Reimagining Clinical Teaching Tools Using a Growth Mindset

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One of the most rewarding aspects of teaching radiologic technology students is knowing they will be prepared for professional practice with the necessary knowledge and skills when they graduate. For many students, the program will change their lives. This is a great motivator for educators to ensure that students graduate feeling secure with what they have learned.

In a clinical setting, expectations and rules are put in place to provide a safe and professional environment for learning. Hands-on work is required to develop students' skills and challenge their critical-thinking ability. Students immerse themselves in the learning experience and develop the confidence needed to handle the challenges of different types of patients, patient limitations, and pathologies. Removing students from the clinical setting hinders their exposure to challenging examinations and complex pathologies that help students develop critical-thinking and problem-solving skills. For example, saying a patient is contracted is easy, but deciding on the safest strategy to complete the examination is challenging when a student cannot see the patient's limitations. However, colleges and clinical programs might experience uncontrollable events, such as an epidemic or pandemic, inclement weather, or a hospital site visit from The Joint Commission; these events might require students to be removed from the clinical environment.

Disruptions in Clinical Learning

A study was conducted to determine how the loss of time in the clinical setting and of direct exposure to patient care affected medical students' learning outcomes.[1] The study included responses from 741 students via a polling system. Students indicated that their ability to develop the skills needed for the profession significantly affected their confidence. The students also expressed that the absence of hands-on education affected their stress and anxiety levels and caused fear of performing after they returned to the clinical setting, affecting their confidence.[1]

New strategies were introduced at Bronx Community College to reinforce elements of clinical practice that require critical thinking, patient assessment, radiograph analysis, patient-staff communication, and radiographic exposure factors assessment. Alternative teaching pedagogies and growth-mindset strategies were introduced to address the unusual circumstances and students' concerns, fears, and mindsets. Integrating a growth mindset allowed students to view the challenges they were facing as a way of progressing toward a common goal, to identify and recognize their learning challenges, and to reinforce self-confidence during a complex situation.

Throughout 2020, radiologic technology students were challenged to meet U.S. Department of Education and American Registry of Radiologic Technologists requirements to graduate because of disruptions to their

education. Educators faced the task of teaching clinical practice when students could not attend clinical assignments because of the COVID-19 pandemic. Students at Bronx Community College reported suffering from anxiety, increased levels of stress, and depression. They were worried they wouldn't graduate on time or might fail the certification exam because of inadequate clinical practice. These stresses affected students' learning process and engagement. Introducing students to a different way of thinking about their limitations and challenges and providing them with a different perspective on learning was essential.

Growth-Mindset Strategies Applied During Disruption

Starting March 2020, Bronx Community College educators developed courses that connected with students and taught curricula effectively via distance learning. Professors and clinical instructors developed new strategies for teaching students using online platforms and videos. These practical strategies have allowed students to flourish outside the clinical setting. However, beyond watching video demonstrations, students need to practice critical thinking through patient assessment and clinical situations that technologists routinely encounter. A growth mindset or active learning can be implemented with clinical students during these disruptions in clinical education.

A growth mindset refers to the deep belief that talents can be developed through practice and can influence thoughts and behaviors. Teaching students the difference between fixed and growth mindsets allows them to view themselves differently. Students with a fixed mindset believe intelligence is static, or fixed, and not easily cultivated. Conversely, students with a growth mindset believe their abilities and intelligence can grow.[2] Integrating elements of active learning and growth mindset are needed to improve students' ability to cope with stress, reduce anxiety, and develop a positive communal learning environment.[3] Jessica Schleider and John Weisz, professors at Harvard University, noted that "introducing a growth mindset boosts physiological recovery from socially stressful situations and significantly declines the onset of depression and anxiety."[3] This mindset allows students to redirect their focus and build the confidence needed for success in the classroom.

Students must develop their practical, technical, and communication skills. For example, students use learned skills to assess a patient's limitations and then use that assessment to modify how images are acquired or to determine the proper exposure factors to use by assessing the patient's pathology, body habitus, age, and hardware. Developing these skills can challenge students when learning remotely or in the clinical setting.

At Bronx Community College, new clinical learning experiences and strategies outside of the clinical environment were created to improve students' confidence and reduce anxieties. New implemented strategies helped to minimize the negative effects on learning outcomes due to the pandemic by helping students cultivate new skills.

The learning objectives for the new clinical experiences were:

- Understand the difference between fixed and growth mindsets.
- Integrate growth mindset or active-learning tools to teach clinical radiologic technology concepts (ie, assignments) that stimulate critical-thinking skills.

The results came from the author's final course assessment where the results of 2 assignments implementing active learning were compared with 3 previous years' course assessments that did not implement active learning. Students improved in critical thinking, patient assessment, knowledge of exposure factors, and image analysis.

Assignments for Building Skills and Self-Confidence

A dialogue requiring students to use critical thinking needed to be created. Student engagement was promoted by discussing a skill radiographers use daily and focusing solely on that skill set. Strategies were simple but effective in engaging students while stimulating their critical thinking. Content areas in radiologic technology that students found challenging were considered. The focus was on elements in a radiographer's daily responsibility that can be discussed and learned remotely. For example, junior-year students typically

Table

Anatomical Technical Factors and Patient Assessment Assignment[a]

Body part	Average-sized adult patient	Child aged 4-7 y	Patient > 250 lb
	1 point	2 points	2 points
Example: finger	52 kVp @ 1.2 mAs	48 kVp @ 1 mAs	54 kVp @ 1.5 mAs
Forearm			
Elbow			
Humerus			
Shoulder AP			
Shoulder PA, Y-view			
Pelvis			
Hip AP			
Lateral knee			
Lateral lumbar spine			
Lateral lumber spot view			
AP cervical spine			
Femur upper AP			
Tibia and fibula lateral			
Chest AP			
KUB (abdomen)			
Right ribs AP			
T-spine lateral			
AP sacrum			
Clavicle axial view			
Calcaneus axial view			

[a] *Instructions: Please provide the technical factors for the body parts listed. You will need to change the factors depending on the patient's body habitus and age. Think about the size, age, and pathology of the patient. These are influencing factors that determine the technical factors used per body part. Each body part is worth 5 points total, with the average adult worth 1 point, and the categories labeled child aged 4 to 7 years and patient weighing more than 250 lb are worth 2 points each. You can provide a broad range if you feel an exact technique is challenging. This exercise will examine your knowledge of technical factors and patient assessment.*

Abbreviations: AP, anteroposterior; KUB, kidneys, ureters, bladder; PA, posteroanterior.

found the process of determining or selecting the correct exposure factors to use as vague and ominous. Although the students learned about kilovoltage peak (kVp) and milliampere second (mAs) didactically, clinical application was unclear. A poll of 32 junior-year students asked how comfortable they felt about selecting exposure factors. Results found that 0 were very comfortable; 5 were comfortable; 12 slightly comfortable; and 15 were not comfortable.

Junior-year students tend to focus more on patient positioning and collimation and less on patient assessment and technical factors. An assignment was created that required students to think critically about the exposure factors they would use when faced with different patient types (see **Table**). A grid was used to challenge the student to consider 3 patient types: an average-sized adult, a child between the ages of 4 and 7, and a patient who weighed more than 250 lb. On the grid's left is a

list of anatomical parts or radiographic positions. The students were asked to determine the technical factors they would use for each patient's anatomical or radiographic position. After the assignment was complete, an open discussion allowed the students to exchange ideas and conclusions. Students debated and shared their rationales for using a specific technical factor. Students learned how best to assess a patient to determine the optimal exposure factor that would result in a diagnostic image. The assignment also provided the students with a self-made technique chart they feel confident using.

A second assignment was created to help students develop their skill in analyzing diagnostic image quality. The students were given a questionnaire (see **Box**). As the students approached a study for analysis, they answered the questions. After the students completed the questionnaire, the instructor and students would review the images together. The students again were engaged and asked questions, used critical thinking, and became passionate about assessing another case. The instructor identified anything they missed and discussed how to correct the issue.

Using a growth mindset, students were asked to create self-monitoring logs after they completed their assignments. Self-monitoring is a strategy that teaches students to self-assess their behavior and record the results.[4] Self-monitoring allows students to record their progression and ease into analyzing and identifying issues with the images. The students can track their learning progress and assess what skills are strong and which need more attention and work. It provides students immediate feedback on their progression and accomplishments.[4]

Students were asked to monitor and track 3 points in their learning:

- Behavior and feelings (specific) – students were asked to monitor how they felt about the skill set they were working on (eg, How comfortable do you feel about your ability to perform image analysis? Use the following rating system: 1 = very comfortable, 2 = comfortable, 3 = slightly comfortable, and 4 = not comfortable).
- Monitoring successes (observable) – Students might not easily observe how well they are doing, but they can monitor how many questions they are answering correctly.
- Confidence and cognitive development (personal) – As students progress, they monitor how confident they feel about analyzing images they have acquired and know how to correct mistakes when repeating an image using a rating system (eg, 1 = very comfortable, 2 = comfortable, 3 = slightly comfortable, and 4 = not comfortable).

Students reported that the process of self-monitoring allowed them to increase their effectiveness in

Box

Radiograph Analysis Assignment

For this assignment, you are responsible for analyzing radiographs and describing the elements and factors seen in the image provided. Answer the 10 questions below for each image. Number each answer for questions 6 and 7 to state each issue clearly. Take your time and slowly look at all the elements you must consider for a good diagnostic image. Assess what you can identify, and do not be discouraged if you feel you are missing something. Remember that you are slowly developing the skill to identify issues.

1. Name the projection observed in the image.
2. What is the source-to-image distance needed for this projection?
3. What would be the optimal technical factors for this projection on a typical patient?
4. Where does the central ray enter, and is there an angulation required to obtain this projection?
5. What are the evaluation criteria for the projection?
6. Analyzing the images, describe any issues with the image that affect the diagnostic clarity of the image and why it is happening (density, technique, artifacts).
7. Analyzing the images, describe at least 2 issues with the image that affect the diagnostic quality of the image (positioning, movement, artifacts). Please explain how to fix the issues.
8. What would you do to correct the issues seen in the image?
9. What pathology do you see in the image? Name or describe the pathology.
10. Is there an alternative method to taking the projection if the patient has limited mobility? If so, what would you do?

identifying the strengths and weaknesses of their work. It helped increase their motivation and gave them a sense of satisfaction when they saw how well they were doing. Students who initially identified as having a fixed mindset began to understand that their ability to learn and build on their knowledge base was open-ended and could grow with persistence. Their attitude toward the assignments for growth mindset were initially met with discomfort, and they were resistant to being given an assignment that required them to actively participate.

Conclusion

Integrating a growth mindset and active-learning pedagogies in radiologic technology education allows for a progressive teaching method outside of the conventional approach. It expands students' ability to think and engage. The transition from giving students information to memorize to allowing students to work things out for themselves promotes student and teacher interaction and helps develop students' communication skills and critical-thinking abilities while building their confidence. As the students' attitudes and learning needs change so should methods of teaching them. Many educators want their students to excel and grow. Knowing that educators are a small part of students' success and helping them step toward a new chapter in their lives and careers after they graduate is a privilege, as is introducing them to an amazing craft and profession.

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References

1. Harries AJ, Lee C, Jones L, et al. Effects of the COVID-19 pandemic on medical students: a multicenter quantitative study. *BMC Med Educ.* 2021;21:14. doi:10.1186/s12909-020-02462-1
2. Baldwin A, Bryce B, Daugherty D, Lewis L, Steenbergh T. *Promoting Belonging, Growth Mindset, and Resilience to Foster Student Success.* National Resource Center for the First-Year Experience and Students in Transition, University of South Carolina; 2020.
3. Schleider J, Weisz J. A single-session growth mindset intervention for adolescent anxiety and depression: 9-month outcomes of a randomized trial. *J Child Psychol Psychiatry.* 2018;59(2):160-170. doi:10.1111/jcpp.12811
4. Perspectives and resources: self-monitoring. IRISCenter. Accessed August 16, 2023. iris.peabody.vanderbilt.edu/module/sr/cresource/q2/p04