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Electronic delivery of lectures in the university environment: An empirical comparison of three delivery styles

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Abstract

The purpose of this study was to consider the efficacy and popularity of "Virtual Lectures" (text-based, structured electronic courseware with information presented in manageable "chunks", interaction and multimedia) and "e-Lectures" (on-screen synchrony of PowerPoint slides and recorded voice) as alternatives to traditional lectures. We considered how three modes of delivery compare when increasingly deeper forms of learning are assessed and also student reaction to electronic delivery. Fifty-eight students in three groups took three topics of a human genetics module, one in each delivery style. Results indicated no overall greater efficacy of either delivery style when all question types were taken into account but significantly different delivery-specific results depending on which level of Bloom's taxonomy was assessed. That is, overall, questions assessing knowledge consistently achieved the highest marks followed by analysis, comprehension, evaluation and application. Students receiving traditional lectures scored significantly lower marks for comprehension questions. Students receiving Virtual Lectures scored high for knowledge, comprehension and application but significantly lower for analysis and evaluation questions. The e-Lectures scored high for knowledge questions and were the median for all question types except application. Questionnaire analysis revealed a preference for traditional lectures over computer-based but nevertheless an appreciation of the advantages offered by them.
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1. Introduction

The statement that "a lecture is a process in which information passes from the notes of the lecturer to the notes of the student without passing through the minds of either" (attributed to RK Rathbun (Gilstrap & Martin, 1975)) is widely quoted in jest but nevertheless is reluctantly accepted as truism in many circles. Lectures have remained the popular mainstay of undergraduate teaching since universities were founded because of their efficiency (one person can teach a large or small numbers of students), because they are tutor-centred

and because they can easily be combined with other teaching methods (Gilstrap & Martin, 1975; Good & Brophy, 1990). Within the last 20 or so years however the proponents of learning via computers have challenged the view that the traditional lecture is necessarily the most appropriate means of facilitating learning in a university environment (e.g. Inglis, Ling, & Joosten, 2002; Kulik, Kulik, & Cohen, 1980; Kulik, Kulik, & Schwalb, 1986; Najjar, 1996). The revolution of computer technology, the explosion of the World Wide Web and the trend of university teaching to become more learner-centred have popularised electronic delivery as an alternative or an adjunct to traditional lectures (Inglis et al., 2002; Kulik et al., 1980; Kulik et al., 1986; Ravenscroft, Tait, & Hughes, 1998). The advantages afforded by the use of computer technology in comparison to traditional lectures are well established, namely that the student has the opportunity to "take the lecture" in a time and place of their own choosing, working at the desired pace and employing a mode of learning most attractive to them (Race, 1994; Evans, Gibbons, Shah, & Griffin, 2004).

Studies citing the value of electronic delivery are numerous and include expositions of the power of virtual learning environments in various forms (e.g. de Lange, Suwardy, & Mavondo, 2003; Green et al., 2006; Janes, 2006). Design considerations are a common feature of research into electronic delivery (e.g. Evans et al., 2004; Macleod, 2000; Greenhalgh, 2001) with special emphasis on graphical user interface (Clariana, 2004; Mayer & Moreno, 2002) and navigation options (Evans & Edwards, 1999; Moss, Redfern, & Brown, 1998; Feifer & Tazbaz, 1997; Nielsen, 2005). Other considerations include levels of interactivity (Lindstrom, 1994; Moore, 1989), longevity and cost (Jolliffe, Ritter, & Stevens, 2001; Race, 2005). Specific examples in biomedicine include the" virtual patients" of Bearman, Cesnik, and Liddell (2001), orthodontics training (Aly, Willems, Carels, & Elen, 2003), and "Web3D anatomy teaching (Brenton et al., in press) although there are many more in other subject areas.

There have been a number of studies that have compared directly the "electronic lecture" with the traditional one (Wofford, Spickard, & Wofford, 2001). For the most part, the "electronic lectures" described in these studies were text based, incorporating varying degrees of multimedia and available either on the Web or a local intranet. For instance, Dewhurst and Williams (1998) suggest that a text-based computer-based learning environment used in their study was as effective as traditional lectures in disseminating factual information but was generally less popular. Maki and Maki (2002) and Williams, Aubin, Harkin and Cottrell, 2001 corroborated these findings of popularity suggesting that the computer-based instruction was not as useful as the traditional format (despite finding it user friendly and recommending to their colleagues) but Tvedten, Walter, Stickle, Henkel, and Anderson (1993) concluded that there was no significant evidence that one method was better than the other. Paradoxically Holt et al. (2001) concluded that students found the computer-based delivery easy and effective to use and "valued the course more highly than conventional lectures". Evans et al. (2004) provided evidence that material presented in an interactive, easily navigable learning environment creates a significant improvement in the student learning experience (measured by test performance and questionnaire) over identical material presented as simply pictures and text in scrollable web pages. In so doing, the claims of previous studies were corroborated (Evans & Edwards, 1999; Feifer & Tazbaz, 1997; Mayer & Moreno, 1999; Najjar, 1996) namely that design of an interactive interface is a critical consideration if electronic lectures are to be a realistic alternative to traditional lectures. Dunsworth and Atkinson (in press) split undergraduates into three groups comparing between them the efficacy of on-screen text, narration, and narration and agent ("Dr Bob") concluding that the agent can promote learning while simultaneously avoiding split attention problems.

A trawl of University web pages reveals that, although learning environments such as WebCT and Blackboard are becoming increasingly popular, the predominant form of electronic presentation of the actual courseware itself remains simple scrollable web pages or PowerPoint slides (presumably mostly used as revision aids). More elaborate means of electronic delivery are less commonplace but seem to fall into three categories. The first, for the purposes of this paper, we will refer to as "Virtual Lectures". By this we mean that courseware is usually text based but presented in a structured manner (with more than one level of navigation and adequate navigational information), often in "bite-sized chunks" (Lynch & Horton, 1999) to aid learning, usually with some form of interaction (e.g. self-assessment questions) and with the liberal use of multimedia such as photographs and video. These Virtual Lectures are usually written in HTML or programmes such as Macromedia Authorware (Evans & Edwards, 1999; Evans et al., 2004). The second (again for the purposes of this paper) we will refer to as "e-Lectures" (Logic Matters). In this case, courseware is presented as a recording