AC 2012-5150: CREATING A WATER AND WASTEWATER EDUCATIONAL PROGRAM WITH INCORPORATED EXPERIENTIAL TRAINING

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Abstract

The EPA requires in the *Final Guidelines for the Certification and Recertification of the Operators of Community and Nontransient Noncommunity Public Water Systems Notice* (1999) that states and US territories establish some sort of experiential or on-the-job training requirement for incumbent water or wastewater operators before they can legally become licensed professionals. In fact, some states require the operator to possess an adequate amount of experience in real-time plant operations, in order to take the certification exam. However, many times utilities discover that after the duration of training has passed, the would-be operator still does not hold the knowledge needed to pass the certification exam. This presents a well-defined problem when attempting to establish a succession plan for future employment needs, an issue currently plaguing the water industry. A resolution of this issue will involve a training program that seeks to model a mix of educational and experiential components which will produce professionals that have attained sufficient academic and operational expertise. This will require facilitators on each wavelength, academic and industrial, to cooperate in order to achieve the desired outcome.

One such program that is currently pursuing such a venture is the Water Training Institute (WTI). Created by funds garnered from the Advanced Technological Education (ATE) division of the National Science Foundation (NSF), the WTI program has sought to address the developing workforce needs of the industry by providing pertinent academic training for aspiring operators, all while striving for partnerships with both industrial and regulatory agencies. The WTI Steering Committee, a group comprised of educational, industrial, and regulatory experts, epitomizes the necessary cooperation to develop a viable training program.

A by-product of such cooperation is a grouping of individual utilities, known as UNet, which have agreed to provide the experiential cornerstone of the educational framework by providing internship avenues for student within the WTI program. This service ensures that graduates of WTI are provided the obligatory experience required for professional licensure. These utilities, in effect, become the instructors of this internship and are given the ability to grade the intern's performance and to provide an adequate amount of real-life experience to the intern, so that successful simulation of day-to-day operation can occur.

Present day evolution of the program has continued by adapting a curricula designed to meet the needs of those who cannot participate in traditional formats. This new format, a modular, self-paced system dissects the original format, breaking the original semester-based format into smaller sub-sections. This grants a greater flexibility to those students that are currently working within the water industry, providing another avenue for a simultaneous educational/experiential curriculum.

Interestingly, these internships have harbored not only experience for interns but have in some instances transitioned into fulltime positions with the utilities that have provided the internship.

This construct is a win-win scenario for both the utility and student, and would not be possible without sufficient cooperation between all three branches comprising WTI.

Introduction

As detailed by Olstein, et. al (2005), the water and wastewater industry faces looming workforce shortages in the wake of the retiring Baby Boomer generation. With them, they take decades of accrued tacit knowledge that will be very difficult to replace. This form of undocumented learning has been found to make up around 80% of the useful operational knowledge at electric utilities and is typically disregarded by most forms of knowledge management capture. As such, the transfer of such knowledge from current worker to future worker must come via on-the-job training experiences or will be lost when effective succession planning is not introduced. In no occupation is this more apparent than for the water and wastewater operator profession.[1]

Unfortunately for most of these utilities, this event also comes at a time when regulatory responsibilities are growing as public health and environmental concerns are pressing state and federal legislators to pursue more stringent standards on both drinking water and wastewater effluent quality, something that requires both advances in treatment technologies at these facilities and a workforce that can effectively utilize them.[2] This indicates that the future of this necessary industry is facing a two-fold challenge which requires an immediate influx of new professionals and a redesign of current training programs.

After the 2005 study, the National Science Foundation (NSF) funded an Advanced Technological Education (ATE) grant to support the construction of an educational program that would effectively address the pending workforce crisis. This industry-demand-driven, workforce development program was developed to work with utilities, state regulatory agencies, and trade associations to design a curriculum format that would provide both the classroom and experiential training that this profession requires, all while reaching the greatest number of potential learners. This training program would work to confront the most immediate needs of the water/wastewater workforce; that of creating an informed and skilled crop of new operators.

With this funding the Water Training Institute (WTI) was formed and immediately faced several challenges. The education provided by this program is provided completely online and unique in that the product of ones studies was an Associate of Science Degree in Water Resource Management, something that is not required by most utilities when recruiting new operators. The program currently has three focuses: water operation, wastewater operations, and utility management, with plans for the addition of storm water management and lab technician track currently under development. Further, it was determined that unlike many undergraduate degree programs, the need for experiential, on-the-job training was just as great as the classroom educational components, and to remain viable in terms of the number of enrollees, a large geographic area needed to be reached from a centralized location. Thus, the program had three implicit challenges: reaching a sufficient enrollment, demonstrating the degree program's value, and finding the correct mix of both educational components, each of which is influenced by provision of sufficient experiential training. By exposing students to the occupation and demonstrating their effectiveness as employees in the field, the pathway to a sustainable educational program is laid.

The Need for Experiential Learning

Knowledge is attained in two general forms: either reflective, theoretical acquisition akin to classroom learning or via practical, experiential routes, such as what an apprenticeship will provide. The natures of both forms of knowledge acquisition simultaneously overlap and differ in specific ways. It is true that classroom learning must be experienced to actually acquire such knowledge and in order to determine the relevancy of a particular experience, its value and application must be understood by those who experience it. However, in the general terms they differ in that experiential learning in knowledge gained by doing and classroom learning is knowledge acquired through discussion.[3] Both of these are of value to most careers yet some professions place a greater worth upon one over the other and in the case of the water industry, tacit knowledge gained through experiential training has typically been the gold standard.

Experiential learning, as defined by the Association for Experiential Education is "…a process through which a learner constructs knowledge, skill and value from direct experience." The formalized practice of this is termed experiential education, incorporating the interaction between student and teacher in this process. This definition implies that this form of knowledge acquisition doesn't occur while a student sits at a desk, taking notes; rather, it is an active approach where the student dynamically participates in an experience. Proponents of this educational system believe that this active participation is how a student is prepared to become an active member of society. In this environment, the student is exposed to all aspects of what is to be learned in a particular setting, including both successes and failures during this process. The value of this is that the learner integrates what is learned with the actions required to perform the task. In this forum, the instructor serves as a liaison, determining which experiences are beneficial to the pupil and guiding them through the experience.[4]

For a water/wastewater operator training program this would entail that the student be able to work on site at a local utility. In this educational process, the potential operator is exposed to the theoretical aspects of the job such as the science behind the use of chlorine as a disinfectant or how activated sludge is integrated into sewage processing of organic compounds. In a classroom or online classroom, this reflective learning is then transitioned into an active experience at the utility. The benefit behind this is that after completing the program, the educational experience has prepared the incumbent operator for the day-to-day operations of a plant. Consequently, they are much better adapted to deal with unexpected occurrences, such as malfunctioning chemical feeders or distribution system intrusions. These are experiences that classroom learning cannot replicate.

The instructor in this educational system becomes the current operator or supervisor at the water utility. They assign the student tasks which they are capable of completing and will be of relevance in future employment scenarios, all while being available to guide the student through the learning experience. This interaction effectively bridges the gap between the undocumented tacit knowledge that the professional has and the transition of this knowledge to the future professional.

Supplying Experiential Learning

Within this framework WTI serves a dual purpose: supplying the classroom learning component and facilitating the introduction of students to utilities. The former is provided to students completely on-line via the Moodle Content Management System (CMS). Coursework, readings, and interaction occur via this system allowing WTI to supply classroom education to a geographically dispersed student body. This helps to stimulate the enrollment needed to justify a sustainable training program. The latter initiates what is the experiential component of the educational program.[5]

To ease the burden of identifying utilities willing to host student-interns, the Utility Network (UNet) was established. As the name indicates this is group of utilities that has agreed to act as mentors to the WTI students by providing them avenues for experiential training at the utilities' facilities. In most instances, students interested in the training are matched with utilities that are in close geographic proximity to them. Since nearly all communities have both a water and wastewater plant near them, this further enhances the ability of students to receive the complete education without setting foot on the centralized WTI location.

Further, the theoretical aspect of the degree program has been adapted to allow the student who either currently works at a facility or wishes to pursue such undertakings the ability to do so. This was done by taking the original three-credit-hour course format and dividing each into a modularized format. For example, the introductory course in the program, Water Supply and Wastewater Control, was subdivided into its sectional components: Hydrology for Water Operations; Drinking Water Sources, Quality, & Standards; Introduction to Drinking Water Treatment; Introduction to Wastewater Treatment; Introduction to Drinking Water Distribution; and Introduction to Wastewater Collection. Each of these modules are taken based upon the chosen track of the student; either water operations, wastewater operations, or utility management. The benefit of this transition is that the student does not need to devote the temporal resources needed to complete a full college course and it is better modeled to provide the necessary Continuing Education Units (CEUs) that nearly all states require to maintain licensure as a water or wastewater operator.

The By-Products of the Experiential Learning Program

As the third year of WTI's existence winds to a close, the program is beginning to experience the fruits of its labor. The first graduate of the WTI program completed their degree in the Summer of 2011. Interestingly, the utility in which this individual completed their experiential component was subsequently offered a full-time position at this facility. In fact, this was not an isolated incident in terms of WTI interns. More times than not, students within the program receive rave reviews from their supervisors at the host utilities. It seems that the educational component is effectively training its students to initially enter the water and wastewater workforce.

However, the program is not without its faults. As WTI students continue to intern at these facilities, the input derived from their supervisors can be utilized to provide feedback to

instructors and correct any errors in course content. Thus, the experiential program seems to serve the twofold purpose of both training the interns and reviewing the classroom training. It is yet another instance in which WTI attempts to produce the most qualified graduates that are possible.

The Future of the Experiential Learning Program

Waiting in the wings for WTI is the movement to an apprenticeship program. In working with the state and federal agencies which overlook this process, the development of an agreement that will be made between WTI, the host utility, and the student must be created. Guidelines of the U.S. Department of Labor's Apprenticeship Program also stipulate that the program meet a minimum of 144 hours of class time and 2,000 hours of on-the-job training, as well other requirement regarding wages and journeymen-to-apprentice ratios. WTI administrators are working to assure that the program is in compliance with federal apprenticeship standards. Once this is completed, the state apprenticeship program will oversee further monitoring and evaluation of the program.

Conclusions

Because of the high value placed upon experiential learning for water and wastewater operators, any training program provided to such individuals must incorporate this into its skeletonized structure. As such, the WTI program has placed a requirement for students pursuing an Associate of Science degree in the program complete an internship with a willing host-utility. Participating utilities are identified using UNet, comprised of utilities that have agreed to host interns at their facilities. This initiative has been a success in terms of helping evaluate the program and facilitating the ability of students to network with potential future employers. Continued evolution of the program will involve the possible creation of an apprenticeship program, as defined by both state and federal regulation.

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