

Using the virtual reality to develop educational games for middle school science ...

[Science](#), [Computer Science](#)



Educational video games are an effective medium for teaching in modern school classrooms. This paper is a report on development issues, effectiveness, and suggestions for using Virtual reality world in the classroom. Two games are discussed in detail to address the development game component, time issues, and more. The Science and Technology Enrichment of Appalachian Middle-schoolers (STEAM) project at Ohio University, after introducing these games, an analysis is given on the impact these educational games had on 7th and 8th standard school students. A section is provided which has suggestions for the development of educational games in modern classrooms. And finally, a conclusion to discuss the effective use of educational games using VR.

We live in a age where technology is upgrading every second and we should also enable self to adapt to it by using technology for learning. One of the challenges for middle school teachers is to adapt lesson plans from the past into effective solutions for students. Rate of children playing video game in India is increasing all along so integrating videogames into the classrooms may be an effective means of improving teaching of science. Most children and teenagers play video games for relaxation.

Incorporating the fun aspects of video game with educational content provides an effective medium for teaching and learning. The students can walk around, interact, drive vehicles, and fly while exploring the 3-Dimensional Virtual world and learning about scientific processes. The virtual world allows students to feel immersed in learning experiences that are not normally afforded to them while remaining in a controlled computer lab

environment under the supervision of their teacher and the graduate fellow. Second Life can be used to help adapt traditional teaching techniques to modern student interest.

Games: Second Life is an online multiplayer Virtual world developed by the San Francisco based firm Linden lab and it was released 15 years ago on June 20, 2003 for windows platform and macOS. Second Life provides a very unique set of tools that make it an ideal platform for educational game development. The built-in script language is easy to learn and use, even for non-experienced programmers. The syntax are almost the same as that of other programming languages so this low learning curve allows for complex scripts to be written quickly. Thus it reduces the development time required. The built-in modeling capabilities provided are also intended for users with little to no experience in 3D modeling and is therefore easy to use. This too increases the ease of development while reducing the time taken to create an educational module. The approximate development time for most of the Second Life learning modules created through the STEAM project is one to three months. This is the time taken from the initial development stages through testing.

Virtual Gallery Walk: The Virtual Gallery Walk is a very unique type of learning module which has been created inside Second Life through the STEAM project. The purpose of the Virtual Gallery Walk is to simulate a traditional gallery walk used in classrooms. In this traditional gallery walk, a teacher would assign a research topic and each student would create a poster on a subtopic of the topic. The teacher would then hang all posters

around the classroom and students could use the posters to learn about each subtopic researched by other students. The Virtual Gallery Walk is the reincarnation of this idea in a more modern and easier way. Students create their posters digitally using Microsoft Word, PowerPoint or some equivalent. The posters can then be uploaded into Second Life by the developer and displayed as virtual posters. The Virtual Gallery Walk has several advantages over a traditional gallery walk. By using the virtual method, no materials aside from research materials are needed; the posters are created entirely using a computer. This can save the money that would have been needed for supplies. It also saves the “ mess” that occurs with classroom projects such as these. No setup or cleanup is required. Another advantage is that no classroom space is required. Since the gallery walk exists entirely inside Second Life, space will not have to be created inside the classroom for these posters to hang. Also, no space will have to be made for students to develop their posters within the classroom. This is essential for small or crowded classrooms in which the space to complete a gallery walk simply doesn't exist. The use of the virtual method also can be done with greater ease. The students simply need to log in to Second Life and they will have access to the entire virtual gallery walk. Problems such as crowding around posters are avoided, and all posters can be displayed in an easy to reach layout. Students have the option to zoom up on a specific poster as well, allowing all posters can be easily read. Sea Jelly Poster created by school student Gallery walk implemented in virtual space The experience proves to be very engaging and enjoyable to the students who see each other's work in virtual environment.

Fruit Fly Genetics: Fruit Fly Genetics is a virtual experiment conducted inside the virtual laboratory. The game creates a virtual laboratory in each student can virtually conduct this experiment. The laboratory is equipped with enough desks for entire classroom. To begin the game, each student chooses a desk and virtually “sits” their avatar at the desk. During the course of the experiment, the avatar is held stationary at the desk and the camera view is held to the working area of the desk. A HUD is used to guide the student through the game. To begin, a user clicks a start button on the HUD and all supplies needed for the experiment appear on the desk in front of them. The HUD then gives students instructions to guide them through conducting the experiment. Each individual player is able to choose the colors they would like the bodies. Avatar sitting at a lab desk Counting dominant and recessive trait combinations. A worksheet also accompanies this game. Students first make predictions about the fruit flies based on Punnett squares and then compare those with the actual results. Doing this experiment in Second Life allows the students to have the experience of doing the experiment without any set up, clean up or materials during a single period. It also makes it available to classrooms in which it would not be feasible to conduct the real life version. Allowing the students to choose the color of the fruit flies also helps the game to be an equalizer between male and female students.

Data / Analysis: To analyze the effectiveness of these games, a research method was created. Twenty multiple choice test questions are created by the combined efforts of the graduate student and teacher pair. Considerable time is taken to equalize the questions and ensure proper formatting during

scheduled professional development sessions. These questions are then divided into two separate tests, a pretest and posttest, each containing ten questions. The tests are equalized with respect to difficulty and often parallel questions are used between the pre and posttests. The research method consists of two days of testing. The first day of testing is conducted before the science content is covered in the classroom. The students are divided into two groups, an experimental group and a control group. The experimental group takes the pretest, plays the game and then takes the posttest. The control group takes only the posttest. The data from these pre and posttests allows for ascertaining the effectiveness of the game as a stand-alone teaching tool. The control groups serves as a baseline to compare the experimental group with. The control group is allowed to play the game after taking the test for the sake of fairness and equality in the classroom. The second day of testing occurs during or directly after the content is covered in the classroom. The entire class takes the same pretest, plays the game and then takes the same posttest. The data from this second day of testing shows the effectiveness of the game as a complement to the standard curriculum. These tests were similar in structure, containing nine multiple choice questions and one short answer question a piece (Schendel, Liu, Chelberg & Franklin 2008). The results from both days are compiled and each student's score is recorded through both days of testing. Afterwards, a statistical analysis is run using SPSS data mining and statistical analysis software on the data collected.

It is clear that student's score have been increased significantly after conducting their research. The mean score for the post-game test is slightly lower than the post-research test. It was hypothesized that this was attributable to the fact the post-game test contained questions whose answers were located on specific posters within the gallery walk. The large number of posters contained in the gallery walk made it difficult for students to view all posters and therefore made these questions difficult. It is possible that these questions increased the overall difficulty of the quiz and that this is the phenomenon represented in the table above. To analyze the effectiveness of the Fruit Fly Genetics educational game module, a similar protocol was used. Before genetics material was taught during class, the students were given a pretest before playing and a posttest immediately after. The material was then taught during normal lessons. After teaching the material, each student was given a pretest, played the game, and then given a posttest. This standard research method was used between the years of 2007 and 2009 to analyze the effectiveness of Fruit Fly Genetics among multiple middle school classrooms. The results from those days of testing were compiled and each student's score was statistically analyzed in a fashion similar to the Gallery Walk.

These results clearly demonstrate that Fruit Fly Genetics was an effective educational computer game that contributed drastically to the students' ability to retain the related lesson knowledge. The mean test scores improved over 25% after playing the game regardless of when the material was taught.

Creating lesson plans to both engage and effectively teach is a difficult problem for teachers in an increasingly digital society. The current generation of students has been raised entirely in this technological era and is comfortable with many of these new gadgets that may still be foreign to much of the teaching generation. It is challenging for educators to accommodate these students in a society that is rapidly changing. Second Life provides a unique opportunity for educators to take advantage of some of these new technologies in a way that is enjoyable and engaging for students, yet easy to use for teachers. The world of Second Life mirrors ours in many ways, allowing a user to relate to it and feel comfortable using it. It also provides many capabilities that are not present in the real world. Things that would not be feasible to do in real life could be modeled in Second Life to allow students to experience them virtually. For instance, it may not be possible to take a class trip to see the pyramids, but a class trip could be taken to the island of Philae in Second Life to view an accurate recreation of the pyramids. A class Second Life trip could also be taken to see a power plant, a factory, etc. The possibilities are literally endless. Second Life also provides a very useable and flexible platform to create interactive digital media intended for classroom use.