Identity Crisis? An exploration of the process of transformation from college student to healthcare professional among diagnostic medical ultrasound students

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Educating the next generation of healthcare professionals

The education of future healthcare professionals has been a topic of vigorous debate as those involved in the process struggle to understand how students learn and how to most efficiently and effectively empower them to master the skills and concepts necessary to be clinically proficient members of the healthcare team. As with medical education (Colliver, 2002), the education of imaging students has traditionally been and often still is provided by imaging professionals or physicians who have little if any background in educational theory or methods. The old adage about the possession of excellent professional skills not necessarily equating to excellent teaching skills is frequently borne out in this setting.

A Historical Perspective

Most of the literature related to the education health professions students is centered on the clinical education of physicians or nurses. There is very little literature available regarding the clinical education of allied health professionals, and even less about the clinical education of imaging professionals. While the studies regarding the clinical education of physicians or nurses can be helpful, there are differences in the level of competency and the type of concepts that must be mastered for medical imaging students. If those educating medical imaging students can better understand how those students learn, they should be better able to effectively teach them. Therefore, it is important to investigate the ways these students process information and apply it to the clinical setting, including potential barriers to the achievement of clinical competency so that educators can help provide them the best possible chance of success.
The history of instruction in allied health education closely mirrors that of medical education, making the literature from that area relevant to this study. There have been multiple attempts to apply cognitive theories to medical education. Hodges and Kuper grouped theories that they found applicable to medical education into three large categories: (1) bioscience theories, (2) learning theories, and (3) sociocultural theories (Hodges & Kuper, 2012). As physicians, many medical educators seem to be most comfortable with the bioscience theories because they fit their paradigm of research and science most closely. Allied health educators also frequently come from a medical professional background, making their comfort zone similar to that of these physicians. While they may not have the research background of a medical doctor, allied health professionals understand bioscience theories because they underpin their own educational background. Over time, there has been a growing interest in the applicability of learning and sociocultural theories to both medical and allied health education.

In 2003, Kaufman described how theories of adult learning, self-efficacy, constructivism, and reflexive practice can be applied to medical education (Kaufman, 2003). He made the case that these theories can be successfully applied to the instructional design of medical education events and to the techniques used by medical educators to enable medical students to “bridge the gap” between the theory they are taught in core medical courses and the application of this knowledge to clinical practice (Kaufman, 2003). Allied health educators face the same “gap” between didactic classes and clinical practice for their students, so it is reasonable to suppose that these theories could be similarly applied to medical imaging education.
The Concept of Clinical Competency

As Kaufman described, the application of didactic knowledge to clinical practice is at the center of the development of the clinical competence that is required of practicing health professionals (Kaufman, 2003). The achievement of clinical competency marks the transformation from health professions student to healthcare professional. The problem is that the definition of clinical competence varies widely depending on context and the level of experience of the person being asked to describe it.

The online medical dictionary defines clinical competence as, “Performing within the legal scope of defined practice, following standards or principles that satisfy the demands of the given situation” (Farlex, 2012). But this definition gives rise to the questions: whose standards; whose principles? Epstein and Hundert define professional [clinical] competence as, “the habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and community being served” (Epstein & Hundert, 2002). This is a much richer description of what is involved and evokes a higher standard. The Society of Diagnostic Medical Sonography (SDMS), a professional society that helps to set the standards of performance for sonographers, describes a competent sonographer as, “an individual qualified by professional credentialing and academic and clinical experience to provide diagnostic patient care services using ultrasound and related diagnostic procedures” (Society of Diagnostic Medical Sonography, 2000). This description is more procedural and seems to be located somewhere between the dictionary and Epstein. Part of this study will involve investigating how sonographers and sonography students define clinical
competency and how their definitions evolve as they move along the trajectory from sonography student to professional sonographer.

**Sensitizing Concepts**

The varying definitions of clinical competence become more clearly important when one considers how health professions students learn in light of the concept of socially situated cognition. Semin and Smith describe how intimately cognition is related to interaction with others and with the situation at hand. They argue that cognition is closely tied to interactions with others, the situation involved, and is a key component of the identity one creates for oneself which also varies according to the situation and interactions with others (Semin & Smith, 2013). For example, a student who may be seen as an expert student and leader by her classmates will be seen as a novice by sonographers at the clinical site. This student’s behavior, confidence level, and cognition will be different in the didactic classroom where she may easily recall the answers to questions, lead discussions, and display confident body language than in the clinical site where she may second-guess her conclusions, be afraid to speak up, and avoid eye contact. The idea of socially situated cognition may prove enlightening to those who desire to understand the process undergone by medical imaging or other health professions students as they work toward clinical competence and self-identity of healthcare professional. The vivid images this idea creates regarding potential barriers students may face as they pursue clinical competence makes this a key sensitizing concept for this study.

The idea of socially situated cognition coupled with the visualization of health professions students’ learning as a process led to consideration of Dreyfus & Dreyfus’ model of knowledge and skills acquisition. They describe a progression from novice to mastery as a
student progresses from new to the area of study to an expert practitioner (Dreyfus & Dreyfus, 1980). They describe the following five stages:

1. **Novice**: mostly concerned with rules, does not consider context.

2. **Competent**: experience has been gained which enables the student to recognize patterns and follow internalized guidelines to respond to situations which resemble previously seen patterns.

3. **Proficient**: further experience from enables the student to respond to situations with a goal in mind and to see multiple aspects of the situation as more or less vital to the goal. However, the situation is only seen from one perspective. The student responds to the situation guided by internalized “maxims” based on previous experience with similar situations.

4. **Expert**: a large library of previous experiences has been logged in the student’s memory so that situations are immediately recognizable and the response is more intuitive than analytical. Some automation of responses has been achieved.

5. **Master**: the student sometimes reaches a near “flow state” where the appropriate response to a situation is carried out with little or no conscious thought. This doesn’t appear to be considered a constant state, but rather the source of an occasional “masterful performance”.

This model of skills acquisition was developed when studying the training progression of air force pilots (Dreyfus & Dreyfus, 1980). It has been widely applied to medical and allied health education with some modifications and mixed reception (Peña, 2010). Peña raises concerns about the ability of the Dreyfus model to explain the acquisition of skills used to solve ill-
structured and complex problems like those experienced by physicians trying to make a diagnosis (Peña, 2010). While Peña’s concerns are strongly argued, this model can serve as a sensitizing conceptual framework to keep in mind as the process of transformation from sonography student to sonographer is investigated.

**Investigating How Diagnostic Medical Ultrasound Students Become Sonographers**

Based on observations of Diagnostic Medical Ultrasound (DMU) students for over a decade and on a desire to better understand the process they undergo as they progress along the trajectory from student to sonographer, a grounded theory study has been conceived to gain insight into how these students process information as they proceed through clinical education and how they identify themselves along the road to achieving clinical competency.

The hallmark of transformation for these students is achieving clinical competency so that they can successfully fulfill their desired professional roles. This study will focus on the process of transformation engaged by diagnostic medical ultrasound students as they proceed through a professional program and clinical education in their efforts to achieve clinical competency as diagnostic medical sonographers. A deeper understanding of the process health professions students undergo as they work toward clinical competence can enable educators to provide more effective instruction and anticipate “bumps along the road” where many students may require more support.

This will be a mixed methods but largely qualitative study. The qualitative component, which aims to understand a process, will utilize Grounded Theory methodology to explore and develop an understanding of how diagnostic medical ultrasound (DMU) students engage with pedagogical content and ultrasound scanning methodology as they work to develop clinical
competency. The initial sample of participants will include DMU students who have completed a case-based simulation hosted within Blackboard where they will have practiced taking on the role of a diagnostic medical sonographer prior to their entry to clinical rotations where they are expected to interact with real patients and other members of the healthcare team. Within the simulation, students will have been required to make the same decisions they would be expected to make in the clinical setting and to use argumentation to justify and critically reflect on the decisions they made. The students will be participating in the simulation environment as part of their normal course work.

For the study, students who have completed the simulation will be asked to voluntarily participate in focus groups at the end of their first clinical rotation to reflect on the impact of the simulation on their clinical experience and on their impressions of their own clinical competence at this milestone of their clinical education. This data will be coded and analyzed for emergent themes that help the researchers to understand the process DMU students undergo as they develop clinical competence. The argumentation artifacts created by study participants as they completed the simulation assessments during their coursework will be coded and analyzed for emerging themes that shed light on the way that DMU students reason through the decisions they will be expected to make as practicing sonographers.

In order to triangulate the data and to gain multiple perspectives on the process, clinical preceptors, experienced sonographers who provide instruction to the students at the clinical rotation sites, will be asked to complete a survey and potentially to participate in focus group interviews regarding their perceptions of the DMU students’ preparedness for clinical rotations and their development of clinical competence. This data will also be coded and analyzed for
themes that describe the clinical preceptors’ perceptions of the process DMU students undergo as they learn in the clinical setting. The Preceptors will also be asked about their own definitions of clinical competence and their expectations of the competence level of students as they enter clinical rotations. Preceptors’ comments on clinical learning evaluations may also be coded and analyzed in an attempt to understand the changes in their perceptions of the DMU students as they progress through the rotation and progress toward developing clinical competency.

The quantitative component of this study will be a comparison of the participants’ clinical evaluation and scanning competency scores to the average scores of the previous 3 years’ cohorts who did not participate in the clinical readiness simulation. Finally, in an effort to compare outcomes with the national average, students’ scores on the American Registry of Diagnostic Medical Sonography (ARDMS) specialty examinations will be compared to the national average. This component of the study will be record review since this is data that is already maintained by the DMU program. The national average is publicly available from the ARDMS. The quantitative piece of this study is designed to assess the impact of the simulation on the development of clinical competency of the DMU students. It is hoped that the opportunity to practice the role of clinical sonographer in a virtual setting before entering clinical rotations will reduce the cognitive load and stress experienced by DMU students as they enter the clinical environment and therefore empower them to work more effectively to attain clinical competence.

**Initial Preparatory Investigation**

In an effort to ensure appropriate design of interview questions and to get an initial grasp of the ways that DMU students assess their own clinical competence, an e-mail interview
was completed with a recent graduate of the DMU program. This was an informal exchange between professor and recently graduated student; however, the student was informed that she was contributing to the design of a dissertation project. The results of that email interview were coded and analyzed in light of the sensitizing concepts for this study to give initial impressions and to help guide the structure for future focus group interviews as well as to help guide the final design of the simulation environment in an effort to make it as relevant and useful as possible.

As the simulation has been finalized and prepared for the pilot launch next semester, current DMU students were asked to complete the simulation activities at the conclusion of their second general ultrasound clinical rotation. In contrast to the students who will be asked to participate in the full study, these students had approximately five months of clinical experience at the time they completed the simulation activities. The goal of this evaluation was to evaluate the usability and relevance of the simulation activities. A focus group interview was conducted following self-paced completion of the simulation activities which included questions regarding the usefulness and relevance of the simulation as well as ways in which the students defined clinical competency and assessed their own levels of competence at this middle stage of their clinical education. The data from this focus interview were coded and analyzed, looking for common themes with the email interview with the recent graduate. Field notes and memos were also utilized to prompt recollection of details and to guide the further analysis of all the data.

While these preliminary activities were designed to ensure the usability of the simulation and guide the design of interview questions for the proposed study, they did provide useful
information that supports the sensitizing concepts and will help to further situate the researchers as they proceed following approval of the Institutional Review Board. This preliminary data is rich and provides interesting glimpses of how the definition of clinical competency evolves even among DMU students as they gain more clinical experience as well as what DMU students value as they look back on their clinical education experience.

Preliminary Findings

As the data from the email interview and focus group were coded and analyzed, the codes of both sources reflected the concepts of competence versus incompetence. The codes could be classified as being associated with “feeling competent” or “feeling incompetent”. When the data from the group of current students were compared to that from the recent graduate, a progression and evolving definition of just what clinical competence means was also revealed.

Competent vs. Incompetent

All participants in the gathering of initial data expressed varying degrees of “feeling incompetent” during their initial clinical experiences. They described not trusting themselves, lacking the confidence to stand up for what they thought, and assuming that all suboptimal outcomes were due to their own lack of skill. A common description from students was having “tunnel vision” or focusing only on anatomy rather than the image as a whole when they began performing sonographic exams. One current student said:

> Eventually I got to a point where I could take a picture and I would look at it and be like, ‘I don’t like that picture’. When we were doing comp’s [in the school scanning lab prior to clinical rotations], I was only focused on finding the anatomy. I didn’t even worry that much about finding the right focal point
because I was like ‘I can’t do that many things at once.’ As I got into my summer rotation I began to feel like ‘I can know whether this is a good image or not a good image’. That was a shift for me. Before, it was like just go find it. Now I was thinking about ‘Is the image good?’ That was a big turning point for me and once I got there I felt much more competent.”

This sentiment seems to reflect an overwhelming cognitive load when students begin to learn to scan (Patel, Yoskowitz, & Arocha, 2009). There is so much going on and so many things to think about that they can’t focus on all of it but must pick the aspects that they find the most important. This description also reflects a focus on “rules” in keeping with Dreyfus’ novice stage. “Find the anatomy” and “find the right focal point” exhibit a rules-based approach to the task rather than an evaluative or higher level analytical approach (Dreyfus & Dreyfus, 1980).

The recent graduate, who is approximately one year ahead of the current students, expressed a similar sentiment regarding a change from “tunnel vision” to a broader focus:

“Additionally, when I started looking at the images as a whole rather than just trying to get the landmarks/anatomy and the proper image I noticed a change in my perception of myself as a sonographer rather than a student. When I began to trust my now-innate skills (ability to scan) and begin looking for things that look different than normal or stand out. I guess when things start to become natural and you don’t have to “think” about taking the image but when I started thinking about what the image means I really began to identify myself as a sonographer.”

This more experienced student described “innate skills” and being able to focus on what the image means rather than on the procedure of creating the image. This reflects characteristics of Dreyfus’ stages of proficiency or even expertise (Dreyfus & Dreyfus, 1980). This recent graduate would not describe herself as an expert, which illustrates some of the difficulty in directly applying Dreyfus’ model to clinical education as described by Peña (Peña,
2010). The difference in the language this student uses compared to that of the current students also reflects an evolving vision of what clinical competence actually involves. This is a topic to be revisited in a subsequent section.

Another way that students describe feeling competent vs. incompetent is in their perception of seeking help from others in the clinical setting. The current students feel comfortable asking for help from their preceptors while the recent graduate wants to be able to do things more independently. The following comments are from current students:

“The thing about ultrasound is that you are never really doing it by yourself.”

“At least be able to start and complete it if you can’t do the whole exam by yourself. I mean, that’s fine. I don’t typically do all of my scans that I start.”

“Right now, I feel like my preceptor asks me questions that I know I’m still going to be working on through my first year.”

Those comments are compared to this comment from the recent graduate:

“Another also, when I stopped getting down on myself for mistakes (even though it still sucks now) but asking questions and for help... I used to think as a student that this meant I was incompetent and inexperienced... but I have learned that as a sonographer this field is not perfect and everyone could use a second set of eyes and another opinion sometimes and this is not a shameful thing. Every day is a learning experience and I honestly learn something new every day and try to better myself.”

Both types of student described the need for support and help in the clinical setting, but the recent graduate described seeking help from colleagues while the current students seemed to describe a dependence on the clinical preceptors to bridge gaps in their clinical skills. Neither approach is necessarily inappropriate; they simply reflect different levels of independence. The
current students describe a need for more active support while the recent graduate recognizes sole responsibility for her work and also that being responsible sometimes means requesting a second opinion from someone with more experience. This difference is harder to directly relate to Dreyfus’ model, but the stages of that model do reflect increasing levels of independence and responsibility (Dreyfus & Dreyfus, 1980).

**Barriers to developing clinical competence.** Students also described interactions and situations that impeded their progress toward clinical competence. The role of the clinical preceptor and the influence of other members of the healthcare team and even patients and families can influence the students’ perceptions of their own competence. One of the current students described interactions with her clinical preceptor that made her feel as if she was regressing rather than progressing toward becoming more competent. She described her clinical preceptor as aggressive and intimidating and described her experience at this site as follows:

“...in my other sites by this point in the rotation I was working. I was doing scans from start to finish with no help. And now at this site I’m still back scanning.”

This student also stated that her preceptor told her that she was expected to know more because she was “being spoon-fed”. This made the student feel less valued and reduced her confidence in her education and her abilities. Other students related similar incidents at a particular clinical site.

The recent graduate related ways that other members of the healthcare team, patients, and families made her feel “bullied” into giving out inappropriate information or over-booking the schedule.
“I started feeling more sonographer-ish whenever I felt comfortable answering patient questions and working the desk aspect of the job (scheduling, talking to drs, working with pacs, etc). At first, I deferred all questions to my preceptors bc I didn’t want to sway[say] something I wasn’t supposed to or wrong but eventually I noticed myself being able to communicate with other workers and patients effectively and sometimes you just can’t say anything/you know what you can/can’t say and can’t be “bullied” into giving out information or pushed around my offices.”

These comments illustrate the concept of socially situated cognition (Semin & Smith, 2013). In the presence of an intimidating preceptor students can be cowed and be made to feel less knowledgeable, resulting in a lack of confidence that feeds the perception of student incompetence for both the student and the preceptor. Likewise, an insecure student may be vulnerable to manipulation by members of the healthcare team and even patients and their families who want the sonographer/student to provide information about exam results that is beyond their scope of practice or in violation of privacy laws. The environment and the people with whom they interact have a direct impact on the DMU student’s ability to process information and respond to requests for action or information. It is important to maintain high standards for assessing competency without projecting a hostile or negative environment for clinical education. Clinical preceptors must remember to be supportive as well critical in their assessments of student competence.
The Evolving Definition of Clinical Competence

Another striking concept that came from the analysis of this preliminary data was the differences in the ways that DMU students defined clinical competence as they progressed through the program as well as their perceptions of the clinical preceptors’ definition of clinical competence. The current students’ description of clinical competence was largely procedural. It included descriptions of being able to carry out steps and complete tasks. One student put it this way:

“It means that you can get the patient from the waiting room, introduce yourself, take the patient back to the room, get all their information into the machine, asking the right questions, explain what you’re going to do, ask them if they have any questions, and at least get the procedure started. Then if you have any questions or need help you can get your preceptor. And then you can also explain to your patient like when you’re done, ‘Your doctor is going to have the results here and here.’ And you need to kind of understand how to finish the whole exam, however the site does it. At least be able to start and complete it if you can’t do the whole exam yourself.”
In contrast, the recent graduate related higher order thinking and processing. She summed up what it means to be clinically competent by relating the ultrasound exam to the entire clinical picture for the patient:

“It’s like my hands and my mind just do it to show the rad what I am trying to prove.”

She was describing the automation of some of the fine motor skills involved in performing ultrasound scans, but her choice of words reflects the way she looks at the ultrasound exam as a way of creating a logical argument for a potential diagnosis. She is using the images she creates as evidence to prove to the radiologist what the correct diagnosis is. This way of looking at the exam exhibits more ownership of the product and a higher level of responsibility for the patient outcome. It also reflects a progression that occurs as students obtain more clinical experience. Again, this brings Dreyfus’ model to mind, evoking images of the conditions described at the mastery stage (Dreyfus & Dreyfus, 1980).

As the current students related their experiences with clinical preceptors, it sometimes seemed that there was conflict between the students’ definition of clinical competence and that of the preceptors. This is important because the preceptors evaluate the students and have a large role in determining whether the students have reached the appropriate level of competency to be allowed to progress to the next stage of the DMU program. The expectations of the clinical preceptors must be made concrete and apparent to the students in order for them to have the best chance of being successful in their clinical rotations. This topic highlights an aspect of the process that should be carefully examined in the preceptor surveys and focus group interviews with the students in the larger study. It will be interesting to further
investigate the impact of the situational nature of clinical competence on the clinical education process.

**Implications for Classroom Learning**

Developing a better understanding of the process that students undergo as they work toward clinical competence can lead to the development of more efficient instructional strategies and more accurate anticipation of areas where students are more likely to stumble along the road. If educators can anticipate the steps or stages that students go through as they transform themselves from student to sonographer, they will be better positioned to facilitate the process and help students achieve the level of competency required to become successful members of the healthcare team. If a pre-clinical experience like the proposed simulation can help students to bring the concepts involved together into a cohesive unit earlier in the educational process, perhaps the clinical education component will be more productive and all students will be fully prepared to function independently by the time they graduate. This would enable them to make the transformation from student to sonographer with more confidence and achieve a higher level of clinical competency as they prepare to become independently functioning members of the profession.

Based on these preliminary data, the trajectory from student to sonographer can be likened to the gathering of a large bunch of balloons. At first, the balloons are separated and possibly have tangles strings, representing the isolation of concepts and the overwhelming nature of the volume of material and skills to assimilate. As clinical education begins, the students begin to draw the balloons together into a cohesive collection, recognizing the relationships between concepts and how these relationships can help to draw the patient’s
clinical picture. Finally, by the end of the clinical education and extending into at least the first few years of the student/sonographer’s professional practice, the balloons are tied together into a cohesive bunch held together by competency demonstrated through completion of the educational program and achieving the professional credentials associated with the competent practice of medical ultrasound. If educators and clinical preceptors can find ways to help the students gather their balloons and tie them into a cohesive bundle, students will be better able to achieve clinical competency and be productive members of their chosen profession. As the larger study goes forward, the potential for theorizing the process and finding a way to communicate it more clearly is fascinating and daunting at the same time. It’s a complex process dealing with ill-structured problems, but common threads and themes are already cropping up. It will be very interesting to see where the larger study leads.

Figure 2: Graphic depicting the way that concepts are brought together into a cohesive unit as clinical education progresses.
References


