

Model Trailer Wiring Lesson

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Introduction / Need for Innovation

Folding STEM concept learning into agricultural laboratory skill acquisition remains a popular topic of discussion among agricultural educators at all levels. Stubbs and Meyers (2015) encouraged preservice teachers to practice developing and delivering STEM integrated lessons. Electricity and electrical wiring have been two of the greatest areas of need expressed by beginning teachers in the agricultural mechanics content area (Washburn, King, Garton, & Harbstreet, 2001). Agriculture, food and natural resources (AFNR) teachers are expected to possess the competencies, knowledge, and skills, to teach basic alternating current (AC) and direct current (DC) electrical concepts and skills to their students (National Council for Agricultural Education, 2015). Even though 98% of AFNR teacher preparation programs indicate that electricity exists in their state's curriculum, fewer than 10% of AFNR teacher preparation programs require a content-specific course in electricity (Burriss, Robinson, & Terry, 2005). In our experience, pre-clinical teachers demonstrate low levels of readiness in several areas of the agricultural mechanics curriculum, specifically electricity and electrical wiring. Beginning teachers have indicated that electricity is the area of greatest need for in-service in agricultural mechanics (Garton & Chung, 1996).

The use of simulation models has proven to be useful in the agricultural mechanics laboratory (Agnew & Shinn, 1990). This model was first observed by the authors when demonstrated by Dr. Curtis Langley at the 2017 Vocational Agriculture Teachers Association of Texas (VATAT) conference. The model serves as a teaching aid for knowledge and skill attainment in direct current trailer wiring. With laboratory space and budget limitations, AFNR teachers are seeking strategies and tools to effectively teach with limited resources (Baker, Thoron, Myers, & Cody, 2008). Often teachers wait to teach trailer wiring until a full-size trailer, a student or class project, becomes available to use as a demonstration.

This model trailer innovative idea is intended to provide teachers with the tools and strategies to teach DC trailer wiring, incorporating STEM concepts, without the need for a full-size trailer. Students actively participate in wiring a scaled model while progressing through the complete lesson, providing a holistic and integrated scenario of trailer lighting concepts and skills.

How it works:

As part of a complete lesson on trailer lighting, a model trailer is constructed and wired. The model presented was constructed of aluminum to reduce weight. The plans included in the lesson use mild steel for constructing the model to reduce cost. Complete construction plans and diagrams for a model trailer, measuring 28" X 16" are provided. The frame is constructed of 1½" angle material. A raceway for electrical wiring, made from ¼" wire loom, simulates protection of wiring beneath the frame of the trailer. The lights used in the model are ¾" red and amber LED trailer lights with rubber grommets. Other required materials include approximately four feet of bonded 4-flat trailer wire, a 4-flat trailer connection, electrical soldering materials (soldering iron, flux, acid brush, acid solder), and heat shrink tube.

The lesson will include a student activity in diagramming DC circuitry for common trailer wiring applications. Using this student-created electrical diagram, students will then complete an appropriate and functional electrical circuit for lighting the model trailer; this can be done individually or in small groups. For the hands-on wiring activity, the model trailer will

serve as a realistic scale model for a full-scale trailer. The evaluation activity in the lesson calls for students to test their completed lighting circuit on the model trailer by connecting to a trailer test control unit using an authentic vehicle trailer connection. The control unit will consist of a power supply, flasher modules, and five switches emulating the lighting controls found in a vehicle (brake lights, turn-signal lights, marker lights, and hazard warning lights).

Results to date:

The model trailer lesson was developed and pilot tested with pre-clinical teachers in the fall of 2017 at Texas A&M University. The pre-clinical teachers participated in a classroom activity introducing the Texas trailer lighting requirements, followed by the laboratory exercise. As part of the lesson evaluation, students shared previous knowledge and experiences with trailer wiring. One student shared “I built a 6’x10’ utility trailer my senior year. It still does not have lights on it because I never knew how to do this.” In this first sample (n=14) of pre-clinical teachers at Texas A&M University, 71% of the students reported being not familiar at all or only slightly familiar with trailer wiring before the laboratory activity. Following the activity, 86% of the students participating indicated they would feel somewhat or extremely comfortable in teaching trailer wiring to their students. The model trailer project presents a solution for teachers teaching with limited resources and large classes. The skills learned using the model trailer are intended to transfer to full-scale projects (Carroll, 1963). The results of the pilot test suggest further research should be conducted to ensure skills acquired using the model trailer transfer to full-scale projects.

Future plans / Advice to others

We intend to create additional curriculum resources for the model trailer project and implement professional development opportunities. The model trailer project contains two components, model construction, and the trailer wiring exercise. Model construction provides an opportunity for teachers to engage students in metalworking and general agricultural mechanics skills. A comprehensive lesson plan and materials packet for teaching model construction and trailer wiring will be available online. We plan to continue providing instruction using the model trailer project to pre-clinical teachers at Texas A&M University.

The model construction and wiring lessons will be included in one of the professional development opportunities on the campus of Texas A&M University in the summer of 2018. At this event, teachers will participate in the design and fabrication of the model trailer, and in using a sample lesson incorporating the model trailer as a classroom teaching aid for trailer wiring. Teachers will have the opportunity to take home their model trailer, and all the resources for teaching trailer wiring in their classrooms.

Costs / Resources needed

The cost associated with the model trailer project can be separated into two laboratory exercises, model construction and trailer wiring. The model trailer could be constructed ahead of time by the instructor, or completed as a laboratory exercise by the students. The materials cost for construction of one model trailer is approximately \$30. Materials for the trailer wiring laboratory exercise costs less than \$5 per model trailer. Metalworking tools and welding equipment are needed to construct the model trailer. To complete the trailer wiring exercise, a teacher would need electrical wiring hand tools and soldering equipment.

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