

Tracking Clinical Competencies On the Web

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Context *The American Registry of Radiologic Technologists (ARRT) has defined several core examinations that student radiographers must perform to demonstrate competency. Furthermore, the ARRT has left the method of tracking competency exams to educators.*

Objective *This article describes a Web-based system that can be used to track clinical competencies.*

Method *The pedagogy employed in designing a meaningful and successful Web site to track competencies can be overwhelming. Considerations include selecting software, the design and implementation process, and providing security to protect confidential information.*

Conclusion *The Web-based system described in this article is innovative, sensible and relatively easy to adopt. This tracking method provides faculty members with instantaneous access and a quick review of the student's competency examinations. Students' competency information for the entire program is contained in 1 electronic file. With minor modification, the system can be used in a variety of educational and administrative settings.*

In recent years the literature has included discussions about the difficulties of defining and tracking clinical competency.¹⁻³ In the nursing profession, there is little consensus about how this process should be accomplished. The same holds true for other health care professions.⁴⁻⁶ Students attending radiography programs assume they will be taught the requisite skills to become competent radiographers. Likewise, employers assume that graduates who have passed the American Registry of Radiologic Technologist's (ARRT) certification examination are competent. Thus, if we are to receive the greatest benefit from competency-based programs, we must not only define competency, but also find a way to make these competencies meaningful and accessible.

The ARRT adopted minimum core clinical competencies for the radiologic sciences in 2002 to establish eligibility for students taking the Registry exam.⁷ A student must demonstrate these competencies in addition to graduating from an accredited program recognized by the ARRT.⁸ Before these requirements, program directors signed a statement on certification applications that indicated all didactic and clinical requirements of the program had been met by the student; thus, students were sanctioned as being competent by the program director's signature.

Competencies and Standard HR3

Competencies came to the forefront in 1995 when the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) implemented standard HR3. This standard states that, "[p]rocesses are designed to ensure that the competency of all staff members is assessed, maintained, demonstrated, and improved on an ongoing basis."⁹ Not only must staff members be assessed and records maintained according to the standard, but many radiology administrators also have stated that it is essential that the radiographers they hire already demonstrate competency in the areas in which they are hired to work.¹⁰ The expectation is that new radiographers will not require additional training. To help educators graduate competent radiographers, the ARRT has specified a set of core competencies that must be met by all students regardless of the program from which they graduate.⁷ Thus, competency assessment has become a method that all programs can use to verify that students are competent to perform a minimum core of radiology examinations.

Defining Clinical Competencies

The ARRT has performed several practice analyses to determine which examinations should be included in the minimum core.¹¹ These competencies are periodically revised, and a new set of competencies became effective

January 1, 2005.⁷ The ARRT has done a commendable job in defining these competencies, but the Registry left the method of assessing and tracking competencies to educators. Additionally, the ARRT recommends that educational programs include a method of maintaining proficiency once competency has been achieved.⁷ Institutions who follow these recommendations undoubtedly will need additional forms to track this data.

Need for a Tracking System

The data to track these competencies have become burdensome. For example, 1 university program uses a tracking method that includes several forms. The faculty often reviews these forms to determine a student's progress in the program. In the past, the method used to review student competency consisted of pulling the student file and completing a check list to identify competencies completed. This process worked but was not efficient. As a result, a faculty member suggested that these forms be posted on the Web for easier access, evaluation and review. The impetus for this suggested change was to provide instantaneous access and a quick review of the student's competency exams for faculty members. It also was suggested that the Web site contain the students' competency information for the entire program in 1 electronic file.

Purpose

The goal of this article is to demonstrate a Web-based design for tracking clinical competencies. The advantages and disadvantages are discussed, with emphasis placed on the process of tracking rather than methods used for assessment. Specifics of the design process that are covered include selection of software, the design and implementation process, and providing security to protect confidentiality. The article reviews forms that are used and how the records are maintained on the Web.

Software Choices

One of the major decisions before building this Web site was to determine the types of software to be used. An initial decision was to use a database such as Microsoft Access (Microsoft Corporation, Redmond, Wash). This software is part of the Microsoft Office Professional Suite. After consideration, it was decided that this database would work, but it did not have the ability to allow a viewer to look at all student records simultaneously without designing specific reports to query the data. Likewise, dynamic Web databases such

as PERL, CGI, PHP or mySQL were suggested. These acronyms refer to higher-level programming languages and require skills in scripting languages.¹² A quick search on Goggle (www.google.com) proved that this method would be time consuming and would require paying a Web designer and programmer. Remuneration was not possible because of limited resources for the project. Also, it was important that the Web site be developed in a timely fashion. Learning new software and programming languages would delay the project.

Microsoft Office

A quick survey of clinical affiliates showed that most users had access to Microsoft Office software. Likewise, this software was readily available on campus. Therefore, it was decided that Microsoft Office Professional 2000 would be used, specifically Microsoft Word and Microsoft Excel. If a clinical site did not have Word or Excel, documents produced with this software could easily be converted to a portable document format (PDF) using Adobe Acrobat (Adobe Systems Incorporated, San Jose, Calif) software. This would enable clinical sites an alternative method of viewing the same data.

In addition to Word and Excel, basic hypertext markup language (HTML) software was needed to implement the project. Dreamweaver MX (Macromedia, San Francisco, Calif) was used for this purpose, but any HTML editing software could have been used. Basic skills in Web design are needed to build a site; however, such a project can be implemented with minimal training. Even a novice designer with basic HTML skills can design a simple Web site that meets the needs of faculty and students. It is beyond the scope of this article to discuss the specifics of Web design, but a similar site can be built with the help of personnel from instructional technology resource centers, which are integral departments at most colleges and universities.

Design Process

When considering the Web site design, the intent was to post all the forms needed by the clinical instructors on the Web. Likewise, the clinical coordinator suggested including the clinical course syllabi and a list of the competency requirements mandated by the ARRT.

With this in mind, the initial development necessitated dividing the clinical core competencies into 5 semesters. This allowed the competencies to be distributed throughout the length of the program. Next, the competencies were distributed on an Excel worksheet to

coincide with the curriculum design of the courses taught each semester. The goal was to be able to open an Excel file and have access to all student records; consequently, it was important to include all clinical competencies on a master competency list. After this form was completed, the rest of the project fell into place because the additional forms needed for the Web site were already in use (ie, course syllabi, room assignments, grading and other forms). It then became a matter of providing hyperlinks to this data.

Web Site Review

It may be helpful for readers to access the Web site while reading this article. The universal resource locator (URL) is www.isu.edu/radsci/rsclinical. The Web site is located on a university server and is currently used by faculty and staff to view, retrieve and track clinical competencies of students in the program.

By navigating to the Web site, the reader will be directed to links for the tracking mechanism. Once there, viewers see a picture of 2 senior students currently enrolled in the program. (See Fig. 1.) This image can be changed at the designer's discretion and adds personalization when current students are represented. The tabs at the top of the Web page direct the reader to the other areas of the site. They are labeled "Home," "Forms," "Syllabi" and "Records." The first 3 tabs are open to anyone wanting to look at the information. Readers may explore the information there; the forms are not copyright protected and can be downloaded and modified. The fourth, or records part of the site, is password protected and requires authentication to enter. Each section of the Web site is reviewed below.

Forms Section

When navigating to the forms section of the site, the viewer is directed to several links. (See Fig. 2.) Directly under the label entitled "Clinical Competency Forms" a hyperlink labeled "R.S. 389 Fall Semester First Year (Excel)" appears. After downloading or reviewing this form, the user sees a list of the clinical competencies required during the first semester. (See Fig. 3.) Clinical instructors (CIs) use this form to evaluate the student, and the student is responsible for faxing or bringing the completed form to the department. The same form is used each semester, but the competencies change to reflect what is being taught. From this form, the secretary adds the date of the completed competency to a



Fig. 1. Home page of the Web site.

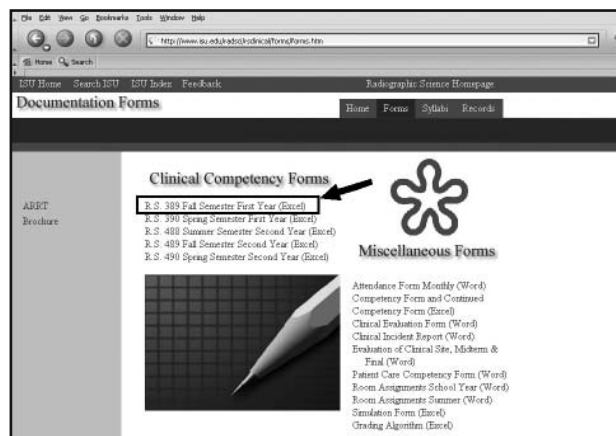


Fig. 2. Forms section of the Web site. Arrow and box indicate the hyperlink for the fall semester clinical competency form.

master list that resides on the secure portion of the Web site. (See Fig. 4.) This spreadsheet is the checklist used to record completion of competencies and validate the ARRT clinical competency requirement.

The viewer also will find a heading entitled "Miscellaneous Forms" in the forms section of the Web site. (See Fig. 2.) CIs can find all the documents needed for tracking student information under this heading.

Hyperlinks to the following documents are included:

- Monthly attendance.
- Competency and continued competency.
- Clinical evaluation.
- Clinical site midterm and final evaluations.
- Patient care competency.
- Room assignments.
- Simulation.

Master Competency List				Competency						
NAME: Student1				Mandatory Date	Elective Date	Sim "X"	Mandatory Date	Elective Date	Sim "X"	
RS 389 Applied Radiography I	CHEST AND ABDOMEN						SPECIAL CHEST, SPINE, & GI TRACT			
		Chest Routine	10/14/03				Chest, age 6 years or younger			
		Abdomen supine	11/20/03				Chest, wheelchair or stretcher			
		Abdomen upright	02/24/04				Chest decubitus			
		Abdomen decubitus					Larynx (soft tissue neck)			
	RS 390 Applied Radiography II	UPPER EXTREMITIES						Cervical Spine		
			Finger or thumb	11/18/03				Thoracic Spine		
			Hand	11/06/03				Lumbar Spine		
			Wrist	10/30/03				Scoliosis Series		
			Forearm	01/29/04				Sacrum and/or coccyx		
		Elbow	02/12/04				Esophagus study			
		Humerus	12/04/03				Upper G.I. Series			
RS 488 Applied Radiography III	GENERAL PATIENT CARE						Small Bowel series			
		CPR	09/29/03				Barium Enema (single or double) contrast			
		Vital Signs (blood pressure, pulse, resp., temp.)	10/27/03				TRAUMA, MOBILE AND SURGICAL			
		Venipuncture	11/03/03				Trauma Cervical Spine (x-table)			
		O2 Administration	10/21/03				Portable Chest			
RS 489 Applied Radiography IV	LOWER EXTREMITIES						Portable Abdomen			
		Foot					Portable Orthopedics			
		Ankle	02/12/04				C-Arm Procedure (surgical)			
		Tibia and Fibula	03/02/04				Operative Cholangiography			
	RS 490 Applied Radiography V	MISC. EXTREMITIES						THORAX, HEAD, GU, SPECIAL PROCEDURES		
			Sacroiliac Joints					Ribs		
			Extremity, age 6 years or younger	06-Apr-04				Sternum		
			Scapula					Facial Bones		
			Clavicle					Nasal Bones		
			Acromioclavicular Joints					Parietal Sinuses		
		Trauma Shoulder (i.e., Y view or transthoracic)					Mandible			
		Toes					Orbits			
		Os Calcis					Skull			
							Zygomatic Arches			
						Cystography or Cystourethrogram				
						IVU				
						Retrograde Urography				
						OTHER				
						Digital Fluoroscopy				
						Digital Radiography				
						Myelography				
						Total Comps	Total Electives	Total Simul		
						14.00	1.00	0.00		

Fig. 4. Master competency list. This is the most important form on the site. This form is partially filled in and shows the number of competency and elective competency exams completed. Boxes connected by a line demonstrate the use of the function “count.” Note the individual student tabs at the bottom of the worksheet. In this example, the student has completed 14 competencies and 1 elective competency. The general patient care dates are excluded from this calculation.

terminal competency to assure students maintain proficiency during the course of the program.⁷ This spreadsheet also helps document these continued competency exams.

Initially, the information for the spreadsheet is captured via a paper mechanism. Ultimately the data is electronically archived and printed for the student’s academic file. As a side note, this spreadsheet was not used previously at the university. It was created specifically for the purpose of providing a single electronic file to track all students. Therefore, this Web-based system has not reduced the paper work required to document competencies. The spreadsheet is still

printed and a hard copy is kept. Regardless, the new system has been advantageous because data are now more accessible.

Record Keeping and Statistical Analysis

When a competency is completed, the department secretary records the date of completion and updates the Excel file. She is the only person authorized to make official changes to a student record. Subsequently, when an end user downloads a form, it is provided in a read-only format. The form can be printed for review purposes but cannot be changed on the server unless the user has specific authorization to

Continued Competency List									
NAME:	RS 390 (8) Req.	RS 488 (10) Req.	RS 489 (10) Req.	RS 490 (10) Req.	Requirements	RS 488	RS 489	RS 490	
Chest routine	01/22/04				Esophagus Study				
Abdomen supine					Upper G.I. Series				
Abdomen upright	02/24/04				Small Bowel Series				
Abdomen decubitus	04/20/04				Barium Enema (single or double) contrast				
Finger or thumb	02/24/04				RS 488 select from the above				
Hand	02/05/04				Chest decubitus				
Wrist	04/06/04				Larynx (soft tissue neck)				
Forearm					Scoliosis Series				
Elbow	02/12/04				Sacrum and/or coccyx				
Humerus	04/22/04				Trauma Cervical Spine (x-table)				
Shoulder	03/09/04				Portable Chest				
RS 390 select from above					Portable Abdomen				
Foot					Portable Orthopedics				
Ankle					C-arm Procedure (surgical)				
Tibia and Fibula					Operative Cholangiography				
Knee					RS 489 select from the above				
Patella					Ribs				
Femur					Facial Bone				
Trauma Extremity					Nasal Bones				
Pelvis					Paranasal Sinuses				
Hip with Frog					IVU				
Trauma Hip (Danielius Miller/Cross Table Lateral)					Sternum				
Sacroiliac Joints					Mandible				
Extremity, age 6 years or younger					Orbits				
Scapula					Skull				
Clavicle					Zygomatic Arches				
Acromioclavicular Joints					Cystography or Cystourethrogram				
Trauma Shoulder (i.e., "Y" view or transthoracic)					Retrograde Urography				
OsCalcis					Digital Fluoroscopy				
Chest, age 6 years or younger					Digital Radiography				
Chest, wheelchair or stretcher					Myelography				
Cervical Spine					RS 490 select from the above				
Thoracic Spine									
Lumbar Spine									
Shaded areas are elective exams									
Total Continued Competencies	9.00				Total Continued Competencies	0.00	0.00	0.00	

Fig. 5. Continued competency list. This form is an extension of the master competency list. It is partially filled in with 9 continued competency exams completed.

make changes. It is important to designate 1 person to officially update student data, thus reducing duplication errors. Additionally, the department secretary is the only person authorized to upload the data to the secure area of the server. This process occurs at mid term and at finals week, but could happen at any set interval.

Statistical Analysis

All competency spreadsheets were designed to provide statistical analysis of each student's competencies. An example is the use of the function "count." (See Fig. 4.) This function keeps a running total of the number of competencies completed by the student. Likewise, the same approach is used to track electives, simulations and continued competency exams. This

system gives faculty members the ability to view student records at any time and to know exactly how many competencies of each category have been completed. This can be especially beneficial if reviewing the competencies from a remote location.

Server Considerations

After choosing the software and designing and constructing the Web Site, the next consideration was placing the site on a server that would be easily accessible yet provide password authentication. The confidential nature of student information mandated a secure environment. WebCT (WebCT, Inc, Lynnfield, Mass) was chosen to house the Web site because it met these requirements and because faculty members were familiar with the software. WebCT is a

course management software that enables educators to create online instructional material by generating Web pages from data they enter into the program's templates.¹³ The software provides an infrastructure for the CIs to enter a secure Web site, thus gaining access to the forms needed to track student competencies.

Housing the Web Site in this secure environment succeeded, but with time the method proved inefficient and difficult to manage. Initially, the WebCT software allowed the designer the ability to provide CIs access to the course because CIs could be added easily. As revisions to the WebCT software occurred, the capability of adding students was taken away from the course designer, and CIs needed to be registered as students in the universal WebCT database before access to the course was allowed. It became an aggravation to the WebCT administrator to add the CIs to the database because it entailed recording nonstudents as students. Because of this difficulty, WebCT lacked practicality and was abandoned.

Alternative Approach

Subsequently, the Web site was moved to an area on the server that could be accessed by anyone given the proper URL. Likewise, confidentiality of student data was maintained by using a secure portion of the site to provide password protection. This allowed CIs access to the data and preserved confidentiality of student information. Additionally, the problems associated with WebCT access restrictions were eliminated.

An advantage of moving the Web site from the WebCT software became immediately apparent. Records that were not of a confidential nature could be posted on a less secure portion of the same site for access by anyone who knew the URL. This was not possible when the Web site was housed using WebCT because the data were located in a secure setting. A majority of the information is not confidential and does not require authentication to access; therefore, this information is now more available to a wider audience such as administrators and other faculties.

Password Protection

A perceived difficulty with implementation was setting up a password-protected Web site. However, this is easily done with the help of a computer analyst. It is fundamentally a matter of setting access permissions on the server for those who are authorized to view the information. When a user has access to the secure portion of

the site, the forms are easy to look at and can be downloaded, viewed and printed with Microsoft Word, Excel or Acrobat Reader.

Diverse Utilization

Assessment must be documented; consequently, the Web-based tracking system demonstrated in this article could be used in a variety of circumstances. The design provides a mechanism to document cognitive and psychomotor skills of students, but with slight modifications may prove beneficial in other scenarios. For example, JCAHO requires that clinical competence be evaluated for all medical imaging staff and holds department managers accountable for ensuring that staff competency is assessed, maintained, demonstrated and continually improved.¹⁴ With this increasing focus on health care practitioner performance and the JCAHO requirements to meet patient-focused and performance-based standards, this method of tracking student competencies could be used to track and document competencies of staff radiographers.

Managers would agree that, "[t]he legal and financial implications of employee performance and safe practice in a rapidly changing practice environment *make continuing professional competence a major concern* for all providers and health care organizations [*italics added*]."¹⁵ The Web aspect of the design could be limited to an organization's intranet or to a specific computer and adapted to meet individual needs of a department.

Future Possibilities

The design of this tracking system could have a more extensive application than investigated in this article. This Web-based system could be used in conjunction with a personal digital assistant (PDA) to track competencies. A small handheld device, the PDA has become useful for recording and retrieving information at the point of patient care. A good example is the University of South Florida Athletic Training Education Program. This program uses PDAs to document clinical competencies performed by students.¹⁶

Additionally, commercial software is available for PDAs that allows synchronization of word processing, spreadsheet and databases.¹⁷ Software could be used in conjunction with PDAs to update competencies at the clinical sites. Data could then be synchronized with the central Excel file housed at the university, an operation called a "hotsync."

This process has not been attempted locally because of certain restrictions, including purchasing PDAs for CIs, performing hotsyncs at the university and performing hotsyncs on the Internet. Though it may be possible to justify the expense for the PDAs, synchronization would require either bringing the PDAs to the university for the hotsync or performing the hotsync remotely online. Unfortunately, performing hotsyncs at the university would be difficult because CIs do not routinely travel to the campus. They are not employed by the university, and one clinical site is 70 miles away from campus. The next option, performing an Internet hotsync, would be an alternative, but it would be difficult to implement.¹⁸ Regardless, an option exists for CIs to remotely hotsync data online, thus eliminating the necessity of traveling to the campus. Again, these possibilities have not been evaluated, but provide future areas for exploration.

Conclusion

Tracking learner behavior and assessing learner comprehension can now be done in ways that were nearly impossible even a few years ago.¹⁹ Though there are many different approaches to document competency, the Web-based system demonstrated in this article is innovative, sensible and relatively easy to adopt. At the culmination of the program, the competency and continued competency forms are printed and filed in the student's permanent record. In addition, the electronic files are archived for future retrieval at the user's discretion. This method is inexpensive and fulfills the required objectives.

Furthermore, the records uploaded to the Web server can be determined by the individuals maintaining and using the information. Likewise, it is not imperative to use Word or Excel software. Potential developers may consider using a database such as Microsoft Access or one of the scripting databases available for the Web.

A disadvantage of this method is that it does not decrease the amount of paper work required to document competency. This was disheartening to developers, but the benefits of the Web site overshadow this disadvantage. The ease and quickness with which student records can be accessed and the ability to retrieve the data from any location outweighs shortcomings associated with this methodology.

Lastly, future research involves the use of PDAs to track clinical competencies and deliver the data to the Web site via a hotsync process. This would require work-

ing out complications associated with the hotsync operation. Nevertheless, these efforts may prove beneficial to some organizations.

This method of using the Web to track clinical competencies may be helpful to other radiologic sciences programs. Furthermore, an astute department director may find this method useful for other purposes. In any case, the developers have found that the virtual Web site is beneficial and an integral part of the program.

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