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Innovation in Radiography Education: The College of Health Care Professions

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INNOVATION IN RADIOGRAPHY EDUCATION: THE COLLEGE OF HEALTH CARE PROFESSIONS

Susan Sportsman, PhD, RN, ANEF, FAAN
Director, Consultation and Services
Elsevier Education

In the 2014-24 Employment Projection Summary, the U.S. Bureau of Labor Statistics predicts that health care support occupations and health care practitioners / technical occupations are projected to be the two fastest growing occupational groups in the United States, representing a combined increase of 2.3 million (about 1- in-4) jobs. (http://www.bls.gov/news.release/ecopro.nro.htm). More specifically related to radiologic technologists (RTs), the Bureau projects that the jobs for RTs in the U.S. will grow 9% from 2014 to 2024, faster than the average of all occupations (http://www.bls.gov/ooh/health/radiologic-technologist/htm#tab-6).

This continued growth in health care employment, including RTs, is driven by the aging of the population, technological advances, and changes in the delivery and reimbursement of health care in the U.S. These factors influence the need for innovative educational approaches to meet the needs of the growing number of patients needing services AND to provide an avenue for professional growth for many providers who wish to expand their scope of practice. The College of Health Care Professions (CHCP) in Texas provides such an innovative approach through an **online completion program for students with a Limited Radiological Certification to complete the additional didactic and clinical courses required to earn an Associate Degree in Radiologic Technology (RT).** This completion program is built to take into account the demands that working adults face, such as being a single parent who cannot be in a ground school throughout the day. It takes the latest in educational technology and online techniques and combines it with live faculty and student support to provide an educational experience that works for students' busy lifestyle while providing superior academic technical experiences.

Practitioners with a Limited Radiography Scope certification typically work in a physician's offices or clinical settings, focusing on radiation protection, image production and evaluation, as well as patient care and podiatric conditions. They also are prepared to perform some of the medical assistant competencies to assist in the office or clinic. Although Limited Scope Technologists are managed at the state level, graduates of a Limited Radiography Scope program take a certification examination that is administered by American Registry of Radiologic Technologies (ARRT). Successful completion of the certification allows them to use the LMRT credential. Individual practitioners are licensed by their state, based upon the benchmark certification pass rate established by state regulation. Preparation as a LMRT may be a final career choice for students or serve as a step toward becoming a Radiologic Technologist (RT). The CHCP Associate in Applied Science, Radiologic Technology completion program allows these practitioners to expand their clinical competence and earn an Associate Degree by becoming full-scope Radiologic Technologists, improving their earning power and professional trajectory.

Innovative Programming

Students in the CHCP Associate in an Applied Science in Radiologic Technology completion program finish the program in 16 months/64 weeks, after which they are eligible to sit for the ARRT Radiologic Technologist Registry in Radiography Examination. This allows the candidates to become full-practice radiographers with beginning level competences that includes fluoroscopy, portable radiologic procedures and competences necessary in trauma and surgery. Practitioners with this credential may be employed in hospitals, urgent care facilities, and private and group physician practices, or as a travel

technologist within the United States, Canada, or Australia. In addition, earning an associate degree allows students to move into baccalaureate programs, including on-line Bachelor of Science in Radiologic Sciences programs and ultimately, to various Master's Programs that may further their career goals. The CHCP program will not only give individual LMRTs the opportunity to enhance their earning power, it will also help to fill the market void for Radiologic Technologists.

Admission Criteria

Students who are graduates of an approved Limited Radiologic Technologist (LMRT) Program may be admitted by two different admissions processes. Students who apply for admission within 6 months of graduation are required to obtain a scored recommendation letter from their respective Program Directors and must be in the process of licensure. Those students have surpassed the 6-month graduation requirement and have a current and valid permanent Texas LMRT License are also eligible for admission.

Student who have extensive clinical experience may have the opportunity to obtain some transfer credit based on prior direct clinical experience in Radiography. They must document verifiable clinical radiography experience equivalent to 1,200 hours at the time of acceptance. The verifiable experience has some stringent guidelines which require verification only by a Board Certified Radiologist or Registered Radiologic Technologist in a supervisory and/or management role.

Applicants are ranked to ensure that students most likely to succeed will be selected for the spaces available in each cohort. One of the innovative strategies to choose candidates most likely to be successful is to require students to take the HESI Mid-Curricular examination prior to admission. This exam, typically given in the mid-point in a traditional Associate Degree Program, covers knowledge and skills in which the LMRT should be competent before moving on to the upper division work. The number of places available for admitted students may vary from cohort to cohort based upon the number of available clinical sites.

CHCP Program

The CHCP completion program is structured into eight, 8-week modules. Each module is composed of two 3.0 semester credit hour on-line courses, manageable for students who are also working and who typically have other obligations. CHCP's transfer policy allows for transfer credit for some general education courses that the student may have already taken. Those students who have completed all of the necessary prerequisites may complete the program in 12 months.

To further support success for the working adult, a Student Service Advisor is assigned to each student. During the first semester, students participate in an intensive orientation regarding time management, study skills and the use of the online learning platform. As the student progresses in the program, the advisor focuses on individual student success. Although the didactic component is online, the CHCP RT Program provides face-to-face review sessions for students and live online classes as well. The goal is to provide the resources needed for success and to make sure students feel well connected throughout their academic journey.

The advisor receives a grade and activity report for each student on an ongoing basis. If the assigned student's performance does not meet expected standards, the advisor reaches out to the student to provide the correct type of assistance. The allocation of resources for the Student Service Advisors demonstrates CHCP's commitment to each student's success and is an example of the combined use of data analysis and a personal touch. CHCP believes that technology can enable a better experience, but human interaction is still critical. Further support for students' success include the CHPC faculty, who are chosen for their expertise in clinical practice and educational principles. The faculty for the core online courses hold a Masters' degree, with additional training in one or more advanced radiologic modalities. All have prior teaching experience, and preparation in teaching online.

The specific course outline for the CHCP Associates in Applied Science, Radiologic Technology is illustrated in Table A below.

Table A: Course of Study

Course			Lecture Clock Hours	Extern Clock Hours	Total Clock Hours	Semester Credit Hours
LMRTTC	LMRT Bridge Credit					23.0
Represents the credits taken during their LMRT program						
MODULE I						
POFT 103	Interpersonal and Communication Skills		48	0	48	3.0
RADR 260	Patient Care and Pharmacology		48	0	48	3.0
MODULE II						
POFM 114	College	Mathematics	48	0	48	3.0
SCIT 103		Anatomy and Physiology	48	0	48	3.0
MODULE III						
PSYT 101	Introduction to Psychology		48	0	48	3.0
RADR 129	Radiographic Imaging and Physics		48	0	0	3.0
MODULE IV						
ENGL 101	English Composition		48	0	48	3.0
RADR 233	Introduction to Surgery/ Trauma/Mobile X-Ray		48	0	48	3.0
MODULE V						
RADR 230	Advanced Positioning and Anatomy		48	0	48	3.0
RADR 250	Advanced Imaging — Fluoroscopy		48	0	48	3.0
MODULE VI						
RADR 217	Radiology Pathology		48	0	48	3.0
RADX 100	Clinical Externship I		0	256	256	5.5
MODULE VII						
RADR 211	Subspecialty Modalities		48	0	48	3.0
RAD X 200	Clinical Externship II		0	256	0	5.5
MODULE VIII						
RADR 117	ARRT Registry Review		48	0	48	3.0
RADX 300	Clinical Externship III		0	256	256	5.0
Total Hours/Credits			**624**	**768**	**1392**	**78.5**

Clinical Practicum

As an online program, students from anywhere in the state may enroll in the program and stay in their home location for Modules 1-5. Modules 6, 7, and 8 include a clinical practicum component. This component requires students to apply knowledge, skills, and attitudes learned in didactic courses into actual clinical experience and complete the required clinical competencies. The clinical practicum must be in clinical sites identified by CHCP. Recognizing that students often must work during their clinical practicum, clinical assignments are scheduled for week-days, allowing students to work during the week-end if necessary. The CHCP clinical sites are located across the state in CHCP campus locations. This allows the students to have additional support by the local campuses. The various locations of the clinical sites allow for some flexibility for students to be assigned to clinical facilities relatively close to home.
Specific locations include:

- **Houston**
- **Austin**
- **Dallas**
- **San Antonio**
- **McAllen**
- **Fort Worth**

To achieve maximum experience during clinical practicum, student rotate through free-standing imaging centers, hospitals, and pain management centers. In each setting, students must demonstrate competencies in all required general diagnostic exams, ER, OR and portable exams, C-arm, and Advanced imaging modalities. CHCP is committed to insuring the integration of knowledge and skills presented in the didactic course into clinical practice. Allocation of significant resources to support students is critical to this integration. For example, like other programs, in each clinical site, a clinical employee serves as a support for the student, guiding their daily activities. However, students also have the support of several CHCP faculty during their clinical experiences. A Clinical Coordinator, who must hold a Baccalaureate degree, is responsible for all student assignments, clinical goals, affiliation agreement, and assists with supervision of clinical instructors for the entire cohort. In addition, several baccalaureate-prepared clinical instructors, also holding a Bachelors' Degree, are assigned to a specific region in the state. This instructor visits all students on a weekly basis within the region, supervising student competence evaluations and monitoring student clinical goals.

Specific Strategies to Support Excellence

The grading system established by the CHCP completion program has been designed to insure that the student's grade in any course reflects their level of competence. As illustrated in Table B below, students must achieve a higher percentage than typical, in order to achieve one of the passing letter grades.

Table B: Grading Scale

Letter Grade	Percentage Range	Description
A	94-100	Outstanding effort and work performance
B	87-93	Extra effort reflecting better than average work
C	80-86	Mastery of subject area with an acceptable work standard
D	73-79	Below average performance/fails to meet minimum standards
F	72 and below	Below average performance/fails to meet minimum standards

The innovative CHCP program not only includes an on-line delivery model for students holding the Limited Medical Radiologic Technologists Certification and state licensure, clinical practicum in locations convenient to the students' home/work, and local faculty to work with the student and preceptor to insure that there is coordination between didactic and clinical experience. It also features "cutting edge" resources from Elsevier Education, including up-to-date texts (ebooks),

such as Handbook of Radiographic Positioning & Related Anatomy, Textbook of Radiographic Anatomy and Workbook of Radiographic Positioning and Related Anatomy. In addition, students have the advantage of an Adaptive Learning product and the HESI standardized testing from Elsevier.

The Radiologic Technologist faculty are required to provide a minimum of two live online lecture classes per term. Content for each live lecture is based on specific content areas of focus.

Face-to-face comprehensive boot camp style review classes are also offered to students each term to provide them with a focused approach to more difficult areas of the curriculum. Students have demonstrated initiative in attending the voluntary review classes. Students voluntary travel from all over Texas to review sessions that are offered at CHCP corporate office location.

Elsevier Adaptive Learning (EAL) Products

Often, a concern associated with on-line courses is the lack of face-to-face interaction between the faculty and the student, which may reduce the faculty's ability to assess on a frequent basis, the student's engagement with the material being presented. In the CHCP completion program, this concern can be addressed by the **Elsevier Adaptive Learning product. Adaptive learning** has the potential to address a wide range of student learning needs, while moving all students toward desired competencies. Adaptive learning builds upon the students' current knowledge base to deliver the next level of content. This facilitates students' learning and helps them take responsibility for their own learning. These systems are designed to:

- Adapt the sequence of the curriculum and learning activities to the needs of the student.
- Individualize the pace of learning and the amount of material presented at any one time (Lemke, 2013).

CHCP faculty report the following advantages to using Adaptive Learning, as defined below by Sportsman, (2015) when they implemented **Radiological Science for Technologists Adaptive Learning** into their curriculum.

Adaptive Learning Systems:

1. Incorporate characteristics similar to the digital gaming so popular among today's students that encourage engagement in the learning process. These characteristics include a) a logical sequence of the presentation of content, b) novelty and variation, c) student choice, d) intellectual safety, and e) clarity of the goal (Fredricks, Blumerfield, & Paris, 2004).
2. Provide a way to level the playing field and establish minimum performance standards across a particular cohort of students, often made up of individuals with a wide variation of academic aptitude.
3. Provide immediate feedback in a non-threatening manner, which encourages students to pay more attention.
4. Provide specific feedback regarding the learner's engagement and performance to both students and faculty. The system encourages students to be accountable for their own learning and reduces the time the instructor must spend assessing individual performance. However, the system does allow instructors to monitor the students' use of the system on an ongoing basis, so if students are not engaged in learning the content, the instructor can intervene.
5. Provide faculty with the kind of focused data they need to direct student remediation. Students who have failed an exam often come to their instructor asking for guidance. If an instructor can see, based upon a dashboard, that a student has not spent an appropriate amount of time with the system, the faculty can then encourage the student to invest more time in the adaptive learning program.
6. Regulate the cognitive load (the amount of content the student is expected to absorb), so that the "optimal zone for learning" is achieved. The optimal zone occurs when tasks are neither so complex the learners are frustrated or so easy that they are bored (Lemke, 2013). Because the content is individualized for the learner, it is more likely to present material in this optimal zone, thus engaging students at their own level. (Sportsman, 2015)

In addition:

1. An Adaptive Learning System helps students be more efficient and effective in managing their study time. It guides them to spend time learning things they DO NOT know, rather than "over-learning" the things they do know. The algorithms that guide the system also highlight content that students are in in danger of forgetting, so it can be retained in long-term memory. Given the combination of the declining academic aptitude of today's students and the increase in course loads, adaptive learning systems provide an efficient way for students to engage in self-directed learning.
2. Aggregate data analysis from adaptive learning systems can help faculty adapt learning activities for a specific cohort based on the statistics of the entire class. In addition, analysis of the aggregate data can also provide class results for use in program evaluation.
3. Passing certification examinations on the first attempt remains important to students and faculty alike. The questions included in adaptive learning systems and the logical, sequential presentation of content encourages critical thinking and prepares students for success on the licensure examination. (Sportsman, 2015)

SIMTIC Radiography e-learning simulation

Students in this program also work with the SIMTIC Radiographic e-learning system. This web-based simulation provides an effective way to practice cognitive clinical skills.

HESI Products

In addition to the HESI Mid Curricular examination used for the admission process, the CHCP Associate Degree in Radiologic Technology completion program uses several of the HESI examination products to evaluate students' performance, including:

- Pre-built, proctored tests assigned to assess knowledge and concepts being emphasized in the various courses. Faculty and students can use the results of these tests to evaluate student development of competencies and can plan individual or group learning activities to emphasize important concepts. These tests also introduce students to standardized testing with examination-style practice questions written at the application level.
- The HESI Radiography Exit exam prepares students for success on the ARRT examination. The exam allows the student AND the faculty to identify each student's strengths and weaknesses, providing individualized remediation. The content is tagged directly to the content in the Elsevier radiography texts, allowing students to receive customized feedback regarding knowledge deficits and targeted remediation for the individual student. The online remediation reporting capabilities allow faculty to track student remediation progress and to insure that each student has a focused approach to their remediation. Faculty also uses the aggregate results of this exam to evaluate the effectiveness of the curriculum.

Program Outcomes

The CHCP RT program, was initially implemented in 2014 and has graduated one cohort of 24 students. The outcomes of this cohort are listed below in Table C.

Table C: Outcome Metrics from CHCP First Cohort

Outcome Criteria	Results
Retention	90.5
Credentialing Participation	100%
Credentialing Exam Pass Rate	94%
Graduate Placement Rate	93%
Student Satisfaction	93%
Student Clinical Participation	100%

Continuous Improvement

An important component of innovation is the extent to which principles of continuous quality improvement (CQI) are applied within the ongoing implementation process. During the initial implementation process, the CHCP faculty found several areas in the curriculum process that needed to be changed to improve student outcomes. Take a look at some of these changes:

1. Applicants with a wide range of academic and practice competence.	→	a. Implement the HESI Mid-Curricular Examination to assess applications competencies upon which the curriculum is built.
1. Assessment of a lack of knowledge regarding patient care and pharmacology.	→	a. Revised curriculum to add courses in these areas.

Conclusion

The College of Health Care Professions has implemented an innovative Radiologic Technology online, and face-to-face instructional program to provide opportunities for the working adult to develop their professional practice, and meet the expanding needs of patients. Using new educational technologies, data-driven student services, and processes designed specifically to facilitate the students' education and success, graduates of this program are able to advance their career trajectory. Without this program, career advancement opportunities for the working adult are very limited. This program serves as a model for other institutions to innovate, and effectively meet the educational needs of working adults, while still providing superior academic outcomes. The end result is a skilled radiologic technologist professional that is able to provide excellent patient care while growing their career.

References

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