by a large number of academic educators. Also, charismatic lecturers in a specific domain can be videotaped and then viewed later or educators could view themselves and work on possible improvements in their presentation skills (Caspi et al., 2005).

The field of higher education can probably be one of the most characteristic examples of the difficulties that the extensive use of group designs may have in providing data that lead to improved practice (e.g., Horner et al., 2005). This can be particularly evidenced when, for instance, the personal style of individual educators may affect the instructional methods in the classroom as opposed to the cumulative knowledge and understanding that should be derived from accurate experimental analysis of the variables being involved in learning (Cooper et al., 2007). Therefore, of equal importance to the above findings are the experimental methods used to conduct and evaluate the current study. Single-case research designs can reveal potential functional relations between the dependent (i.e., students' academic performance) and independent (i.e., traditional & video-

based lectures) variables in much detail which are not influenced by styles of presentation or forms of interaction in teaching. Such relations, however, were not clearly identified in these results as no steady trend in the data emerged. For example, it would be interesting to assess which component(s) of the video-based lectures (i.e., interactive discussions, vignettes of real life situations or instructional demonstrations) might have caused more changes in the students' performance. Administration of longer videos for a longer period (e.g., one semester) might have detected their effects on the dependent variables; however, this was not possible to occur in this study due to time constraints. Yet, it is very significant to know that video-based lectures containing such components can be effective and, therefore, these results can be used as a guide for future studies to develop pedagogically sound instructional videos for a novice learner.

The findings raise also other questions which need to be addressed in future studies. For instance, further research is needed to investigate retention of the teaching material over longer period of time and especially whether this learned knowledge has been transferred effectively to a practical situation. Of course, replication of the present results would be the subject of other studies in which the length of the lectures would be as much closer as possible to those typically used in higher education (e.g., 1-hour lectures). Also, investigation of using different media to deliver similar teaching material would facilitate the structure of online courses by carefully determining the responsible variables for ensuring a balance between the time taken to produce such media and the benefits these provide to the students (Weller, 2002). Questions regarding sample size are often raised in relation to single-case research designs and have been explicitly addressed elsewhere (e.g., Johnston and Pennypacker, 1993). Basically, the use of a small number of participants in such designs - each of whom is considered an intact experiment since repeated measures of his/her behaviour are obtained - is essential for identifying the functional relations between dependent and independent variables and hence, demonstrating experimental control over the behaviour of interest (e.g., Cooper et al., 2007). Of course, replication with additional students and implementation of video-based lectures at different institutions and educational areas may increase the generality of the present results. Further, it would be interesting to assess whether a similar set of data would be obtained if a similar type of study had been conducted with school level students who may experience a variety of CAL activities (e.g., Ecalle et al., 2009; Hurd, 2009; Chang et al., 2008).

It has been well documented that different learning styles and different learning approaches may have a diverse influence on student academic performance (e.g., Biggs, 2003). Specifically, it has been suggested that learning technology may enhance the student learning pattern (e.g., Laurillard, 2002); yet in problem-based learning (PBL), an approach highly used in current educational practice (Bosse et al., 2010; de Leng et al., 2007). Moreover, e-learning environments and generally online courses designed to meet the increasing demands for distance learning have already benefited from the extensive use of video-based teaching material and web-based video streaming services, even from using YouTube videos (e.g., Bracher et al., 2005; Fill and Ottewill, 2006; Snelson and Elison-Bowers, 2009). As universities worldwide adopt and promote their use, educators should follow the rapid technological evolutions and re-consider other technologies that could facilitate better the dissemination of important practical skills (Ballantyne and Knowles, 2007; Cannon and Newble, 2000).

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