On-demand Video Tutorials for Introductory Physics

Tetyana ANTIMIROVA, Juliana CARVALHO

Ryerson University, M5B2K3, Toronto, Ontario, Canada

Abstract. A series of video tutorials were created to challenging topics that are common in an introductory physics curriculum. These supplementary tutorials consist of a theoretical introduction - review of the main concepts in the topic the video addresses - followed by problem solving examples. The tutorials were screen-captured using Camtasia. The tutorials were made available to the students in science and engineering programs online via either course management system (D2LBrightspace) or Google Drive. Students can access them on-demand. Initial students' response to this resource has been positive. Examples of video tutorials will be demonstrated.

1 Project Motivation

Students in introductory physics courses often lack problem-solving skills. The issue of providing sufficient problem-solving experience is even more difficult to address in large classes [1], which are typical in today's science, engineering and pre-medical programs in North America. A research project on the effectiveness of the active learning strategies in large-enrollment courses commissioned by Higher Education Quality Council of Ontario (HEQCO) was conducted in 2012-2013. It involved the students in a large-enrollment first year introductory physics class for science programs in a large public university [2]. The study examined how the active engagement strategies [3,4] affected students' learning. The quality of students' conceptual learning was measured by the gains on the diagnostic instruments such as Force Concept Inventory (FCI) [5, 6]. The research interviews with students revealed a desire for additional web-based materials specific to the topics covered in a course syllabus and accessible on demand. Students expressed particular interest in materials aimed at improving their problem-solving skills. The interviewees seemed to favor the format of mini-tutorials targeting the concepts that are known to be particularly difficult, videos of problem-solving examples demonstrating effective problem-solving strategies and modeling the problem-solving process.

2 Project Description and Future Directions

The initial set of tutorials covered topics in linear kinematics, oscillations and simple harmonic motion, one-dimensional waves and magnetism. In addition, a remedial math tutorial was created. The entire process of creating the tutorials involved the choice of topics, writing the scripts, preparing and recording the presentations (via screen and voice capture), editing and finally producing video files. In addition, video captioning for individuals with impaired hearing was made available. The completed tutorials were uploaded onto the course management web page of introductory physics courses for science students and were shared via Google drive with the students in the introductory course for the engineering students in Winter 2017 term. The video tutorials provided a supplemental online instruction, which compliments the lectures and in-class tutorials. The students have the opportunity to access the tutorials at their convenience and the opportunity to progress through the tutorials at their own pace.

The initial informal feedback from the students was positive. The results of an informal survey indicated that the students find the tutorials easy to follow and more helpful than reading a textbook. Note that no formal evaluation objectively measuring the effect of the tutorials on students' learning outcomes was undertaken so far.

The creation of such materials requires the institutional support. The grant from Ryerson Learning and Teaching Office funded this project which provided part-time employment, work experience as well as valuable learning opportunities to the students who were hired to help with the project.

3 Conclusion

In light of recent interest in open study materials, the creation, accumulation and sharing of this type of resources across the educational system is a natural step towards a more open educational system. The number of students in introductory physics courses for science, pre-medical and engineering programs is quite large, and therefore the creation of open resources suitable to facilitate students learning can potentially have a significant positive impact. This is work in progress, and we hope to add to this collection of tutorials in the future. We also plan to carry out a more formal evaluation of the tutorials' impact on students learning.

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