THE MULTIMEDIA ENHANCED ELECTRONIC TEACHING SYSTEM

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INTRODUCTION

This paper presents the Multimedia Enhanced Electronic Teaching System (MEETS), which was created for the teaching of engineering courses. The MEETS was developed in response to the growing need of allowing demonstrations to the teaching of courses with large enrolments, which have traditionally been limited to smaller classes. It was successfully implemented for a core undergraduate course in Mechanical Engineering on mechanics. This paper includes feedback from the students on the use of MEETS and the plans for its future implementation.

In teaching mechanics, it is critical to clearly explain and demonstrate the motions of machines with appropriate diagrams, live demonstrations and animations. In the past decade, PowerPoint has been commonly employed by University instructors. However, employing PowerPoint incorrectly may give rise to difficulties. There could be less participation by the students and a tendency to present material at too high of a pace for the students to follow. As Brown¹ argues, the use of instructional technology is not beneficial to teaching or learning when the purpose is not clear and it is merely used as a "placeholder".

Two years ago, the authors surveyed the undergraduate students in the third year Mechanical Engineering program. They indicated their strong preference to continue to take handwritten notes from material written by the instructors during lectures either on transparencies or on blackboards. The preference of the Engineering students was to stay actively engaged in the learning process during lectures rather than passively view projected still PowerPoint images. In the teaching of University level courses on mechanics, it is critical to clearly explain and demonstrate the motions of machines with appropriate diagrams, live demonstrations and animations.

OVERVIEW OF THE MEETS

The MEETS uses two high resolution document cameras to project hand written notes. Figure 1 illustrates the subsystems and interconnections of the MEETS. The EPDDA (i.e., The Easel Paper Dispenser Display Adapter), along with document camera 1 and video projector 1, has some similarities to a traditional transparency roll and an overhead projector. However, instead of a transparency roll, the EPDDA incorporates a paper roll. The personal computer (PC) is employed to show animations of mechanical systems.

Figure 2 illustrates a schematic of the EPDDA. The paper roll is mounted on the feed spool, and its end is fed through a slot in the base of the EPDDA, and onto the take-up spool. Document camera 1 is directed onto the flat portion of the paper on the base of the EPDDA, approximately the size of a letter sheet of paper. The feed and take-up spools are connected to easy to use hand wheels. The instructor may advance the paper by turning the hand wheel connected to the take-up spool, causing the projected images to move slowly upward. The hand wheel on the feed spool may be turned to go back for review purposes. It is also possible to project images from a sheet of letter-sized paper when placed in the viewing area. The sheet was transferred to document camera 2 so that the EPDDA may be used. The small VGA monitor (15 cm) is mounted next to document camera 1, and is intended solely for the instructor. The monitor shows the same image as displayed on video projector 1 and acts as a viewfinder for the instructor. Figure 3 shows a photograph of the EPDDA in use.

The MEETS is able to provide visual real time physical demonstrations of engineering systems. In the demonstration of a small mechanical system using document camera 1, it may be required to use the zoom control. In this instance, the instructor should use the small VGA monitor to ensure that the projected images remain in view. Figure 4 shows the demonstration of a small hand held gear train. Figure 4(a) illustrates an instructor demonstrating the gear train using the MEETS. The small VGA monitor shows the same image as that appears on projection screen 1 (see Figure 4(b)). The lecturer need not look over their shoulder to ensure the images are in view.

Figure 2: Schematic of the EPDDA. Figure 3: The EPDDA in use.

Figure 4: Demonstration of a small gear train (a) Use of the EPDDA/MEETS, and (b) Image on projection screen 1.

The authors believe that the MEETS has advantages compared to the implementation of a tablet PC. Using the MEETS, images of the hand of the instructor, along with the ink markers and drafting devices, appear during writing or graphical constructions. The students therefore naturally follow the material being added, and can more readily understand the graphical procedures employed. It also allows the instructor to point to the locations of interest. Furthermore, the MEETS allows lecturers to comfortably write lecture notes with the accustomed feel of ink markers and paper. There are no differences of the instantaneous positions of the tip of the marker and the script drawn on the paper, as may occur when using a tablet PC.

DISCUSSION

The MEETS was used to teach both the undergraduate and graduate courses in Mechanical Engineering, and was recently employed for a large undergraduate course on mechanics with 195 students together in one classroom. The students provided feedback of their experiences of taking lectures with the MEETS. The following comments were submitted: "The MEETS is an incredibly effective teaching tool for large classes."; "... (MEETS) allowed the instructor to show several live demonstrations which helped students attain a practical understanding of the presented material"; "... helped students to clearly follow the lecture material (by showing the actual hand of the instructor writing the material on paper)"; "... allows the instructor to point to important areas of interest on the displayed notes enhanced the quality of communication... ". In view of the positive responses, the authors plan to use the MEETS for providing on-line lectures starting in the fall 2010².

REFERENCES

1. Brown, B, *EDUCAUSE Review*, 2009, 44:4.
2. Cleghorn, W L, Dhariwal, H. 3rd ISEE, 2010.

Figure 1: Subsystems and interconnections of the MEETS.