

**Using Interactive Case Studies to Practice Small Gasoline Engine Troubleshooting**

**Tyler Granberry**  
**Louisiana State University**  
**903-748-2565**  
**tgranb1@lsu.edu**

**Dr. J. Joey Blackburn**  
**Louisiana State University**  
**225-578-7892**  
**jjblackburn@lsu.edu**

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### Introduction

Teaching agricultural mechanics poses numerous unique challenges. Equipment costs, adequate laboratory time, and virtual teaching are especially challenging when addressing skillsets associated with agricultural mechanics (McCubbins et al., 2016; Wells & Hainline, 2021). To address some of these issues, the Case Study Technique (CST) has shown promise in increasing student performance compared to more traditional educational methods such as assigned readings and discussion (Bonney, 2015). CST is a noteworthy method for educators to integrate active learning and bridge gaps between theory and content (Popil, 2011). Yadav et al. (2007) found that over 88% of faculty who have used CST in science courses believe the technique provided students a greater perspective and a deeper content understanding. Further, research has indicated that students enrolled in undergraduate agricultural communication courses that employed case studies as part of instruction were more likely to seek information and think critically about agricultural issues (Akins et al., 2019). The use of case studies, however, does not come without challenges. The unique format, ambiguity, and previous level of exposure to case studies can be challenging for students (Huynh et al., 2019). Additionally, instructors found difficulty with the required skill level for successful delivery, difficulty with assessment, and limitations in their ability to find or create quality case studies (Yadav et al., 2007). This innovative idea seeks to address these issues by delivering a free route for students to practice small engine troubleshooting online through the gamification of case studies. Gamification is defined as “the use of game design elements in non-game contexts” (Deterding et al., 2011, p. 10). In the gamification of case studies, interactive fiction and text-based adventure games have elements that can blend naturally with the narrative format of many cases. Innovation of case study design using Google Forms allows for gamification of small engines troubleshooting case studies and holds instructional potential for agriculture educators.

### How It Works

Using Google Forms, instructors can create interactive case studies following a text-based adventure game format. A text-based adventure game is “a software program which presents an artificial environment with which the user must interact in order to solve the problems presented in the game” (Cavallari et al., 1992, p. 173). The design and development of an interactive case study in Google Forms is straightforward; each page of the case study can be entered as a question in its own section, with various answer choices that use the *go to section* function to send students to a unique outcome based on their choice. Linking sections and creating loops creates branching scenarios that allow students to choose a path to diagnose problems and repair an engine based on provided descriptions. Pictures, videos, or web page links can supplement each page to enhance the experience. By allowing students to choose their path through the case study, the instructor grants autonomy to make incorrect or adverse decisions and encourages critical thinking. By allowing students choice in paths of progression through the case study, the outcome is an interactive format that grants students the autonomy to make incorrect or adverse decisions in the case. Students learn how to think, plan, and reason through this presentation method, simulating real-world decision processes (Naumes & Naumes, 2012). Despite the ability

to make mistakes, the virtual format alleviates the potential for injury or damage to equipment resulting from their mistakes. An interactive case study created with Google Forms can integrate into any learning management software as a link. Instructors can assign point values to specific choices and track each student's time to completion. A record of student activity when interacting with the case study is generated and available for review by the instructor, providing detailed insight into students' participation within the study. The activity record can be downloaded as a data set, allowing for more in-depth analysis.

### **Results to Date**

A single small engines interactive case study was designed as a proof of concept for this project. Beta testing with undergraduate agricultural education students who have previously received virtual and face-to-face instruction in small engines yielded positive feedback for this method as a supplementary learning tool, especially if utilized in an online learning environment. The feedback from beta testing is aligned with the findings of Jayaratne and Moore (2017), who found that over 30% of students in online courses preferred case studies as learning activities, and 44% stated that they perceived case studies as helpful or very helpful.

### **Future Plans**

Further development of this innovative idea includes researching the effectiveness of the interactive case study format as an educational tool for small gasoline engine troubleshooting. To adequately test the implementation of interactive case studies, additional case studies will be created for various small gasoline engine conditions. Additionally, creating files to be used as templates and the development of grading rubrics may assist instructors with the time challenges associated with the institution of new technology (Huynh et al., 2019).

### **Resources Needed**

Google Forms is a free tool included with all Gmail accounts; therefore, there are no monetary costs associated with using this format for case study development and delivery. However, the preparation time component of CST is still present in using this format. Time is required to learn how to use the software effectively. Further, time is also required to create, format, upload, and administrate access to the case study. According to Yadav et al. (2007), time spent finding and creating quality cases is a limiting component for instructors using CST, and the use of Google Forms is not exempt from this issue. Interactive case studies are not designed to replace hands-on instruction in small gasoline engine troubleshooting; however, they may provide a low-cost option for students to practice critical thinking skills associated with the content in a controlled, virtual format.

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