Part I: Brief Project Description

Teaching students to think and be critical thinkers on their own can be one of the most challenging parts of being a teacher. My ultimate goal is to have students think on their own and wonder about the world around them. In order to accomplish this goal, I would incorporate "Genius Hour" or "20% Time" in my classroom During this time, only once a week, students research and learn about a topic of interest to them. Through learning about this topic, students have to research, present a preliminary "pitch" to classmates to gather feedback, journal about their project/topic and then creating a final presentation to be shared. Topics can range from learning something such as sign language to inventing an automatic pencil dispenser to creating a better prosthetic leg for someone who has lost his/her leg in a fire. Through this process, students will learn different ways to give feedback as well as way sot evaluate information when researching.

Part II: Outlined Transformation

Each students' problem is self-chosen, a variety of facets of understanding will be accomplished by each student. However, no matter what the project is, all students will demonstrate understanding in the facets of explanation, interpretation, and self-knowledge. By the end of the project, students will be able to explain the how, why, and because for the solution(s) to their problems. Through experimentation and trial and error, they will have developed justifications and answers for their solutions or products. Throughout the process, students will draw on their prior knowledge and life experiences to test solutions they believe are viable. From the results, they can infer what worked about the solution and what didn't work to generate their next steps. During each Genius Hour students will keep a journal of their process. They will record their metacognition about the project using questions starters such as what when well, what didn't go well, why did this happen, what could I have done differently, what could have been prevented, and what is my next step to demonstrate their understanding of their self-knowledge. The number of facets of understanding that each student will accomplish will be determined by the type of problem the student chooses to tackle with this project.

For many projects students will use the technology to build a physical model or prototype of their solution and then test it out. Based on their findings from the test trials they will make modifications to the model/prototype. They will have the freedom to choose which technologies they will use and integrate together to create the best solution. By using physical building materials the students will gain hands on experience for the idiosyncrasies (effects of gravity, trying to connect pieces together so they move fluidly, building a stable structure, etc.) that make the solution work or not work that can only be fully understood by actually interacting with the model in the real world. By using the physical technologies the students are able to put their ideas into practice in an authentic environment.

The assessment for Genius Hour would focus more on the process and less on the actual outcome. My focus area of concern is getting students to think and question more critically so the process and reflections produced in their journals will provide insight into their thought process. However, students' final presentations and their findings with conclusions to how their problem was "solved" would also provide evidence as to how far the students are progressing in their questioning and thinking processes.

Part III: Total PACKage

Context

I teach science at a rural middle school in southern Michigan with about 100 students per grade level. Many of my students qualify as low income and do not have access to the internet outside of school. Many of the elementary students in my district struggle with math, reading and writing. In order to counteract this deficiency, there is an emphasis on these subjects rather than science and social studies which results in low exposure to elementary science education.

However, I am fortunate enough to have a class set of chromebooks and access to a 3d printer. Although wireless internet is available, wireless connectivity can be a challenge sometimes depending on the time of day. Our technology department is run through our county ISD and while they try their best to troubleshoot the best they can, it is often up to the classroom teachers to troubleshoot own problems. There are no educational technology specialists available but rather information technology specialists who do not have a teaching background.

Recently, the state of Michigan has made a move to adopt new science standards that focus on students creating models, emphasizing experimental design and providing evidence to support their claims. This is a large shift in science education because often science has been thought of as memorizing facts and information rather than students discovering and explaining concepts and relating them to their lives.

Content

My overlying goal is to have students be critical problem solvers. When presented with a problem students should be able to generate possible solution, test the solutions, explain why their solution worked or did not work and later adjust their solution until it is viable.

In the past, students have struggled with abstract concepts. In middle school, developmentally students are transitioning from being concrete to abstract learners. Students also struggle with creativity and often think there is only one correct answer to every problem. The process of coming up with a viable solutions is new to them. Most problems they have encountered in the past have one point of access and one correct solution. Students have learned to operate this way because much of their previous science knowledge is of isolated facts that have been memorized and later forgotten. The process of evaluating and revisiting one's work is foreign to students probably due to time constraints which do not allow for further analysis.

Technology

I am fortunate enough to teach middle school science at a school where my students have access to a 3d printer as well as students having access to chromebooks in my classroom. However, while these technologies are great for creating virtual models, researching and sharing work but they are not so great for allowing students to create physical models or prototypes of their solutions to their problems. Technologies such as tinkertoys, clay, legos, littleBits and K'Nex, allow students to make their solutions come to life. In order for students to critically think and become problem solvers, they must have access to materials that allow them to try out and create solutions. Many students, especially middle school students, are still

concrete learners so having access to hands on materials that allow them to experiment and problem solve on their own. These technologies are reusable, sturdy, versatile, and connect with students prior knowledge/experiences so students are able to bring their solutions to life. For example, when a student is trying to design a prototype using a new technology the student needs to figure out how to use the new technology as well as design/build the prototype. However, when students use a technology they are familiar with the students can focus on the various aspects of the prototype and not concentrate as much on the technology.

Using the technologies already available to the students along with the technologies in this grant, students have a variety of tools to demonstrate their solutions. By having these hands on materials available, students are not limited to digital models. Students can build a model or solution that best suits the way their brain understands the problem. Some students may choose to start their solution in a digital form to jumpstart their ideas. Then when they build a physical solution they may find pitfalls that were not evident in the digital model such as the structure being too weak to support itself in a real life environment that has the force of gravity. Digital technologies like Chromebooks and 3d printers have limitations when students are creating solutions that can be overcome with hands on manipulatives like tinkertoys, clay, legos, Littlebits, and K'nex.

Pedagogy

Students will not be successful in Genius Hour if I just throw them into it because they have little to no experience with this concept and are still concrete learners. In order for Genius Hour to be successful, I would have to build my students problem solving and inquiry skills to a level where they could be successful by scaffolding my instruction. Using the Stanford Design Thinking Model as a foundation, students would participate in introductory activities like building paper towers and aluminum foil penny rafts with limited supplies to introduce the idea of constraints. Then they would build mouse trap cars and bridges to learn how to modify their designs to get the best results. Eventually the students would be ready participate in an inquiry based Genius Hour where they would identify a problem/question and use available resources and their inquiry skills to find the best viable solution.

Companies like Google, and 3M, and Apple are proponents for Genius Hour like time and use it with their employees. Some of Google's applications like Gmail, AdSense, and Google News are products of Genius Hour like time. Google started Genius Hour like time because it, "allows innovative ideas and projects to flourish and/or fail without the bureaucracy of committees and budgets." (20-Time In Education Inspire. Create. Innovate.) This same concept can be applied in the science classroom except without the bureaucracy of curriculum and grades. Instead the focus shifts from grades to actually finding a viable solution. This helps students become internally motivated instead of externally motivated by grades.

Due to the Long Tail Effect it is nearly impossible to pick a whole class assignment that all students are interested in. But with Genius Hour the students get to pick their own topics/problems. The benefit of adding choice peaks the students' interests and increases their time on task. Not only do students have choice in the topic/problem but they also have choice in which technologies they want to use to model/solve the problem. The fact that the students are establishing ownership in their topics/problems means that they will be more likely to try Genius

Hour and also more motivated to find a viable solution.

The Total PACKage

The main goal of Genius Hour is to have students become better problem solvers through the lens of solving problems they are interested in. How the technology, pedagogy, and content interact is critical to the success of any Genius Hour project. The technology cannot be the driving force behind the lesson. Instead it should be integrated in such a way to enhance the lesson. The purpose of this grant is not get the technologies so that students can do Genius Hour. Instead the purpose is to get the technologies to enhance Genius Hour. The addition of the new technologies will give the student more flexibility in the solutions (digital and physical models) they create for their problems therefore deepening their understanding of the problem solving process particularly emphasizing the modification of their solution.

Through Genius Hour, students will be going through John Dewey's four natural impulses in learning. Students are communicative because they are writing and journaling about their findings and experiences regarding their project as well as showcasing it to others. Students are also constructing and investigating different problems along with their solutions and finally they are often creating models to show different affordances and constraints of their solution. Students not only discover the information themselves but prior to investigating it, they show classmates to gather feedback through the RISE (reflect, inquiry, suggest, and evaluate) model for feedback and the CRAAP (currency, relevance, authority, accuracy, and purpose) test for evaluating information. Genius Hour is student led inquiry at its finest because the students are coming up with a problem, researching and investigating to find a solution, testing the solution and modifying it as needed. Throughout the entire process, they are journaling about their work to show their deepened understanding of the problem.

The SAMR Model

By incorporating the new technologies (tinkertoys, clay, legos, littleBits and K'Nex) into Genius Hour, they are not replacing or substituting the old technologies rather redesigning the task of creating a model of their solution. With the old technology, students can create 2d and 3d models in the digital form but with the new technology, they are able to create physical models that must withstand the constraints of the real world including gravity and movement. For example, in a digital 2d and 3d model, students do not have to worry about how pieces fit together seamlessly to allow for fluid movement. However with a physical model the supports and joints of the model need to withstand gravity and be functionable. By having the physical models, it brings a new element to the design process and deepens the students understanding of the problem solving process.

Part IV: Evaluation

The evaluation of Genius Hour and students' progression in their problem solving skills cannot be reflected by a single letter grade dependent on the solution, but rather a series of assessments/checkpoints. Students will begin their process by filling out a survey with several ideas as well as a game plan on how they are going to accomplish each one. Next, the teacher will conference with each student about their potential problems and ideas. The student will then explain a possible solution or game plan to solve each problem/question. The student will narrow down the topics/ideas to one through a series of questions and explanations. Once

student has his/her idea narrowed down, he/she will do preliminary research using the CRAAP test to begin discovering on his/her possible solution. Later students will deliver a Shark Tank like pitch to classmates and receive feedback using the RISE model. The student will then start building/creating a solution and checking it effectiveness. They will make modifications to the solution as needed until they have found the best possible solution. 1

Throughout the process, the student will keep a reflection journal. The majority of the assessment for Genius Hour will be based on the reflection journal. In the journal, the student will keep a running record of how he/she is approaching the problem and why, possible solutions he/she has tried and why they did/did not work, modifications he/she will try to make it better, what his/her next step is, what he/she could have done differently, how something could have been prevented, and why he/she is using a specific technology to create his/her model. These reflections will give the teacher insight into the student's mindset and thought process as he/she works on problem solving. The prompting questions also allow for the student to push his/her thinking farther. The depth of his/her reflections, connections to previously learned material, potential modifications, and next steps will display to the teacher how the student is progressing through the problem solving process. In the end, the final product/presentation will be used to communicate his/her findings. This final product will be to an outside audience such as the school board, students of different grade levels or via YouTube. The grade will not be solely dependent on the effectiveness of their solution. Instead his/her grade will be a reflection of how he/she used the problem solving process to find their solution.

Part V: Key Issues in Educational Technology

Genius Hour has several connections to key issues in educational technology, but the main connections are creativity and critical thinking.

Building creativity in students is currently undergoing a large push in education. Genius Hour helps students tap into their creativity, give them a space to be creative without a negative effect (if it doesn't work then modify it), and rewards them for being creative. It is built off the premise that when people are working on topics that are important to them, they are more willing to take risks and try new things or in essence be creative. When students are invested in a project, they are more willing to see it through until the end and put forth an honest effort. Genius Hour also piggybacks off the creativity movement in Maker Spaces and shows the you don't have to be an expert to create content. Genius Hour prompts creativity and experimentation in students.

The problem solving process embedded in Genius Hour forces students to become critical thinkers. Instead of just throwing a possible solution together and assuming it work, students have to use a form of technology to build/create their solution. Then they must test it out. Most solutions will not work the first time they are tried or they can be drastically improved upon. This is where the critical thinking really starts to kick in. Students must build off what they know and think will happen to make modifications to improve the solution. The process of testing and modifying/improving continues until the best viable solution is created. This makes students think deeply about what is not working and how it can be fixed/corrected which is critical thinking at its finest.

Reference

20-Time In Education Inspire. Create. Innovate. (n.d.). Retrieved July 26, 2016, from http://www.20timeineducation.com/