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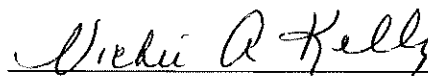
CREATING EFFECTIVE ONLINE LEARNING IN AN EVOLVING HEALTHCARE
PROFESSION

A Project
Presented for the
Master of Health Science Degree
Washburn University

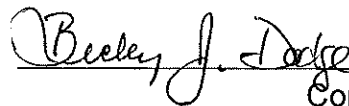
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Abstract

In order to meet the demands of society, higher education institutions are offering more opportunities for online education. Although distance education courses are not as common in healthcare fields, research has proven that the use of online instruction techniques can improve student learning, even for clinical based concepts. In order to provide the student with the best educational experience, many aspects must be taken into account when creating an online course. Some aspects for the instructor to consider include the course design, the method of content delivery and assessment as well as the appropriate selection of various technological tools to incorporate within the course in order to promote student engagement. This article presents an overview of theories and applications of online learning and describes the implementation of proven techniques in order to create an effective online course for a distance education based allied health program.

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Healthcare professionals are continually expanding their skill set due to the invention of advanced treatment techniques and technologies. In order for healthcare programs to properly prepare students for the evolving health profession, programs must continually review and revise course content to better align with the demands of the profession. With the increased use of online delivery methods in higher education, healthcare programs are beginning to recognize the advantages of offering online course content. Although developing course content can be a challenge in any setting, it can be particularly difficult for online courses and pose even more challenges for online courses within healthcare programs. Careful consideration must be taken into account in order to design an online healthcare course that follows recommended online learning theories while maintaining the integrity of the profession.

Purpose

Recent updates in radiation therapy program curricula implemented by the American Society of Radiologic Technologists (ASRT) society, expected radiation therapy clinical requirement revisions proposed by the American Registry of Radiologic Technologists (ARRT), and an increasing need to guarantee a culture of safety in radiation therapy departments has led to the need to better educate and train students in quality assurance within radiation therapy departments. In order to meet the demands of the profession, radiation therapy programs must focus more on quality assurance and management knowledge and skills in both didactic and clinical education courses. For a distance education program, careful consideration of the curriculum design and assessment must also be taken into account in order to ensure effective online instruction and achievement of learning.

Significance of the Project

The radiation therapy program staff at Washburn University, along with members of the advisory board, made the decision to restructure a three credit hour course in order to emphasize the role of quality management (QM) and quality assurance (QA) concepts in healthcare, and more specifically, within radiation therapy departments. The intent of the course redesign is not only to better align with recommended program curriculum and clinical expectations, but also to better prepare radiation therapy students for their future as professionals in an evolving healthcare career. The course development will consist building synchronous course presentations, determining and constructing appropriate assessment opportunities, providing course materials to enhance student learning in an online environment, and creating an online design that is easy to follow and demonstrates integrity of program. Review of online learning concepts, particularly in the healthcare setting, and methods of curriculum design, learning theories, and the selection of appropriate assessment techniques will help provide a strong foundation on how to successfully construct the course for the online based radiation therapy program.

Project Objectives

- Analyze recent curriculum changes and proposed clinical revisions for radiation therapy programs.
- Assess the needs of the profession to ensure a culture of safety in radiation therapy departments.
- Implement necessary changes of course curriculum to meet the needs of the profession and better align course curriculum updates.
- Review methods and concepts related to online learning and online learning in healthcare programs.

- Determine appropriate methods of online instruction and assessment.
- Create an online course environment to enhance student engagement and learning.
- Apply concepts of online learning to develop an effective online course.

Background of the Activity

Radiation therapy involves the planning and delivery of high doses of radiation to targeted areas of the body in order to treat cancer patients. Since such high doses of radiation are administered on a regular basis, the radiation therapy team must follow strict guidelines and procedures in order to safely and effectively treat cancer. If a mistake occurs it can ultimately lead to the mistreatment of a patient. In recent years there have been several events in radiation therapy that have resulted in a culture of safety movement in both radiation therapy departments and programs. In 2010 the *New York Times* published an article that reported several mistreatment incidences that occurred in various radiation therapy departments in New York, which unfortunately led to the death of the affected patients. The cases in New York resulted in a further investigation in which several hundred cases came to light across the country in which treatment mistakes occurred due to various equipment malfunctions (Bogdanich, 2010). Each of these cases could have been prevented with proper quality assurance measures.

The field of radiation therapy has also made tremendous technological advancements throughout the past several decades, giving rise to the need for more detailed quality assurance testing on radiation therapy systems and equipment. Technological advancements within the field have enabled a more precise delivery of radiation while limiting the exposure to normal structures as well as the ability to have

improved imaging techniques to better target areas of interest for treatment. However, more integration of complex systems increases the amount of daily, monthly and yearly testing which must be done in order to ensure the systems and equipment are accurate and functioning properly. Qualified staff should be properly trained on the increased quality assurance procedures and each department should participate in a quality management program.

As a result of the unfortunate incidences of 2010, along with the increased technological advances within the field, national organizations have taken measures in order to create an improved culture of safety in radiation therapy departments. In 2010 the American Society for Radiation Oncology (ASTRO) launched the Target Safely campaign, composed of several key elements to protect patient safety. The Target Safely campaign focuses on better integration of radiation oncology systems, the development of a national error reporting system, reinforcing accreditation standards within radiation oncology departments, and improving education for both radiation therapy professionals and patients. ASTRO's board of directors approved a proposal for a national reporting system, known as the Radiation Oncology Incident Learning System (RO-ILS), in June of 2011. The system is designed to create national awareness and promote sharing of reported incidents with the intent to use the collected information as an educational tool to facilitate higher quality patient care. The learning system should enable the reporting and tracking of incidences without the fear of repercussion. The Integrating Healthcare Enterprise-Radiation Oncology (IHE-RO) was established in 2004 and has since become a part of the Target Safely initiative in order

to increase system interoperability and functionality between Radiation Oncology departments and personnel (American Society for Radiation Oncology, 2015).

In 2012, ASTRO also sponsored a publication titled "Safety is No Accident: A Framework for Quality Radiation Oncology and Care". This publication was compiled by a network of professionals within the Radiation Oncology field and focused on creating a culture of safety by outlining important aspects related to patient care, roles and qualifications of members of the radiation oncology team, as well as providing an overview of quality assurance guidelines (American Society for Radiation Oncology, 2012). The contents of the publication provided a resource for educating radiation therapy professionals on a variety of components related to quality care, patient safety and even quality assurance testing requirements.

In addition, recent changes and prospective revisions have been made to radiation therapy program curriculum and clinical requirements. The ASRT published updated curriculum guidelines in 2014 that included a more comprehensive Quality Management category. The revised guidelines incorporated more concepts related to the technological advancements in the field including more advanced imaging and simulation techniques. Recently, in 2015, the ARRT proposed revised clinical requirements that include the addition of quality assurance competencies for students as well as the addition of more testing on Quality Control procedures on the national board exam. Following the recent changes, the new edition of one of the benchmark textbooks commonly used in radiation therapy programs added material on both a culture of safety in radiation therapy departments as well as strengthening material

within the quality assurance chapter of the fourth edition of Principles and Practice textbook (Leaver & Washington, 2015).

Considering the demands of the profession and the need to continually align with recommended curriculum and clinical guidelines, the radiation therapy program at Washburn University made the decision to redesign a course to focus more on quality assurance measures. Since the program consists of a distance education platform, the course design must also take into account online learning theories and models in order to create an effective online course. This process will involve the review of educational and assessment theories as well as best practices for applying relevant models within an online environment in order to enhance student engagement and knowledge.

Literature Review

Online Learning

In recent years, there has been an increased need to improve accessibility of college courses to students unable to attend traditional on-campus instruction. In order to meet this need, distance education has become a growing trend amongst higher-education institutions and has been influenced by social, economic and technological advancements (Courtney & Wilhoite-Mathews, 2015). Every year the Sloan Consortium sponsors a survey in regards to the status of online learning in higher education, which includes responses from 2,800 colleges and universities within the United States. Within the survey, an online course is commonly defined as a course in which eighty percent or more is delivered in an online fashion and no face-to-face interaction is required. According to the 2014 Sloan Consortium survey, the number of students taking at least one online course doubled in a six-year span with an increase

from 3.5 million students in the fall of 2006 to 7.1 million students in the fall of 2012. The percentage of online enrollment also rose to nearly thirty-three percent of the total enrollment for the reported higher education institutions (Allen & Seamen, 2014). Considering the increasing demand for online education, educational organizations must continue to increase online availability in order to meet the needs of society.

Online education can be offered through a variety of formats and setup as either the primary course delivery method or used to provide supplemental material for traditional courses. When an online course is used in conjunction with a face-to-face course it is known as a hybrid or flipped course. This structure allows faculty to upload additional resources for students to access in order to enhance comprehension of knowledge either before or after in-person instruction is delivered. When an online structure is used as the primary course delivery, it can also be offered using either an asynchronous or synchronous approach. With asynchronous design students are able to access all lectures and material online at their convenience; however, a synchronous setup allows an opportunity for the instructor to schedule live sessions with students through the use of various video conferencing systems. The implementation of synchronous meetings allows instructors to present relevant material and with the advantage that students can ask questions and receive immediate response. Synchronous technology also allows for the session to be recorded, which is beneficial for students to be able to access the recording at a later time to help reinforce concepts (Courtney & Wilhoute-Mathews, 2015). Although both hybrid and fully online courses are becoming more popular, fully online courses have improved educational opportunities for students across a larger area.

In addition to online education increasing accessibility, there are several advantages to offering online courses for both faculty and students. The online setup allows for easy course access that enables faculty the ability to deliver course work from any location. The freedom to login from any location at any time also improves student convenience to explore course material and participate in learning activities at times that best fits the student's schedule. The internet based format also provides instructors with the opportunity to add supplementary resources including additional research information, educational videos, related articles and even links to external sites or sources. The more supplemental material that is added to the course, the more opportunity is provided to students to be able to engage in meaningful learning. In addition, the online setup also offers students the ability to easily navigate to the external sources and eliminates the need for students to have to download or search for the extra content on their own. When discussion boards are utilized, instructors have the capability to include guests or professionals to the discussion creating a networking opportunity between the students and the experts (Britt, 2006). Students have the benefit not only to discuss pertinent topics with imbedded professionals, but also with other students enrolled in the class. This type of structure encourages both student-to-student and student-to-instructor interactions and conversations, which is an important component in any educational experience. Researchers have also reported several benefits to online testing, including the use of immediate access to results and grades, cultivating a student-centered environment, and the ability to more accurately measure student learning (Gaytan & McEwen, 2007).

Although technology has allowed for improved methods of online instruction, the implementation of such evolving educational tools can also lead to obstacles for both faculty and students. One major concern for online teachers consists of the amount of time required to build the course. One of the first tasks of online course development involves determining the appropriate method of instruction and assessment. After the instructional method and assessment decisions have been made the instructor must then select the best software to use and determine how to use it effectively to build the desired content. When designing the course the instructor should remain focused on the purposefully selected objectives, so that the chosen instructional method will work to enhance the desired learning outcomes. Technology can easily become overwhelming, so it is important to consider all aspects of its implementation when deciding on the educational tool to use. Students also struggle with the required technologies and may also encounter issues with a poor Internet connection when accessing the course or using the educational tools imbedded within the course (Britt, 2006). To help reduce the chance of technical errors, it is important to provide students with detailed information in regards to computer and software requirements so that the various educational tools will work properly on personal computers. In addition, adequate technical support should be provided to both educators and students in order to work through technical issues in a timely manner and avoid major interruptions in student learning.

In addition to learning the technological tools, educators must also become experts on the learning management system that will be utilized for the course platform. Learning management systems (LMSs) consists of specialized software used to design and deliver course content. The LMS infrastructure can be customized and

implemented for face-to-face, hybrid and fully online courses based upon the needs of the course. By using the LMS, educators have the ability to create an interactive course environment through the use of presentations, discussion forums, surveys, testing and providing feedback on student work (Kowalczyk, 2014). Students are able to access course information and material through the LMS as well as complete and submit assigned assessment activities. Learning management systems can be complex and can effectively create a collaborative learning atmosphere when used to the fullest extent.

With the expanded use of robust learning management systems and continuous advancements in online technological tools, educators should also receive proper training on the systems in order to help safeguard success in online learning. If faculty members are properly trained on the software that has been selected for integration in the course, they can in turn help guide students through the systems and reduce the chance of technical issues throughout the course. In fact, many times the instructor is responsible for training students on how to use the various tools used within the course, so if there is a lack of knowledge on the educator side many challenges could arise that might in turn interfere with student learning. Faculty and adjunct training can occur in many formats, depending on the level of training needed. Particularly when implementing a new learning management system, traditional face-to-face training sessions should be made available for all faculty members. In addition, offering roundtable sessions focused on specific systems or tools can also be used so that instructors may pose questions and receive suggestions on solutions from coworkers. The ability to offer one-on-one tutoring sessions can also help improve the probability of

creating well-designed courses. Although initial training is important, support should not stop there, as teachers will need continued guidance throughout the academic year. The opportunity to conduct voluntary and confidential course audits and evaluations should also be made available in order to address areas of weakness in course design and continue to improve course quality (Mbizo, Stewart, Sutton, & White, 2010).

Other barriers related to student success in online courses may include the lack of student responsibility, student interaction, instructor contact and communication. Although these are all obstacles that commonly restrict student learning, there are various methods that can be used in order to overcome these concerns (Kowalczyk, 2014). As with any classroom setting, it is essential that the online instructor set expectations and policies for students to uphold. Faculty should be specific in regards to how often students should access the course, the best form of instructor-student communication, how quickly students should expect to receive responses, clear guidance on discussion forums and accessing course resources, and also provide clear deadlines for assessment activities. Simply outlining the expectations and policies within the course syllabus can help reduce student confusion and hopefully increase the chance of student success in the course.

Student engagement in the course can be a challenge in any educational setting; however, online courses can be particularly challenging since there is no face-to-face student interaction. Although technologies provide the method of interaction, the course itself must be designed in a way that promotes student collaboration and active engagement. One theory that is often related to online learning consists of the Community of Inquiry (CoI) model. The basic CoI model theorizes that in order for

learning to occur, there should be a combination of teaching, social and cognitive presences within the course as demonstrated in Figure 1. The teaching presence entails that the instructor is directly involved within the course or promotes facilitation amongst students on shared ideas or topics. When students are able to interact with course content it is commonly referred to as having a social presence and when a topic is explored or resolved a cognitive presence has been achieved. The incorporation of this model in online education it helps to encourage both student-to-instructor and student-to-student collaboration as well as the reflection and comprehension of course content and development of problem-solving skills (Learning theories and student engagement, 2014). An example of the Col model application is the use of a facilitated online discussion forum in which students must interact and reply to other students with the instruction to reflect and summarize on the given topic. Using the model as a guide, there are many ways to incorporate student involvement and create a sense of community.

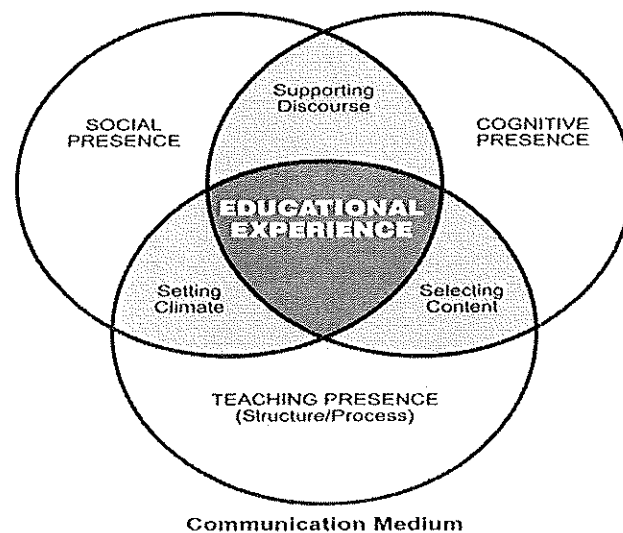


Figure 1. Community of Inquiry (CoI) Model. Demonstrates the need for a teaching, social and cognitive presence to create an educational experience. (Learning theories and student engagement, 16)

With the increased growth and availability of online courses, the quality and integrity of online courses is often in question. Faculty should be held accountable for the quality of a course developed online and one approach to help ensure high-quality courses would be through an assessment program involving self-assessment as well as course review from peers and students. Proper training also comes in to play when developing quality courses and should be made readily available to all online instructors. In addition to offering training, guidelines should be set for developing courses (Mbizo et al., 2010). If faculty were required to build courses based on formalized objectives there would be more standardization of quality amongst online courses. Authenticity of student work can also be a concern for fully online classes; however, there are several methods of ensuring student integrity. The use of a Learning Management System allows for students to have individual logins in which they must create passwords to access the course and therefore assessments. The LMS login is also tied to a school account and photo identification of the student. In addition to the password-protected account, faculty members also have the option to incorporate methods such as lockdown browsers, timed testing as well as exam proctoring (Britt, 2006). Although not guaranteed to eliminate cheating in an online or face-to-face course, these systems work to deter student cheating and protect the integrity of the learning process. The use of continuous course evaluation and implementation of appropriate security measures can help to maintain the integrity and quality of the online course.

Online Curriculum Design and Assessment.

As with a traditional in-person course, the first part to designing curriculum consists of defining the course objectives in accordance with Bloom's Taxonomy. Course outcomes may be set by the institution or influenced by content standards set by the state or national agencies. The use of the revised edition of Bloom's Cognitive Taxonomy of Educational objectives can help guide instructors in classifying and creating effective course objectives in order to help focus instruction and student learning activities. Once objectives have been outlined, the Bloom's model can also aid faculty in creating assessment opportunities. When selecting the learning activity it is important to select a method that will help students meet the designated outcomes. The type of assessment may be in the form of a test, performance review, essay, discussion, portfolio or other various activities (Gronlund & Waugh, 2013). The method of assessment selected should be based on the level of student learning expected for the given content.

When building lectures and assessments it is also essential to keep in mind that students have different learning styles. The three most common learning styles consist of auditory, visual and kinesthetic styles. The visual learner comprehends material best by watching lectures and seeing and writing information, whereas the auditory learner retains information better through listening or speaking. On the other hand, the kinesthetic learner recalls information better through hands-on experience or by hearing information while doing something active (Indiana University, 2015). Instructors creating an online course have the capability to offer multiple forms of instruction due to

the online infrastructure. Through the use of various forms of technology, teachers can create content that appeals to students visually, aurally and by text. Commonly used methods that have been proven effective in e-learning includes the use of narrated and scripted presentations, interactive presentations, discussion or chat forums, and the incorporation of videos or other outside resources (Kowalczyk, 2014). Since all material can be retrieved via the Internet, students can access content at any time and from any location. Considering that students progress at different rates, students also have flexibility on when they can review the material and how much time they spend learning the content. In recent years, more advanced forms of technological tools have been made available in online education, which has made it possible for educators to be able to design courses in a way that meets the needs of a diverse student population.

Although using technology can enhance student knowledge, it is important to select an appropriate tool to use that will not interfere with the intended outcomes. One method that can be used in evaluating the effectiveness of the technology is the SECTIONS model. The SECTIONS model is a revision of the ACTIONS model developed by A.W. Bates and is intended to act as an aid for educators in making decisions in regards to suitable technological tools to implement within the course curriculum. The model provides questions for educators to ponder on eight different topics, all in relation to challenges applicable to incorporating a new technology. Unlike the ACTIONS model, the SECTIONS model takes into account the type of students that will be taking the course and using the desired tool (Bates & Poole, 2003). Figure 2 outlines the model revised by Bates and Poole (2003). Although it takes time for the

faculty member to fully assess the tool using the given model, it is important for the success of the course and student.

S	Students: what is known about the students—or potential students—and the appropriateness of the technology for this particular group or range of students
E	Ease of use and reliability: how easy is it for both teachers and students to use? How reliable and well tested is the technology?
C	Costs: what is the cost structure of each technology? What is the unit cost per learner?
T	Teaching and learning: what kinds of learning are needed? What instructional approaches will best meet these needs? What are the best technologies for supporting this teaching and learning?
I	Interactivity: what kind of interaction does this technology enable?
O	Organizational issues: What are the organizational requirements and the barriers to be removed before this technology can be used successfully? What changes in organization need to be made?
N	Novelty: how new is this technology?
S	Speed: how quickly can courses be mounted with this technology? How quickly can material be changed?

Figure 2: SECTIONS model by A.W. Bates and Gary Poole

Once the objectives and assessments have been completed, providing feedback is necessary for student growth. Although offering feedback can pose a challenge in online education, it is vital to offer instructor comments and insight on a regular basis. In order for feedback to be most effective for student learning, it should also occur within a timely manner. Faculty can offer their commentaries in written or oral form; however, it is best when it is supported by a rubric (Gaytan & McEwen, 2007). A well-designed rubric provides criteria against which the student will be assessed as well as a performance scale with definitions on what constitutes each specific achievement level (Gronlund & Waugh, 2013). The use of a rubric also helps outline student expectation

and reduces the chance of student confusion on the assignment. The rubric also allows for clearly defined reasoning for scoring so students know exactly how they performed on the given task.

Research has shown that online education can be successful and actually enhance student learning outcomes as long as appropriate training, consideration of student learning styles and appropriate course design and assessment methods are utilized for an online platform. All of these factors take time and resources, so educators should remain open to new teaching and learning styles. In addition, technical support should be provided to educators and students so that the use of advancing technologies to enhance comprehension of concepts does not in turn interfere with student learning. With the demand of distance education on the rise, it is important for faculty and institutions to offer online courses of quality and integrity.

Online Learning for Healthcare Professions

Limited research has been conducted on online learning in healthcare professions, mainly due to the complex nature of programs needing to incorporate clinical education within the curriculum. Even though the use of online education is more challenging in Healthcare programs due to the hands-on aspect of clinical professions, in recent decades many higher education institutions have recognized the need and benefit for creating distance education programs within in the healthcare field. The United States has experienced issues with nursing and allied health professional shortages over the years, particularly in more rural areas. In order to respond to the need for more health care professionals in rural areas, many universities turned to methods of distance learning. In fact, the need was so great at one point that the

United States Department of Labor provided a three million dollar grant to a program within the state of Minnesota in order to create distance education program for nursing. Facilities such as the Mayo Clinic and University of North Dakota School of Medicine also struggled with a lack of laboratory scientists, so in an effort to increase staffing the institutions created online courses for individuals to achieve certification. These programs incorporated a level of hands-on clinical training to meet professional standards (Lippincott, Williams, & Wilkins, 2002).

There has also been an increased use of online learning techniques for educating healthcare professionals due to improved online education outcomes demonstrated in recent literature. In fact some research revealed that the use of electronic learning methods were determined to be equivalent or even superior to that of traditional methods of instruction. Healthcare educators have incorporated the use of online technologies in order to enhance student learning and understanding of concepts, particularly with the use of video. Various studies have shown that the use of clinical demonstration videos can actually improve student and professional performance. The ability to review the videos electronically and at the convenience of the student lead to increased retention of processes. In a study conducted by Cooper and Higgins (2014) it was concluded that the use of online learning techniques can improve traditional instruction and educators should be encouraged to integrate videos to help enhance clinical skills.

In addition, online instruction has become more popular for the use of healthcare continuing professional development (CPD) or continuing professional education (CPE) opportunities. New technologies have increased opportunity to allow for online

continuing education activities, which has allowed for healthcare professionals to share knowledge and information. The ability to collaborate amongst professional peers has been acknowledged as an important aspect in certifying effective learning for healthcare providers (Langlois & Sandars, 2006). The instructional design of the offered CPE activity should also be taken into account in order to ensure usability and promote interactivity amongst participating professionals. Studies have shown that the appropriate use of online learning for continuing education can in fact increase knowledge of the chosen topic. Other advantages of offering online CPEs include the flexibility and accessibility offered to busy professionals as well as the capability to select relevant topics to their profession (Pullen, 2006). Considering the success of online continuing education thus far, the use of online education for healthcare will continue to offer improved methods of engaging in learning activities and networking with other healthcare professionals.

Online Learning in Radiologic Science Programs

Online education has not been widely embraced in Radiologic Science programs, so limited information is known about the current trends and outcomes of online learning in radiation sciences. However due to the proven effectiveness of online education, programs are realizing the benefit of incorporating more methods of online instruction. In fact within a three-year span from 2009 to 2012, there was a 30% increase in the use of online courses as reported by participating radiologic science educators. The Joint Review Committee of Education in Radiologic Technology conducted the survey, which included 729 accredited radiologic science programs. The survey results reflected an increase in implementing hybrid courses as well as some fully online courses (Copley &

Kowalczyk, 2013). Kowalczyk (2014) conducted an additional study amongst a random stratified sample of 373 radiologic science educators in which 102 responses were received. Of these responses, 36.4% of the educators offered fully online courses and a majority programs offered hybrid courses (Kowalczyk, 2014).

In general, radiologic science faculty have been slow to adapt to online education, partially due to the need for necessary training required for educators to successfully design courses using appropriate pedagogical methods. In order for online courses to be effective, they must create a student-centered learning environment in which collaborative learning can occur. Educators should also recognize the necessity to use different pedagogical strategies in order to meet the needs of students with differing learning styles. A well-designed course also fosters student-to-student and student-to-instructor relationships (Kowalczyk, 2014). In radiologic science programs it is also important to include activities that would encourage student-to-clinical applications. The complexity of online course design can create barriers for radiologic science educators; however, studies have proven that incorporating electronic learning activities can improve student retention of knowledge and application of concepts to real-world settings. So for educators to design successful online courses, it is important for them to remain open to learning new teaching styles and technological tools in order to better meet the needs of the students (Kowalczyk, 2014).

The study performed by Copley and Kowalczyk (2013) that surveyed radiologic science educators, concluded that the most frequently used technology in online courses consists of discussion board forums. In addition, educators also used various forms of asynchronous and synchronous technologies for the delivery of course content.

The most common tool used for content delivery was Microsoft PowerPoint, followed by other programs such as Prezi, Soft Chalk and Elluminate. Although the use of PowerPoint is effective for presenting relevant material, it alone does not promote student-interactive learning. In order to support collaborative learning in an online environment, a variety of instructional strategies should be used that foster visual, aural and text learning initiatives. By incorporating a variety of instructional tools and techniques, educators can promote successful student interaction, collaboration and reflection (Copley & Kowalczyk, 2013). The use of a learning management system also provides a platform in which the selected educational tools and activities can be displayed and accessed for student use. The LMS can also help with the layout of course design as well as add security and integrity to the course and work of the student (Britt, 2006). Overall, the use of online education in radiologic science programs can be successful as long as appropriate methods of content delivery, interactive learning activities and integration of secure assessment methods are utilized.

Implementation Plan/Methodology

The radiation therapy course design focuses on quality assurance concepts in order to help meet the increased expectations of the radiation therapist profession. It is a sixteen-week online course consisting of five modules that containing module-level objectives that align with recommended curriculum guidelines set forth by the ASRT, and will cover quality assurance topics related to radiation oncology. In order to best serve the interest of the learner, the online course incorporates asynchronous and synchronous content delivery methods as well as several different forms of assessment opportunities. The assessment selection takes into account the intended learning

outcomes as well as student learning styles and the desired level of student comprehension and knowledge. Researchers who have reviewed methods of online instruction in healthcare settings have discussed the challenges of online learning for healthcare professionals due to the need for hands-on clinical experience (Lippincott et al., 2002). Considering this and the fact that much of the content has a strong hands-on influence, the course offers many opportunities for students to engage in both didactic and clinical learning activities. The Community of Inquiry (CoI) model (Learning theories and student engagement, 2014) and SECTIONS model (Bates & Poole, 2003) was also taken into account in the development of course content in order to optimize student learning.

Throughout the sixteen-week course, approximately twelve synchronous sessions are scheduled through the use of an online chat room. The use of the online classroom allows both the instructor and students to login at the same time and have live student-to-instructor and student-to-student communication, which are important aspects in creating an educational experience according to the Community of Inquiry model (Learning theories and student engagement, 2014). The selected format lets the instructor offer verbal presentations on course content to those in attendance. Students also have the opportunity to ask questions and receive immediate feedback, which is beneficial for student learning. Another advantage includes the ability to record the lecture and make the recording available to students to reference at their convenience (Courtney & Wilhoute-Mathews, 2015). In addition to receiving immediate responses, the selected format also allows for student-interactivity by creating poll questions to help engage students and assess student knowledge, by breaking the students into groups

to discuss content and then respond to the class, as well as the ability to have students present or add to the content much like in a traditional classroom setting. For the purpose of this course, students will have regular engagement by incorporating these aspects into the lecture. Appendix A demonstrates the use of the online classroom to deliver synchronous course content while engaging student learning with the implementation of poll questions. Using the poll question model, the instructor can also view student responses to help assess student knowledge and optimize student comprehension of important concepts. The course also includes one asynchronous session in the form of a narrated lecture, which is shown in Appendix B. The asynchronous presentation emphasizes student interaction and learning by using the technology to incorporate review questions throughout the presentation. In an effort to accommodate various learning styles, the narrated script is provided to students so that they may follow along with each slide. Students are also required to complete the narrated lecture prior to scheduling the correlating clinical activity in order to help enhance student understanding of the procedures reviewed in the lecture.

All of the course content is uploaded and made available to students through the use of an online learning management system (LMS). The course design is organized into modules and each module contains sub-modules comprised of relevant content such as lecture materials, assessment activities and drop boxes, and study aids or additional resources. The designated layout is used to allow for easy student access to necessary material and is displayed in Appendix C. Each module is outlined on the left and provides the dates in which the content will be covered. The use of the START HERE folder is created to guide students to important course content at the beginning of

the course start date. Material posted within the folder includes pertinent information such as the course syllabus as well as instructions and how to guides for any technologies used in the course. Each student also has an individual login and password to be able to enter the online course through the LMS, which provides a sense of security and integrity to student work (Britt, 2006). A robust LMS also allows the instructor to monitor student progress through the course material. Outside of lecture and assessment material, additional resources are imbedded within the course to help enhance student-learning opportunities. According to the literature, the use of additional material to enrich the course can improve student engagement and knowledge of course content (Gaytan & McEwen, 2007). For this course all assessments are completed or submitted within the LMS under the students designated login. In addition, resources and review activities are added to each module to help foster an interactive learning environment.

Each course module contains an assessment activity, including written essays, clinical reflections, discussion boards, group activities, and a more comprehensive student project. The type of activity developed for the module is based on the desired level of learning necessary for the module content. For the purpose of this course, the use of a group activity will help assess a base level of student knowledge while also encouraging student-to-student interactions. The activity was selected based on the research completed by Kowalczyk (2014), which concluded the importance of offering student-to-student interactions in order to enhance student learning. When a more detailed comprehension of material is needed for the course, a discussion board forum is setup to help students analyze pertinent information and an essay is utilized in order

for students to explain the knowledge gained from the module content. Since several of the lessons require components of clinical application, students will complete required clinical activities and reflections. With the evolving field of radiation therapy treatment delivery and equipment, it is important for students to display an understanding of the required quality assurance procedures and concepts. Considering this, students are required to complete a project that involves clinical participation of quality assurance tests and creating a presentation or handout with an overview of the designated procedures. For the project, students are provided with a choice of format for submitting the assignment in an effort to consider student-learning styles. Overall, the course incorporates several different methods of assessing the students' knowledge of the given content. Use of diverse assessments is supported by studies which claim that a variety of interactive activities and assessments within an online course helps to create a student-centered environment, which is valuable in student learning (Copley & Kowalczyk, 2013).

For any assessment completed by the student, a customized rubric is utilized to grade the submission. All course rubrics contain the performance scale as well as an outline of specific criteria required for students to achieve each level of performance for each category being graded. The design of the rubrics is in accordance with the suggestions provided by Gronlund and Waugh (2013) in creating a well-designed rubric. Detailed rubrics help to eliminate student confusion on assessment expectations as well as create a standardized grading format for the instructor to follow. The online rubric also allows for immediate student feedback, which is important for student growth and improvement as suggested by Gaytan and McEwen (2007). Each rubric is provided

within the learning management system and is accessible to students at all times. An example of a custom rubric is provided in Appendix D. The rubric outlines specific criteria used to grade the Quality Management Paper assigned in Module 1 of the course and is provided to students along with the assessment instructions with the intent to provide clear instruction and reduce student confusion.

The course contains a total of three exams, which are scheduled throughout the semester. Two of the exams cover content over specific modules and the third exam consists of a comprehensive final. All of the exams are offered online through the learning management system, which also enables the use of security measures such as student logins, timed exams and proctoring methods (Britt, 2006). The Radiation Therapy program at Washburn University takes several precautions when administering exams in order to defer cheating. Each exam is proctored and accessed through a lockdown browser and is timed to allow students one minute per question. In addition, students are provided with strict guidelines to follow that require the use of a camera to record the exam. Prior to starting the exam students must also show a full view of the testing environment. The proctoring system provides both a video and timeframe of the recorded exam for instructor review. Through the use of proctoring, academic integrity can be maintained within an online course.

Once all of the content is built for the course, the material is uploaded within the online learning management system platform. When creating an online course it is important to consider a clear layout and design for the course in order to reduce student confusion when accessing material. The quality assurance course is divided into modules and is clearly labeled and placed into chronological order. Since various forms

of technology are used for lectures, exams and study aids, it is also important to provide proper training to the faculty and students so that the use of the technology does not interfere with student learning outcomes (Mbizo et al., 2010). Washburn University offers online education support for both faculty and students. Additionally, program faculty provide students with face-to-face training at the beginning of the academic year and also upload technical guides into the learning management system on the various forms of technology used within the courses. For this course, a member of the university instructional design staff has also reviewed the layout of the course and provided feedback and suggestions for improvement. The course syllabus also provides students with contact information for technical support as well as detailed information on instructor expectations in order for the student to succeed. All of these methodologies are utilized in order to help limit challenges related to online education.

Outcomes/Summary of the Project

The knowledge gained from completed research on online education and online education in relation to healthcare and radiologic science fields helped to create an online course for the Radiation Therapy program at Washburn University. Due to recent advancements in the field and profession, the course design better prepares students for the radiation therapy profession. All course lectures and assessments are built according to outlined objectives, in recommendation of national professional standards, and are designed with consideration to the various learning theories discussed in the literature. The intent of the course design is to create a student-centered environment in order to enhance student learning while minimizing faculty and student challenges related to online education and the use of technologies. Although online course

construction proves tedious and time consuming, particularly when implementing new technologies, the ability to create an online course that can improve student comprehension of concepts is a worthwhile task.

Course assessment occurs on a regular basis through the use of student course evaluations. Student evaluations provide feedback on the layout of course design, use of technologies, relevancy of the course and overall performance of the instructor and course content. Suggestions and feedback provided by students are taken into consideration each year in effort to continuously improve course outcomes. Course outcomes are also assessed by annual results of student performance scores on the quality assurance component of the national registry exam. In addition, the program evaluates yearly student and employee surveys, which address program effectiveness and student knowledge and preparedness for working in the field as a radiation therapist and meeting the expectations of the profession.

Conclusion

It has been demonstrated through research that online education is effective for student learning; however, limited information is available for the implementation of online courses in health care related programs. Studies that have been done conclude that the use of online learning resources can improve student knowledge as well as enhance clinical performance skills. In any circumstance, building on online course poses many challenges, so faculty must remain open to learning new techniques and be willing to endure the time commitment involved in training and developing appropriate student assessments for an online format. In addition, faculty members that teach in healthcare programs must take into consideration both didactic and clinical

learning objectives in order to construct a high quality course that best serves the student and the profession. By applying online learning and course design concepts as well as taking advantage of available technologies, it is feasible for faculty of online healthcare programs to create courses that ensure the comprehension of student knowledge as well as meet the needs of professional requirements.

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Appendix A

Synchronous Content Delivery

The screenshot shows a Zoom meeting interface. The main window displays a slide titled "Poll Question" with the following text:

■ What members of the Radiation Oncology team play a role as a part of the Quality Improvement team? Select all that apply.

- A. Radiation Physicist
- B. Medical Director
- C. Receptionist
- D. Radiation Therapist
- E. Medical Billing

A poll results window is overlaid on the slide, titled "refer to slide". It shows the following data:

Option	Progress	Percentage	Count
A	<input type="checkbox"/>	0%	0/1
B	<input type="checkbox"/>	0%	0/1
C	<input type="checkbox"/>	0%	0/1
D	<input type="checkbox"/>	0%	0/1
E	<input type="checkbox"/>	0%	0/1

At the bottom of the poll results window, there is a checkbox for "Broadcast Results" which is currently unchecked.

The Zoom interface also shows a top menu bar with "Meeting", "Layouts", "Pods", and "Audio". The right sidebar contains "Attendees (1)", "Share", "Discussion", and "Chat (Everyone)".

Appendix B


Asynchronous Content Delivery

Monthly QA Presentation with Quizzing

Monthly Quality Assurance

Gantry Angle Indicator

- Test completed at 0, 90, 270, 180 degrees
- Tolerance: 1 degree
- Influencing factors:
 - General mechanical or electrical failure
 - Gantry sag/flex due to weight of gantry and its pressure over time or issues with the counter balance.



Monthly QA Presentation with Quizzing

Appendix C

Online Course Design

Search Topics 🔍
Start HERE ▾
Print ⚙ Settings

- Overview
- Bookmarks
- Course Schedule
- Table of Contents
- Start HERE** 9
- Course Information 1
- Respondus Lockdown Browser Resources 4
- Adobe Connect Software for Live Meetings 4
- Mod. 1: Quality Management (1.18-2.7)
- Mod. 2: Operational Issues (2.15-2.27)
- Exam One 1
- Mod.3: QA for CT, Tx Planning, Reauthorization

Add dates and restrictions... ✓ Published ▾

This module contains many important resources for the class. Please review and make note of their location so that you can find them whenever needed.

The Syllabus is very important, it is my contract with you regarding the course. You must read it to be able to succeed. Student's are responsible for knowing the contents of the syllabus and adhering to all requirements and deadlines.

Add Existing Activities ▾
 Bulk Edit
Expand All | Collapse All

Course Information

Add Existing Activities ▾
 Course Syllabus ▾ ✓

Respondus Lockdown Browser Resources

Add Existing Activities ▾
 Technology To-Do List ▾ ✓

Appendix D

Assessment Rubric

Grading Rubric—QM Paper

Category	Exceeds Expectations ('A' Level Work)	Meets Expectations ('B' Level Work)	Approaching Expectations ('C' Level Work)	Unsatisfactory (Resubmit)
Spelling, Punctuation and Grammar (5 pt max)	No errors in spelling, punctuation and/or grammar are present.	Only 1 error in spelling, punctuation and/or grammar are present.	Two or three errors in spelling, punctuation, and/or grammar are present.	Four or more errors in spelling, punctuation and grammar are present.
Components/Requirements (10 pt max)	All topics are included in the paper. Paper is double-spaced, 12 point standard font, and meets the required 2-3 page length.	All topics are included in the paper. Paper is double-spaced, 12 point standard font, and meets the required 2-3 page length.	1 Topic is missing from the paper and/or the paper barely meets the 2 page minimum length. Paper is double-spaced, 12 point standard font.	More than 1 topic is missing from the paper and/or the paper is clearly less than 2 pages in length or does not follow required format.
Depth of Content (30 pt max)	Covers topics in-depth with details and examples. Subject knowledge is excellent.	Includes essential knowledge about the topic. Subject knowledge is sufficient.	Includes basic information about the topics. Subject knowledge is limited.	Includes minimal information about the topics. Subject knowledge is insufficient.
Components of QM Program (30 pt max)	The importance and purpose of quality management in radiation therapy, the team members involved in the process and the role QM has on treatment delivery is discussed in great detail with excellent examples and explanations.	The importance and purpose of quality management in radiation therapy, the team members involved in the process and the role QM has on treatment delivery is discussed in sufficient detail with good examples and explanations.	The importance and purpose of quality management in radiation therapy, the team members involved in the process and the role QM has on treatment delivery is discussed in a basic manner with limited examples and explanations.	The importance and purpose of quality management in radiation therapy, the team members involved in the process and the role QM has on treatment delivery is not discussed in full and is missing examples and explanations.
Overview of Site QM program (25 pt max)	Detailed overview of the site's QM program is discussed and demonstrates an excellent understanding of the program. Paper includes a minimum of 3 ways/techniques the site implements to ensure safe treatment delivery.	Overview of the site's QM program is discussed and demonstrates sufficient understanding of the program. Paper includes 2-3 ways/techniques the site implements to ensure safe treatment delivery.	Overview of the site's QM program is discussed in a basic manner and demonstrates a general understanding of the program. Paper includes 1-2 ways/techniques the site implements to ensure safe treatment delivery.	Overview of the site's QM program is discussed in a very limited manner and demonstrates a lack of understanding of the program. Paper lacks discussion on techniques implemented at the site to ensure safe treatment delivery.

Grading scale: A (93-100), B (85-92), C (75-84), Unsatisfactory (0)