The Effect of Scenario-Based Exercises on HVAC/R Students

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Concordia University

A Research Report Presented to the Graduate Program in Partial Fulfillment

Of the Requirements

For the Degree of Masters in Education

Concordia University - Portland

2016
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The [local] County Community College (LCCC) Heating, Ventilation, Air-Conditioning and Refrigeration (HVAC/R) program bases much of its instruction on lab activities. These lab activities traditionally focus on equipment and systems familiarization, installation, troubleshooting and repair. Recent feedback from community partners voiced the need for an emphasis on interpersonal communication, customer service and professionalism, also known as “soft skills”. As a result, the HVAC/R program at LCCC will be incorporating soft skills elements into every lab exercise through a scenario based lab structure. To explore the effect of this new element to the lab exercises the action research project will focus on the following question: What is the effect of scenario-based lab exercises on the required knowledge acquisition of community college HVAC/R students?

Review of the Literature

Realism in Lab Exercises

Efforts to incorporate lectures on professionalism as well as customer service with scenario exercises have had limited success in the HVAC/R program. Research shows that scenario training that simulated work improved student learning (Lindgren, 2012). Such research implies that it would be beneficial to incorporate the soft skills scenarios with the equipment training. Rather than giving the students a lab task sheet and a piece of equipment, the students would receive a work order and enter the lab to face the customer prior to working on the equipment. The use of actors and special effects has been found to be the element of training most liked by the students (Booth-Kewley & McWhorter, 2014). In the case of LCCC’s HVAC/R program, budget constraints would mean that the customer would be an instructor or fellow student engaging in role-playing activities; as for special effects, it is much more effective (and entertaining) to have the students witness actual component failure, but, again budget constraints may dictate the use of special effects to simulate the results of equipment failure (Garton & Robinson, 2006).
A critical element of soft skills training is teaching students how to deal with the emotions of customers along with their own. Dealing with angry customers is a rite of passage for all HVAC/R technicians, and the emotions of parties involved in customer service negotiations affect the outcome. Using realistic scenarios involving an emotional customer during lab exercises promise to provide students useful tools that will help them when they face delicate situations in the field (Thompson, Adams & Walderr, 2007).

Achievement of Student Learning Outcomes

There has been extensive work that implies that realism in training increases the achievement of Student Learning Outcomes (SLOs) in CTE. Students who received scenario-based exercises as part of their training retained information better than students that received lecture based training (Alinier, William & Gordon, 2004). Students in the HVAC/R program very quickly find themselves confidently grappling with complicated mathematical concepts as a necessity of the job. Students must readily calculate the amount of air and moisture in a room, and relate air volume to air velocity, in order to calculate system capacity and other calculations normally reserved for physics students. The performance of CTE student on standardized math tests can be improved by incorporating more rigorous math instruction into certain CTE courses. The increased retention of mathematical concepts is a result of the context for the math that only practical CTE exercises can provide (Stone, Alfeld & Pearson, 2008).

Scenarios related to soft skills training will require SLOs and exercises that require students to learn interpersonal communication and conflict management skills. Incorporating customer service and interpersonal communication skills into daily exercises can help students gain confidence in their ability to better serve the customer, by having the ability to listen with empathy and with an open mind to the customer’s complaint (Darwinkel, Powell & Tidmarsh, 2013).
Marketability of Program Graduates

At the beginning of most HVAC/R program, employers are found to be focused on the need for technical skill in their new employees. The chief complaint is that new employees do not have the skills to read a tape measure and other requirements. As a result, most HVAC/R programs focus on improving students’ technical abilities. Eventually, however, the industrial community began to ask for other skill sets. Local companies have difficulty finding employees who can show up to work on time, stay at work once they arrive, and interact with customers in a way that will not embarrass the company. (Garton & Robinson, 2006). Very little research has been done to study the scenario wherein CTE students are completely lacking in the one soft skill that cannot be taught: Character. This absence of character generates the situation where students who successfully obtain credentials to work in the HVAC/R arena do not gain or retain employment within the industry. A large number of former CTE students eventually work in areas other than the field in which they were trained (Tillman & Tillman, 2008). The ability to cope with people of differing backgrounds and viewpoints is an area that requires a great deal of attention (Garton & Robinson, 2006).

Analysis

The research conducted for this review supports the importance of realism in scenario-based lab exercises, but realism in training can be difficult to implement equally to all students. Large classes and time constraints bring the risk of some students not having the same opportunities to engage fully in the scenario. Special care must be taken to ensure that teams are not so large that students miss the opportunity to participate in the exercise (Booth-Kewley & McWhorter, 2014).

In the past, scenarios utilized in the LCCC HVAC/R program were reserved for task assessments, but Lindgren (2012) found that such practices only provide students with feedback at the
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point of evaluation, when it is too late to be useful. Students benefit more from scenarios presented throughout the training, not just during assessment. (Booth-Kewley & McWhorter, 2014).

Research has also shown the benefits of CTE scenario-based learning in achieving SLOs. The context provided by realistic scenarios can be brought to bear to help students understand difficult soft skills concepts (Darwinkel et al., 2013). Skills in mathematics can be strengthened when presented in the CTE context, but care must be taken to ensure that the concepts match the context of the CTE field of study (Stone et al., 2008). For example, statistics would have no place in HVAC/R, but the ideal gas law would.

Employability of graduates of the HVAC/R program relies heavily on technical ability (Tillman & Tillman, 2008), but soft skills, to include character can be a great barrier to successful acquisition and retention of employment for aspiring technicians (Garton & Robinson, 2006).

Conclusions

The research shared in this review provides a preliminary roadmap to follow in developing immersive, realistic exercises for the HVAC/R courses offered at LCCC. Realistic training should be provided throughout the course, and not be limited to the final evaluation (Lindgren, 2012). The exercises must allow each student to have the opportunity to play all of the applicable roles related to team-based scenarios (Booth-Kewley & McWhorter, 2014), and soft skills must have a prominent role in all lab exercises (Thompson et al., 2007). Incorporating these aspects into the HVAC/R curriculum will help ensure that students receive the skills necessary to make them marketable to the industry, and ultimately successful, seasoned Journeyman and Master Technicians.

In addition to realism and immersion, the exercises must have appropriate SLOs that are relevant to industry needs. Soft skills SLOs that have appropriate rubric measures should be incorporated into the training scenarios to give students confidence in dealing with other people in a professional setting (Darwinkel et al., 2013). Technical SLOs incorporating elements of higher math
should be tied in to general studies SLOs to assist students who pursue a degree pathway (Stone et al., 2008). Realistic simulations can increase student achievement of SLOs (Alinier et al., 2004), and both must continue to be monitored for relevance to industry to maximize marketability of program graduates (Tillman & Tillman, 2008). However, all of the relevant scenario-based training in the world will not help a graduate find and keep a job if they don’t have the soft skills that are critical for success in the adult world. The HVAC/R program cannot provide character to students. However, the HVAC/R program scenarios can help students recognize character traits that can lead to failure, and character traits that lead to success.
References


