Research

What's the Connection? Applying Experiential Learning Principles to Introductory Small Engines Instruction

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Introduction

Agricultural mechanics instruction has a long-standing history within agricultural education curricula (Wells, Perry, Anderson, Shultz, & Paulsen, 2013). This content area has the potential to engage students in numerous ways through the development and emphasis of technical content knowledge and problem-solving skills (Pate & Miller, 2011). As such, the instruction of small engines could serve a useful role in developing critical thinking skills through a reflective experiential learning process. Experiential learning theory has long played a considerable role in agricultural education (Baker, Robinson, & Kolb, 2012). The notion of learning through active engagement in real-world problems (i.e., learning by doing) has long been used as a foundational point for the hands-on nature of agricultural education (Baker et al., 2012). This is especially true in the realm of agricultural mechanics, where hands-on content delivery in a laboratory environment is typically the method of choice (Phipps, Osborne, Dyer, & Ball, 2008). Extensive literature does not currently exist regarding the use of experiential learning theory's applications in the context of agricultural mechanics instruction, especially regarding small engines content. This research study addresses Research Priority 3, "*What are effective models for STEM integration in school-based agricultural education curriculum?*" (Stripling & Ricketts, 2016).

Conceptual Framework

Each small engine learning module was developed using Kolb's Experiential Learning Theory as an instructional framework for lesson development, delivery, and student practice. Kolb Experiential Learning Theory includes four stages: (a) concrete experience, (b) reflective observation, (c) abstract conceptualization, and (d) active experimentation (Lamm, Cannon, Roberts, Irani, Snyder, Brendemuhl, & Rodriguez, (2011). The overall purpose of this instructional design was the development of independent student practice for rebuilding and diagnostic analysis of small engine operation by utilizing Kolb's Experiential Learning Theory (1984). The purpose of using Kolb's Experiential Learning Theory was to provide a degree of metacognition for students to synthesize their experience and then apply their new skills to future lessons.

Methods

Power Equipment Technology is a required course at Auburn University for all pre-service Agriscience Education students and is taught by a Professor of Agriscience Education at Auburn. A single small engine lesson was chosen for this investigation and emphasized the compression phase of the four-stroke engine, associated systems, and components necessary for compression to occur. Utilizing *concrete experience* students were asked to visualize the individual components and then tear down the systems required for compression (length of stroke, cylinder diameter, fuel/air, piston placement, head, crankshaft, flywheel) working cooperatively with the course instructor. This assured student understanding of proper systems operation and tear down procedures. After completing the tear down of the compression system, students were required to perform *reflective observation* on the procedures and components by diagraming the compression system in sequential order of occurrence and cooperatively evaluate and discuss other students diagram and explanation of the compression stroke through the use of abstract *conceptualization*. Students ideas, explanation, corrections, and new skills were discussed in cooperative learning groups and then to the class. Students were then able to modify their process of teardown and understanding of the compression system based on peer feedback and discussion. Students were tasked with *active experimentation* to rebuild the compression system using modified conclusions from the group and class discussion.

Results

Course modules were conducted during 16 weeks of synchronous instruction in the agriculture mechanics lab. Power Equipment Technology consisted of 105 guided and independent activities, organized in 28 learning modules during the 2017 spring semester. Student aptitude in mechanical applications at Auburn University was assessed in early January, prior to the start of the Spring 2017 Power Equipment Technology course. Students ($N=33$) indicated a low understanding ($M=1.8$, $SD=2.45$) or very low understanding ($M=1.1$, $SD=3.67$) of mechanical processes related to small engine operation and repair. Post evaluation of student performance (N=33) indicated a statistically significant increase in understanding and proficiency (M=4.1, SD=1.98) after the treatment related to compression system rebuilding.

Conclusions

This study demonstrated the need for novel approaches for the instruction of small engine theory and critical thinking. Students demonstrated greater understanding and application of complex processes when Kolb's Experiential Model was implemented. The researchers are currently in the evaluation phase of the Power Equipment Technology course utilizing Kolb's Experiential Learning Theory as framework for small engine instruction. This style of instructional design demonstrated the need for reflective and experiential approach to complicated mechanical systems in both abstract and concrete learning. Student performance supports this conclusion.

Implications

The use of innovative instructional processes for small engine and mechanical instruction is vital to pre-service teachers understanding and confidence in the agriculture mechanics classroom. Investigations designed for quantitative analysis between traditional small engine instruction and enhanced teaching utilizing Kolb's Theory of Experiential Learning should be investigated further. Review of this enhanced teaching style yielded several considerations for future mechanical courses: incorporation of Kolb's Experiential Learning Theory for all pre-service agriscience educators, continued development of teaching and learning theories in the Power Equipment Technology, and interdisciplinary STEM investigation with elementary teacher educators.

References

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