

AC 2010-1791: WATER TRAINING INSTITUTE: INDUSTRY LINKAGES AND INSTITUTIONALIZATION

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Ms. Wade is the Education Coordinator for the Water Training Institute (WTI) at Bowling Green Community College (BGCC), a division of Western Kentucky University (WKU). In addition to giving guidance to existing and prospective students in the WTI program, she teaches WTI and associated STEM courses at BGCC. She also provides outreach and education for existing water operators in the form of CEU trainings. Ms. Wade holds a Master of Science Degree in Biology from WKU, and was employed as an analyst in the WATERS Laboratory at WKU for 5 years prior to her current position.

Water Training Institute: Industry Linkages and Institutionalization

Background

Provision of adequate water and wastewater treatment is crucial to successful rural economic development¹. It is also vital to public and environmental health. In order to obtain the licensure necessary to work in this field, a combination of education and on-the-job experience is required². However, the bulk of the water treatment industry's workforce needs in the United States are in remote rural areas that, even if within commuting distance to community or technical colleges, rarely amount to sufficient numbers to warrant establishment of degree programs at local institutions. Therefore there is a capacity challenge in meeting a growing workforce demand for an industry whose needs are geographically dispersed and generally insufficient in numbers for sustaining localized academic or vocational programs.

Approximately 111,000 people worked in the water and wastewater industry in 2006, with an anticipated 15,000 jobs being created in the next 10 years³. Fifty percent of these water and wastewater operators are expected to retire within the next seven years⁴. Workforce issues, particularly the impending retirement of Baby Boomers, industry growth, and the increased competition for employees, have been in the top five concerns among water professionals surveyed over the past four years^{5,6}.

According to the Bureau of Labor Statistics' Occupational Outlook Handbook (2008-09 Ed.), the employment opportunities for drinking water and wastewater treatment plant operators are excellent due to the large number of upcoming retirements in the industry and the subsequent need for qualified individuals to fill these positions. The Handbook also states that completion of an associate degree or a 1-year certificate program increases an applicant's chances for employment and promotion.

The Center for Water Resource Studies (CWRS) and the Bowling Green Community College (BGCC) of Western Kentucky University (WKU) formed a partnership in 2007 to address this anticipated Water and Wastewater Operator/Technician shortage by creating the Water Training Institute (WTI). WTI is a joint initiative with the employment sector, state primacy agencies, and trade associations to refine a curriculum driven by industry needs. It utilizes on-line course delivery to provide options for both traditional and non-traditional students.

Three tracks that lead to an Associate's Degree currently exist in the program: Water Operations, Wastewater Operations, and Water Utilities Management. Several affiliated tracks are being developed, such as Stormwater Management and Energy Management. This paper will focus on the components of the program designed to integrate with, and be driven by, industry needs.

Industry Linkages

One of the keys to success of the WTI program is establishment and maintenance of a governance structure that ensures programmatic direction is driven by practitioners rather than

academicians. While ultimate responsibility for academic credibility and accreditation rests on the program faculty, program sustainability is defined in terms of the value placed on graduates by employers and their regulators. Four trade associations are currently involved with the WTI program, and hold seats on the Steering Committee: Kentucky/Tennessee Section of American Water Works Association (KY/TN AWWA), Kentucky Water and Wastewater Operators Association (KWWOA), Kentucky Rural Water Association (KRWA) and Tennessee Association of Utility Districts (TAUD). Although these associations have a local scope, they have the potential for scalability since most are linked to national organizations (American Water Works Association and National Rural Water Association).

CWRS hosted a workshop for WTI Steering Committee members and potential instructors in October 2009. Two significant aspects of the WTI program were discussed during the meeting: development of a utility network and an on-line mentoring network. Both networks will ensure that the program stays on the pulse of the constantly evolving water industry.

Utility Network

Since the WTI program can be delivered completely on-line, a utility network, or UNet, has been created to serve as a local point-of-presence for students in the program. Memoranda of Agreement are being signed with utility and municipality partners that are willing to provide access to local facilities (computers, laboratories, treatment/distribution/collection systems) for remote students. Participation in the utility network affords both rights and responsibilities in execution, governance, and direction of WTI.

On-line Mentor Network

An on-line mentoring network is being established that integrates practitioners into the recruitment, retention and educational processes. This concept is loosely modeled on the Service Corps of Retired Executives (SCORE), and uses the open-source Content Management System (CMS) called Drupal as a networking tool to engage existing and retired operators as mentors for students in the program. Creating this basis for professional interaction is another key to the program's success. The mentors can be involved in several aspects of the program, such as providing expertise to the educators, participating in discussion forums, and giving career guidance to students enrolled in the program. During the annual workshop, branding of the mentoring network was discussed, such as possible names and logos, as well as how the network will be established. For example, who will be the initial mentors, and will they require any pre-approved training/qualifications? It was decided that a core group of mentors would be identified by the Steering Committee, and this group would convene to discuss branding, as well as their roles and responsibilities.

Student Incentives

Partnering utilities and municipalities are also developing internship and cooperative educational opportunities to ensure work-based experiences for students. WKU students may receive one institutional credit hour for every 80 hours of supervised program-appropriate internship executed with a participating utility. In addition, some individual utilities are offering tuition reimbursement for current employees who are pursuing academic degrees or certificate programs.

Many of the trade associations, and some of the utilities, expressed an interest in developing a scholarship fund for potential and existing students in the program. Although some of the trade associations have the administrative capacity to manage a scholarship program, it was proposed that the WKU Foundation be the back office for the WTI scholarship program, since the Foundation will administer these ‘custodial scholarships’ and delegate the funds without charging overhead. Multiple scholarships can be established, and named at the creator’s discretion. The Steering Committee, or sub-committee thereof, will be responsible for establishing funding criteria, reviewing scholarship applications and making funding decisions. A scholarship application template has been drafted.

Institutionalization

A key expectation of most state agencies for licensure in the water industry is hands-on or on-the-job experience. In many states, including Kentucky, academic qualifications can substitute for some, but not all, experience requirements. The capacity challenge therefore is providing sufficient experiential content within an academic program, being delivered to a geographically dispersed audience. The combination of these core capacity challenges cannot be adequately or holistically met by traditional community or technical colleges.

The WTI program addresses this issue by combining on-line delivery of classes with a network of utilities willing to assist with hands-on learning. The program is designed to be delivered entirely online, allowing students to pursue their degree with unparalleled flexibility. The WTI courses are delivered through an open-source Course Management System (CMS) known as MOODLE (Modular Object-Oriented Dynamic Learning Environment). As many research studies have shown, active learning is more powerful than passive learning at getting students to retain and apply course content to novel and practical situations^{7,8}. WTI utilizes on-line discussion forums for use among course cohorts in each core class. This active engagement with course content gives students an enhanced sense of empowerment, ultimately leading to a more interested, motivated, and participatory student.

Modularization

The use of modularized courses to improve retention and student success is well documented^{9,10}, and has even been applied to internship/apprenticeship situations¹¹. Each industry-specific course has been developed using a modular structure to maximize engagement and knowledge retention by the students.

Modularization of courses was discussed during the October 2009 workshop. All of the trade associations partnering on the WTI Program hold statewide conferences on at least an annual basis. The possibility of developing specialty tracks or short courses at these conferences that would earn the students a portion of their academic credit in addition to CEUs was discussed. This would benefit existing water operators who are interested in pursuing a degree, since many employers send operators to such conferences to obtain the required number of CEUs to retain their license. In order to ensure these courses are eligible for academic credit, several criteria would have to be met. First, a modular format would have to be in place that would establish the amount of academic credit the student would be eligible for after successful completion of the short course. For example, an 8-hour short course may transfer into 0.1 student credit hours at

the academic institution. Other issues that would need to be addressed are the tracking of students and testing of knowledge retention on the subject matter covered. Often, CEUs are offered to attendees for their presence in the class, rather than their absorption of the subject matter. However, some type of assessment, such as a quiz, would be required of students in the WTI Program if short course material is to be used for academic credit. Assessment tools must be reviewed and approved by the Steering Committee prior to implementation.

Curriculum Evaluation and Refinement

Also during the workshop, there was a focus on ensuring that the knowledge, skills and abilities (KSAs) of graduates from the program are appropriate and complete, based on current industry expectations. An independent program evaluator from the Industrial Psychology Department at WKU was retained to develop job analysis questionnaires for experts in the water industry to complete. A total of five questionnaires were distributed at the workshop, each based on the KSAs expected of an entry-level water operator (drinking water treatment or distribution, and wastewater treatment or collection system operators). The responses to the questionnaires will be used to assess the appropriateness of content in the degree program.

Another major focus of the workshop was to refine the original curriculum that had been developed, by identifying any gaps in the proposed courses that had been realized since the start of the program. The Committee agreed that proposals for both a Certificate and a full Program should be initiated within the University. Currently, an existing Utility Management track exists within the Business Division of the Bowling Green Community College. However, the Water Training Institute in its current format would be better suited under the Liberal Arts and Sciences Division of the BGCC. Establishment of this new degree program requires approval from the University Curriculum Committee, as well as the state Council on Postsecondary Education. One of the core classes in the program is Physics 101: Concepts of Motion. It was proposed that this be changed to Engineering 130: Electrical Engineering, in order to address the increased technical knowledge and level of instrumentation new operators face.

Transitions

CWRS is in the process of creating transition opportunities for students from 2-year degree programs to 4-year degree programs if desired, through the creation of formal articulation agreements between various departments and colleges at WKU. This would allow for a seamless process for students to continue on to receive a 4-year degree if interested. CWRS plans to develop articulation agreements with the Technology Management and/or Construction Management programs through the Architectural and Manufacturing Sciences (AMS) Department, housed in the College of Science and Engineering at WKU, and with the Public Administration program through the Political Science Department, housed in the College of Arts and Letters at WKU.

Recruitment and Outreach

Finally, an educational outreach program that integrates into high school science curricula is being developed. This program is aimed at recruiting young adults into the water and wastewater industry. The focus will be on recruiting students who would typically directly enter the workforce or a trade/vocational school, but have demonstrated potential for success in an academic program if a perceptible practitioner focus can be maintained.

WKU also offers the Reaching Each Adult Learner (REAL) program that encourages non-traditional students to seek or complete a degree by providing counseling and resources for adult learners, including career services and scholarship opportunities.

In order to recruit existing operators into the program, the trade associations involved with WTI have agreed to promote the WTI program through their email communications and periodic newsletters distributed to members.

Conclusion

It is expected that the WTI degree program, which provides a combination of on-line instruction and localized experiential programs, such as internship opportunities at water treatment plants within the student's community, will assist in filling the workforce needs of the water and wastewater industry.

As a demonstrably functional framework is being put in place, the program is being extrapolated to address other regional policy, academic discipline and industrial sector issues beyond the initial Kentucky and Tennessee target area. University-offered Water and Wastewater Operator Certificate Programs are being developed to fast-track students into the industry and allow current operators to reach advanced certification levels at an accelerated pace.

Bibliography

1. Neal, J. (1994). Water/wastewater: crucial infrastructure for rural economic development. *Management Quarterly*.
2. Kentucky Administrative Regulations (2009). Title 401, Chapter 8: Public Water Supply. Section 030: Certification of Operators.
3. Bureau of Labor Statistics (2006). Water and Liquid Waste Treatment Plant and System Operators, U.S. Department of Labor, <http://www.bls.gov/oco/ocos229.htm>.
4. American Water Works Association (2008). AWWA Undertakes New Workforce Initiative, *E-MainStream*, 5(9).
5. Scalera, Pat (2007). The Perfect Storm? The Aging Infrastructure and Work Force, *Rural Water*, 28(4).
6. Runge, J. and Mann, J. (2008). State of the Industry Report 2008: Charting the Course Ahead, *Journal of the American Water Works Association*, 100(10).
7. Kassop, M. (2003). Ten ways online education matches, or surpasses, face-to-face learning. *The Technology Source*.
8. Kubala, T. (1998). Addressing student needs: Teaching on the internet. *THE Journal*, 25(8), 71-75.
9. Comford, Ian R. (1997). Ensuring Effective Learning from Modular Courses: a cognitive psychology-skill learning perspective. *Journal of Vocational Education and Training*, 49(2).
10. Feldman, Bill (2001). Our Turn: Interactive Modular Instruction in Mathematics, Bill Feldman, *All Things Academic*, 2(2).
11. Comford, Ian R. and Debbie Gunn (1998). Work-based learning of commercial cookery apprentices in the new south wales hospitalities industry, *Journal of Vocational Education and Training*, 50(4).