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Short communication

Effects of applying multimedia design principles in *PowerPoint* lecture redesign

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Abstract

Objective: To measure the effect of a multimedia design principle adherent *PowerPoint* presentation on test item performance, student satisfaction, student confidence in potential exam performance, and classroom dynamics.

Design: Two versions of an identical lecture were presented in different formats over subsequent years (2011, 2012, and 2013). One with traditional *PowerPoint* slides and the other redesigned to comply with multimedia design principles. Student scores on identical exam items were compared and a voluntary student survey was used to evaluate the activity.

Assessment: Students performed statistically better on identical exam items, were very satisfied (mean = 7.4 of 10) with the redesigned *PowerPoint* format, confident in their potential exam performance, and a majority (66%) wanted to see pictures and narration more often.

Conclusion: Students may retain information better when presented in a multimedia design adherent format. Student reaction was positive and indicates that students may prefer this method to traditional *PowerPoint* slides.

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Introduction

Curricular delivery and teaching students is in a state of dynamic change. Accreditation Council for Pharmacy Education (ACPE) Standards 10.12 and 10.13 encourage colleges to deliver a didactic curriculum that actively engages learners and addresses the diverse learning needs of students.[1] In addition, various authors have commented on the need for change in the current state of information delivery and call for a paradigm shift in the way educators view their roles in the classroom.[2–4] Course redesign to meet these recommendations may involve significant over-hauls in curricular structure which may be cumbersome and challenging to implement.[4] With this in mind, improving current curricular delivery by making small transitions to a more effective delivery format may be a useful tool for faculty members and colleges.

The importance and need for change in curricular delivery is clear, but students may be resistant to such a substantive change in the way they receive material. A study performed by Rivkin and Gim[5] found a statistically significant portion of students preferred traditional lecture to active learning. They state in their findings that traditional lecture is not obsolete and a variety of teaching formats will likely engage students better.[5] Considering this, a wholesale change in curricular delivery from traditional lecture to team-based learning, problem-based learning, or any other active learning techniques may not be in the best interest of students or all faculty members.

Student reliance on *PowerPoint* presentations for note-taking is not surprising given the frequent use of these slide presentations by faculty members. Also, students likely have been heavily exposed to *PowerPoint* in their under-graduate and high school education. Although *PowerPoint* presentations can be created in a variety of formats, a

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majority of faculty members rely solely on traditional *PowerPoint*, in which slides are filled with bullet points and excessive wordiness that may lead to student boredom and fatigue during lectures.[6]

Several authors have denounced traditional *PowerPoint* as a method of delivering information and have coined the phrase, "death by *PowerPoint*," to describe the inadequacies of this delivery form.[3,7,8] A specific flaw in traditional *PowerPoint* is that it simply transfers factual information for students to learn by rote memorization. This often coincides with lack of student engagement and poor retention of material by the student. Traditional *PowerPoint* may also contribute to a state of boredom among learners due to the lecturer's dependence on the slides during the presentation. Instead of supplementing a lecture with information via the slide set, use of traditional *PowerPoint* has replaced the lecture format entirely.[3,7,8]

In a paper discussing the roles of innovation in education delivery, Blouin et al.[4] state that it is not necessarily the learning format (e.g., lecture and problem-based learning) that enhances student learning, but rather skilled use of the instructional methods chosen. This raises the question of whether faculty members truly know how to use *PowerPoint* as an instructional method or that it is the teaching method to which they are most accustomed. Issa et al.[6] call for medical educators to evaluate their usage of traditional *PowerPoint* presentations in educational delivery and consider ways to improve delivery and formatting in order to enhance the didactic portion of their curriculum.

Multimedia learning refers to learning from words and pictures.[6] At the heart of this type of learning is the majority of technology-based educational delivery including *PowerPoint*, computer-aided instruction, virtual patients, and human patient simulation. With the popularity of *PowerPoint* and emphasis on utilizing technology for curricular improvement, a sound understanding of multimedia learning is vitally important for these changes to successfully enhance student learning.

Multimedia design principles refer to specific literature-based recommendations to improve learning from multimedia material.[9] The cognitive theory of multimedia learning provides the underpinning theories and logic for effective multimedia design principles.[6] This theory is based on well-researched descriptions of how students learn from words and pictures.[6] These principles, first described by Richard Mayer, are endorsed by the Association of American Medical Colleges Institute for Improving Medical Education. They suggest using these principles for guidance when developing or purchasing educational technology resources that contain multimedia.[10]

One fundamental principle in multimedia design is managing learners' cognitive load to avoid overload. Mayer presents nine methods to reduce cognitive load in multimedia.[11] These include three principles aimed at reducing competition for the learners' limited cognitive capacity: (1) the coherence principle (eliminating extraneous words, pictures, narration, and sounds), (2) the signaling principle (highlighting essential material with signals such as arrows, etc., to guide learners), and (3) spatial contiguity (placing printed words next to corresponding graphs/tables). Other techniques to help avoid essential overload, where things are too complex for students to grasp and understand during class, are "pretraining," the modality principle, and segmenting. Pretraining is simply receiving training such as pre-lecture reading assignments, prior to the learning activity to orient the learner to the topic. The modality principle involves utilizing words as narration instead of on-screen text. Segmenting refers to breaking complex topics down into smaller chunks of information to aid the learner in cognitive processing. The redundancy effect emphasizes that students learn better when words are presented as narration alone instead of narration and on-screen text. The last two solutions Mayer proposes are temporal contiguity (corresponding animation and narration should be presented simultaneously) and spatial ability effect, in which high-level spatial learners learn better from well-designed instruction.[11]

Current evidence supports that applying multimedia design principles to *PowerPoint* presentations can improve both retention and application of material.[12] Issa et al.[6,12] have demonstrated that *PowerPoint* lectures redesigned to be adherent with Mayer's multimedia design principles can improve both short and long-term transfer and retention of material in medical students. A cited weakness of current studies is the lack of detailed description of how the redesign was undertaken.[13]

In this study, a traditional *PowerPoint* lecture on osteomyelitis and septic arthritis was redesigned applying multimedia design principles in an attempt to improve student learning as measured by identical exam item performance, classroom dynamics, and lecture effectiveness. The authors also fully describe the process of redesign that was used.

Methods

In this study, two versions of the same lecture were given during the spring semester of the second professional year. The traditional *PowerPoint* version of the lecture given in the spring of 2011 was redesigned by the lecturing faculty member for the subsequent years (spring 2012/2013) adhering to multimedia design principles as defined by Mayer and Moreno.[11,14] The Figure is an example of the original and redesigned slides. The lecture material covering osteomyelitis and septic arthritis contained identical learning objectives and was presented by the same faculty member in the same time allotment. Presentation content order was also maintained in both lectures. Slide formatting was the only notable difference in *PowerPoint* slides.

When reformatting the lecture to be more adherent to multimedia design principles, the traditional *PowerPoint* lecture was viewed in slide sorter view. From this view, content and presentation order were maintained as each