PANDORA
Macromedia Flash Animation Use in EE 235 [1]

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INTRODUCTION

The goal of the Hands-on Laboratory-driven Electrical Engineering Curriculum Program (Pandora) is to create distance learning curriculum to address the need for skilled workers in electrical and computer engineering. The curriculum is distinguished by its use of initial motivating experiments, student interaction and collaboration, and reasonably priced instrumentation tool kits. Funded by the Fund for Improvement of Post Secondary Education (FIPSE), the courses are aligned with the Accreditation Board for Engineering and Technology (ABET) learning outcomes and target students in two-year and four-year institutions and those who are in geographically remote communities.

The Pandora program has explored the use of Macromedia Flash animation software to promote interaction in electrical engineering education on campus and for distance learning. Flash animations have been used in an on campus course, Electrical Engineering 235, Continuous Time Linear Systems (EE 235). This is an introductory course in continuous time signal analysis, basic signals (including impulses, pulses, and unit steps), periodic signals, and convolution of signals. EE 235 also covers Fourier series and transforms in discrete and continuous time. Flash animations are utilized in the laboratory component of this course. As part of the Pandora program evaluation, the Office of Educational Assessment (OEA) solicited feedback about the use of Flash animations in EE 235 from the course instructor and Teaching Assistants (TAs).

Course Instructor Feedback

Two Program Evaluation Division researchers interviewed the Autumn 2002 course instructor for EE 235. Use of Flash animations in the course, how they benefit or detract from the course, and any desired improvements or changes were discussed. The interview lasted approximately one hour.

The instructor relayed that Flash animations are not used extensively in course lectures, but are presented during the laboratory discussion sessions. Approximately one-third of lab time involves Flash animations. The instructor reported Flash animations help students visualize concepts such as convolution and manipulation of signals, and they assist mathematical presentation of material. Furthermore, the animations help students with visual learning styles understand the material more easily. An especially useful Flash animation involves integral set-up. With "drag and drop" computing skills, students complete the integral set-up process themselves. Within this virtual environment, the trial and error process is constrained, and thus, learning occurs more easily and more quickly than in a real laboratory in which options, and by implication potential errors, are unrestricted. In this way, Flash animations promote active learning and develop student problem solving abilities in a less open-ended and overwhelming environment.

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The instructor commented on ways the Flash animations may detract from learning. Some typographical errors have been identified in the text of the animations, and these need to be corrected. Also, linking the animations very closely to the course notes can be confusing for students when instructors deviate from the course notes developed by the original instructor. As teaching styles vary and instructors exercise their freedom to add information or alter the manner in which topics are presented, it would be helpful for Flash animations to be linked less directly to course notes.

Teaching Assistant Feedback

TAs facilitate the laboratory sessions of EE 235. As such, they also have valuable insight into how students use the Flash animations, how the animations assist or impede learning, and for which course concepts Flash animations are most useful. Additionally, TAs can provide meaningful suggestions for improving future use of Flash animations.

A Program Evaluation Division researcher e-mailed a brief open-ended survey to the two EE 235 TAs. The survey questions were: 1) How are students using Flash?; 2) How is Flash helping students?; 3) What aspects of Flash are most helpful for understanding course material?; 4) What aspects detract from learning?; 5) What aspects of Flash are most difficult to understand?; 6) What changes would you suggest to the Flash components? Responses to each question are summarized below.

1. How are students using Flash?
Students in EE 235 are using the Flash animations to supplement lectures and text materials (e.g., coursepak). It is an interactive tool that aids and supports step-by-step problem solving.

2. How is Flash helping students?
Flash animations help students visualize difficult concepts such as convolution and signal transformation. Because students have unrestricted access to the animations, they help students jump ahead to understand material not yet covered in lectures. In this way, their learning may be accelerated. The anytime and anywhere access to Flash animations also permits students to obtain assistance when TAs or instructors are unavailable (e.g., late nights and weekends).

3. What aspects of Flash are most helpful for understanding course material?
The TAs identified self-pacing as one helpful feature of the Flash animations. This permits students to "click ahead" if they quickly grasp a concept, or return and review more elusive concepts. Another benefit is the visual, three dimension representations that Flash permits. This mode of presentation aids visualization of concepts involving motion, and it adds the dimension of time to static two dimensional representations. Finally, the TAs noted that the Flash animations are reliable. Unlike fallible humans, the animations never skip steps necessary for accurately explaining and understanding a concept.

4. What aspects of Flash detract from learning?
Although self-pacing was identified as a helpful feature of Flash animations, it was also considered to detract from learning. Because it is easy to "click ahead," much of the written information that is essential for understanding is skipped. Even if written information is read, quickly clicking through the animations does not promote absorption of the content. Lastly, concurrent presentation of Flash animations with the TAs' explanations distracts students from attending to the verbal content presented during the lab.

5. What aspects of Flash are most difficult to understand?

The TAs reported nothing is difficult about using the technology, because the Flash animations only require simple computing skills such as "click," "drag," and accessing the Internet.

6. What changes would you suggest to the Flash components?

The TAs made many positive comments regarding the usefulness of Flash animations for assisting students with understanding concepts. However, they felt the animations could be improved. Specifically, a "back" button should be added to the animations so students do not have to restart an animation to review a previous step. This would be especially helpful for long examples. Also, rapid "clicking ahead," resulting in skipped information, could be remedied by making the animations more interactive. Valuable written information could be presented in a manner that requires students to interact with the animation in order to receive this information.

CONCLUSIONS AND RECOMMENDATIONS

Flash animations are being used successfully in EE 235 to help students visualize and understand difficult concepts through active learning that enhances student problem solving. This technology consistently presents accurate information in a self-paced environment permitting students to avoid boredom or confusion by "clicking ahead" or returning to review. Unfortunately, the self-paced environment may prevent all essential information from being read or deeply processed when students "click ahead" too rapidly. It is recommended that Macromedia Flash animations continue to be used as a teaching tool. Furthermore, the course instructor's and TAs' suggestions for improving the animations should be implemented, as they will likely result in easier navigation of the animations, and may result in better understanding of the course material and improved learning.