The Safe and Proper Use of Wrenches: An Instructional Video

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Abstract: This instructional design project attempts to determine the feasibility of creating an effective method of delivering consistent, anytime, anywhere instruction for a secondary automotive technology course. A number of design elements will be investigated to address visual, auditory and kinesthetic learning styles. Design elements which will be investigated include those derived from cognitive theories of multimedia learning, such as signaling, spatial contiguity, temporal contiguity, personalization, and modality, as well as presentation length, the use of still images, animated images, color, and text font. A review of pertinent literature indicates that this instructional design project is feasible, so the next step is to create the instructional module; the pre-test, post-test and post-survey; then test the module’s initial design and functionality. The subjects testing the module would be Educational Technology students from the College of Education at the University of Hawai‘i at Manoa. They would be pre-tested and post-tested to determine material retention, and post-surveyed to determine functionality of design elements.

Introduction

Consistency in instruction in a hands-on class, such as Automotive Technology, is paramount to effective learning, particularly when teaching safety and core fundamentals, for example, the safe and proper use of a subset of hand-tools, wrenches. The scheduling of first year Automotive Technology classes at one Oahu secondary school creates a challenging situation. Instructional periods are scheduled in blocks of eighty minutes. There are two periods, classes, of first year Automotive Technology students, an A5 and a B6. Each class meets every other school day. An “A” day consists of periods one, three, five and seven. The “B” days consist of periods two, four and six. One class is scheduled in period five; the other class in period six. Both classes in the first quarter of the year
focus on general shop safety, as well as the safe and proper use of basic hand-tools. Each class in the second quarter, and half of the third quarter, has a different focus. The period five class is focused on internal combustion engines. The period six class is focused on brake systems. After the middle of the third quarter, period five changes to brake systems, while period six shifts to internal combustion engines. All students proceeding to the advanced class must enter with similar basic knowledge. Therefore, a clear need exists for an effective method of conveying consistent information in this essentially hands-on class, where students will ultimately be asked to physically apply their knowledge during a demonstration, with a question and answer session, while in the shop.

Since learning theory indicates that students have a variety of learning styles, the information should be presented in various formats, for example, audio, visual and kinesthetic. Therefore, a video-based instructional module, no more than fifteen minutes in length, will be designed to function online and as a DVD, to teach the safe use of a subset of basic automotive tools, wrenches, to secondary school students in Honolulu, Hawaii; it will be evaluated by University of Hawai‘i at Manoa, College of Education, Educational Technology students for usability and functionality.

According to Mayer (2003), multimedia’s instructional potential lies in the skillful blending of words and images, which results in deeper learning than the more traditional method featuring words alone. A recorded multimedia instructional module is potentially an effective method of delivering consistent, anytime, anywhere instruction. Utilizing video, blending static and dynamic images with narration, appears to be a method worth pursuing.

This proposal is for the development of a twelve to fifteen minute video-based
An instructional module, which will function independently online, as well as in DVD format, to teach the safe and proper use of a subset of basic automotive tools, wrenches, to secondary students in Honolulu, Hawaii. The module’s structure, interface, functionality and delivery of content will be evaluated by University of Hawai‘i at Manoa, College of Education, Educational Technology subjects. The module needs to be available both online, and in DVD format, due to the fact that some students do not have a high speed Internet connection at home, but do possess some form of DVD player.

**Instructional strategy**

On the shop floor, demonstrate the ability to:
- identify 9 different classes of hand tools used in the shop
- determine the proper tool(s) to use in a given situation
- safely and properly use each class of hand tool

On the shop floor, demonstrate the ability to:
- identify the different wrenches used in the shop
- determine the proper wrench to use in a given situation
- safely and properly use a wrench

Be able to accurately answer 9 out of 10 multiple-choice questions regarding the safe and proper use of wrenches, after viewing a 15-minute video-based instructional module on the topic.

- 7th Grade reading level - English
- 7th Grade writing level - English
- Able to operate a DVD player
- Able to operate a computer’s DVD player function

Educational objectives provide guidelines to one’s curriculum and the curriculum in turn guides the instruction. The objectives also aid in determining the methods and
specifications of evaluation. In this case the target audience is the first year Automotive Technology student within the secondary level of education and one major objective is to increase the student’s knowledge base of the hand-tools used within the automotive industry, as well as their safe and proper use.

This project has two goals: first, to determine if the participants can accurately answer nine out of ten multiple-choice questions regarding the safe and proper use of wrenches, after viewing a twelve to fifteen minute video-based instructional module on the topic; second, to analyze the design elements of the module that were perceived to assist or hinder retention of information presented. The first goal, the educational objective, falls within Bloom’s "Cognitive" domain, under “Knowledge.” Bloom's taxonomy has been selected because the Hawai‘i Department of Education has moved from Gagne to Bloom. Bloom's taxonomy has three domains: cognitive, affective and psychomotor. Each of which have varying levels of achievement (Krathwohl, Bloom & Masia, 1964).

**Cognitive.** This domain involves objectives as simple as recalling previously learned material up to the act of creatively combining a variety of ideas or materials to synthesize something original. The target audience has varying levels of prior knowledge, from the novice to those with some experience with hand-tools. Although recalling previously learned material is a lower level objective it is fundamentally critical to performing safely in this environment. With practice a student should be able to assess a given situation and possibly create an appropriate wrench to use.

**Affective.** The objectives of the affective domain range from simply giving attention to specific phenomena, up to the consistent demonstration of internalized
qualities such as character and conscience. The student should demonstrate confidence when discussing and using wrenches, as well as consistently practice their safe and proper use.

**Psychomotor.** In this domain, objectives focus on motor skills or muscular control, manipulating to some degree physical objects, or performing an act requiring neuromuscular co-ordination. The student’s knowledge and confidence should be visible when on the shop floor safely and properly tightening and loosening nuts or bolts, manipulating to some degree physical objects, with the appropriate wrench, performing an act requiring neuromuscular co-ordination.

The audio and video aspects of the module will be enhanced with a fill-in-the-blank worksheet. Learners being able to take some degree of control over a presentation has been found beneficial, therefore the video will be divided into chapters allowing the student to not only fast-forward, rewind and pause, but also jump to specific sections of the video as needed. This allows the student make use of the worksheet at their own pace. Although the viewing, listening and writing activities are condensed, collectively the three have an impact on retention.

Due to a student being able to use the module independently, it is critical to design an instructional module that will motivate the student. A review of relevant literature indicates that instructional modules with video have higher appeal than those with only audio and text (Pomales-García & Liu, 2006). This also was supported by Choi & Johnston (2005). Print materials were enhanced by adding audio-video in a study by Gold, Swann & Chief (2002). In addition, module length impacts learner motivation (Pomales-García & Liu, 2006).
**Formative Evaluation Methodology**

**Site.** The evaluation will be conducted on campus in a classroom at the University of Hawai‘i at Manoa, College of Education, Wist Hall. The room has yet to be confirmed with the Educational Technology Department office.

**Test audience.** Sixteen University of Hawai‘i at Manoa, College of Education, Educational Technology students are to be recruited to evaluate the module. The students range in age from early-twenties to mid-fifties, both sexes, and come from diverse ethnic backgrounds. They will be solicited by going to classes, face to face, and by department E-mail. Participation requires taking a pre-test, viewing a twelve to fifteen minute video pertaining to the safe and proper use of wrenches, filling out a short worksheet during the video, and taking a post-test and exit survey. The entire process will require approximately thirty-five minutes of each participant's time. Data from the instruments will be summarized into broad categories. No personal identifying information will be collected or included with the research results. Participants will be required to bring a laptop computer capable of playing a DVD and accessing the University of Hawai‘i at Manoa's wireless system.

**Evaluation procedures.** A quantitative pre and post-test as well as a quantitative and qualitative post-survey will be administered.

**Instruments.** Two, ten question multiple-choice tests and one survey consisting of ten Likert-scale questions and two open-ended questions regarding design issues.

**Data analysis plan.**

<table>
<thead>
<tr>
<th>Event</th>
<th>Data Collection and Analysis Sequence</th>
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<tbody>
<tr>
<td>Subjects Arrive</td>
<td>Receive a random packet – DVD or On-line</td>
</tr>
<tr>
<td></td>
<td>Take Pre-test</td>
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<tr>
<td></td>
<td>View Video and Use Worksheet</td>
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<tr>
<td></td>
<td>Take Post-test</td>
</tr>
<tr>
<td></td>
<td>Take Survey</td>
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</tbody>
</table>

6
<table>
<thead>
<tr>
<th>Subject: Depart</th>
<th>Leaving instruments for analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrument Analysis</td>
<td>Compile results of Pre-test</td>
</tr>
<tr>
<td></td>
<td>Compile results of Post-test</td>
</tr>
<tr>
<td></td>
<td>Compare results of the Pre and Post-tests</td>
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<tr>
<td></td>
<td>Compile results of Survey</td>
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<tr>
<td>Write-up Findings</td>
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The pre-test and post-test data will be compiled and displayed in line graph format showing trends resulting from participating in the module. The Likert-scale survey data will be analyzed on a per question basis with the results being displayed in a bar graph format. The open-ended questions on the survey will be analyzed for “themes” and summarized in a narrative format. All data will be narratively summarized in the conclusion.

<table>
<thead>
<tr>
<th>Projected Completion Date</th>
<th>Objective</th>
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<tbody>
<tr>
<td>October 2009</td>
<td>Design Pre and Post-test Post-survey</td>
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<tr>
<td>November 2009</td>
<td>Shot and edit material; print instruments Develop and submit IRB package Fine tune module</td>
</tr>
<tr>
<td>January 2010</td>
<td>Put module on-line and burn DVDs Test on multiple platforms</td>
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<tr>
<td>February 2010</td>
<td>Conduct module evaluation, tests and survey Schedule evaluation Conduct evaluation</td>
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<tr>
<td>March 2010</td>
<td>Analyze data and draft paper Gather data Conduct data analysis Summarize results</td>
</tr>
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Timeline

Implications of Research

Research related to secondary education students have been difficult to find, even more difficult is finding research related to multimedia and hands-on courses for secondary education students. This project will hopefully provide some information that
ignites an interest in doing more research along these lines. Should this project succeed, more projects need to be developed to verify the results. Also, research needs to be conducted to determine if multimedia-based instruction can be taken to the next level for secondary education students, determining the proper tool(s) to use in a given situation.

Balancing the possibility of the module’s success is the possibility of the module’s failure, in which case research needs to be done to determine the reason, or reasons, for failure. The final outcome of this project, positive, negative or somewhere in between, will add to the body of knowledge related to an asynchronous video-based instructional module for secondary education students enrolled in a predominantly hands-on course.
Reference


