Incorporating Higher Education Computer Animation Principles into Primary Education Math Systems
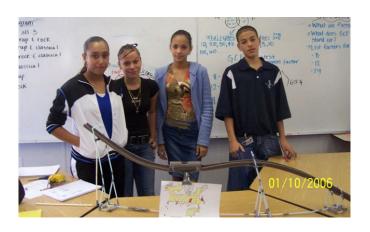
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1   Introduction

Animation is founded on mathematical systems and equations. To effectively engage middle school math students in a problem with tangible results, the authors developed a project involving both college undergraduates and eighth grade students. The purpose of this project was to engage both levels of students in an activity that utilized concepts in mathematics (algebra, ratio, proportion, estimation) and computer generated visualization.

2   Procedure

After covering units on algebraic thinking, ratios, and proportions, the eighth grade math students at Westridge Middle School in Orlando, Florida, participated in an assignment from Gatortrax (a math and engineering summer camp for teachers) that covered all three concepts by having the students build model roller coasters. The roller coasters were to be constructed from tape, straws and foam tubing. The students had also recently covered speed, acceleration and force in their science class, therefore the project related to two curricula. The project took math and science concepts and related them to real world experiences by also imposing budgetary constraints on the price of tape, straws, and foam tubing. Students were placed in groups of four to five and introduced to the project using whole group instruction. Each group received a project folder with guidelines, building specifications, report questions and problem solving that related to the construction process. They were then asked to figure out the height of each of the four roller coaster towers using the concepts of ratio and proportion. Each group was required to write algebraic expressions used to help determine each towers' height. They were then to draw sketches of each tower and estimate construction costs. After all of these tasks were complete groups were allowed to "purchase" straws and tape and begin tower construction.The groups were also researching the history of roller coasters and how the work. After construction was complete, groups calculated the actual cost of building their design and testing began. Coasters were tested with marbles and deemed either functional or not functional.

The roller coasters that best fit construction specifications and functioned correctly had photographs taken. These photos along with the roller coaster measurements were transmitted to Professor Kilmer and undergraduate students at Purdue University in the Department of Computer Graphics Technology. Students in the Introduction to Computer Animation class were to reconstruct the roller coasters in 3D StudioMax based on this information. The college students were given a lab assignment that suggested that they had been commissioned to construct a working model of a proposed roller coaster design. A group of young engineers (the middle school students) had designed a physical model of the roller coaster, and now the college students must prove to them that it will or will not work. The first step in the undertaking was to complete a three-dimensional computer model of the proposed roller coasters. Working with a partner, the Purdue students constructed the roller coaster based on the mathematical information and digital photographs. The second step in the assignment was to produce a simulation showing the functionality of the roller coasters within a virtual three-dimensional environment using procedural animation techniques. Models were then embellished to produce a virtual roller coaster in a real world scenario at a major theme park by way of digital compositing.

Completed virtual roller coaster animations were then sent back to the eighth grade students in order to show them how their proposed roller coaster designs would or would not function in the real world.

3   Conclusion

Computer Graphics Technology students at Purdue were introduced to a real world challenge that allowed them to utilize their skills in order to produce an outcome that not only served the course curricula but the computer graphics technology profession as well. The middle school math students were able to participate in an interdisciplinary study that utilized their math skills and challenged them to collaborate with and explore the field of computer graphics.