Realia PowerPoint: How to Make a Small Engine Cutaway

A Senior Project

Presented to

the Faculty of the Agricultural Education and Communication Department

California Polytechnic State University, San Luis Obispo

In Partial Fulfillment

of the Requirements for the Degree

Bachelor of Agriculture Science

by

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Abstract

The Purpose of this project was to create a PowerPoint that could be used by high school agricultural programs and small engine instructors to design and build a 3-deminsional cutaway engine model and implement realia into the classroom. This project will serve a learning tool to help agriculture instructors to teach students the inner workings of an engine and the relationships between parts. This project should be taken under consideration by all agricultural mechanic programs that teach small engines. This project will be beneficial to all students that want to learn small engines.

Acknowledgements

I would like to thank Gary Weisenberger and Virgil Threlkel of the Cal Poly BRAE department with their role in this project. Without their recommendation, knowledge and donation, I would not have been able to complete this project. I greatly appreciate all of their support and help in this project.

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Chapter One

Introduction

Agriculture Education has the responsibility to develop and maintain the agricultural industry. Students need to have a clear representation on what they are required to learn to be able to be a productive part of the agriculture industry. Realia will provide a clearer representation of agricultural products and will strengthen the both the classroom instructions and Supervised Agriculture Experience portions of Agricultural Education.

Statement of the Problem

Due to lack of interest, realia examples are being limited in the classroom. High schools need to have more hands on learning aids that will entice students to want to learn. Realia gives students the opportunity to use their sensory abilities to enhance their learning. The problem is that some educators and administrators see realia as a non-essential learning tool. The use of realia in Agricultural Education will better prepare students to develop knowledge about the agriculture industry.

Importance of the Project

The importance of the project is to illustrate why the use of realia is needed in Agricultural Education. Students deserve to have the ability to learn from hands on experiences and aids to have better their industry knowledge.

Purpose of the Project

The purpose of the project is to educate the importance of the use of realia to agriculture educators.

Objectives of the Project

The objectives to accomplish the devised plan of this project are to:

1. Develop a 3-demensional instructional aid for a small engines coarse.
2. Develop slides describing the various parts of the model.
    a. Labeling each part of the engine
    b. Describe the difference between two stroke and four stroke engines

Definition of Important Terms

Agricultural Education - Agricultural education teaches students about agriculture, food and natural resources. Through these subjects, agricultural educators teach students a wide variety of skills, including science, math, communications, leadership, management and technology.

Career Technical Education (CTE) - A program of study that involves a multiyear sequence of courses that integrates core academic knowledge with technical and occupational knowledge to provide students with a pathway to postsecondary education and careers.

Future Farmers of America or National FFA Organization (FFA) - A youth based organization that enhances the leadership skills, develops personal growth, and implements career development to the student.

Realia - Objects from real life used in classroom instruction by educators to improve students' understanding of other cultures and real life situations.

Supervised Agricultural Experience (SAE) - A practical application of classroom concepts designed to provide "real world" experiences and develop skills in agriculturally related career area.

Summary

Realia or 3-demensional instructional aides are not used as often as they need to be. High schools owe it to their students to have more hands on learning aids that will motivate to students to be leaders in the agricultural industry. 3-demensional models can give students many opportunity to use their sensory abilities to enhance their learning by being able to touch, feel, and even smell the model. Some educators and administrators see realia as a tool that is time consuming and expensive to create rather than its potential use to educate. The agricultural industry is looking for better prepared students to enter and the use of realia in Agricultural Education will better prepare students to develop knowledge needed. The importance of the project will show school administration and educators the use of realia is beneficial to the education system, the students and the agriculture industry. The project will develop an instructional model aid for a small engines coarse. Develop slides that will describe the various parts of the model for instructional purposes. Also, the project will describe the difference between two stroke and four stroke engines.

Chapter Two

Review of Literature

Career Technical Education

Career Technical Education, CTE, is a program that integrates core classes with technical and occupational experience, which leads students to further education and/or careers. CTE has had many contributors along the way. At the beginning of the last century ideas of education were changing. Educational Progressives, like Charles Prosser, viewed the classical traditional education as inefficient, not motivating, and irrelevant for a growing industrial society (Findlay, 1993).

Charles Prosser's main contribution to CTE was his 16 theorems. These theorems set a framework to how CTE would be established. Prosser's theorems has been summarized by Camp and Hillison (1984).

> 1. Vocational education will be efficient in proportion as the environment in which the learner is trained is a replica of the environment in which he [sic] must subsequently work.
> 2. Effective vocational training can only be given where the training jobs are carried on in the same way, with the same operations, the same tools, and the same machines as in the occupation itself.
> 3. Vocational education will be effective in proportion as it trains the individual directly and specifically in the thinking habits and the manipulative habits required in the occupation itself.

4. Vocational education will be effective in proportion as it enables each individual to capitalize his interests, aptitudes, and intrinsic intelligence to the highest degree.

5. Effective vocational education for any profession, trade, occupation, or job can only be given to the selected group of individuals who need it, want it, and are able to profit by it.

6. Vocational training will be effective in proportion as the specific training experiences for forming right habits of doing and thinking are repeated to the point that these habits become fixed to the degree necessary for gainful employment.

7. Vocational education will be effective in proportion as the instructor has had successful experiences in the application of skills and knowledge to the operations and processes he undertakes to teach.

8. For every occupation there is a minimum of productive ability which an individual must possess in order to secure or retain employment in that occupation.

9. Vocational education must recognize conditions as they are and must train individuals to meet the demands of the "market" even though it may be true that more efficient ways for conducting the occupation may be known and better working conditions are highly desirable.

10. The effective establishment of process habits in any learner will be secured in proportion as the training is given on actual jobs and not on exercises or pseudo-jobs.

11. The only reliable source of content for specific training in an occupation is in the experiences of masters of that occupation.

12. For every occupation there is a body of content which is peculiar to that occupation and which practically has no functioning value in any other occupation.

13. Vocational education will render efficient social services in proportion as it meets the specific training needs of any group at the time that they need it and in such a way that they can most effectively profit by the instruction.

14. Vocational education will be socially efficient in proportion as in its methods of instruction and its personal relations with learners it takes into consideration the particular characteristics of any particular group which it serves.

15. The administration of vocational education will be efficient in proportion as it is elastic and fluid rather than rigid and standardized.

16. While every reasonable effort should be made to reduce per capita cost, there is a minimum level below which effective vocational education cannot be given, and if the course does not

> permit this minimum of per capita cost, vocational education should not be attempted. (p. 15-16)

Prosser helped shape CTE when his philosophies were included in the Smith-Hughes Act that was enacted in 1917. The Smith-Hughes Act and other federal legislation have had effects on career and technical and technical curriculum. These legislation have provided funds for high-quality education and state and local education agencies have been required to meet certain standards to be able to qualify for these funds. Since legislation has required that career and technical education be under public supervision and control, the standards associated with federal funding have had great impact on curriculum development in career and technical education.

Agriculture Education

Agricultural education is a mixture of agricultural science, business and leadership. Agriculture education is designed to prepare students to the ever changing agriculture industry. Agriculture education develops essential technical and leadership skills necessary for students to assume a leadership role in the industry. Agricultural Education is composed of three components, classroom instruction, supervised agricultural experience, SAE, and FFA. In the classroom, students learn conceptual ideas and hands on applications. In the SAE program, students gain on the job training and experience real life situations. The last component of Agriculture Education, FFA, teaches students leadership and problem solving skills (National FFA Organization, n.d.).

Realia

Realia is the combination of all learning materials including real objects, real situations, direct experiences and activities used by teachers. The use of realia speeds up the learning process while making learning more desirable to students (Bishop, 1980, p. 4-9). Students have a better chance of learning when they are able to touch and see the information (Peregoy & Boyle, 2005). It is very important for students to be interested in learning and more important the teacher gaining the interest of the students. Having students interact with objects can keep students interested in the subject. Objects can help teachers illustrate what they expect from students in turn helps the student become more engaged in the learning process.

Research funded by the Minnesota Mining and Manufacturing Company, showed learners had a 10% retention of what they read, 20% retention of what they heard, and a 30% retention of what they saw, 50% retention of what they saw and heard, 90% retention when the subjects were performed. They results show when students are engaged in a hands on learning atmosphere they have an ability to comprehend the lesson more accurately (Bishop, 1980, p. 4-9).

Chapter 3

Methods and Material

The purpose of this senior project is to create an instructional guide for instructors to incorporate realia into the classroom. The PowerPoint in this project is to allow high school agriculture teachers a reference guide to promote realia. The reader will learn why realia is important in the class room and how to incorporate it into the classroom. When created a cutaway engine for student learning it creates a more desirable learning situation. The materials required to successfully create the cutaway engine should be found in most high school agriculture mechanic departments.

Disassembling

Prior to cutting the engine housing, it is recommended to remove all interior parts. Start by removing the carburetor assembly working down to the head assembly and then lastly remove the piston and crack in the block assembly.

Cleaning

All parts need to be cleaned to remove all carbon, oil and fuel residue with a solvent bath. This removes the safety hazards involved with spontaneous combustion during the cutting phases.

Choosing Where and How to Cut

When choosing where to cut, it is important to remember to maximize the visibility of the inside of the engine without altering the functionality of all the interior parts. It is recommended to use a large band saw to the engine parts as well as a small angle grinder to clean any sharp edges or residue left over from the cleaning process.

Cutting the Carburetor

Once the carburetor is disassembled, it is easier to see how the fuel flows from one part to another. By cutting the carburetor, it allows students to see the many small passageways that fuel must flow through in a carburetor, it is easy to understand why fuel must be properly filtered. This also explains how old fuel can plug up a carburetor, decreasing power to the engine and/or making the engine inoperable. The cutaway carburetor also shows how the different components of a carburetor can be repaired and/or replaced like the metering jets.

Cutting the Engine Head

When cutting the engine head, less is best. The head will show students the intake and exhaust valves and how they correlate with the timing of the camshaft. This will also allow students the ability to view the valve train assemblies and compare the similarities that this small engine shares with the large industrial engines gives a good understanding of the process by which most all engines function.

Cutting the Engine Block

The cut on the engine block will be the largest and most visible for students. The engine block houses the bigger components of an engine such as the crankshaft and pistons. It is best to cut from where the engine head mounts down to the crankshaft. This allows students to see how the piston rotates in the cylinder.

Summary

It is important to research pictures of cutaway engines based on the model of engine that the agriculture mechanic department has, as all engines are similar in how they work, they are also as different in the way they design and placement of part. Using the cutaway engine as a piece of realia will allow students to gain the basic understanding of how the interior parts of an engine works while keeping the pieces working as originally attended by the manufacturers.

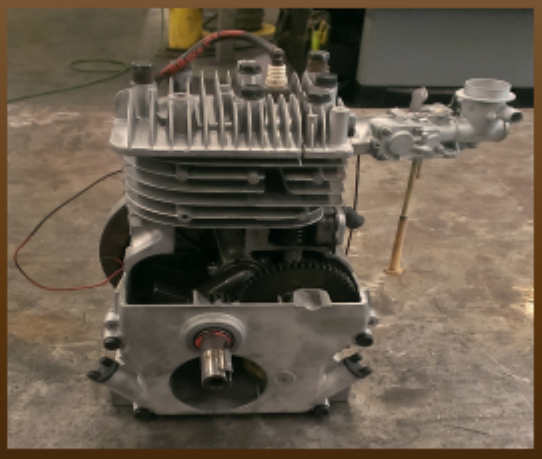
Chapter 4

Realia PowerPoint: How to Make a Small Engine Cutaway

In the following chapter you will find an instructional guide to help agricultural mechanic instructors build a 3-deminsional cutaway engine. The PowerPoint highlights steps to properly create a cutaway engine. The PowerPoint is intended to be instructional, but the steps can be altered to any other type of engine that may be used to gain desired results.

How to Make a Small Engine Cutaway

Gary Potter



The Beginning

- First select a small engine
- I Selected a Briggs & Stratton 5 HP engine

Disassemble

- Remove all outer components such as covers, fuel tank, air breather, etc

Disassemble Cont.

- Remove the flywheel screen
- Use channel locks to remove the hex screw that holds the flywheel on.
- The flywheel shaft is tapered and to remove the flywheel you only have to tap it outwards and it will come off the shaft.

Disassemble Cont.

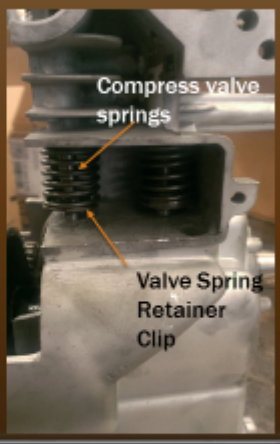
- To remove the head, remove the head bolts at the top of the engine.

Disassemble Cont.

- Remove the crankshaft cover to gain access to the crank shaft, piston, camshaft
- Remove camshaft, piston, and crankshaft

Disassemble Cont.

- After the crankshaft and camshaft are remove. Remove the valve spring assembly
- Remove the oil breather to gain access to the valve springs.
- To remove the valve springs, compress the springs and remove the valve spring retainer clip

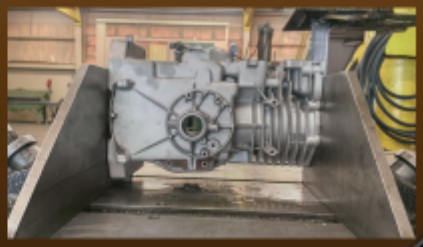


Clean Engine

- After all parts are removed from the engine block, the engine should be degreased in solvent then sand or media blasted to remove all paint and grease.

Set Up For Cutting

- The easiest way to cut the engine is to set it up in a vertical or horizontal band saw
- The engine can be cut using a cut-off wheel

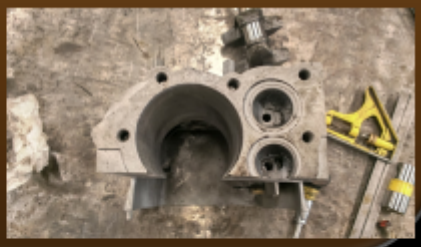


Cutting

- There is no right or wrong when cutting the engine
- There is however key locations that would best achieve the desired effect of the model.
- It is key to keep as much of the structural integrity of the engine as possible.

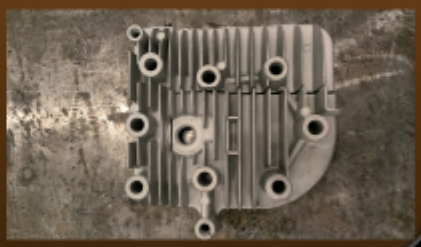
Cutting

- It is also important to be able to install as many of the engine components back on the engine as possible after the cuts
- The purpose of cutting the engine block is to be able to see the inner workings of the engine.



Cutting

- Making key cuts allows you to reinstall the cut pieces like a 3-dimensional jig-saw puzzle



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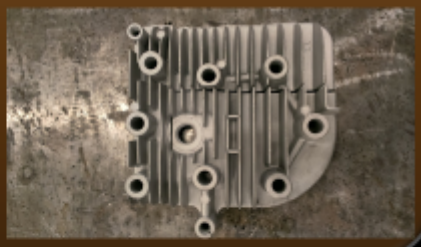


Reinstallation

- Prior to installing the camshaft, the intake and exhaust valve lifters need to be installed

Reinstallation

- Install piston to the crankshaft through the top of the cylinder
- The piston rings need to be compressed to be able to slide down the cylinder wall
- If you do not have a ring compressor, a hose clamp may be used on small pistons like this

Reinstallation

- Ring gaps should be facing towards cylinder wall to reduce chance of getting caught on open edge of cylinder wall

Reinstallation

- Reinstall camshaft
- When installing camshaft, the engine needs to be timed
- Both the timing gear on the camshaft and the crankshaft have punched timing indicators
- They need to mesh together to be timed correctly

Reinstallation

- Reinstall intake and exhaust valves and valve springs

Reinstallation

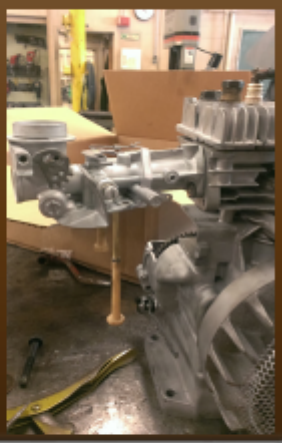
- Reinstall crankshaft cover

Reinstallation

- Reinstall head assembly
- Note: The head was cut into three pieces. All pieces were saved and installed back onto the engine. This is optional

Reinstallation

- Reinstall the remaining pieces as desired.
- Note: In this model the carburetor was the only remaining part, but items like the fuel tank and air cleaner could have been sectioned and reinstalled.



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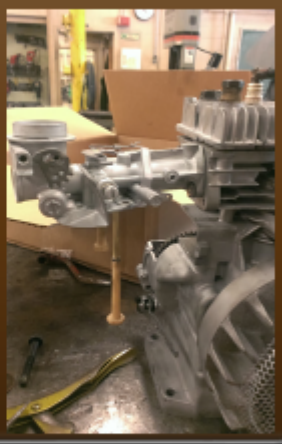

Chapter Five

Summary, Recommendations and Conclusion

This chapter will serve as the conclusion for the project of creating a PowerPoint on how to make a small engine cutaway. The goal of this PowerPoint was to give agriculture teachers a resource to implement realia into the classroom. This project can also be used by students as a Supervised Agricultural Experience (SAE) and entrepreneurship project by creating cutaway parts and realia models for other agricultural departments to purchase and use.

Summary

The goal of this PowerPoint was to give agriculture teachers a resource to implement realia into the classroom. This project will serve a learning tool to help agriculture instructors to teach students the inner workings of an engine and the relationships between parts. This project should be taken under consideration by all agricultural mechanic programs that teach small engines. This project will be beneficial to all students that want to learn small engines.

Recommendations

The following recommendations should be considered before completing another cutaway project

1. Create a more detailed cutaway
    a. Create a stand and labels for various parts on the engine
    b. Paint various ports, such as the intake and exhaust ports
2. Replace the spark plug with a LED light that lights up on every power stroke

    a. Had the author known more electrical and PLC programs, this would have been a desired addition to the project

3. Create a lesson plan based on the project
4. Meet regularly with your senior project advisor.
    a. Meeting with your advisor on a consistent basis will keep the project on track. This is important during your last quarter of the project to make sure the project isn't pushed off and done in a fast manner. Always schedule an appointment at each meeting to ensure there will be more completed by the next meeting.
5. Take each quarter seriously by not leaving all the main editing to the last quarter.

Conclusions

This PowerPoint will hopefully serve as an educational resource for high school agricultural educators as well as their students. This will help students and instructors gain skills and knowledge on how to create a cutaway model as well as the inner working of a small engine. Hopefully agricultural mechanic departments will use this project as a reference guide and promote various types of realia into their classroom.

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