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The Use of Minecraft as an Educational Tool to Improve Student Performance in the Classroom

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Abstract

While the author will be speaking directly of his experiences in a classroom and district setting, he argues that these same ideas can be carried out by others who would perform the same tests that he does. The idea behind exploratory class is to give students in grades 6 through 8 the opportunity to see what kinds of classes that are offered at Panorama schools as well as introduce them to possible career choices like automotive repair or construction trades that they might find interesting and wish to pursue later in life. Since there are over 60 students in each grade, students are divided into three groups and each group goes through a rotation of two other classes like physical education and art, or agriculture science and cooking, alongside of tech class. Teachers in these rotations see each group on a three day rotation and have a total of fifteen days with each group per semester. It is difficult for students to build lasting connections to curriculum unless it is memorable to them and they can internalize it and find ways to make connections to their daily lives.

This schedule makes retention of information given to students low as they have two additional days before we meet again. It is because of this issue that teachers continue to look for new curriculum and delivery methods for these students, so that the lessons being taught are meaningful and that they can apply in other classes as well as outside of the school setting. It is the hope of the author that the use of the Minecraft program will give students that connection they need to not only recall information being taught in my class, but that it will help with the delivery of the 21st Century Skills curriculum.

The Use of Minecraft as an Educational Tool to Improve Student Performance in the Classroom

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Introduction

Due recent changes to the Iowa Legislative Educational Standards in regards to the usage of Iowa Core Curriculum, Industrial Technology (IT) educators are revising their curriculum so that the new standards are being taught alongside their current curriculum. For Industrial Technology Education, these new standards are now centered on what is called 21st Century Skills. These new skills are focused on subjects like creatively thinking, design and development of innovative technology products, as well as problem solving, collaboration with peers and experts, the use of interactive technology, and critical thinking skills to conduct research, in order to solve problems, and make informed decisions (Department of Education 2006).

Finding new ways to integrate these skills into the current curriculum without a large disruption of the learning environment presents a challenge for teachers of any subject. Since there are other standards and competencies for IT education like being able to accurately read a ruler to layout a project, or how to operate a power tool in a correct and safe manner, that are required by the State of Iowa for a student to be considered "competent" or "skilled" before graduation, these new 21st Century skills and competencies must be included seamlessly, without time being taken away from the current content.

The author of this paper has been a teacher of Industrial Technology for 8 years in grades 6 – 12 at Panorama Community School District. He works diligently work to find innovative ways to deliver curriculum that is up to date with the latest trends and technologies, while also examining these trends for relevance in the industry. Since our students are finding new ways to occupy their thoughts and time with things like mobile devices that can stream internet videos and games, or social media, the author is always looking for new ways to grab their attention and spark a new idea. He would like students to be able to go on a trip one day and be able to identify the type of bridge they see as they go by. It is his hope that students to be able to go home and tune up their vehicle properly since they learned it in their small engines repair class.

A growing trend in education now is to use video games as a supplement to current delivery of curriculum. Some of this is due to the way gaming challenges students in that there are sometimes specific learning objectives, like learning vocabulary words, or even improving reading skills, to be met in games, and that mastery of these skills can show competency in

technological reading and collaboration with others as well as critical analysis and problem solving (Elliot, 2014).

Statement of purpose

While the author will be speaking directly of his experiences in a classroom and district setting, he argues that these same ideas can be carried out by others who would perform the same tests that he does. The idea behind exploratory class is to give students in grades 6 through 8 the opportunity to see what kinds of classes that are offered at Panorama schools as well as introduce them to possible career choices like automotive repair or construction trades that they might find interesting and wish to pursue later in life. Since there are over 60 students in each grade, students are divided into three groups and each group goes through a rotation of two other classes like physical education and art, or agriculture science and cooking, alongside of tech class. Teachers in these rotations see each group on a three day rotation and have a total of fifteen days with each group per semester. It is difficult for students to build lasting connections to curriculum unless it is memorable to them and they can internalize it and find ways to make connections to their daily lives.

This schedule makes retention of information given to students low as they have two additional days before we meet again. It is because of this issue that teachers continue to look for new curriculum and delivery methods for these students, so that the lessons being taught are meaningful and that they can apply in other classes as well as outside of the school setting. It is the hope of the author that the use of the Minecraft program will give students that connection they need to not only recall information being taught in my class, but that it will help with the delivery of the 21st Century Skills curriculum.

Research questions to be answered

The outcome(s) of this research will be looked at in two parts. The first will determine if the usage of the game Minecraft meets the standards under 21st Century Skills. It is believed that students will gain increased use of critical thinking skills in order to problem solve and discover that working with their peers to collaborate on projects is a natural and profitable practice when completing assignments. Moreover, it is the hope of the author that students find it easier to work with their peers than before.

The second aspect of this study looks at student engagement and retention of information that is being taught with the addition of Minecraft as opposed to students of the past who were taught without the program. Engagement and retention will be measured by comparing student test scores for a period of the past two years 6th grade class, against those the study group will complete. The study will compare the test scores of the final vocabulary exam that will be given to students at the end of this unit.

Literature review

Iowa Core began as Senate File 245 which was signed by then Governor Thomas J. Vilsack. The goal of Iowa Core required "...identification of a model core curriculum..." in which schools across the State of Iowa would model their classrooms after the State standards in order to have consistent education standards statewide (Department of Education, 2006, pg. 4). In 2008, Senate File 599 extended further reforms to include kindergarten through eighth grade content for social studies and 21st Century skills which was also signed by the Governor. The reformation progress continued on until the final draft of the Common Core standards was issued in June 2010 (Iowa Department of Education, 2016).

The purpose of The Iowa Core standards is to "...describe what students should know and be able to do from kindergarten through 12th grade in math, science, English language arts and social studies" (Iowa Department of Education, 2016). Furthermore, the Department of Education feels that 21st Century Skills are a "well-researched set of standards in literacy and mathematics and essential concepts and skills in science, social studies, and 21st [C]entry learning" (Iowa Department of Education, 2012, para. 2). Under 21 Century Skills, educators are concerned with civic literacy, employability skills, financial literacy, health literacy, and technology literacy (Iowa Department of Education, 2016; Morgan, 2015). The main focus of the, 21st Century Skills as reported by Huerter is to "...prepare students to be active members of a 21st century society" (Huerter, 2013. Pg. 8).

The standards of Iowa Core Curriculum differ by grade in that each standard will build upon itself in subsequent grades to become more rigorous and help achieve student growth and improvement in their educational performances. For example, one of the 5th grade standards for technology literacy requires students to "use interactive technologies in a collaborative group to produce digital presentations or products in a curricular area (Department of Education, 2016).

Under the 6th grade standard this competency becomes a little more difficult for the student as they are required to "collaborate with peers, experts, and others using interactive technology (Department of Education, 2016).

For the purpose of this study the standards for 6th grade 21st Century Skills were looked at and addressed. These standards address political science-civic leadership skills, employability skills, financial literacy skills, health literacy, and finally, technology literacy (Department of Education, 2016).

For Industrial Technology Exploratory class, technology literacy and employability skills are addressed. More specifically under employability skills, students will be exposed to the concept of "...adapt[ing] and adjust[ing] to various roles and responsibilities in an environment of change" (Department of Education, 2016). 6th grade students will be experiencing rotating types of classes for the first time in their educational experiences so it is important to try to transition these students into expecting and adapting to change that will be occurring while in not only this class, but subsequent classes like mine as they continue through their educational career.

Another standard/concept deals with ethical behavior and social responsibility at all times. It is important that students learn what is considered ethical and to have integrity in their behaviors and work. Students will be held to that standard while they attend school so it is important that they can be trusted to do their work without cheating and to be instilled with a strong sense of right and wrong.

Under technology literacy skills, students will be exposed to the concepts of learning how to become critical thinkers; to be able to conduct research and problem solve for themselves. This concept is important in that students need to be able to work out complex problems or situations on their own without the need of someone always showing them how to do things when they become stuck on a problem. By learning how to analyze and resolve a problem, students become self-reliant which builds their moral and self-confidence.

Home video games were introduced in the early 1980's and have become a popular way to entertain both youth and adults alike (Sáez-López, Miller, Vázquez-Cano, & Domínguez-Garrido, 2014). It was estimated that in 2008 that video games were now used by 97% of youth

and that 53% of adults utilize some sort of gaming system or game (Lenhart, Jones, & Macgill, 2008; Schaffhauser 2013). With this sort of popularity among users, and with the advances in creation of games from pong, which was the first game released to consumers, to games like World of Warcraft, it is no surprise that gaming is now a prevalent part of society. What used to be considered the norm, games were only playable on a video gaming console that was attached to your home television or played by a computer, games today can now be played on a phone, tablet, portable computer (laptop). This varied access allows for games to be played anywhere the player chooses to be; games have become mobile. It is therefore, no surprise that video games, and gaming itself have an increased presence in schools as part of an essential tool in education.

In 2012, a study of 500 teachers was conducted about their attitudes about games in the classroom. The study revealed that 32% of the teachers questioned actually using video games in their classrooms weekly (Richardson, 2012). The study also found that 70% of the teachers surveyed believed that video games increase student motivation as well as engagement during the activity (Richardson, 2012). Richardson states that the use of video games in the classroom "... help personalize instruction [to] better access [student] knowledge, and collect helpful data" (pg. 46). Among the games being used in schools, one game is starting to gain more attention by teachers; that game is called Minecraft.

Minecraft was first created and released to the public in 2009 by Mojang, a Swedish company (Bebbington, & Vellion, 2015.; Uusi-Mäkelä, 2015, Richardson, 2012). The program started out as one man working on his own time to create a virtual world where the player could basically do anything they wanted. The creator, who called himself "Notch", would take his early releases and let other players test what he had created in order to look for problems with his programming. The game was an instant hit with over 100 million registered players and was recently bought out by Microsoft for $2.5 billion dollars (New York Times 2016, Elliott 2014).

Minecraft is a virtual world in which the players are not limited following a game script or narrative; there is no set of rules in order accomplish tasks. As the game begins, a player is thrust into a randomly generated world and set loose to do whatever they want. There are no beginning instructions that pop up to direct the player, no welcome screen setting the stage for the theme of the game, and no one there to act as a guide for the player. The game allows the

players to "... build structures, mine for minerals, hunt for animals, photograph the landscape, build machines and vehicles ... or simply go exploring" as they see fit to do (Elliott, 2014). In fact, a player can basically do whatever he/she wants to do. Morgan (2015) states that Minecraft is only limited "... by [the player's] imaginations" (pg. 12), there is not anything that cannot be created or done within the virtual construct of the game platform. This kind of open autonomy is a perfect setting for teachers to utilize in a classroom. The lessons that can be built into this program for students to run is only limited by the imagination of the teacher creating the lesson. It is for this reason that I have chosen to use Minecraft as a medium for lessons with my exploratory class.

Research Method

Students in both the research group and the control group (who were comprised of students in the 6th grade exploratory class for the past two years) were first given an online worksheet (Appendix 1) with the vocabulary words and a set of web links that they were to click to search for the terms and corresponding definitions. Students were to fill out the worksheet on their computers, then submit them to the teacher via email for a check for correctness and review. Once complete, students were to print down their vocabulary sheet and keep it for study and reference and reinforcement through the course of the Minecraft/Bridge unit. Seven to eight class periods were then devoted to instruction about bridge types, styles, materials, and spans.

At the end of the instructional days the control students were then put into groups of two or three and spent the remaining six to seven classes designing and building a bridge made out of balsa wood. This gave students an opportunity to work collaboratively on their assignment which is one of the requirements for 21st Century Skills. Once complete, the balsa bridges would be tested by attaching a bucket to the bridge. Buckets were suspended between two desks, and then would have sand poured into them. When the bridge failed, collapsed, the bucket would be weighed in order to gauge the strength of the design. The class would then spend a period talking about their results and how they could change their design to improve each bridge. Students would then be given a post assessment with the same vocabulary words to see how many words they remembered which would then be graded and included in their final grade that was comprised of participation points awarded during class, as well as regular assignments that were turned in (Appendix 2).

This is where the variable of using Minecraft begins. Under the method being studied, the same amount of days were devoted to the same curriculum and opportunities to reflect upon their vocabulary words. Instead of having students build a balsa wood bridge, the remaining time was devoted to the use of Minecraft. Students built their bridge(s) in the computer virtual world I created in the Minecraft program to use for this part of the lesson.

The computer lab that was used contained 20 stations that had the Minecraft program installed. Due to the large class size of certain sections (two out of the three sections had 22 or more students in them), there were not enough computers for each individual student to use. One to two students from each section had to partner up with another student at any given time and took turns working at the computer station.

Students were placed into random groups of 4 participants at the beginning of this project and would work together each class period on the assignments in Minecraft. The students were kept in the same control groups to ensure continuity of the project and students would not have to start over with their designs at the start of each day. They could literally pick up where they left off at the end of the last class period, thus allowing instructions to be given to them all before they left to continue their projects (Figure 1).

Figure 1. *Students meeting in "commons" area prior to working on projects*

As soon as the class was logged in, they would make their way to the transport station that would take them to their group work areas. As students proceeded to the transport, they would see signs set up along the way that reinforced their vocabulary words (Figure 2). This was different from the control group in that the test group had opportunities to reinforce the vocabulary since they could see it on the screen every time they passed the signs, whereas the control groups did not have that kind of reinforcement. If they wanted to review their vocabulary words, control students would have to go back to their worksheets.

Once in their assigned areas, each group was tasked to build a specific type of bridge. Instructions were given to each group in the way of an information sign that told the group what type of bridge they were to build, what kinds of materials to use, and where to place the bridge (Figure 3). Students would then begin collaborating to assign jobs to each participant and building their bridge.

Figure 2. Student interaction with vocabulary

The teaching version of Minecraft allows instructors to share the virtual world that the students are in and he/she can move freely from one area to the next in order to check on student progress. The program also gives the teacher the ability to be invisible and move around the area. This allows us to freely view the students' progress without the student(s) knowing of the teacher presence. With this ability I was able to determine if the group was building their bridges with the correct materials and to correct dimensions given to them without interrupting their work.

When the projects were completed, the entire class would inspect each of the designs and the groups would discuss the building process, difficulties that they dealt with, and what they would do differently if they were to do build this type of bridge again. Following a day of discussion with the participants they were then given the vocabulary post-test and a unit score was assessed (Appendix 2).

Figure 3. Student Instructions

Data analysis

In order to determine if student engagement and retention of information that is being taught with the addition of Minecraft improves, the author created two spreadsheets that included the students' gender and their final score on the post vocabulary test. The first spreadsheet included only the data for students that participated in the study; the **test group**. The second spreadsheet included data of students from the previous two years, the **control group**, those who had not used the Minecraft program. Each student was given a number for identification and privacy and once the scores were added to the spreadsheets, the data was then sorted from most correct answers to least correct.

The makeup of the **control group** was as follows: 190 students, with 87 female and 103 male. For the **test group** there were 72 students, 32 female and 40 males. Since scores were used for the previous two school years, there is a higher number of control subjects than there are test subjects.

After calculating the scores of the **control group** it was determined that the average score was 8 out of 15 questions were answered correctly. Within the **control group**, 38 students, or 20% of the population scored within the average range of 8. 80 students (42%) scored above average, and 72 students (38%) scored below the average. The breakdown of gender is as follows: 32 females and 48 males scored within the average range, 17 females and 21males scored above average, and 38 females and 34 males scored below average. It is interesting to note how close the difference between females and male scores at the below average range (Appendix 3).

For the **test group** the average score students had correct was 10 out of 15. This group had 26 (36%) of the students earning an average score of 10. 22 (31%) earning an above average score, and finally, 25 (35%) received a below average score on the vocabulary posttest. The percentage of students in each category given was closer in percentage in the test group than in the control group. The **test group** was made up of 12 female and 10 male in the average range, 9 female and 14 male in the above average range, and 11 female and 14 male who scored below the average range on the vocabulary. Again, there is a similarity in the closeness of female/male ratio of students who scored in the below average range (Appendix 4).

Conclusions and recommendations for future study

The average score on the vocabulary was raised by two points with the test group which was not as high as I had hoped to achieve. There was an increase in the amount of students who made the average score given that it was high than the average of the control group. The number of students who scored above average dropped from 42% to 36% which was surprising given that scores did improve. The one improvement that I did see here was that students who scored below the average dropped to 35% from the 38% with the control group. Given that the test group is smaller than the control group it is understandable that fewer test group students scored below the average than those in the control group. It is difficult to determine if Minecraft was the sole purpose for the increase in student scores. It is recommended at this time by the author that another study is done with the same parameters to test the outcome of the study not only against the control group, but against the scores by the current test group and see if there is an improvement between the two groups, and against the overall control.

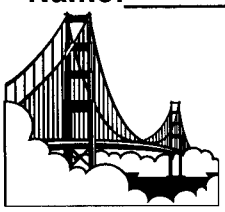
As far as determining if the use of Minecraft meets the goals and expectations of 21st Century Skills, it was determined by the author that students were indeed engaged in collaboration and communication with each other throughout the process. Students worked together in and communicated through the use of the in-game chat feature and the author noted that students would sit and talk about the project at the start of the class and make sure everyone had an understanding of the tasks at hand before they would begin.

Student engagement was high during this part of the class. Every student in each session was actively participating and stayed on task the entire work session. Students demonstrated high order critical thinking skills and problem solving while working on their bridge projects. Students had to calculate the length, or span of the bridge to determine where to place their support structures in order to ensure the bridge was strong and would withstand the assumed weight. Since critical thinking and problem solving are part of 21st Century Skills, students have demonstrated competency of those skills.

It has therefore been determined by the author that Minecraft does aid in the delivery of the skills and requirements laid out by the Iowa Core Curriculums' 21st Century Skills. There was no additional teaching that had to be done to integrate those skills into the curriculum, the desired outcome of this study was achieved.

Appendix 1

Name:_____



Building Bridges Vocabulary

Directions: Use the following websites to define the vocabulary words.

www.pbs.org/wgbh/nova/bridge/meetarch.html

www.pbs.org/wgbh/nova/bridge/meetbeam.html

www.howstuffworks.com/bridge1.htm

1. Abutments:
2. Spandrels:
3. Anchorages:
4. Span:
5. Compression:
6. Tension:
7. Buckling:
8. Snapping:
9. Dissipate:
10. Transfer:
11. Truss:
12. Torsion:
13. Deck-stiffening trusses:
14. Resonance:
15. Dampeners:

Appendix 2

Bridge Vocab Quiz

Name:_____ Score:_____/15

1. Abutments:
2. Spandrels:
3. Anchorages:
4. Span:
5. Compression:
6. Tension:
7. Buckling:
8. Snapping:
9. Dissipate:
10. Transfer:
11. Truss:
12. Torsion:
13. Deck-stiffening trusses:
14. Resonance:
15. Dampeners:

Appendix 3

Control Group Data

Total Female	87	Score Average	8.04
Total Male	103		
Total Students	190	Average Grade	0.54

Students Who Received Average Score			Male	Female
38	Population Average	20%	48	32
Students Who Received Above Average Score				
80	Population Average	42%	21	17
Students Who Received Below Average Score				
72	Population Average	38%	34	38

Appendix 4

Test Group Data

		Score	
Total Females	32	Average	10
Total Males	40		
Total Class	72	Grade %	0.68

Total Students Who Achieved Average Score

26	Population Average	36%	Males	Female
			10	12

Students Who Achieved Above Average Score

22	Population Average	31%	15	9

Students Who Achieved Below Average Score

25	Population Average	35%	14	11

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