Technological Design Exam
Have Time, Will Tell
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Version History:

V #	Date	Short Listing / Description of Changes
1	Jan 31/11	Initial work written out and basics stated.

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The Scenario

To create a very interesting – and perhaps a rather challenging – learning opportunity (or a set of bite-sized learning activities) for high school students that involves "Grandfather" clock design and construction.

Design Brief

Learning Opportunity Design

Science

The science related learning opportunity deals with fundamental laws of physics such as: Gravity, Conservation of Mass-Energy and Conservation of Momentum.

Grandfather clocks utilize the laws of gravity as the main source of input. Weights in the clock have "potential energy" which powers the clock. As the weights fall they power the clock by spinning a complex system of gears which in the end make the face of the clock tell time.

The law of conservation in a grandfather clock is demonstrated by the pendulum the swings inside of the casing. "Theoretically, a perfect pendulum would swing back and forth forever. However, because of friction losses, energy must be continuously added to the system a little at a time." –Energy Control Application Quiz.

Math

Math is an integral learning opportunity because of the fields of study related to fabrication. Examples of these are: Measurement and Ratios.

Measurement is important because of the role it plays. When designing or fabricating you need to know how large the object you are creating is.

Ratios are important because of the knowledge concerning proportions. You need to know when your weights are half the size of your clock. In addition, using important relations such as the "Golden Ratio" can help you output a more structurally sound output.

Art

There are many opportunities to use art in the creation of a clock lending itself well to our learning opportunity process. Art is very important because if you do not make the clock aesthetically pleasing then no one will want to purchase it or even look at it. Furthermore, using concepts of art such as symmetry will make the clock more structurally sound.

Tech

Tech is the subject with the most learning opportunities because it is the main focus of the assignment. Building a Grandfather clock is a huge undertaking when in concerns Tech design. There is so much to plan for, design fabricate. The steps in the design process become essential to creating a working finished output. Students need to be organized, know what they are responsible for and do it.

Clock Case Design

My design for the clock case is grounded in art and safety.

The art style that I am utilizing is called Art Deco. Some conventions of Art Deco are sweeping curves bold vertical stripes of materials and inlaid wood. I think I will be able to use these well when creating a case for a grandfather clock.

The bottom of the case will be very wide to avoid falling over. This is a matter of safety because I do not want my product to harm anyone.

Research Report

The research I have done indicates that there are many Art Deco grandfather clocks.

This is good news and bad news to me. I now know that it has been done before so it is possible to do. This also means that the design I have in mind is more likely to already have been done.

I have been influenced in my design choice by a picture that I have found on the web (see fig. 1). I am going to model the top of my case like the clock in the picture but I intend to have a different base and viewing window.

Figure 1

One thing that surprised me when I did my research is that all the Grandfather clocks have very small bases. I thought that these clocks would have wider bases to avoid tipping over. I will still make my base wide to avoid harm to the consumer.

Something important that I learned in researching clocks is that the case must be over 1.8 m to be considered a “Grandfather” clock.

Requirements

1. Safe. Safety is my number one concern because I do not want the clock to fall on anyone. I am assuming that the wider the base the less likely it is to fall on someone.
2. Structurally Sound. I want to the clock to be structurally sound so that it lasts a long time and gives a reasonable amount of use to the consumer. I am assuming that the consumer is taking proper care of the clock.
3. Aesthetically Pleasing. It is important to me that the clock looks as pleasing as possible. This will create the maximum profits from sales. In addition, making the clock look the best it can will give me the greatest pride in my work.
4. High Fabrication Quality. Fabrication of the case is must be done well by skilled tradesmen who have experience working with wood. I do not want someone with no experience trying to recreate the clock from my blueprints. In the most likely case someone without skill won't perform to my satisfaction and cause an imperfection in the clock case. That is why have a skilled fabricator is an important requirement.
5. Wood Material. To make a case out of wood is a requirement for this project but it is also a constraint to me. I would prefer to make the clock case out some sort of metal. In this case fabricating out of wood is a requirement and a constraint.
6. Height. The height of the case must be 1.8 meters or over in order to be called a "Grandfather" clock. This means that in order to meet the requirement of being a grandfather clock it needs to be 1.8 meters tall.
7. Joints. It is a requirement that I use one Dado Joint in my project as well as one Miter Joint.

Learning Activity Summary

Knowledge

In the process of the activity the student will come to know, understand and appreciate many things about Grandfather Clocks. They will come to know the properties and laws of physics that power a grandfather clock, understand how they power the clock, and appreciate the miracle of how they came to be and how humans have utilized them to our needs.

Thinking

Students will reason out what they have to do to fabricate a clock and how to complete these steps. They will need to go through all of the stages in the design process in order to fully comprehend what they are going to achieve. Hopefully students will also realize their accomplishment of what they have done and how they taken the principles of nature and used them to their needs.

Application

The students will need to create a design process and organize themselves into teams and assign themselves different team roles such as: Project manager, Quality Assurance, Design Manager and so on. In addition students will fabricate the case of the clock in the shop.

Communication

Communication is vital to this project. Students will need to communicate what they are doing to the outside world as well as communicate with each other.

Students will need to tell people what they achieved and make a presentation detailing what they did to get their final product.

The students will need to communicate to others in the group if they hope to complete their project. They will need to converse between their assigned groups and each other within the groups.

Self-Evaluation

I feel I did very well on this exam. This might be some of my best work in the entire course. I am very proud of my output and I wish most of my output could have been similar to this. Even if I feel I did well there is still sections I know I could improve.

I feel that I did adequately at approaching the design problem and going through the design process. I didn't meet my own standards at each level of the design process. I feel that if I had more time I could have gone way beyond what I accomplished today. All in all I think that I approached it well but didn't meet my own standards.

Requirements

I failed expectations by not providing an orthographic drawing. I also had trouble making the window pane wooden. When I put the wooden frame into the assembly file it did not stay with the wood texture.

I met the requirements of using a miter joint in the window pane on the front of the clock. I met the requirements of a Dado joint by placing the clock tower in the base via a Dado joint. I fear that in practice the Dado joint might not be deep enough.

I went beyond expectations by adding glass to the empty window pane where it would have been left empty.

Safety

I addressed safety by creating a base to support the clock tower. The base is very wide to avoid the clock tipping over.

Improvements

If I were to do a version 2 I would add a lot more detail. I would go through the document and improve and replace the language I used with more specific language.

Not Addressed

In my report I could have mentioned a few more concepts of design. I could have mentioned the function of a clock case is to keep clock components safe. I could have also touched upon the ergonomics of the clock tower in terms of ease of access and how easy it is to repair and maintain the case.