Supporting physiology learning: the development of interactive concept-based video clips

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The accommodation of diverse student learning approaches and maintenance of good academic outcomes are often difficult to achieve in university courses, particularly where large classes are concerned. These issues become even more significant when dealing with first-year students in science courses with high levels of factual and conceptual content (18). In this report, we describe the construction and use of pedagogically sound, yet inexpensive, video clips that can be used to support learning of physiology concepts. To avoid confusion, we have used the term “video clip” with specific reference to concise, audiovisual presentations generally <15 min in length (15) rather than the more general term “podcast” (3–5, 9, 13). A feature of the video clip design was the addition of interactive components that suggested the viewer engage in some form of active learning. The video clips were designed to support student learning in a large (n = 177) Biomedical and Physical Sciences course mainly concerned with human anatomy and physiology. Access to the video clips was optional, and the students also had access to other online learning resources that included “whole lecture” Lectopia recordings (50 min recordings, audio plus PowerPoint slides), multiple-choice questions (MCQs; WebLearn), and an in-house-designed “interactive anatomy atlas.” Students were able to access the video clips via the RMIT University BlackBoard system, which also incorporated a tracking function to measure student access to resources. The tracking system only provided information about online access and did not distinguish between online access and downloading of the videos. Some insight into the effectiveness of the clips was provided by the tracking data and by completion of a paper-based question (using a 5-point Likert scale). This work formed part of a comprehensive study evaluating student access and the use of a range of anatomy and physiology online resources. The study was approved by the Human Ethics Committee of RMIT University, and 105 student volunteers (59% of the class) agreed to participate.

Development of Concept-Based Video Clips

To make the process of constructing the video clips simple and thereby obviate the need for specialized equipment or training, video clips were generated using the QuickTime and Photo Booth video recording capabilities of a Mac computer. Editing of the material was accomplished using the iMovie application, and the finished product was exported as a movie. Each clip consisted of a title slide, a short (1–2 min) introduction, a content section (2–9 min), and a final assessment/feedback section (1–3 min), as shown in Fig. 1.

The introduction consisted of a “talking head” (the presenter’s face recorded using Photo Booth), displayed with a static or moving background (available within the Photo Booth application; Fig. 1A). This short initial part of the clip was designed to increase learner motivation and attention but was not used in the remainder of the video clip because simultaneous views of a presenter and presented material have not been found to enhance podcasts (2). However, vision of the academic at the beginning of the video clip was used to provide a message spoken in a relaxed, conversational voice to enhance the personal approach (12). Because there is evidence that “active learning” can be more effective than passive approaches, the presenter spoke “to” the student and suggested that they undertake an activity, e.g., generate a concept map, provide a summary, illustrate a homeostatic pathway, draw a labeled diagram, etc. From a pedagogical point of view, this approach is supported by the fact that auditory instruction can provide a powerful means of guiding student note taking and making notes per se and has been shown to result in higher test achievement than just listening (6, 16). It is also important to appreciate that the suggested activities required some degree of abstraction and understanding rather than simply requiring a transcript of the information. For example, the presenter in the “nerve cell” video clip (Fig. 1A) suggested that the student use the information to generate a picture of a nerve cell incorporating the location of relevant ion channels, something not actually shown in the presentation. The suggestion was as follows:

What I’d like you to do, when you have finished going through the clip, is just make a drawing of a typical nerve cell, as shown in one of the slides, and see if you can label it up with where the different types of ion channels are going to be located. Also show at what point different types of electrical activity are going to be present in the nerve cell, for example, graded potentials, action potentials, and also indicate chemically gated and voltage-gated ion channels. If you could map that out it would be a really good revision tool for you guys.

The content section (concept explanation; Fig. 1B) consisted of PowerPoint images, including text and graphics, synchronized with audio narration (recorded using QuickTime). In some cases, a graphics tablet was used to highlight important sections (e.g., outlining specific structures or processes and providing additional written information). Simplicity was an important feature of this section, with minimal text and the use of clear visual presentations to optimize explanations, an approach mimicking that used in our lectures, in which discussion of a concept was preferred to the presentation of large amounts of factual information (7, 8). Thus, content was limited (both by intent and available time) to essential information, in line with cognitive load theory (7, 17). The content section was followed by a relevant MCQ, at which point the viewer was asked to pause the video to consider an answer.
Next, the answer, derived from typical lecture class feedback (audience response recorded using TurningPoint), was displayed (Fig. 1C). The actual response values were not considered critical because the correct answer was indicated together with a focussed discussion of the concept with particular emphasis on explaining why the distractors were incorrect. Explanatory feedback has been found to encourage better learning than simply indicating a correct or incorrect response (11). A total of 42 concept-based video clips were created (mean duration: ~9 min, range: 4–14 min, average size: 46 MB), covering physiological concepts related to nervous, respiratory, endocrine, and reproductive systems. The online tracking did not function correctly for 3 video clips, and thus the tracking data refer to 39 video clips.

The combined effect of the personalized message and the active learning activities was intended to provide an interactive resource rather than a passive viewing experience, and some gauge of the success of the approach was provided by the 51 students who both accessed the clips (as determined by the Blackboard tracking resource) and completed a survey (using a 5-point Likert scale), with 96% of the students (49 of 51 students) agreeing or strongly agreeing that “the ‘concept clips’ provided useful learning support for lectures.” The 57 students who accessed the video clips did so on 427 occasions, with all clips being accessed by some students (range: 1–39 clips/student with a median of 3.0 clips). Nearly half of these students (49.1%) accessed a single clip (or clips) more than once, with a maximum of seven accesses for a given clip for the same student. As the video clips could be downloaded (rather than being accessed online), it is possible that the repeat viewing rate was higher than that suggested by the data. The survey and access data suggest that these students did, in fact, use the video clips, but we did not establish how they used the content or the extent to which the active learning components were used. It is important to stress that the clips did not, in themselves, cover all relevant content and that students were required to access other learning resources in conjunction with the clips, e.g., prescribed sections of the textbook (1, 10, 14). The fact that only 54% of students (57 of 105 students) accessed the video clips is an important finding in itself, since it leads one to consider the question of what motivates students to use such resources and how greater use might be promoted. Alternatively, it poses the question as to whether use or failure to use a resource simply relates to the number of alternative learning resources provided (e.g., the Lectopia recordings, Weblearn, and interactive anatomy atlas) and the time available to use them. Although further studies are required to establish the educational effectiveness of the clips, the results were encouraging, and it seems likely that concept-based video clips, developed using sound pedagogical principles, can provide an easy to develop resource to support learning in physiology.

Fig. 1. Screenshots from a typical concept-based video clip. A: “talking head” video section. B: one slide from the contents section of the video clip. The slides were coupled with audio, and this figure was annotated (around ~70 mV) during the discussion to stress the point being made. C: the final section of the video clip showing a typical class response to a multiple-choice question. Although the correct answer is indicated, the distractor responses formed an important part of the discussion.
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