



Dr. Gretchen A. Mosher is a post-doctorate researcher and lecturer at Iowa State University, where she earned her BS, MS, and PhD degrees. In addition to her work with adult learners, she has taught students at the university, community college, and

secondary levels. Research interests include the role of employee perceptions on workplace safety and quality, safety and quality decision-making in agriculture, and best educational practices for the successful implementation of occupational safety and quality management programs. Dr. Mosher was the 2010 recipient of the ATAME Graduate Research and Poster Award and was awarded the Warner Graduate Student Research Award from Epsilon Pi Tau Region 4 in 2011. Dr. Mosher may be reached at [gamosher@iastate.edu](mailto:gamosher@iastate.edu).



Dr. Steven A. Freeman is a professor in the Agricultural and Biosystems Engineering Department and associate director of the Center for Excellence in Learning and Teaching at Iowa State University. He coordinates the occupational safety option of the industrial

technology degree program and the occupational safety certificate program for the department. His research interests are in agricultural and workplace safety and the scholarship of teaching and learning associated with safety, engineering, and technology curricula. Dr. Freeman may be reached at [sfreeman@iastate.edu](mailto:sfreeman@iastate.edu).



Dr. Charles R. Hurburgh, Charlie to most everyone, is a native Iowan from Rockwell City (Iowa, USA). He continues to operate the family farm, and is a Professor of Agricultural Engineering at Iowa State University. He has BS, MS, and doctorate degrees from Iowa State, and

specializes in quality management systems with related traceability, measurement and sensor technologies. He is the author of more than 220 technical and general articles on grain quality, measurement science and grain marketing. Dr. Hurburgh manages the ISU Grain Quality Research Laboratory and the Extension-based Iowa Grain Quality Initiative. Dr. Hurburgh participates in European Union projects on GMO marketing and traceability. He also serves on the US Technical Advisory committees for two ISO working groups—traceability, and ISO 22000 food safety management systems and on several industry food safety/quality management groups. Dr. Hurburgh may be reached at [tatry@iastate.edu](mailto:tatry@iastate.edu).

# Design of an Online Course in Quality Management Systems for Adult Learners

By Dr. Gretchen A. Mosher, Dr. Steven A. Freeman, & Dr. Charles R. Hurburgh, Jr.

## ABSTRACT

Quality processes are an important part of any business. The introduction of quality management systems in the workplace offers many benefits for organizations who wish to remain competitive. Online presentation of quality management concepts offers an efficient and cost effective delivery method for workplace learning. However, adult learners often do not have the same level of comfort with online educational programs as college-aged students. Adult learners also have other special needs that must be considered when developing educational material for the workplace.

The manuscript describes the process used to develop and deliver an online non-credit course in quality management systems specifically for adult learners. Two challenges guided the development and presentation of this course: introducing quality management systems to a new audience and teaching to adult learners in an online environment. Both challenges were approached with a focus on adult learning theory. Specific information on the evaluation of the students using appropriate online and adult learning practices is also discussed. Information and implications from the manuscript may provide guidance for training and development professionals within the field of industrial technology who develop and lead workplace educational programs for adults.

## INTRODUCTION

The adult workforce in the United States is participating in work-related educational activities. The American Society of Training and Development (ASTD) estimates that organizations

in the United States spent over 125 billion dollars on employee learning and development in 2009 (Patel, 2010). According to data from the National Center for Educational Statistics, 33.3 percent of adult educational activity involved work-related courses (U.S. Department of Education, 2008; Kleiner, Carver, Hagedorn, & Chapman, 2005). The rate of online workplace education has increased, with 27.7 percent of all formal learning hours available online in 2009 as compared with 23.1 percent of formal learning hours available in 2008 (Patel, 2010). With the increase in online workplace education programs, the interest in effective and appropriate learning style for adults, particularly in an online environment, has increased (Bilke, Xia, Bailey, Rodchua & Sinn, 2006; O'Lawrence, 2006).

Adult learners have specialized needs and may bring different motivations to learning environments than traditional aged students (Cranton, 2006). The adult workforce also has constraints that often keep workers from being able to take advantage of conventional continuing education opportunities. These constraints include scheduling issues, family commitments, heavy job demands, alternative learning styles, and inconvenient locations (Manning & Vickery, 2000; O'Lawrence, 2006).

Distance education strategies can be used to address many of the constraints of traditional occupational educational programs designed for adults. Past research on distance education has focused on traditional college-aged learners (Smallwood & Zargari, 2000; Burgess & Strong, 2003; Watwood, Nugent, & Deihl, 2009), but distance education methodologies specific to adults are less common (Dobrovolny,

2006). This manuscript describes the development, delivery, and evaluation of an online continuing education course in quality management systems. Factors that particularly support adult learners in a distance education environment are emphasized.

## **WORKPLACE EDUCATIONAL PROGRAMS**

While the process controls and verification of standards inherent to quality management systems are not new to many industries, these ideas are a radical departure from the commodity-based system typical of bulk commodity handling and processing firms (Hurburgh & Lawrence, 2003). Preliminary research on the use of quality management systems within a bulk commodity handling and processing facility demonstrated several benefits, including increased operating efficiency, a better ability to meet customer specifications, and tighter security controls (Laux, 2007).

Moreover, external and internal change is required of organizations who wish to maintain their competitive advantage. However, managing organizational change requires that several factors be in place. To encourage the success of workplace educational programs, Garvin, Edmondson and Gino (2008) recommend a supportive learning environment, concrete learning processes and practices, and a leadership team that supports and rewards workplace learning. Several educational-themed factors are considered critical or important for successful organizational change by Chrusciel and Field (2003). Education-based factors include user-training, curriculum dealing with the change, perception of personal gain by users, user involvement, and assessment. In this case, two major changes were introduced to prospective students: the use of quality management systems in the commodity handling and processing industry and the practice of workplace learning in an online format.

Although teaching adults in an online format has some obstacles, perhaps

a larger challenge to implementing a quality management system at a commodity handling facility is the business environment (Hurburgh & Hansen, 2002; Voigt, 2005). As a commodity-based business, the focus is on large volumes, with low profit margins, for the lowest cost. Although additional documentation and monitoring of quality metrics has the potential to create opportunities for increased efficiency and profits (Laux, 2007), prioritizing quality processes for employees is a significant challenge.

## **ADULT LEARNERS**

Adult education is often described as voluntary or self-directed. However, Cranton (2006) and (Brookfield, 2001) question the universal application of self-direction to all adult learners. Cranton (2006) suggests that student motivation and interest levels may be dependent on several components that cannot be controlled by the educational facilitator. Ortega, Tormoehlen, Field, Balschweid, and Machtmes (2003) conclude that the success of non-credit educational programs and curriculum depends heavily on the appropriateness and relevance of the subject matter content. Cranton (2006) agrees on the relevancy of the content but adds that a strong leader or facilitator can improve even mandatory educational programs. Chrusciel (2004) believes the perception of personal gain by participants also plays a role in the success of an educational program and the change that accompanies it.

Cranton (2006) and Knowles (1980) stress that many adults prefer practical, applied and skill based knowledge over academic, theoretical, and informational knowledge. To meet the needs of adult learners, information must be useful, applicable, and relevant to their workplace situation and context. In addition, acknowledging the previous experience of adult students is an essential component of successful adult education (Dollisso & Martin, 1999).

Two issues were confronted in the development of the quality management

systems course. Finding a way to introduce adult learners to both new content and a relatively new delivery method was the first challenge. The second task was to provide a realistic evaluation of the knowledge gained by students using strategies best suited to adult learning and a distance education environment. The development process began with consideration of the curriculum design framework.

## **CURRICULUM DEVELOPMENT FRAMEWORK**

Many conventional curriculum and program development approaches for both traditional and adult learners have used the theoretical framework developed by Tyler (1949) and updated by others (Posner, 1988). This framework develops curriculum by answering four fundamental questions:

1. What is the purpose and goals of the curriculum?
2. What educational experiences must be provided to meet these goals?
3. How must the educational experiences be organized for the most effective instruction?
4. How can the goals be evaluated to determine the effectiveness of the educational experiences?

Although Tyler's approach has been validated and tested by numerous curriculum professionals since its inception (Beyer & Apple, 1988; Posner & Rudnitsky, 1997; Reid, 1992; Schon, 1996) some scholars see major shortcomings to this top down approach (Eisner, 2003; Plihal, Laird, & Rehm, 1999). Tyler's framework emphasizes efficiency, standards, learner competency, and cost effectiveness – resulting in a technical perspective of curriculum planning that has been an important component of career and technical education for more than five decades. Plihal et al. (1999) argue that many adult learners do not function well under Tyler's approach or by using a technical perspective. Tyler's model does not account for personal life experiences or diversity in contexts, and therefore is not well suited for some adult learners.

Many curriculum design frameworks have been introduced as alternatives to Tyler's model. One of these is backward design (Wiggins & McTighe, 2005). Backward design differs from traditional curriculum design in several ways. First, backward design begins by determining what students should know at the end of the program or unit rather than using pre-determined content as a basis for educational objectives. This information is summarized using broad concepts known as "big ideas". Using big ideas as a basis, the developer works backward to develop an assessment plan, create learning activities, and align content scope and sequence appropriately with the major concepts of the course. Second, rather than treating all areas of knowledge as equally important, content areas are classified by relative importance within the curriculum. After determining which topics are the most important, educational activities and the curriculum scope and sequence can be developed based on the significance of the concepts rather than simply moving sequentially from one topic to the next.

A final difference between backward design and other curriculum approaches is the emphasis on the learning activities. Rather than using pre-determined content to form learning activities, class activities are developed to link closely with the big ideas of the course to immerse students completely in the concepts and patterns; ensuring students leave the course with a clear understanding of the knowledge supporting the big ideas. Although these differences may seem insignificant, they represent a departure from conventional curriculum design methodologies.

The curriculum approach of backward design complimented many of the characteristics of adult learners. For this reason, this approach was chosen as the curriculum design methodology for the development of a continuing education program on quality management systems. The backward design procedure is not intended to be a rigid methodology, but the process does allow the designer to follow a thoughtful and

purposeful path focused on maximizing student learning. Backward design can be summarized by three steps (Wiggins & McTighe, 2005):

1. Identify desired results
2. Determine acceptable evidence
3. Plan learning experiences and instruction

The first step of identifying the desired results is perhaps the most difficult because it requires the instructor to prioritize and make choices about which content to include. Using the desired results, big ideas are developed and these ideas drive content decisions for the course. Ideally, educational programs could cover every conceivable bit of information the learner could possibly need, but this approach is not possible or practical. As part of the process of prioritizing course big ideas and the resulting content, the educator might consult curriculum standards or learning outcomes. However, in the case with work-related education for adults, instructors must first determine the desired results of the educational program (Wiggins & McTighe, 2005). Determining the desired results involves choices based on the priority assigned to each course topic. Major concepts are represented by the big ideas.

All students are expected to complete the educational program knowing the content that connects to each big idea (Wiggins & McTighe, 2005). Because of the broadness of the big ideas, a course typically has a small number of big ideas. Big ideas for the course were developed by the instructors in consultation with bulk commodity handling professionals and experts in adult and distance education. The big ideas developed for the quality management course are listed below.

#### **Big Ideas for Quality Management Systems Course**

1. Quality management systems are a means of requiring discipline and reproducibility in a production process.
2. Quality management systems are easily integrated with standard

operating procedures and normal business activities.

3. Quality management systems can be used as a solution for procedure-based business needs.
4. Quality management systems depend on a strong framework of management, evaluation, and cost-benefit analysis.

Once the big ideas have been identified, the next step is to determine acceptable evidence to measure student learning. Tasks and criteria are developed to measure the learner's level of understanding and knowledge of each big idea and content connected with these ideas (Wiggins & McTighe, 2005). For adults in a work environment, this might include criteria such as observations, performance appraisals, or unit production quotas or it may include the ability to perform specific skills or actions. Assessment of adult learners could also include more conventional assessment activities such as quizzes and contributions to discussion groups. Acceptable evidence of learning for this program is identified at the end of the paragraph. Once learner tasks and criteria are created and an evaluation plan is established, developing relevant and appropriate content to support the tasks becomes relatively straightforward (Wiggins & McTighe, 2005).

#### **Acceptable Evidence of Learning**

At the end of the course, students will be able to:

1. Describe the framework, benefits, and goals of a quality management system as used in a bulk commodity handling organization.
2. Use statistical tools to manage inventory and continuously improve organizational processes.
3. Integrate daily procedures and tasks into a quality management system configuration.
4. Identify links between quality management systems and other mandated workplace programs such as safety, facility security, and bioterrorism.
5. Collect and organize data from daily operations for use in evaluation and cost-benefit analysis.



Using the evidence of acceptable learning as a basis, planning learning experiences and instructional activities are the final development steps. During the third step of planning learning experiences and instruction methods, the educator must consider the specific knowledge, skills, and activities needed for the learners to reach the desired results and how the information generated by these learning experiences will be presented. This portion of the curriculum includes the specific content for each learning session and may consist of an overview of the lesson, learning outcomes specific to that session, presentation format and media needs, and source materials. Once content is developed, the course is ready for delivery.

### ***DISTANCE EDUCATION***

Distance education strategies can be used to address many of the constraints of traditional occupational educational programs. Time and space are just two of many limitations that can be eliminated or minimized by distance education. Learning is available to students on a 24-hour schedule and gives students control over their learning schedules. In addition, students must accept greater responsibility for their learning and decisions concerning their learning processes (Chang, 2006).

However, Freeman and Embleton (2000) recommend that prospective distance educators understand that the development of a completely online course requires skill in instructional design as well as a great deal of time and financial resources. The time needed presents an especially challenging requirement for education professionals. Freeman and Embleton (2000) also caution against transferring an existing face-to-face course to an online course without appropriate modifications. Some traditional course components must be reconsidered including group activities, instructor presentations, and textbook choices (Burgess & Strong, 2003; Freeman & Embleton, 2000). Even so, distance education provides opportunities for faculty to improve and enhance student learning as well

as expand their own teaching toolbox (Dobrovolny, 2006; Burgess & Strong, 2003; Freeman & Embleton, 2000)

### ***ONLINE COURSE DELIVERY***

The quality management system course was offered through an existing distance learning program offered through a partnership between Purdue University (PU), Kansas State University (KSU) and the Grain Elevator and Processing Society (GEAPS). This program serves professionals in the bulk commodity handling and processing industry. Many of these professionals work in rural areas with limited access to high speed internet or other advanced distance education tools. For this reason, recording software was used to record the audio of the presentation to align with accompanying instructor material in slides put on a CD. Students were able to play back the audio and visual information at their convenience and as many times as needed for understanding without concern about internet functionality or speed. Students were required to be online for some components of the course. Additional course material, discussion questions, copies of the CD presentations, and quizzes were only available on the course website.

The course was designed for a 5-week time frame. Four instructors led the first offering in January and February of 2010. In addition to listening to the course material, students worked through online quizzes, responded to discussion questions, and read others' discussion responses and supplemental course readings. Ten units of study were covered in the five week time period, so the suggested pace for students was two units per week. Students needing additional time were granted limited time to complete the course or were counseled to re-enroll at a later date, depending on their progress at the end of the 5 weeks. Student access to course web site resources ended after the completion of the course, but the CDs were retained by the students for future use and review.

Students enrolled the course represented a wide variety of perspectives within the bulk commodity handling and processing industry. The twenty-two students were mostly males (three female), from eight states and three countries. Their career experience included quality control, quality management, auditing, occupational safety, operations management, and consulting. Time in the industry varied from less than one year to over thirty years.

Presenting content to such a varied group was a major challenge of course development. Another challenge often cited is encouraging the constructive interaction among students and between students and the instructor in an online learning environment (Mariani, 2001). Interaction is an important part of the learning process for adult learners (Cranton, 2006). Furthermore, many adults enjoy an environment where they can share and discuss their experiences related to the learning material (Dollisso & Martin, 1999).

Based on the theoretical needs of adult students to draw upon their experiences and share them with others as part of their learning, open-ended discussion questions were developed. Students were strongly encouraged to participate in discussions about the unit's topics with their classmates. Discussion topics were based on course content and were developed to serve as one piece of evaluative information used to measure acceptable evidence of learning. Mariani (2001) suggests that discussion between students is an important part of assessment. This is especially true for adult students, who generally enjoy the opportunity to apply lesson concepts to their own situations and discuss their past experience with the course content (Cranton, 2006). The questions asked students to think further about the topics presented, to apply lesson concepts to their own organizations, and challenged them to ponder the next steps for quality management in the bulk commodity handling and processing industry. Student responses to discussion questions also provided instructors the opportunity to evaluate student

attainment of the acceptable evidence of learning for the course. Examples of discussion questions developed for the course are shown in the list below.

#### **Sample of discussion questions**

- What do you think the future holds for quality management systems in the grain handling and processing industry?
- How vulnerable is the U.S. agricultural production system to a biological, chemical, or other bioterror event? Is the level of concern too high, too low, or just right?
- What value do you believe better inventory management could bring to your organization?
- If you were to implement a quality management system, what would be some challenges you foresee?
- Can you think of risks and liabilities within the grain industry that cannot be managed and/or controlled with a quality management system?
- If your supervisor asked you for a cost/benefit analysis for a quality management system, where would you go to find information?

Using the discussion questions resolved several issues of concern for the instructors regarding online learning and catered to adult student preferences as well. Discussion questions increased the interaction between both the students and between the students and instructors. Moreover, the students were able to apply the course content to their own organization's needs, discuss strategies and concerns with other students, and share workable solutions with the entire group. During discussions, students were able to demonstrate their competency in the areas identified as acceptable evidence of learning.

In addition, discussion activities provided students the opportunity to talk about unfamiliar content with their peers while using their existing knowledge of the bulk commodity industry to form a practical and participatory learning circle. A learning circle environment, which draws upon the past

experiences of students and provides an opportunity to apply course information directly to their own situation, has been identified by researchers as an important component of adult education (Cranton, 2006; Knowles, 1980).

A second component of student evaluation was online quizzes. The quizzes allowed the instructors to check on levels of student understanding of major concepts of each unit. Wiggins and McTighe (2005) suggest that selected response quizzes or exams are well suited for assessing factual information, general concepts, and discrete skills. Results of the quizzes provided feedback to both the student and the instructor by identifying areas of conceptual misunderstanding.

Two theoretical frameworks were used to evaluate the course and the curriculum development process. Palloff and Pratt (2009) promote a learner-centered approach focusing on assessment that is aligned and embedded within the course design. Appropriate activities in an online learning environment include self-reflection and context-specific discussion. Palloff and Pratt (2009) also note the importance of student input, especially when the development of community learning and increased self-efficacy with the content are primary goals of the course.

The four-level theoretical framework from Kirkpatrick and Kirkpatrick (2007) was also used to evaluate the course and curriculum. Four levels are evaluated as part of the framework: reaction, learning, behavior, and results. The reaction level is used to evaluate participants' thoughts on the course and use the feedback for improvement of future offerings. The second level of Kirkpatrick and Kirkpatrick's (2007) evaluative framework is an evaluation of the learning. Determining the effectiveness of student learning is important in workplace training because without learning, behavior change cannot occur. The third level of the Kirkpatrick and Kirkpatrick (2007) framework measures behavior, and more specifically, the change in behavior that can be linked di-

rectly to the education program. Finally, results are measured. To best measure a course's results, it is helpful to have a control group to compare with the group that was exposed to the program being evaluated. If it is not possible to have a control group, the return on expectation (ROE) may be estimated as "evidence of proof" for positive outcomes from the education program.

The application of the Kirkpatrick and Kirkpatrick (2007) framework to the course evaluation is discussed in the next two sections. Strategies suggested by Palloff and Pratt (2009) were also used to evaluate the course and curriculum and are discussed with respect to the final evaluation of the course and changes integrated as a result of the evaluation.

### ***EVALUATION OF THE COURSE AND CURRICULUM***

At the completion of the course, students were offered the opportunity to evaluate the course and the material presented. An electronic evaluation form was developed by the GEAPS business office to determine how well the course content met student expectations. The evaluation instrument was a generic form to measure all GEAPS courses, therefore, results are not meant to be interpreted as the only data with which to draw conclusions about the course. The evaluation below was part of a larger qualitative and quantitative assessment plan. The primary purpose of the evaluation was to determine the usefulness of the course to students professionally and for continuous improvement purposes. Both pieces of information were used to determine future course offerings. To evaluate the effectiveness of the course content and delivery, more qualitative methods were used.

About 50 percent of the students enrolled evaluated the course. Of those completing the evaluation, 100 percent felt the course had met their expectations and would be useful to them professionally, demonstrating a return on expectation (ROE). Students also

rated several components of the course, including the content of units, networking opportunities among classmates, and the course website. These ratings are shown in Table 1.

Students also provided open-ended feedback. Overall, comments were positive, but several pieces of constructive feedback were offered. These are summarized below.

**Open-ended feedback from students**

1. Include a capstone or final project to apply skills and knowledge learned in the course
2. More examples of real life companies using quality management systems
3. Technical and course management issues (better align slides and audio, provide transcripts for review and note-taking, suggest additional references)
4. Provide templates or formats for development of process documentation and quality programs

**DISCUSSION**

The curriculum was evaluated using quantitative data from the GEAPS form, qualitative feedback given by the students, and by a post-course de-briefing session held by the instructors. The basis of evaluation included student understanding of the big ideas and demonstrated competency of the acceptable evidence of learning developed for the course. Theoretical frameworks were also used to evaluate the effectiveness of the curriculum and the course (Kirkpatrick & Kirkpatrick, 2007; Palloff & Pratt, 2009).

The electronic evaluation form was developed by the GEAPS corporate office to evaluate the course from a business perspective rather than an instructional perspective. In this context, data from the GEAPS instrument measure only the first level of Kirkpatrick and Kirkpatrick (2007) evaluation framework – the reaction of the students to the course. Results were positive, as 100 percent of the students indicated that the course was helpful to them professionally. Other data measured at the

**Table 1. Student Ratings of Course Components<sup>1</sup>**

Course component	Excellent	Good	Fair	Poor
Content of units professionally useful	1	8	-	-
Network opportunities	3	5	1	-
Website ease of understanding	4	5	-	-
Website ease of use	6	2	1	-
Website access	6	2	1	-
Website comprehensiveness	3	6	-	-
Website accuracy	3	5	1	-
Overall course rating	3	6	-	-

<sup>1</sup>N = 9; a dash line “-” indicates no data was reported

reaction level are shown in Table 1.

In addition, qualitative feedback from students rated course content very well in terms of connection to the workplace and the use of context-specific examples. The connection to the workplace and the use of examples that can be directly applied to the work environment are important components of adult education (Cranton, 2006). Components identified as acceptable evidence of learning also depended on knowledge from the workplace and the use of context-specific examples. The high ratings in workplace connection and context-specific examples reflect positively on the goal of the instructors’ to develop the course with adult learner needs in mind.

The second level of Kirkpatrick and Kirkpatrick’s (2007) evaluation system focuses on learning. The discussion questions provided the best evidence for evaluating student learning and demonstrated competency with the acceptable evidence of learning. Specifically, the learning of knowledge and skills and the changing of attitudes are the focus of the second level of evaluation in the Kirkpatrick and Kirkpatrick model (2007) as well as in the evidence of learning identified for the course. Student responses indicated this type of learning. Responses given by students clearly explained their enhanced knowledge and changed attitudes, especially concerning the big ideas and evidence of learning relating to integrating QMS procedures with daily

routines and the use of QMS as a solution to procedure-based business needs.

The third level of Kirkpatrick and Kirkpatrick’s (2007) evaluation system examines the behavior. Although constraints of time and distance made direct behavioral observations impossible, some evaluation of intended behavior change was evident from discussion responses and in the final qualitative assessment of the course. Students discussed changes they planned for their organization based on the course, allowing instructors to measure how well the acceptable evidence of learning items two and three were attained. However, measuring how well the intended changes were implemented was not possible. Even if behavior could have been observed, Kirkpatrick and Kirkpatrick (2007) note that any measurement of behavior change should be delayed until the new behaviors “take root”. A time frame of two to six months was suggested. Even if distance and expense constraints were eliminated, full evaluation at the behavior level would have not been possible in the project, in part because of the time delay needed to measure behavioral change (Kirkpatrick & Kirkpatrick, 2007).

The fourth level of the Kirkpatrick and Kirkpatrick (2007) evaluation plan focuses on results. The same limitations from level three can be applied here (i.e. needing time to fully evaluate the results and constraints of distance and time), but two guidelines provided



by Kirkpatrick and Kirkpatrick (2007) in measuring results were followed. The first was the suggestion to demonstrate the return on expectation (ROE). Student qualitative evaluations and discussion reactions indicated a positive return on expectation in the QMS course. Moreover, the ability of students to collect and organize data as per the acceptable evidence of learning item number five was addressed in discussion questions and in the final evaluation completed by students.

The second guideline offered by Kirkpatrick and Kirkpatrick (2007) was to use evidence to evaluate when proof was not possible. The point was very applicable in this case, where solid proof of results and behavior change was difficult to measure. Evidence provided by student evaluations and student assessment on the effectiveness of the course must suffice. If students were able to demonstrate their acceptance and knowledge of QMS through their discussion and quiz results, these data along with student evaluation of the course provide an adequate indicator of effectiveness.

Additional evaluation followed the framework of Palloff and Pratt (2009), encouraging students to reflect on their learning and provide input on ways to improve the course. Generally, students were pleased with the content, favorably rating six of the ten units. Based on student evaluations, four units that were rated neutral or below were targeted for substantial revision. Furthermore, using student input suggesting the need for a final project to aggregate course concepts, a final project was developed for the 2011 offering of the course. The major goal of the final project was to provide students a better opportunity to demonstrate their competence in the items outlined as acceptable evidence of learning.

The goals of the QMS course were to introduce an unfamiliar topic to a resistant audience and to develop a distance course with learning activities especially suited for adults. Based on course evaluations, discussion question responses, qualitative feedback, and

quiz results, instructors feel as though the effectiveness of the course and the curriculum framework were favorable as evaluated with Kirkpatrick and Kirkpatrick's (2007) four-level training evaluation and Palloff and Pratt's (2009) method of evaluation.

Several limitations on the evaluation exist. Although many of the traits of adult learners were present in the students, they did not conform to all commonly held beliefs concerning adults and learning. All those who took the course, therefore, their motivation was considered to be very high and they remained engaged in the course content, discussion, and learning activities throughout. In addition, students were able to see the value of the course content and apply several course concepts to their workplaces, based on their discussion responses and final evaluations of the course.

However, according to the final evaluations of the course, most learners felt unprepared to begin the process of creating and implementing a quality management system in their own workplace. The inability of the students to apply course concepts to their direct workplace environment could involve several factors. First, the novelty of the material may have prevented students from being able to make the leap from the classroom to the workplace. Second, the lack of experience students had to draw on to develop quality management systems likely contributed to the lack of application. Finally, the risk adverse and resistance to change mentality of the bulk commodity handling industry could have played a role in the students' lack of confidence in their ability to apply course concepts to their workplace. Based on their final evaluations, students overwhelmingly asked for more context-specific examples and for guides or templates to assist them in developing quality management systems. Both requests reflect the theoretical learning needs of adults (Cranton, 2006) and both were integrated into the 2011 course offering.

Finally, this course was studied with one small group of less than 25 stu-

dents. The experiences with the course could be very different with other students. Additional evaluations of future course offerings will be beneficial. One major indicator of learning in adult education programs is behavior change. In this project, due to time, distance, and financial constraints, behavior and results from the project could not be fully measured. This limits the ability to evaluate the course and the curriculum approach.

The advantages of online education in a workplace environment are clearly an impetus for its continued use. The ability to reach workers in their environment without the constraints of time or distance is clearly advantageous. Even so, online education for working adults holds special challenges, especially when new or unfamiliar material is presented. Understanding the needs of working adults as well as the constraints of distance education can make the learning curve involved with an online course less intimidating for both instructors and students.

## REFERENCES

- Beyer, L.E. & Apple, M.W. (1988). Values and politics in the curriculum. In L.E. Beyer & M.W. Apple (Eds.), *The curriculum: Problems, politics, possibilities*. (pp. 3-16). Albany, NY: State University of New York Press.
- Bilke, T., Xia, J., Bailey, B.D., Rodchua, S. & Sinn, J. (2006). Quality model in web-based distance learning: A case study. *Journal of industrial technology*, 22(4).
- Brookfield, S. (2001). Unmasking power: Foucault and adult learning. *Canadian journal for the study of adult education*, 15(1), 1-23.
- Burgess, L.A. & Strong, S.D. (2003). Trends in online education: Case study at Southwest Missouri State University. *Journal of industrial technology*, 19(3).
- Chang, S.H. (2006). An assessment of the effectiveness of interaction in distance education based on student satisfaction with the learner-centered paradigm. Unpublished doctoral dissertation, Iowa State University. Pro Quest AAT 3217261.

- Chrusciel, D. (2004). Considerations for dealing with significant organizational change. Unpublished doctoral dissertation, Iowa State University. Pro Quest AAT 3145632.
- Chrusciel, D. & Field, D.W. (2003). From critical success factors into criteria for performance excellence – An organizational change strategy. *Journal of industrial technology*, 19(4).
- Cranton, P. (2006). *Understanding and promoting transformative learning: A guide for educators of adults (2<sup>nd</sup> ed.)*. Jossey-Bass: San Francisco, CA.
- Dobrovolny, J. (2006). How adults learn from self-paced, technology-based corporate training: New focus for learners, new focus for designers. *Distance education*, 27(2), 155-170.
- Dollisso, A. & Martin, R.A. (1999). Perceptions regarding adult learners' motivation to participate in educational programs. *Journal of agricultural education*, 40(4), 38-46.
- Eisner, E.W. (2003). Questionable assumptions about schooling. *Phi Delta Kappan*, 86(2), 128-134.
- Freeman, S.A. & Embleton, K.M. (2000). Enhancing a residential safety course with the development of an online component: A limited case study. *Journal of industrial technology*, 16(4).
- Garvin, D.A., Edmondson, A.C., & Gino, F. (2008). Is yours a learning organization? *Harvard business review*, 86(3), 109-116.
- Hurburgh, C.R. & Lawrence, J.D. (2003). The need for quality management systems. *Resource: Engineering and technology for a sustainable world*, 10(9), p. 29.
- Hurburgh, C.R. & Hansen, R.S. (2002). Quality management systems for agriculture: Principles and case studies. Presentation given at the 2002 Integrated Crop Management Conference, Ames, IA, December, 2002.
- Johnstone, J.W. & Rivera, R.J. (1965). *Volunteers for learning*. Aldine Publishing: Chicago, IL.
- Kirkpatrick, D.L. & Kirkpatrick, J.D. (2007). *Implementing the four levels: A practical guide for effective evaluation of training programs*. San Francisco, CA: Berrett-Koehler Publishers, Inc.
- Kleiner, B. Carver, P., Hagedorn, M., & Chapman, C. (2005). Participation in adult education for work-related reasons: 2002-03 (NCES 2006-040). U.S. Department of education, National Center for Education Statistics. Washington, D.C: U.S. Government Printing Office. Downloaded July 6, 2009 from <http://www.nces.ed.gov/pubsearch>.
- Knowles, M. (1980). *The modern practice of adult education: From pedagogy to andragogy*. New York: Cambridge.
- Laux, C.M. (2007). The impacts of a formal quality management system: A case study of implementing ISO 9000 at Farmer's Cooperative Co., Iowa. Doctoral dissertation, Iowa State University. Dissertation Abstracts International B68/07.
- Manning, C.K. & Vickery, C.E. (2000). Disengagement and work constraints are deterrents to participation in continuing professional education among registered dietitians. *Journal of the American dietetic association*, 100(12), 1540-1542.
- Mariani, M. (2001). Distance learning in postsecondary education: Learning whenever, wherever. *Occupational outlook quarterly*, 45(2), 2-10.
- O'Lawrence, H. (2006). The influence of distance learning on adult learners. *Techniques*, 81(5), 47-49.
- Ortega, R.R., Tormoehlen, R.L., Field, W.E., Balschweid, M. & Machtmes, K.L. (2003). Determining critical subject matter content for a safety certification program for youth employed in agricultural production. *Journal of agricultural education*, 44(4), 67-79.
- Palloff, R.M. & Pratt, K. (2009). *Assessing the online learner*. San Francisco, CA: John Wiley & Sons, Inc.
- Patel, L. (2010). 2010 State of the industry: Continued dedication to workplace learning. *T+D*, 64(11), 48-53.
- Plihal, J., Laird, M. & Rehm, M. (1999). The meaning of curriculum: Alternative perspectives. In J. Johnson and C.G. Fedje (Eds), *Family and consumer sciences teacher education: Yearbook 19. Family and consumer sciences curriculum: Toward a critical science approach* (pp 2-22). Peoria, IL: Glencoe/McGraw-Hill.
- Posner, G.J. (1988). Models of curriculum planning. In L.E. Beyer and M.W. Apple, (Eds.), *The curriculum: Problems, politics, and possibilities* (79-97). Albany, NY: State University of New York Press.
- Posner G.J. & Rudnitsky, A.N. (1997). *Course design: A guide to curriculum development for teachers* (5<sup>th</sup> Ed.). New York, NY: Longman.
- Reid, W.A. (1992). *The pursuit of curriculum: Schooling and the public interest*. Norwood, NJ: Ablex.
- Schon, D. (1996). From technical rationality to reflection-in-action. In R. Edwards, A. Hanson & P. Raggatt (Eds.), *Boundaries of adult learning* (pp. 8-31). New York, NY: Routledge.
- Smallwood, J.E. & Zargari, A. (2000). The development and delivery of a distance learning (DL) course in industrial technology. *Journal of industrial technology*, 16(3).
- Tyler, R.W. (1949). *Basic principles of curriculum and instruction*. University of Chicago Press: Chicago, IL.
- Voigt, J. (2005). Maintaining quality and purity in commercial elevators and equipment. Proceedings of the Grain Elevator and Processing Society (GEAPS). Downloaded on February 23, 2009 from <http://www.geaps.com/proceedings/2005/voigt.cfm>.
- United States Department of Education. (2008). Recent participation in formal learning among working-age adults with different levels of education. Issue brief NCES 2008-041, National Center for Educational Statistics: Jessup, MD. Downloaded on March 31, 2011 from: <http://nces.ed.gov/pubs2008/2008041.pdf>.
- Watwood, B. Nugent, J. & Deihl, W. (2009). *Building from content to community: (Re) Thinking the transition to online teaching and learning*. (White paper). Richmond, Virginia: Virginia Commonwealth University, Center for Teaching Excellence. Downloaded May 5, 2010 from [www.vcu.edu/cte](http://www.vcu.edu/cte).
- Wiggins, G. & McTighe, J. (2005). *Understanding by design (2<sup>nd</sup> Ed.)*. Association for supervision and curriculum development, Merrill/Prentice Hall: Alexandria, VA.



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