# Introduction to ECGs/EKGs

Designer names: Brooke Oliver, Stephanie Roller, Nicole Manley

Theory to Practice Design Project Final Report

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## Executive Summary

The purpose of this instructional unit is to revise the existing EKG curriculum to be more engaging and provide fully online material designed to simplify complex concepts and enhance understanding of EKG rhythm recognition. The training aims to offer an interactive and accessible approach, covering the principles of electrocardiography, including EKG rhythm recognition, arrhythmia intervention techniques, and cardiac pacemaker therapy. This revised curriculum will address the challenges students and professionals face in rhythm identification, particularly in distinguishing similar cardiac rhythms. The overall goal is to help participants gain a basic understanding of the heart's conduction system, how to read and interpret EKGs and learn essential treatment methods for arrhythmias and myocardial infarctions. This approach aims to improve proficiency in rhythm recognition through a more engaging and comprehensive online training program.

The target audience includes both entry-level students with little to no EKG experience and professionals needing to review their skills for their roles in the ER or hospital settings. The age range is quite broad, from 18 to 45, with a primary focus on individuals aged 22 to 25. Participants are motivated by the direct relevance of the EKG material to their professional roles, the goal of career advancement, fulfilling educational requirements and improving patient care capabilities, which enhances their interest and eagerness to learn about EKG.

We utilize case-based learning in this instructional unit so that students can engage in an interactive, authentic, and situated learning environment. With this model, we're creating realistic activities and patient scenarios (with EKG rhythms, symptoms, reasons for entering a clinic/ER) that push students to comprehend, apply, and consolidate EKG knowledge in one place.

Within a series of eLearning courses built in Articulate Storyline, learners will be able to work through segmented activities, then specific case studies, by listening to narration, clicking on markers and other interactive elements, answering knowledge checks, and finally arriving at a diagnosis, treatment, etc. They will receive corrective feedback, as well as learn from guided models and coaching. Scaffolding will be used to transfer their knowledge from previous simpler activities to more complex, well-rounded case studies. This is based on the cognitive apprenticeship model, with demonstrations and coaching more present at the beginning, then a gradual push towards independent mastery.

The anticipated student learning outcomes will be to identify key structures and properties of the heart's electrical conduction system, interpret 6-second and 12-second EKG rhythms, to describe proper treatments to arrythmias, and analyze authentic case studies, devising interpretations, diagnoses, and treatment plans with given scenarios.

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## Instructor Notes

This fully online, asynchronous ECG/EKG instructional unit requires minimal preparatory work from instructors. The instructional unit will be built as a series of lessons in Articulate Storyline. An AI Chatbox will act as an integrated coach and assist learners throughout the courses. It can also be used as an opportunity for students to refresh or explore conceptual EKG knowledge. This unit can be used as a supplemental resource for cardiology students. Instructors should remind students that the answers given by the AI Chatbox should always be vetted for accuracy, and instructors should be available for follow-up questions or confirmations about EKG conceptual topics. A discussion board via Blackboard Collaborate will be available for learners that have questions that are more specific to individual cases. Learners can respond to one another on this platform and share their own experiences. Instructors should encourage students to use the discussion board as well as monitor it and respond where appropriate.

During the development of the instruction unit, instructors should use the Review 360 tool to review the course to ensure content accuracy and functionality, noting any issues for the instructional designer by providing feedback via comments in the review pane.

If instructors plan to use the case studies provided in the instructional unit during in-person or synchronous online classes, they should familiarize themselves with the content to assist students if needed.

**How to Share**

For both in-person and online instructors who wish to share this instructional unit with their students, a few simple steps are required:

1. Provide a link to the instructional unit to your students.
2. Offer guidance to your students on the requirements to access and complete the instructional unit.
3. Assist students who may need help or have questions as they take the instructional unit.

**Access Requirements**

To access and complete this training, students will need a desktop or laptop computer and a stable internet connection. While the training can be taken on a mobile device or tablet, it is not recommended due to potential limitations in functionality. Additionally, calipers may be useful for students as they interact with the on-screen EKGs, enhancing their experience and accuracy in analyzing the data.

**Job Aid and Additional Resources**

At the bottom of this report, we provide a job aid for learners and instructors to learn how to properly utilize the AI Chatbox. The xAPI key will be implemented on our end, so learners will not be required to have a paid version of ChatGPT. Otherwise, no additional readings or videos (besides the ones we develop) are included in the lessons, but we do offer additional resources for learners to explore, such as:

- Simpl Patient Monitor (an app where students can monitor a virtual patient's vitals, including identification of EKG strips)

- Skillstat: 6 Second ECG Simulator (provides various 6-second EKG strips for learners to identify)
- ECG Wave-Maven (offers patient vignettes alongside rhythm identification exercises)
- Dr. Smith's ECG Blog (provides detailed expert analyses of various EKG cases)
- *Life in the Fast Lane's* ECG Library (database that contains anything and everything related to EKG)
- simECG: ECG Simulator (learners are exposed to pre-set rhythms, but can alter heart rate, PR interval, P wave, QRS complex, T wave, etc. to see how the rhythm changes)
- ECGs Made Easy 7th edition by Barbara J Aehlert (a book focused on EKGs, provides explanations on how to identify the rhythms and practice EKG strips with answers)

## Instructional Unit Overview

**Purpose**

The purpose of this unit is to revise the existing EKG curriculum to be more engaging and provide students with fully online material that is designed to simplify complex concepts and offer a more interactive and accessible approach to enhance understanding and improve proficiency in EKG rhythm recognition. This unit aims to provide a basic understanding of how the heart's conduction system works, and a review of the principles of electrocardiography, including EKG rhythm recognition, arrhythmia intervention techniques, and cardiac pacemaker therapy.

**Target Learning Audience**

1. Who is your target learning audience?
   Our target learning audience includes both entry-level students with little to no EKG experience, and those who have prior experience with a need to satisfy review requirements for the ER or hospital they work at. Both groups often face challenges with rhythm identification, especially distinguishing between similar cardiac rhythms. The age range is quite large, ranging from 18-45. However, the primary audience will include those between the ages of 22 and 25.

2. How many will be involved in the learning environment at any one time?
   The training is fully online, so there is no limit to the number of students that can participate at one time, and it is accessible to all, as long as they have access to a computer and a stable internet connection.

3. What are the prerequisites for the learning environment (e.g., knowledge, skills)?
   Because the skill level of the students is diverse, there are no specific prerequisites required for this training. Students may either be highly skilled in ECGs/EKGs interpretation or a novice. Depending on the level of expertise the student has prior to the training, they may achieve different outcomes. For example, a student with more experience may become more sufficient in quickly analyzing complex rhythms, whereas a student with little to no experience may be able to quickly identify if the rhythm is life-threatening or not.

4. What motivates your participants?
   Our participants are primarily motivated by the direct relevance of the EKG material to their professional roles and aspirations. The prospect of improving their patient care capabilities significantly boosts their interest, confidence, and eagerness to learn more about EKG.

   While some participants are driven by the goal of simply completing the program, others are motivated by a variety of factors, including:

   - Acquiring knowledge critical to their current job roles
   - Shifting careers into the healthcare sector
   - Fulfilling educational requirements
   - Gaining a better understanding of cardiology
   - Advancing in their current careers

- Improving their ability to treat patients

**Learning Objectives**
Upon the completion of the unit, learners will be able to:

- Identify the key structures and properties of the heart's electrical conduction system during anatomy review assessments.
- Accurately interpret cardiac rhythms from 6-second rhythm strips and 12-lead rhythm strips during case-based assessments.
- Describe essential treatment methods for arrhythmias.
- Define the basic principles of both temporary and permanent pacemakers and their functions in managing heart conditions.
- Apply treatment methods accurately in simulated clinical assessment scenarios.

**Outline of the Instructional Unit**

1. What topics will you cover and in what order?
   We will cover the following topics in this instructional unit:

   - **Training Session 1:** Principles of EKG Complex and Measurements (label the complex, measure the intervals and durations)
   - **Training Session 2:** Sinus Rhythms (sinus block, sinus arrest, normal sinus rhythm, sinus bradycardia, sinus tachycardia, sinus arrhythmia)
   - **Training Session 3:** Atrial Rhythms (atrial fibrillation, atrial flutter, atrial tachycardia, premature atrial contractions)
   - **Training Session 4:** Junctional Rhythms (premature junctional contractions, junctional escape rhythm, junctional bradycardia, junctional tachycardia, junctional escape beats)
   - **Training Session 5:** Ventricular/Lethal Rhythms (ventricular fibrillation, ventricular tachycardia (monomorphic & polymorphic), premature ventricular contractions, asystole, PEA, IVR, Accelerated IVR)
   - **Training Session 6:** How to interpret a 12-lead EKG
   - **Training Session 7:** Treatments for rhythms in symptomatic patients (medications, temporary pacemakers, defibrillators, etc)

2. When, where, and how will the instructional unit be delivered?
   The instructional unit will be available asynchronously online, available as soon as a learner is enrolled. Hospitals will distribute the yearly training to healthcare professionals, and it will serve as supplementary material for students enrolled in an EKG course.

3. What technology (if any) is needed to access the training, course materials, or complete assignments for the instructional unit?
   Learners will be required to have access to a computer and a stable internet connection, as well as various medical simulation technologies and a pair of calipers, to access the training and course materials, as well as complete assignments for the instructional unit.

4. Which objective(s) are addressed in each training session?
   - **Training Session 1:** Identify the key structures and properties of the heart's electrical conduction system during anatomy review assessments.
   - **Training Session 2:** Accurately interpret cardiac rhythms from 6-second rhythm strips during case-based assessments.
   - **Training Session 3:** Accurately interpret cardiac rhythms from 6-second rhythm strips during case-based assessments.
   - **Training Session 4:** Accurately interpret cardiac rhythms from 6-second rhythm strips during case-based assessments.
   - **Training Session 5:** Accurately interpret cardiac rhythms from 6-second rhythm strips during case-based assessments.

- **Training Session 6:** Accurately interpret cardiac rhythms from 12-lead rhythm strips during case-based assessments.
- **Training Session 7:** Define the basic principles of both temporary and permanent pacemakers and their functions in managing heart conditions. Describe essential treatment methods for arrhythmias.

5. How will learning be assessed (e.g., projects, multiple choice test)? When will the assessment occur during the lesson/session (i.e., pre, during, or post)?
   Knowledge checks and interactive activities will be used to assess learning during the training sessions, with automatic feedback provided. Every lesson will feature questions related to its learning objectives and topics. After the instructional unit, a post-exam will assess all the training session topics and learning objectives.

| Topic | Learning Activities | Delivery & Timeline | Technology | Learning objective | Assessment |
|---|---|---|---|---|---|
| Introduction | Review learning objectives and course goals<br><br>Address how to navigate the course | Asynchronous eLearning module | Internet access, learning management system access,<br>computer access, enrolled in the course | Identify the key structures and properties of the heart's electrical conduction system during anatomy review assessments.<br><br>Accurately interpret cardiac rhythms from 6-second rhythm strips and 12-lead ECGs/EKGs during case-based assessments. | N/A |

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| | | | | Describe essential treatment methods for arrhythmias.<br><br>Define the basic principles of both temporary and permanent pacemakers and their functions in managing heart conditions.<br><br>Apply treatment methods accurately in simulated clinical assessment scenarios. | |
| Principles of EKG Complex and Measurements | • Label the parts of the EKG complex and identify what each portion of the complex represents (such as ventricular repolarization, atrial depolarization, etc.) | Asynchronous eLearning module | Internet access, learning management system access,<br>computer access, enrolled in the course | Identify the key structures and properties of the heart's electrical conduction system during anatomy review assessments. | Knowledge checks on EKG measurements, regularity, and labeling an EKG complex. |

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| | • Label the conduction system throughout the heart<br>• Discuss the normal measurements seen on an EKG rhythm strip (PR interval, QRS duration, etc.)<br>• Determine the regularity of EKG strips (whether the rhythm is regular or irregular) | | | | |
| Sinus Rhythms | (sinus block, sinus arrest, normal sinus rhythm, sinus bradycardia, sinus tachycardia, sinus arrhythmia) | Asynchronous eLearning module | Internet access, learning management system access,<br>computer access, enrolled in the course | Accurately interpret cardiac rhythms from 6-second rhythm strips during case-based assessments. | Knowledge checks on Identifying and differentiating between sinus rhythms. Anatomy of an EKG. |
| Atrial Rhythms | (atrial fibrillation, atrial flutter, atrial tachycardia, premature atrial contractions) | Asynchronous eLearning module | Internet access, learning management system access,<br>computer access, enrolled in the course | Accurately interpret cardiac rhythms from 6-second rhythm strips during case-based assessments. | Knowledge checks on Anatomy of an EKG, identifying and differentiating between sinus rhythms and atrial rhythms with a focus on newly covered material |

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| Junctional Rhythms | (premature junctional contractions, junctional escape rhythm, junctional bradycardia, junctional tachycardia, junctional escape beats) | Asynchronous eLearning module | Internet access, learning management system access,<br>computer access, enrolled in the course | Accurately interpret cardiac rhythms from 6-second rhythm strips during case-based assessments. | Knowledge checks on Anatomy of an EKG, identifying and differentiating between sinus, atrial, and Junctional rhythms with a focus on newly covered material |
| Ventricular/ Lethal Rhythms | (ventricular fibrillation, ventricular tachycardia (monomorphic & polymorphic), premature ventricular contractions, asystole, PEA, IVR, Accelerated IVR) | Asynchronous eLearning module | Internet access, learning management system access,<br>computer access, enrolled in the course | Accurately interpret cardiac rhythms from 6-second rhythm strips during case-based assessments. | Knowledge checks on Anatomy of an EKG, identifying and differentiating between sinus, atrial, junctional, and ventricular rhythms with a focus on newly covered material |
| How to interpret a 12-lead EKG | Are there signs of a heart block (long PR interval, multiple P's per QRS), signs of a bundle branch block, which leads correlate with which specific coronary vessel to best determine STEMI location | Asynchronous eLearning module | Internet access, learning management system access,<br>computer access, enrolled in the course | Accurately interpret cardiac rhythms from 12-lead rhythm strips | Knowledge checks on How to assess a 12 lead EKG, Anatomy of an EKG, identifying and differentiating between sinus, atrial, junctional and ventricular rhythms. with a focus on newly covered material |

| | | | | | |
|---|---|---|---|---|---|
| Treatments for Rhythms in Symptomatic Patients | (medications, temporary pacemakers, defibrillators, etc.) | Asynchronous eLearning module | Internet access, learning management system access,<br><br>computer access, enrolled in the course | Describe essential treatment methods for arrhythmias.<br><br>Define the basic principles of both temporary and permanent pacemakers and their functions in managing heart conditions.<br><br>Apply treatment methods accurately in simulated clinical assessment scenarios. | Knowledge checks on Treatments for select rhythms, how to assess a 12 lead EKG, Anatomy of an EKG, identifying and differentiating between sinus, atrial, junctional and ventricular rhythms. with a focus on newly covered material |
| Conclusion | Review of the learning objectives and key points throughout the instructional unit | Asynchronous eLearning module | Internet access, learning management system access,<br><br>computer access, enrolled in the course | Identify the key structures and properties of the heart's electrical conduction system during anatomy review assessments. | Post-assessment (50 questions) ~7 questions per training session topic |

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| | | | | Accurately interpret cardiac rhythms from 6-second rhythm strips and 12-lead ECGs/EKGs during case-based assessments.<br><br>Describe essential treatment methods for arrhythmias.<br><br>Define the basic principles of both temporary and permanent pacemakers and their functions in managing heart conditions.<br><br>Apply treatment methods accurately in simulated clinical assessment scenarios. | |

## Instructional Design Decisions

**Constructivist Instructional Design Principles and Strategies**

Our design aligns thoroughly with Merrill's First Principles of Instruction, incorporating the tenets in mostly sequential order (Merrill, 2020).

Demonstration Principle

First, we highlight the Demonstration Principle when our healthcare "expert" introduces atrial rhythms, the differences between regular and irregular rhythms, and atrial depolarization and its representation on an EKG strip (Merril, 2020, p. 5-6). Later in the course, we invoke this principle again by creating an authentic patient scenario (with EKG rhythms, symptoms, etc.) that our healthcare character carefully works through. The expert's reasoning is highlighted through narration, interactive markers, pop-up windows, and more. An AI Chatbox, with the expert's personality, will also be offered if students want to pause and ask questions on any of the EKG concepts.

Application Principle:

Our Application Principle is activated once students complete the demonstration and are given their own activities to complete (Merril, 2020, p. 6-8). They will identify EKG rhythms, such as atrial rhythm, atrial flutter, and premature atrial contractions, while the healthcare expert offers tips on what to look for. Next, students will interpret atrial rhythms, with clickable icons highlighting p-waves, PR intervals, QRS complexes, etc., and corrective feedback given on their interpretations. After the healthcare expert compares different atrial rhythms, the learners engage in interactive matching exercises, such as labeling components and matching rhythm names to strips. Again, they are offered corrective feedback. In the end, learners will be offered a short but complete case study (after being walked through an example case study), guided, and corrected by the coach. The AI Chatbox coach will also be available to answer conceptual questions.

Problem-Centered Principle:

Our Problem-Centered Principle is introduced when learners work on longer, less coach-guided case studies with patient histories, symptoms, and EKG strips (Merril, 2020, p. 8-9). They learn to interpret EKGs, make diagnoses, and suggest patient management plans by working through increasingly difficult scenarios, with knowledge gained from previous examples applying to their current assignments. These case studies will become more complex, and the learners will be pushed towards independence, with less hints and less feedback displayed. The knowledge checks will also slowly decrease until the learner only answers questions at the end—they must be correct *all the way* through, without coaches pointing them in the right direction, for these tests.

Activation Principle:
Our Activation Principle is concurrent with our Problem-Centered Principle, and our whole project (Merril, 2020, p. 9-10). The existing experience of previous case studies are used to build onto more difficult scenarios, where students relate concepts to each other and consolidate their learning. These mental models will strengthen as learners encounter more authentic scenarios until the rhythms they interpret and decisions they make become increasingly second nature.

Integration Principle:
The Integration Principle is promoted when students are prompted to reflect upon and defend their reasoning, interpretations, and decisions in long-answer questions, just as the healthcare expert did in their own demonstration (Merril, 2020, p. 11). Not only that, but they will hopefully be able to carry their experiences in our situated learning environments into real healthcare environments. This principle would be applied, not in the online instructional unit, but in the classroom or in the workplace as students integrate what they learned into the real world.

During these scenarios, from a scientific perspective, we also design to reduce cognitive load. For example, we will not include animations *and* text *and* narration, shifting the text to narration, which will occur at the same time as any animations (modality effect, redundancy effect, temporal congruity effect); we won't provide non-relevant visual material (coherence effect); we will offer a short pre-training segment to teach definitions and other terms of interest (pre-training effect); and our case studies will be broken into logical steps (segmenting principle) (Mayer & Moreno, 2003, p. 5).

**Cognitive Apprenticeship Design Principles**
We purposefully built a cognitive apprenticeship model into our lessons (Collin et al., 1991). In our more guided demonstrations or assignments, the thinking of the "expert" is *modeled* for the students to learn from. Then, we offer increasingly difficult and complex activities and case studies, each *scaffolding* on the last, with the *coaching* and feedback fading as learners gain independence. Students are given opportunities to *articulate* their reasoning for interpreting rhythms, making diagnoses, etc., just as they saw the coach do, and at the end, they can write and *reflect* on their achievements, challenges, changes in comprehension, etc. We also offer many added resources they can *explore* on their own. This also takes place in a situated cognition environment, so the activities aren't divorced from what they may encounter in their fields, such as what should occur in a genuine apprenticeship.

**Collaborative Practices**
While these activities can be completed individually, learners are welcome to collaborate within their classroom environments as well as via a provided open-forum discussion post. We worked

to incorporate Vygotsky's themes of sociocultural learning such as guided participation, psychological tools, and the Zone of Proximal Development (Polly et al., 2018).

The guided participation and coaching are innately scaffolded, as our expert will model EKG interpretation, diagnostic decision-making, etc. and will offer tips and tricks during increasingly complex tasks until the learner has developed the skill and can practice on their own. In this way, the learner is collaborating with the coach, the responsibility of successfully activities moving through activities shifting from coach to learner. The AI Chatbox is another way the learner can collaborate with an expert source. Our tools consist of careful repetition of terms, realistic EKG images, a built-in expert guide, and an AI Chatbox included to fill any conceptual gaps. These tools can be used (and hopefully will) to study with others, collaborating on definitions, interpretations, diagnoses, etc.

The entire lesson model is scaffolded from modeling of definitions and key terms to simple guided activities, to more complex guided activities, a case study model, to simple semi-guided case study, and to independently solved complex case studies with the AI Chatbox still open for questions. Almost all of the instructional unit exists in the Zone of Proximal Development, since students will be constantly learning new concepts and stretching themselves with assignments but will work throughout with varying degrees of coaching (Polly et al., 2018). Lastly, our lessons are again all cemented within situated, authentic cognition, so students can begin to apply what they've learned into their careers.

**Constructivist Instructional Approach**

The instructional approach we utilized for the TPID project is Case-Based Reasoning (CBR). CBR is an experience-based approach to solving new problems. As stated in *Principles of Case-Based Reasoning*, "CBR systems improve their performance, becoming more efficient by remembering old [successful] solutions given to similar problems and adapting them to fit a new problem rather than having to solve it from scratch" (Sànchez-Marrè, p. 1).

This methodology was chosen due to its effectiveness in introducing and reinforcing complex concepts, particularly in the context of EKG interpretation.

We intend to initially introduce the fundamental concepts and principles of EKGs, employing scaffolding techniques to guide learners through the interpretation process by posing targeted questions that help them identify one component at a time. As learners progress through the units, they will gradually become more adept at interpreting EKGs independently, without additional assistance. CBR aligns well with this instructional strategy as it involves demonstrating solutions to problems early on—in this case, how to read and interpret an EKG. Later, learners will be presented with unfamiliar problems and will need to apply previously learned solutions to these new scenarios. For instance, when examining an EKG, learners will

learn to determine the presence of a P-wave, assess the narrowness of the QRS complex, and evaluate the rhythm's speed.

The key features of the CBR approach are realized in our instructional unit by enabling learners to retrieve similar cases from memory, adapt those cases to fit current problems, and then apply the adapted solutions to resolve new challenges (Sànchez-Marrè, p. 1). This method not only promotes deeper understanding but also enhances the learners' ability to apply their knowledge in practical, real-world situations.

**Technology Integration Decision**

We incorporated an AI Chatbox into our instructional unit because EKG can be a complicated topic, and our learners have conveyed that it's difficult for them to memorize and interpret all the rhythms. We can teach the basics within our course, but we cannot anticipate every question a learner may have. An AI Chatbox is a software program that uses artificial intelligence (AI) to simulate human-like conversations with users. An AI Chatbox that is represented by a healthcare "coach" will assist in answering additional questions that the learner may have during our unit. Students can interact with the AI Chatbox by clicking on an icon, opening a new page, and asking almost any knowledge question about EKG that the "coach" will answer thoroughly (Ming, 2024). Students will be informed that the AI cannot interpret rhythms for them; it is only intended to serve as a guide. They can then apply this more general content knowledge to specific cases as they work through them. We plan to develop various healthcare scenarios in Storyline that allow us to utilize case-based learning, with invented, realistic patients, vital signs, EKG rhythms, and more.

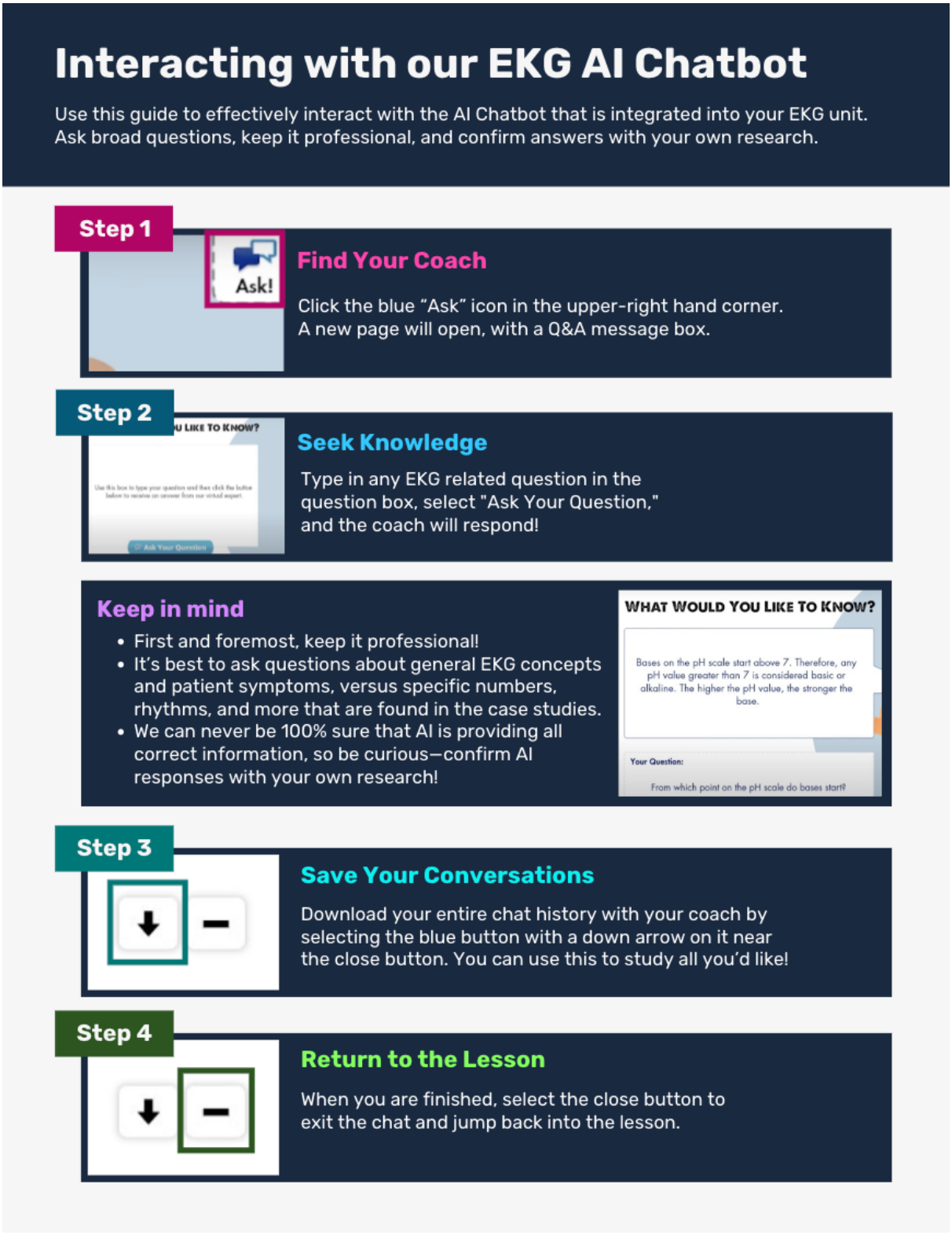
This AI Chatbox tool can be used to engage, enhance, and extend learning goals supporting the Triple-E framework ("About the Triple E Framework"). We must ensure that we are not adding technology for the sake of it—ultimately, it needs to support our learning goals and objectives. In our case, we believe our learning goals and objectives are supported since we are using a cognitive apprenticeship instructional strategy. Our instructional unit setup shows an example case study with an "expert" moving through their thought processes. Then, case studies will be presented to the students with increasing complexity and slowly decreased coaching. The OpenAI Chatbox will enhance the presence and support of the coach, supplementing learners' foundational EKG knowledge as they progress through each case study and fostering a more engaging and supportive learning experience.

We ensure that our technology fits according to the Triple E framework. The Triple E framework is based on three components: Engagement in learning goals, Enhancement of learning goals, and Extension of learning goals ("About the Triple E Framework"). Our instructional strategies will be integrated into the AI chatbot tool to align with the "Engage," "Enhance," and "Extend" mantras of the Triple-E framework. Our scenario-based learning represents the "Extend"

category, with opportunities for students to exit the typical classroom and engage in authentic, job-relevant applications. The AI Chatbox exemplifies "Enhance" by providing in-depth, advanced knowledge of EKG, answering unforeseen questions, and guiding students through their scaffolded case studies. This allows students to apply insights gained from the AI Chatbox directly to specific scenario assessments. Lastly, the AI Chatbox represents “Engage.” Although it may increase the amount of time a student works on an assignment, it will support deeper learning and understanding of the material, allowing them to move quickly and efficiently through the cases, scenarios, and assessments. This guidance will motivate the students to continue through the case studies as they become more challenging. It will also encourage them to be more active learners, pushing them to seek out the knowledge they require and how to properly apply it to real-life situations.

**Job Aid**

https://infograph.venngage.com/ps/rrnTajON1A




**Note:** Screenshots are integrated from Ming, 2024 and Noraiz, 2024, both cited below.

Instructional Unit Plan

| Training Session #1 Description | |
|---|---|
| **Session 1:** Principles of EKG Complex and Measurements<br>*Tutorial (50 minutes)* | |
| **Topics** | Students will cover the basics of cardiac anatomy and electrical pathways. They will learn how the electrical pathways affect the EKG complex. They will learn how to label each part of the EKG complex and each measurement that should be performed. |
| **Learning objectives** | • Identify the key structures and properties of the heart's electrical conduction system during anatomy review assessments. |
| **Instructor Preparation** | |
| Ensure that the online learning modules are accurate, engaging, and up to date. This involves reviewing the material to confirm its correctness and relevance, while also checking for any outdated information or errors. The goal is to help learners fully understand the content being discussed. Since these modules are completed online, instructors' primary role should be to verify that the materials are accurate and support learning effectively. | |
| **Materials and Equipment** | |
| AI Chatbot Job Aid: https://infograph.venngage.com/ps/rrnTajON1A<br><br>Introduction to ECG/EKGs online course<br><br>Open-forum Discussion Board on BB Collaborate | |
| **Body of the Training Session** | |
| **Warm-up** (10 minutes)<br>The Storyline lesson begins with a video showing a patient in the Emergency Department undergoing an EKG, which is then passed to a physician for interpretation. In this video, the physician provides context about the patient's symptoms and any relevant information to the learners.<br><br>**Main Learning Activities** (40 minutes)<br>Learners will engage in an interactive Storyline scenario that continues from the warm-up video. In this scenario, a physician coach will guide them through the process of identifying and measuring each component of the EKG. The physician will also explain how each part of | |

the EKG complex correlates with cardiac physiology. For example, they will highlight how ventricular contraction corresponds to the QRS complex, which represents ventricular depolarization. To enhance understanding, a heart model will be displayed on the screen, allowing learners to visualize the anatomy as the physician explains the relationship between the EKG complex and the electrical impulses traveling through the heart.

**Instructional design principles/strategies/teaching methods**:
In this Storyline lesson, we use the Demonstration Principle when the healthcare expert introduces the EKG complex, explaining how to identify and measure it, as well as its components. The expert's reasoning is illustrated through narration, interactive markers, pop-up windows, and other tools. An AI Chatbox, reflecting the expert's personality, will also be available for students to pause and ask questions about any of the EKG concepts. Within our cognitive apprenticeship framework, we highlight the modeling section, with heavy coaching.

We also use the Application Principle during practice activities. Once learners complete the demonstration, they will identify and interpret EKG rhythms, while the healthcare expert offers tips on what to look for as well as provide corrective feedback where needed. Within our cognitive apprenticeship framework, we scaffold our activities with increasing complexity, with the coaching still an active element.

**Practice and Feedback*:***
Learners will have the opportunity to practice analyzing multiple EKG strips throughout the Storyline lesson, with support from an AI Chatbox. This interactive tool will enable them to ask questions when uncertain and build confidence in their understanding before taking the assessment. The AI Chatbox will guide and help learners arrive at the correct answers, rather than simply providing the solutions.

## Feedback and Assessment Plan

At the end of the lesson, students will complete a Storyline quiz to assess their knowledge retention. The quiz will include both labeling tasks for the EKG complex and open-ended questions requiring students to explain, in their own words, what occurs at specific points of the EKG complex—the articulation stage of cognitive apprenticeship. Before the quiz, students will have the opportunity to receive feedback and guidance from the AI Chatbox. If a quiz question is answered incorrectly, students will be provided with the correct information in written form, accompanied by a diagram whenever possible. While these knowledge checks occur at the end of each lesson, a larger summative assessment will take place at the end of all the lessons, allowing learners to apply their knowledge in practical scenarios.

| Training Session #2 Description | |
|---|---|
| **Session 2:** Sinus Rhythms<br>*Tutorial (50 minutes)* | |
| **Topics** | Learners will learn to identify sinus rhythms, these include Normal Sinus Rhythm, Sinus Bradycardia, Sinus Tachycardia, Sinus Arrhythmia, Sinus Block, and Sinus Arrest. Learners will be able to determine if treatment is necessary and treatment protocol. |
| **Learning objectives** | • Identify the key structures and properties of the heart's electrical conduction system during anatomy review assessments.<br>• Accurately interpret cardiac rhythms from 6-second rhythm strips and 12-lead rhythm strips during case-based assessments.<br>• Apply treatment methods accurately in simulated clinical assessment scenarios. |
| **Instructor Preparation** | |
| Ensure that the online learning modules are accurate, engaging, and up to date. This involves reviewing the material to confirm its correctness and relevance, while also checking for any outdated information or errors. The goal is to help learners fully understand the content being discussed. Since these modules are completed online, instructors' primary role should be to verify that the materials are accurate and support learning effectively. | |
| **Materials and Equipment** | |
| AI Chatbot Job Aid: https://infograph.venngage.com/ps/rrnTajON1A<br><br>Introduction to ECG/EKGs online course<br><br>Open-forum Discussion Board on BB Collaborate | |
| **Body of the Training Session** | |
| **Warm-up** (10 minutes)<br>The Storyline lesson opens with learners applying their knowledge from Lesson 1 by labeling EKG rhythm complexes (P, Q, R, S, T) and measuring the selected portions (PR interval, QRS complex, QT interval).<br><br>**Main Learning Activities** (40 minutes) | |

Learners will participate in interactive case studies where they are on the Med Surg floor with a nurse as their guide through the sinus rhythms. Learners will be able to view different patients' rhythms and learn how the Med Surg floor is managing any symptomatic patients. The nurse will also explain the electrical pathway these rhythms are taking originate from the SA Node. Normal Sinus Rhythm and Sinus arrhythmia will be identified first as they involve no treatment. Next, the learners will see Sinus Bradycardia, which only requires treatment if the patient is symptomatic. Last, they will see Sinus Tachycardia, which only requires treatment if the patient is symptomatic. The nurse will cover the treatment options for both Sinus Bradycardia and Sinus Tachycardia.

Patient details will be presented to the learner, along with EKG strips showing sinus rhythms. The learner will be asked several successive questions regarding the patient's rhythm strip and must analyze it and respond. Question difficulty will increase as the scenario progresses, and the learners will be guided to identify the rhythm.

**Instructional design principles/strategies/teaching methods:**

In this Storyline lesson, we start with the Activation principle, asking learners to draw on the previous knowledge they gained during prior lessons with practice activities and knowledge checks. This will serve as an organizer for the learner's new knowledge and skills gained during this lesson. This is within the scaffolding tier of cognitive apprenticeship, new knowledge built on old knowledge.

Then, we use the Demonstration Principle and cognitive apprenticeship's modeling when the healthcare expert introduces the distinct types of rhythms, describes what they are, and what pathways they take in the electrical system. An AI Chatbox, reflecting the expert's personality, will also be available for students to pause and ask questions about any of the EKG concepts.

We use the Application Principle during practice activities. Once learners complete the demonstration, they will practice analyzing multiple EKG strips and identifying them, while the healthcare expert offers tips on what to look for as well as provide corrective feedback where needed. Again, the coaching and scaffolding stages of cognitive apprenticeship are relevant here.

**Practice and Feedback*:***

Learners will have the opportunity to practice analyzing multiple EKG strips; this will include all the rhythms covered in this Storyline lesson, with support from an AI Chatbox. This interactive tool will enable them to ask questions when uncertain and build confidence in their understanding before taking the assessment. The AI Chatbox will guide and help learners arrive at the correct answers, rather than simply providing the solutions.

## Feedback and Assessment Plan

At the beginning of the Storyline lesson, students will review what they learned in the previous lesson by answering questions on the EKG complex and cardiac anatomy. These questions will include labeling a complex, describing what is happening during each portion of the EKG complex, and the measurements of the PR interval and QRS duration.

At the end of the lesson, students will complete a Storyline quiz to assess their knowledge retention. The Storyline quiz will include both labeling tasks for the EKG complex and rhythm interpretation. Students will be asked to discuss the treatment of select rhythms and the order the treatment process should happen. Before the quiz, students will have the opportunity to receive feedback and guidance from the AI Chatbox. If a quiz question is answered incorrectly, students will be provided with the correct information in written form, accompanied by a diagram whenever possible. While these knowledge checks occur at the end of each lesson, a larger summative assessment will take place at the end of all the lessons, allowing learners to apply their knowledge in practical scenarios.

<table>
<tr><th colspan="2">Training Session #3 Description</th></tr>
<tr><td colspan="2">Session 3: Atrial Rhythms<br>Tutorial (50 minutes)</td></tr>
<tr><td>Topics</td><td>Learners will learn to interpret atrial rhythms such as atrial tachycardia, atrial fibrillation, atrial flutter, and premature atrial contractions. Learners will be able to determine when treatment is necessary and treatment protocol.</td></tr>
<tr><td>Learning objectives</td><td>• Identify the key structures and properties of the heart's electrical conduction system during anatomy review assessments.<br>• Accurately interpret cardiac rhythms from 6-second rhythm strips and 12-lead rhythm strips during case-based assessments.<br>• Apply treatment methods accurately in simulated clinical assessment scenarios.</td></tr>
<tr><th colspan="2">Instructor Preparation</th></tr>
<tr><td colspan="2">Ensure that the online learning modules are accurate, engaging, and up to date. This involves reviewing the material to confirm its correctness and relevance, while also checking for any outdated information or errors. The goal is to help learners fully understand the content being discussed. Since these modules are completed online, instructors' primary role should be to verify that the materials are accurate and support learning effectively.</td></tr>
<tr><th colspan="2">Materials and Equipment</th></tr>
<tr><td colspan="2">AI Chatbot Job Aid: https://infograph.venngage.com/ps/rrnTajON1A<br><br>Introduction to ECG/EKGs online course<br><br>Atrial Rhythm Interactive Demonstration link<br><br>Open-forum Discussion Board on BB Collaborate</td></tr>
<tr><th colspan="2">Body of the Training Session</th></tr>
<tr><td colspan="2">Warm-up (10 minutes)<br>The Storyline lesson opens with learners applying their knowledge from Lessons 1 & 2. There will be a mixed knowledge check that has individuals label the EKG complexes and identify previously learned sinus rhythms.</td></tr>
</table>

**Main Learning Activities** (40 minutes)
Learners will participate in interactive case studies where they accompany a cardiologist in their office during patient visits. The cardiologist will explain various atrial rhythms, how to differentiate them, and the symptoms patients may experience with each rhythm. The cardiologist will explain atrial rhythms begin at AV node and learners will follow the electrical pathway through the cardiac anatomy. They will also discuss the medications and treatments used when patients exhibit symptoms. To reinforce learning, learners will be engaged throughout the session by identifying rhythms and applying the concepts discussed.

Patient details will be presented to the learner, along with EKG strips showing atrial rhythms. The learner will be asked several successive questions regarding the patient's rhythm strip and must analyze it and respond. Question difficulty will increase as the scenario progresses, and the learners will be guided to identify the rhythm.

**Instructional design principles/strategies/teaching methods:**
In this Storyline lesson, we start with the Activation principle and cognitive apprenticeship's scaffolding, asking learners to draw on the previous knowledge they gained during prior lessons with practice activities and knowledge checks. This will serve as an organizer for the learner's new knowledge and skills gained during this lesson.

Then, we use the Demonstration Principle and cognitive apprenticeship's modeling stage when the healthcare expert explains various atrial rhythms, how to differentiate them and the symptoms patients may experience with each rhythm, as well as how the electrical system ties it all together.

Our Problem-Centered Principle is introduced as learners work on a coached and guided interactive patient scenario with patient histories, symptoms, and EKG strips. They learn to interpret EKGs, make diagnoses, and suggest patient management plans by working through increasingly difficult scenarios, and they apply knowledge gained from previous interactive cases. This is approaching the Integration Principle, as students are beginning to independently consolidate and apply all of their previous knowledge in large, complex tasks.

We use the Application Principle during interactive cases and patient scenarios. Coaching is gradually withdrawn, and the learners continue to receive feedback as they make choices and engage with what they have learned.

**Practice and Feedback*:***
Learners will have the opportunity to practice analyzing multiple EKG strips; this will include all the rhythms covered in this Storyline lesson, with support from an AI Chatbox. This interactive tool will enable them to ask questions when uncertain and build confidence in their understanding before taking the assessment. The AI Chatbox will provide guidance to help learners arrive at the correct answers, rather than simply providing the solutions.

| Feedback and Assessment Plan |
| --- |
| At the beginning of the Storyline lesson, students will review what they learned in the previous lessons by answering questions on the EKG complex, cardiac anatomy, and Sinus Rhythms. These questions will include labeling a complex, describing what is happening during each portion of the EKG complex, the measurements of the PR interval and QRS duration, and rhythm identification.<br><br>At the end of the Storyline lesson, students will complete a quiz in Storyline to assess their knowledge retention. The quiz will include both labeling tasks for the EKG complex and rhythm interpretation. Students will be asked to discuss the treatment protocol for selecting rhythms. Before the quiz, students will have the opportunity to receive feedback and guidance from the AI Chatbox. If a quiz question is answered incorrectly, students will be provided with the correct information in written form, accompanied by a diagram whenever possible. While these knowledge checks occur at the end of each lesson, a larger summative assessment will take place at the end of all the lessons, allowing learners to apply their knowledge in practical scenarios. |

<table>
<tr><th colspan="2">Training Session #4 Description</th></tr>
<tr><td colspan="2">Session 4: Junctional Rhythms<br>Tutorial (50 minutes)</td></tr>
<tr><td>Topics</td><td>Learners will focus on junctional rhythms, such as junctional rhythm, junctional bradycardia, accelerated junctional rhythm, junctional escape beats and premature junctional contractions. Learners will be able to determine when treatment is necessary and treatment protocol.</td></tr>
<tr><td>Learning objectives</td><td>• Identify the key structures and properties of the heart's electrical conduction system during anatomy review assessments.<br>• Accurately interpret cardiac rhythms from 6-second rhythm strips and 12-lead rhythm strips during case-based assessments.<br>• Apply treatment methods accurately in simulated clinical assessment scenarios.</td></tr>
<tr><th colspan="2">Instructor Preparation</th></tr>
<tr><td colspan="2">Ensure that the online learning modules are accurate, engaging, and up to date. This involves reviewing the material to confirm its correctness and relevance, while also checking for any outdated information or errors. The goal is to help learners fully understand the content being discussed. Since these modules are completed online, instructors' primary role should be to verify that the materials are accurate and support learning effectively.</td></tr>
<tr><th colspan="2">Materials and Equipment</th></tr>
<tr><td colspan="2">AI Chatbot Job Aid: https://infograph.venngage.com/ps/rrnTajON1A<br><br>Introduction to ECG/EKGs online course<br><br>Open-forum Discussion Board on BB Collaborate</td></tr>
<tr><th colspan="2">Body of the Training Session</th></tr>
<tr><td colspan="2">Warm-up (10 minutes)<br>The Storyline lesson opens with learners applying their knowledge from Lessons 1-3. There will be a mixed knowledge check that has individuals label the EKG complexes and identify previously learned sinus and atrial rhythms.</td></tr>
</table>

**Main Learning Activities** (40 minutes)
Learners will participate in interactive case studies where they are guided to the CCU where patients are recovering from open heart surgery and intensive invasive cardiac procedures. A nurse will guide learners through junctional rhythms, explaining cardiac surgeries can cause junctional rhythms. These rhythms originate at the AV Junction and learners will follow the electrical pathway from there through the cardiac anatomy. The nurse will explain when treatments must be used and what those treatments are. Learners will engage in rhythm identification throughout the Storyline lesson with the AI Chatbox as a guide.

Patient details will be presented to the learner, along with EKG strips showing junctional rhythms. The learner will be asked several successive questions regarding the patient's rhythm strip and must analyze it and respond. Question difficulty will increase as the scenario progresses, and the learners will be guided to identify the rhythm.

**Instructional design principles/strategies/teaching methods:**
In this Storyline lesson, we start with the Activation principle, asking learners to draw on the previous knowledge they gained during prior lessons with practice activities and knowledge checks. This will serve as an organizer for the learner's new knowledge and skills gained during this lesson.

Then, we use the Demonstration Principle and cognitive apprenticeship's modeling stage when the healthcare expert explains various junctional rhythms, what causes them, and how they travel through the electrical system, as well as potential treatments and when they should be used.

We continue to use the Problem-Centered Principle as learners work on less coach-guided case studies with patient histories, symptoms, and EKG strips. They learn to interpret EKGs, make diagnoses, and suggest patient management plans by working through increasingly difficult scenarios, and they apply knowledge gained from previous interactive cases. This is approaching the Integration Principle, as students are beginning to independently consolidate and apply all of their previous knowledge in large, complex tasks.

We use the Application Principle during interactive cases and patient scenarios. Coaching is gradually withdrawn, shifting to the more independent stages of cognitive apprenticeship, and the learners continue to receive feedback as they make choices and engage with what they have learned.

**Practice and Feedback*:***
Learners will have the opportunity to practice analyzing multiple EKG strips; this will include all the rhythms covered in this Storyline lesson, with support from an AI Chatbox. This

interactive tool will enable them to ask questions when uncertain and build confidence in their understanding before taking the assessment. The AI Chatbox will guide and help learners arrive at the correct answers, rather than simply providing the solutions.

## Feedback and Assessment Plan

At the beginning of the lesson, students will review concepts from previous lessons by answering questions on the EKG complex and rhythm interpretation. Students will be asked to discuss the treatment protocol for selecting rhythms. These questions will include labeling a complex, describing what is happening during each portion of the EKG complex, measurements of the PR interval and QRS duration, sinus rhythms, and atrial rhythms.

At the end of the lesson, students will complete a quiz in a Storyline to assess their knowledge retention. The Storyline quiz will include identification and treatment options for Junctional Rhythms. There will be questions about the identification process for Junctional Rhythms. Before the quiz, students will have had the opportunity to receive feedback and guidance from the AI Chatbox. If a quiz question is answered incorrectly, students will be provided with the correct information in written form, accompanied by a diagram whenever possible. While these knowledge checks occur at the end of each lesson, a larger summative assessment will take place at the end of all the lessons, allowing learners to apply their knowledge in practical scenarios.

| Training Session #5 Description | |
|---|---|
| **Session 5:** Ventricular and Lethal Rhythms<br>*Tutorial (50 minutes)* | |
| **Topics** | Learners will focus on ventricular and lethal rhythms, such as ventricular fibrillation, ventricular tachycardia, premature ventricular contractions, idioventricular rhythm, accelerated idioventricular rhythm, asystole, and pulseless electrical activity. |
| **Learning objectives** | • Identify the key structures and properties of the heart's electrical conduction system during anatomy review assessments.<br>• Accurately interpret cardiac rhythms from 6-second rhythm strips and 12-lead rhythm strips during case-based assessments.<br>• Apply treatment methods accurately in simulated clinical assessment scenarios. |
| **Instructor Preparation** | |
| Ensure that the online learning modules are accurate, engaging, and up to date. This involves reviewing the material to confirm its correctness and relevance, while also checking for any outdated information or errors. The goal is to help learners fully understand the content being discussed. Since these modules are completed online, instructors' primary role should be to verify that the materials are accurate and support learning effectively. | |
| **Materials and Equipment** | |
| AI Chatbot Job Aid: https://infograph.venngage.com/ps/rrnTajON1A<br><br>Introduction to ECG/EKGs online course<br><br>Ventricular Case Study Review 360 link<br><br>Ventricular Post-Assessment Review 360 link<br><br>Open-forum Discussion Board on BB Collaborate | |
| **Body of the Training Session** | |
| **Warm-up** (10 minutes)<br>The Storyline lesson opens with learners applying their knowledge from Lessons 1-4. There will be a mixed knowledge check that has individuals label the EKG complexes and identify previously learned sinus, atrial, and junctional rhythms. | |

**Main Learning Activities** (40 minutes)
Learners will participate in interactive case studies where they observe an interventional cardiologist performing heart catheterizations on various patients in the Cath Lab. The cardiologist will explain that ventricular rhythms originate in the ventricles, specifically from the bundle branches or Purkinje fibers, rather than the SA node. Learners will be guided through the identification and treatment of these rhythms, with a focus on recognizing those considered lethal. The cardiologist will also discuss potential symptoms patients may experience related to these rhythms.

Patient details will be presented to the learner, along with EKG strips showing ventricular rhythms. The learner will be asked several successive questions regarding the patient's rhythm strip and must analyze it and respond. Question difficulty will increase as the scenario progresses, and the learners will be guided to identify the rhythms.

**Instructional design principles/strategies/teaching methods:**
In this Storyline lesson, we start with the Activation principle and cognitive apprenticeship's scaffolding stage, asking learners to draw on the previous knowledge they gained during prior lessons with practice activities and knowledge checks. This will serve as an organizer for the learner's new knowledge and skills gained during this lesson.

Then, we use the Demonstration Principle and cognitive apprenticeship's modeling stage when the healthcare expert explains various ventricular and lethal rhythms, as well as the identification and treatment of these rhythms, with a focus on recognizing those considered lethal.

We continue to use the Problem-Centered Principle as learners work on less coach-guided case studies with patient histories, symptoms, and EKG strips. They learn to interpret EKGs, make diagnoses, and suggest patient management plans by working through increasingly difficult scenarios, and they apply knowledge gained from previous interactive cases. Cognitive apprenticeship's scaffolding is emphasized heavily, along with the push towards more independent practice. This is approaching the Integration Principle, as students are beginning to independently consolidate and apply all their previous knowledge in large, complex tasks.

We use the Application Principle during interactive cases and patient scenarios. Coaching is gradually withdrawn, and the learners continue to receive feedback as they make choices and engage with what they have learned.

**Practice and Feedback*:***
Learners will have the opportunity to practice analyzing multiple EKG strips; this will include all the rhythms covered in this Storyline lesson, with support from an AI Chatbox. This interactive tool will enable them to ask questions when uncertain and build confidence in their

understanding before taking the assessment. The AI Chatbox will guide and help learners arrive at the correct answers, rather than simply providing the solutions.

## Feedback and Assessment Plan

At the beginning of the Storyline lesson, students will review the concepts from previous lessons by answering questions on the EKG complexes and rhythm interpretation. These questions will include labeling a complex, describing what is happening during each portion of the EKG complex, measurements of the PR interval and QRS duration, and interpretations of sinus rhythms, atrial rhythms, and junctional rhythms.

At the end of the lesson, students will complete a quiz, in Storyline, to assess their knowledge retention. The Storyline quiz will include identification and treatment options for Ventricular and Lethal Rhythms. Some treatment protocol questions will be open ended. There will be questions about the identification process for Ventricular and Lethal Rhythms. Before the quiz, students will have had the opportunity to receive feedback and guidance from the AI Chatbox. If a quiz question is answered incorrectly, students will be provided with the correct information in written form, accompanied by a diagram whenever possible. While these knowledge checks occur at the end of each lesson, a larger summative assessment will take place at the end of all the lessons, allowing learners to apply their knowledge in practical scenarios.

| Training Session #6 Description | |
|---|---|
| **Session 6:** How to Interpret 12-Lead EKGs<br>*Tutorial (50 minutes)* | |
| **Topics** | Learners will learn how to interpret 12 Lead EKGs and determine if the EKG currently shows signs of ischemia, such as ST elevation, ST depression, peaked T waves, and no Q waves. |
| **Learning objectives** | • Identify the key structures and properties of the heart's electrical conduction system during anatomy review assessments.<br>• Accurately interpret cardiac rhythms from 6-second rhythm strips and 12-lead rhythm strips during case-based assessments.<br>• Apply treatment methods accurately in simulated clinical assessment scenarios. |
| **Instructor Preparation** | |
| Ensure that the online learning modules are accurate, engaging, and up to date. This involves reviewing the material to confirm its correctness and relevance, while also checking for any outdated information or errors. The goal is to help learners fully understand the content being discussed. Since these modules are completed online, instructors' primary role should be to verify that the materials are accurate and support learning effectively. | |
| **Materials and Equipment** | |
| AI Chatbot Job Aid: https://infograph.venngage.com/ps/rrnTajON1A<br><br>Introduction to ECG/EKGs online course | |
| **Body of the Training Session** | |
| **Warm-up** (10 minutes)<br>The Storyline lesson opens with learners applying their knowledge from Lessons 1-5. There will be a mixed knowledge check that has individuals label the EKG complexes and identify previously learned sinus, atrial, junctional, ventricular, and lethal rhythms.<br><br>**Main Learning Activities** (40 minutes)<br>Learners will participate in interactive case studies where they are in the Emergency Department with a physician. Patients will come in with symptoms that will lead them to | |

receiving a 12-lead EKG. The physician will lead them how to identify ischemia and myocardial infarctions. The physician will lead the learner through how to tell the difference between a NSTEMI and a STEMI. The physician will cover treatment options with the learner.

**Instructional design principles/strategies/teaching methods:**
In this Storyline lesson, we start with the Activation principle, asking learners to draw on the previous knowledge they gained during prior lessons with practice activities and knowledge checks. This will serve as an organizer for the learner's new knowledge and skills gained during this lesson.

Then, we use the Demonstration Principle and cognitive apprenticeship's modeling stage when the healthcare expert introduces how to identify ischemia and myocardial infractions, along with the differences between a NSTEMI and a STEMI.

We use the Application Principle during practice activities. Once learners complete the demonstration, they will practice analyzing multiple 12-lead EKG strips and identifying them, while the healthcare expert offers tips on what to look for as well as provide corrective feedback where needed.

**Practice and Feedback*:***
Learners will have the opportunity to practice analyzing multiple EKG strips; this will include all the rhythms covered in this Storyline lesson, with support from an AI Chatbox. This interactive tool will enable them to ask questions when uncertain and build confidence in their understanding before taking the assessment. The AI Chatbox will guide and help learners arrive at the correct answers, rather than simply providing the solutions.

## Feedback and Assessment Plan

At the beginning of the Storyline lesson, students will review the concepts from previous lessons by answering questions on the EKG complexes and rhythm interpretation. These questions will include labeling a complex, describing what is happening during each portion of the EKG complex, measurements of the PR interval and QRS duration, and interpretations of sinus rhythms, atrial rhythms, junctional rhythms, ventricular and lethal rhythms.

At the end of the lesson, students will complete a quiz, in Storyline, to assess their knowledge retention. The quiz will include identification and treatment options for 12-Lead EKGs. There will be questions about the identification process for ischemia and myocardial events on 12-lead EKGs. Before the quiz, students will have the opportunity to receive feedback and guidance from the AI Chatbox. If a quiz question is answered incorrectly, students will be provided with the correct information in written form, accompanied by a diagram whenever possible. While these knowledge checks occur at the end of each lesson, a larger summative

assessment will take place at the end of all the lessons, allowing learners to apply their knowledge in practical scenarios.

| Training Session #7 Description | |
|---|---|
| **Session 7:** Treatment Scenarios<br>*Tutorial (50 minutes)* | |
| **Topics** | Learners will experience multiple scenarios where treatment is required. They will have to identify the correct rhythm and the correct treatment algorithm. |
| **Learning objectives** | • Identify the key structures and properties of the heart's electrical conduction system during anatomy review assessments.<br>• Accurately interpret cardiac rhythms from 6-second rhythm strips and 12-lead rhythm strips during case-based assessments.<br>• Apply treatment methods accurately in simulated clinical assessment scenarios.<br>• Define the basic principles of both temporary and permanent pacemakers and their functions in managing heart conditions. |
| **Instructor Preparation** | |
| Ensure that the online learning modules are accurate, engaging, and up to date. This involves reviewing the material to confirm its correctness and relevance, while also checking for any outdated information or errors. The goal is to help learners fully understand the content being discussed. Since these modules are completed online, instructors' primary role should be to verify that the materials are accurate and support learning effectively. | |
| **Materials and Equipment** | |
| AI Chatbot Job Aid: https://infograph.venngage.com/ps/rrnTajON1A<br><br>Introduction to ECG/EKGs online course<br><br>Open-forum Discussion Board on BB Collaborate | |
| **Body of the Training Session** | |
| **Warm-up** (10 minutes)<br>The Storyline lesson opens with learners applying their knowledge from Lessons 1-6. There | |

will be a mixed knowledge check that has individuals label the EKG complexes and identify previously learned sinus, atrial, junctional, ventricular, and lethal rhythms.

**Main Learning Activities** (40 minutes)
Learners will participate in various interactive case studies that place them in situations previously covered in the lessons. Learners will focus on identification of the rhythm, whether the patient is symptomatic or not, and how to proceed with treatment. The AI Chatbox will be available for assistance to guide learners, but the goal is to get learners to critically think through the material.

**Instructional design principles/strategies/teaching methods:**
In this Storyline lesson, we start with the Activation principle, asking learners to draw on the previous knowledge they gained during prior lessons with practice activities and knowledge checks. This will serve as an organizer for the learner's new knowledge and skills gained during this lesson.

Then, we use the Demonstration Principle when the healthcare expert introduces how to identify the correct treatment algorithm based on patient histories, symptoms, and EKG strips.

We use the Application Principle during practice activities. Once learners complete the demonstration, they will practice analyzing multiple 12-lead EKG strips and identifying them and applying treatment methods accurately in simulated clinical assessment scenarios, while the healthcare expert offers tips on what to look for as well as provide corrective feedback where needed.

We continue to use the Problem-Centered Principle as learners work on case studies with patient histories, symptoms, and EKG strips with minimal coaching. They learn to interpret EKGs, make diagnoses, and suggest patient management plans by working through increasingly difficult scenarios, and they apply knowledge gained from previous interactive cases. This culminates in the Integration Principle, as students are independently consolidating and applying all of their previous knowledge in large, complex tasks.

**Practice and Feedback*:***
Learners will have the opportunity to practice analyzing multiple EKG strips; this will include all the rhythms covered in this lesson, with support from an AI Chatbox. This interactive tool will enable them to ask questions when uncertain and build confidence in their understanding before taking the assessment. The AI Chatbox will guide and help learners arrive at the correct answers, rather than simply providing the solutions.

## Feedback and Assessment Plan

At the beginning of the Storyline lesson, students will review the concepts from previous lessons by answering questions on the EKG complexes and rhythm interpretation. These questions will include labeling a complex, describing what is happening during each portion of the EKG complex, measurements of the PR interval and QRS duration, and interpretations of sinus rhythms, atrial rhythms, junctional rhythms, ventricular rhythms, lethal rhythms, and 12-lead EKGs.

At the end of the lesson, students will complete a quiz, in Storyline, to assess their knowledge retention. The quiz will include identification and treatment options for all rhythms throughout various scenarios. There will be questions about the identification process for Ventricular, Lethal Rhythms, ischemia, and myocardial infarctions. Before the quiz, students will have the opportunity to receive feedback and guidance from the AI Chatbox. If a quiz question is answered incorrectly, students will be provided with the correct information in written form, accompanied by a diagram whenever possible. While these knowledge checks occur at the end of each lesson, a larger summative assessment will take place at the end of all the lessons, allowing learners to apply their knowledge in practical scenarios.

## Multimedia Instructional Material

**Material 1: (Ventricular Post-Assessment, Review 360 Link) (Stephanie Roller)**

This material is part of Session 5: **Ventricular and Lethal Rhythms**. The assessment follows the lesson and case study on this topic, aiming to ensure students can identify specific lethal rhythms and determine appropriate treatments for patients. Students are expected to apply knowledge from the case study and utilize critical thinking skills to answer the questions effectively.

The design of this quiz aligns with Mayer and Moreno's **multimedia learning theory**, particularly adhering to the **coherence principle** by including only essential information and using relevant images (Mayer & Moreno, 2003). Additionally, the **segmenting principle** is integrated across the lesson structure, as rhythms are categorized and taught in manageable segments. Each rhythm lesson focuses on small, focused content chunks, which helps learners process and retain information effectively. Reinforcement after each lesson ensures students consolidate their understanding.

**Material 2: (Interactive Patient Case Study, Review 360 Link) (Brooke Oliver)**

This material is used in Session 5: Ventricular and Lethal Rhythms. Patient details will be presented to the learner, along with an EKG strip showing a ventricular rhythm. The learner will be asked several successive questions regarding the patient's rhythm strip and must analyze it and respond. Question difficulty will increase as the scenario progresses, and the learners will be guided to identify the rhythm and determine its regularity. This activity encourages critical thinking and practical application of knowledge acquired during the lesson.

I followed Mayer and Moreno's multimedia learning theory to design this instructional material by first, being aware that "each channel in the human information processing system has limited capacity" (Mayer & Moreno, 2003). I structured my design to minimize any unnecessary cognitive load to avoid overloading the learner's capacity, by using the following solutions: Segmenting, Synchronizing, Weeding, and Eliminating Redundancy.

The interactive case study utilizes segmenting in that questions break up the scenario into segments where the learner has to respond. Once they get the correct answer or fail too many times, they receive corrective feedback and can click Continue to move on to the next segment. The case study also synchronizes the presentation of corresponding visual and auditory material. As the narration plays, chat bubbles and corresponding text appear, as well as characters and buttons that are relevant to what is spoken. Weeding is utilized by eliminating interesting but extraneous material. Only the most critical information is included in a concise and direct manner to help the learner engage in essential processing. Although I do have some simultaneous text and narration, I believe I still eliminate redundancy and reduce cognitive load by only

including the text that is spoken by the characters on the screen in the visual format of chat bubbles as if they are speaking to each other or the learner.

**Material 3: (Atrial Rhythm Demonstration with AI Chatbox, Review 360 Link) (Nicole Manley)**

We plan on incorporating our AI Chatbox into all our training sessions, but the one I'm specifically creating is a demonstration within Session 3: **Atrial Rhythms**. A cardiologist character will delve into diagnosing an atrial rhythm; I'm scaffolding off earlier atrial rhythm content and situating it within an authentic case study. Within this demonstration, the cardiologist will examine symptoms, history, vitals, etc. and highlight valuable information, describing how they differentiate their diagnosis and arrive at a treatment plan. These thoughts will serve as repetition from previous atrial rhythm content, emphasizing how atrial rhythms can be distinguished from sinus rhythms, and how certain atrial rhythms can be distinguished from each other. An AI Chatbox will be offered in an icon at the top of the Articulate Storyline screen, and when a lightbox slide appears, the cardiologist character will appear to answer any more questions learners have.

Since this is a demonstration section, with heavy coaching and important material to learn, I follow Mayer and Moreno's multimedia learning theory to streamline this process (Mayer & Moreno, 2003). First off, to make it clear that there is even an AI Chatbox to activate, I will implement the signaling effect with a brief explanation at the beginning of the lesson highlighting its icon. Since verbal narration and visual text and animations can provide cognitive overload, I will rely on mostly verbal narration (besides some dialogue boxes) and animations due to the modality effect and redundancy effect. Although we are showing a physician character in a healthcare setting, I will remove as many unnecessary visual details as possible with the coherence effect, so the learners can focus on relevant knowledge. Lastly, I will not form this lesson in one large, unskippable block. With the segmentation effect, the diagnosis process, treatment process, and follow-up process will be separated into different sections. All these effects and design choices will hopefully reduce cognitive overload.

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