

Aligning Outcomes, Assessment and Activities:

Creating Significant Learning Environments: Learning Outcomes Planning for the CRUX

Blended Learning Course in Cardiac Sonography

EDLD 5313 – Creating Significant Learning Environments

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Creating Significant Learning Environments: Learning Outcomes Planning for the CRUX Blended Learning Course in Cardiac Sonography

Big Hairy Audacious Goal (BHAG)

Students in the CRUX Blended Learning Course will become confident, reflective, and clinically prepared novice cardiac sonographers who can independently connect anatomy, transducer manipulation, image-plane formation, and optimization principles to produce diagnostic-quality echocardiographic images in real patient encounters.

This BHAG provides the overarching purpose for the learning environment. It reflects the long-term impact we want students to achieve, not merely passing assessments, but demonstrating early professional competence, clinical reasoning, and self-directed learning habits essential for safe patient care.

Fink (2013) emphasizes that significant learning environments must be anchored in transformative goals that extend beyond content mastery. A BHAG helps learners understand the “why” behind the course and motivates deeper engagement, especially in high-stakes health science programs.

Learning Environment / Situational Factors Analysis

This section follows the structure of the Learning Environment, Situational Factors Worksheet and contextualizes the CRUX course within the realities of cardiac sonography education.

1. Specific Context of the Teaching/Learning Situation

- **Course Format:** Blended (70% asynchronous CRUX preparation; 30% synchronous lab).
- **Duration:** One semester; weekly modules.
- **Setting:** Community college cardiac sonography program; Brightspace D2L or Google Classroom.
- **Class Size:** 12–20 students.
- **Modality Constraints:** Limited lab time; high demand for individualized coaching; heavy cognitive load.

2. Expectations of External Stakeholders

- **CAAHEP, ARDMS, CCI and ASE:** Require competency in anatomy recognition, image acquisition, optimization, and clinical reasoning.
- **Clinical Sites:** Expect students to arrive with foundational scanning knowledge and professional behaviors.
- **Institution:** Requires alignment with program outcomes and accreditation standards.

3. Nature of the Subject

Cardiac sonography is:

- Highly visual
- Psychomotor-intensive
- Cognitively demanding
- Dependent on spatial reasoning

- Dependent on real-time decision-making

Students must integrate anatomy, acoustic physics, machine controls, and patient interaction simultaneously, making cognitive load management essential (Sweller et al., 2019).

4. Characteristics of the Learners

- Novice sonographers with limited spatial orientation skills.
- Diverse academic backgrounds; many are adult learners.
- High anxiety due to clinical expectations.
- Need structured, predictable learning pathways.
- Benefit from visual modeling and repeated practice.

5. Characteristics of the Instructor

- Expertise in cardiac imaging, curriculum design, and competency-based instruction.
- Facilitator, coach, and mentor rather than lecturer.
- Committed to student-centered learning and constructive alignment.

6. Special Pedagogical Challenges

- Limited lab time for hands-on practice.
- Students often arrive unprepared due to lack of structured pre-lab resources.
- High cognitive load during scanning.
- Need for consistent feedback loops.
- Need to build confidence and reduce performance anxiety.

Questions for Formulating Significant Learning Goals

Using the modified worksheet, the following questions guided the development of the learning outcomes:

Foundational Knowledge

- What essential anatomy, terminology, and sonographic principles must students know before scanning?
- What prior misconceptions must be corrected early?

Application

- What skills must students practice repeatedly to produce diagnostic images?
- How will students apply optimization principles in real time?

Integration

- How will students connect anatomy, probe movement, and image appearance?
- How will CRUX help them integrate visual models with hands-on practice?

Human Dimension

- How will students learn to collaborate, communicate, and give/receive feedback?
- How will they develop confidence and professional identity?

Caring

- How will students develop commitment to patient-centered care and high-quality imaging?

Learning How to Learn

- How will students become self-directed learners who prepare before lab?
- How will reflection help them identify next steps for improvement?

These questions ensure that the learning outcomes address all six dimensions of Fink's Taxonomy, creating a holistic and significant learning environment.

Learning Outcomes 3-Column Table

CRUX Blended Learning Course for Cardiac Sonography

Column 1: Learning Outcomes (Fink's Taxonomy)

Foundational Knowledge

1. Identify cardiac structures in standard echocardiographic views.
2. Describe the relationship between anatomy, transducer position, and image-plane formation.

Application

3. Apply introductory optimization principles (depth, gain, focus, sector width) during guided practice.
4. Analyze image quality using appropriate cardiac sonography terminology.

Integration

5. Connect CRUX visual models to hands-on scanning behaviors in lab.
6. Integrate anatomy, probe movement, and machine controls to improve diagnostic quality.

Human Dimension

7. Collaborate with peers to interpret images, provide feedback, and refine scanning technique.
8. Demonstrate professional communication and reflective practice.

Caring

9. Develop commitment to producing diagnostic-quality images that support patient care.

Learning How to Learn

10. Use reflection and instructor feedback to identify next steps for improvement and self-directed learning.

Column 2: Learning Activities

Asynchronous (CRUX-based)

- Labeled image review
- Guided notes
- Mini-lectures
- Vocabulary practice
- Image comparison activities
- Pre-lab reflection prompts

Synchronous (Lab-based)

- Instructor-guided scanning practice

- Peer coaching using checklists
- Image critique discussions
- Real-time optimization practice
- Collaborative problem-solving

Reflective Activities

- Weekly reflection journals
- Peer feedback loops
- Self-assessment checklists

Column 3: Assessments

Formative

- Low-stakes quizzes
- Image-plane matching
- Optimization checklist
- Peer feedback participation
- Guided notes submission
- Weekly reflections

Summative

- Image critique assignment
- Written explanation of image-plane formation

- Lab performance evaluation
- End-of-unit competency check

Assessments are aligned to outcomes and activities using constructive alignment (Biggs & Tang, 2011), ensuring that students practice exactly what they will be assessed on.

Learning Goals	Learning Activities	Assessment Activities
Foundational Knowledge 1. Identify cardiac structures in standard echocardiographic views. 2. Describe the relationship between anatomy, transducer position, and image-plane formation.	Asynchronous (CRUX-based) • Labeled image review • Guided notes • Mini-lectures • Vocabulary practice • Pre-lab reflection prompt Synchronous (Lab-based) • Instructor-guided scanning practice • Image critique discussions	Formative • Low-stakes oral quizzes • Image-plane oral matching • Guided notes submission • Weekly reflection Summative • Written explanation of image-plane formation • Lab performance evaluation • End-of-unit competency check

Learning Goals	Learning Activities	Assessment Activities
Application 3. Apply introductory 2D optimization principles (frequency, depth, gain, focus, sector width, TGC / LGC, dynamic range, power) during guided practice. 4. Analyze image quality using appropriate cardiac sonography terminology.	Asynchronous (CRUX-based) - Labeled image review - Guided notes - Mini-lectures - Vocabulary practice - Image comparison activities - Pre-lab reflection prompt Synchronous (Lab-based) - Instructor-guided scanning practice - Peer coaching using checklists - Image critique discussions - Real-time optimization practice	Formative - Low-stakes oral and written quizzes - Optimization checklist - Peer feedback participation - Guided notes submission - Weekly reflection Summative - Image critique: scan assignment - Lab performance evaluation - End-of-unit competency check

Learning Goals	Learning Activities	Assessment Activities
Integration 5. Connect CRUX visual models to hands-on scanning behaviors in lab. 6. Integrate anatomy, probe movement, and machine controls to improve diagnostic quality.	Asynchronous (CRUX-based) • Guided notes • Image comparison activities • Pre-lab reflection prompt Synchronous (Lab-based) • Instructor-guided scanning practice • Peer coaching using checklists • Image critique discussions • Real-time optimization practice	Formative • Peer feedback participation • Guided notes submission • Weekly reflection Summative • Image critique: scan assignment • Lab performance evaluation • End-of-unit competency check

Learning Goals	Learning Activities	Assessment Activities
Human Dimension 7. Collaborate with peers to interpret images, provide feedback, and refine scanning technique. 8. Demonstrate professional communication and reflective practice.	Asynchronous (CRUX-based) - Guided notes - Pre-lab reflection prompt Synchronous (Lab-based) - Peer coaching using checklists - Image critique discussions - Real-time optimization practice - Collaborative problem-solving	Formative - Peer feedback participation - Guided notes submission - Weekly reflection Summative - Image critique: scan assignment - Lab performance evaluation - End-of-unit competency check

Learning Goals	Learning Activities	Assessment Activities
Caring 9. Develop commitment to best practice, producing optimized, diagnostic-quality images that support optimal patient care.	Asynchronous (CRUX-based) - Guided notes - Pre-lab reflection prompt Synchronous (Lab-based) - Image critique discussions - Real-time optimization practice	Formative - Guided notes submission - Weekly reflection Summative - Image critique: scan assignment - Lab performance evaluation - End-of-unit competency check

Learning Goals	Learning Activities	Assessment Activities
Learning How to Learn 10. Use reflection and instructor feedback to identify next steps for improvement and self-directed learning.	Asynchronous (CRUX-based) • Guided notes • Pre-lab reflection prompts Synchronous (Lab-based) • Instructor-guided scanning practice • Peer coaching using checklists • Image critique discussions • Real-time optimization practice • Collaborative problem-solving	Formative • Low-stakes quizzes • Image-plane matching • Optimization checklist • Peer feedback participation • Guided notes submission • Weekly reflections Summative • Image critique: scan assignment • Written explanation of image-plane formation • Lab performance evaluation • End-of-unit competency check

Impact on My Innovation Plan

The Course Outcomes planning process and 3-Column Table directly strengthen the CRUX innovation plan in several ways:

1. Ensures Constructive Alignment

By mapping outcomes to activities and assessments, CRUX becomes a structured learning pathway rather than a collection of resources. This alignment is essential for competency-based health science education (O'Shea et al., 2023).

2. Reduces Cognitive Load

Breaking outcomes into Fink's categories helps sequence learning in a way that reduces extraneous cognitive load, critical for novice sonographers (Sweller et al., 2019).

3. Supports Self-Directed Learning

CRUX is designed to shift foundational learning outside the lab. The 3-Column Table clarifies how students will learn how to learn, reflect, and prepare independently.

4. Strengthens Accreditation Alignment

The outcomes align with CAAHEP, ARDMS, CCI and ASE expectations for anatomy recognition, image acquisition, optimization, and professional behaviors (Hilty et al., 2022).

5. Enhances Faculty Collaboration

The table provides a shared framework for faculty to coordinate instruction, evaluate student progress, and refine the curriculum.

6. Improves Transparency for Students

Students can clearly see how each activity contributes to their development as cardiac sonographers, increasing motivation and engagement.

Conclusion

This comprehensive planning document, BHAG, situational factors, significant learning questions, and 3-Column Table, creates a strong foundation for a significant learning environment in cardiac sonography. It ensures that CRUX is not simply a digital resource but a transformative instructional innovation that prepares students for real-world clinical performance.

References

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