Study of the use of Vernier tools to Advance Concept Visualization in a Classroom Environment

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Extended Abstract

Increasingly, our students are coming to college already possessing advanced skills and practices with regard to electronic learning and communication. The computer and its electronic offshoots are so integral to their modes of thought, learning and communication that they literally live in a virtual world [1,2,3].

Efficiency in student learning can be expanded by going above and beyond finding solutions to simple textbook problems. These problems are usually ideal cases, and often have limited connections to real world situations. However, when students can think and act like true scientists in the classroom, they improve their understanding and develop strong problem-solving and critical thinking skills. As educators, we can create a classroom environment which promotes students' creativity by utilizing open-ended projects that investigate realistic, inventive, and complex problems. This approach not only boosts student enthusiasm, but also aligns classroom topics more closely with contemporary industrial environments and practices.

The main goal of the investigation behind this case study is to incorporate active learning into the classroom environment by using Vernier technology, e.g. LabQuest 2, Logger Pro and LabQuest Viewer [4], to engage students and help them retain the information. The study aims to bridge the gap between theoretical and experimental data analysis in a classroom. Figure 1 illustrates an example of the implementation of the proposed approach.

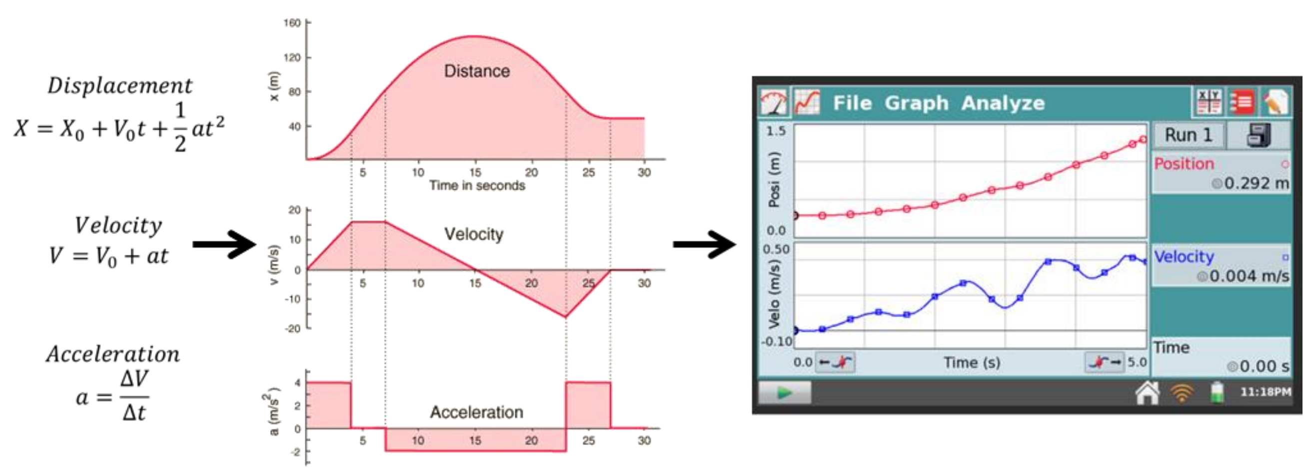

Figure 1. Illustration of visualizing data from textbook [5,6] to application in Vernier LabQuest2

One of the most effective methods of describing motion is to plot graphs of position, velocity, and acceleration *vs.* time. From such a graphical representation, it is possible to determine in which direction an object is going, how fast it is moving, how far it traveled, and whether it is speeding up or slowing down [4,5,6]. In this example (Figure 1), it is demonstrated that the difference between an ideal case of a physics problem in motion and real-time application approach provided by LabQuest2 technology for the first 5 seconds in duration, when the student starts from rest. It is shown that the variation in velocity is depended on how the student has been moving.

It is critical to have a data visualization tool that can communicate the features of the dataset in an efficient and effective way. The Vernier products provide real-time data collection from sensors and transfer the data to a computer station. The results can be presented as graphs, tables and charts, which are major features of scientific and engineering presentations. This case study examines the process of integrating this equipment into the classroom environment. Through observations, interviews, surveys, and examination of student work, we will be comparing the impact of the study and changes in pedagogy for the courses designed by using Vernier tools versus courses taught in a traditional format. The primary focus of the study is currently on the Engineering Physics courses. The versatility of the Vernier tools will provide the opportunity to expand the study to the other branches of scientific courses. Though this case study is still an ongoing project, initial outcomes include increased ability of faculty to visually explain complex problems, increased ability of students to conceptualize engineering problems and increased engagement of students by incorporating visualization tools in the classroom environment.

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