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# INSTRUCTIONAL DESIGN PLAN

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## Principles of Vascular Access: Peripheral IVs, Arterial Lines, and Central Lines

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----Prepared for Course HPTT 802: Instructional Design for Health Professions Education---



### ACKNOWLEDGEMENTS

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## GOAL STATEMENT

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### **I. Write Goal Statement here**

- The overall goal of this module is to improve third year medical student exposure to vascular access devices that we use on a regular basis in most medical specialties. The E-module and subsequent simulation exercises will allow them to understand the basic indications and procedural steps of placing a peripheral IV, an arterial line, and a central line as measured by their performance in team-based, simulated patient scenarios requiring utilization of each. These are critical skills that currently the students get little exposure to but will need to understand to safely apply to patient care throughout their careers.

## NEEDS ANALYSIS

### 1. Subject and Concept Area

- Subject: Medicine.
  - i. Vascular access – placement of peripheral IV, central lines, arterial lines
- Concept: This subject fits into the concept area of procedural skills and will focus on medical students in their third year rotating on their surgical clerkship.

## PERFORMANCE GAP AND NEEDS ASSESSMENT TABLE

Current Practice	Desired Result: Ideal Practice	Performance Gap/ Educational Need	This is a Gap in: (Include all that apply)	Learning Objective	Designed to Change (Include all that apply) Competence, Performance, Patient Outcomes
Students practice placing lines on models during skills lab, but often have little prior knowledge or experience with them	Students come to skills lab prepared for the tasks they will be practicing	Awareness of reasons for line placements, complications, basic procedural steps	<input checked="" type="checkbox"/> Knowledge <input checked="" type="checkbox"/> Competence <input type="checkbox"/> Performance	Identify common indications, complication, and procedural steps for each type of line in the skills lab	<input checked="" type="checkbox"/> Competence <input checked="" type="checkbox"/> Performance <input type="checkbox"/> Patient Outcomes
Students do not currently have the opportunity to critically think through scenarios in which different types of access may be necessary	Students are given the opportunity to think critically about when and why to use certain types of vascular access based on patient factors	Awareness of clinical scenarios in which each type of line may be necessary, basic knowledge of managing possible complications of each	<input checked="" type="checkbox"/> Knowledge <input checked="" type="checkbox"/> Competence <input checked="" type="checkbox"/> Performance	Correctly perform the steps for placing each line on a model and identify patient scenarios in which each is needed.	<input checked="" type="checkbox"/> Competence <input checked="" type="checkbox"/> Performance <input checked="" type="checkbox"/> Patient Outcomes

## RESOURCES:

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1. Curriculum Objectives, College Standards (UNMC College of Medicine)
2. Local survey of physicians and students regarding student educational needs
3. Professional and specialty (surgery) society guidelines

### 2. Gap, Problem or Learning Need

- Medical students are expected to understand basic indications and steps for placing various types of arterial and venous lines (Anderson, et. al, 1998). Their main exposure to these procedures, especially for those not pursuing a procedural specialty, is during their surgical clerkship in their third year of medical school. However, the vast majority of central or arterial lines are placed in the trauma bay or in the surgical intensive care unit, and currently less than half of the medical students rotate in one of these areas during their eight-week clerkship. This means that many students will never see one of these lines placed or need to interpret results from them such as arterial wave forms or whether a central line is appropriately placed based on a chest x-ray.

For this reason, the clerkship has developed skills labs for all the students to practice these skills and gain some exposure regardless of their assigned surgical rotation. The current skills lab design allows students to practice placing each type of line at least one time on a high-quality mannequin but does not allow for discussion or critical thinking to determine when and where to place a line in each patient scenario. In addition, the students often come to these sessions unprepared, not understanding why or when to use various lines, and have not done any pre-reading regarding basic steps of each. They have access to optional online videos to review these, but the videos are currently outdated, poorly executed, or even no longer accessible.

Anderson M.B., et. al. (1998). Learning Objectives for Medical Student Education. Retrieved from <https://www.aamc.org/system/files/c/2/492708-learningobjectivesformedicalstudenteducation.pdf>

### 3. Surveys, Interview, Research

- The main sources of information about student competency in these skills are the students themselves, faculty members they work with, and the clerkship director. Each cohort of students has a feedback session at the end of every rotation that I hold to talk about aspects of the course. Most agree the simulated skills labs are a valuable learning experience, but that having some more structured preparatory content would help them gain the most out of the experience. In discussion with the clerkship director, he too has voiced a need to improve the quality of the resources for the students.

### 4. Academic Committee Recommendations

- There are no current recommendations for design from an academic committee. Rather, in regular meetings discussing the clerkship, there is frequent discussion of

the need to update many learning resources for the course, with vascular access being one of them.

#### 5. Proposed Solution

- The proposed solution is to develop an E-learning module that provides in depth (to appropriate level) discussion of what each type of vascular line is, what indications for use are, common complications and management, and then basic procedural steps to placing a peripheral IV, an arterial line, and a subclavian and internal jugular central line. The students will complete the online module prior to the simulation session.

During the simulation session, there will be a very brief review of what is learned in each module while the students practice each skill. Then, the students will be separated into groups to simulate a trauma or ICU team. They will be given a clinical scenario in which one of these lines is indicated, choose the correct line, and demonstrate basic procedural steps on a simulation trainer. Some of these scenarios will also include post-procedural complications that they will then need to determine how to manage.

#### 6. Delivery Format

- Session one will be an online asynchronous E-learning module covering the content for the simulation session
- The simulation session will take place in a face-to-face session in the Davis Global Center and will consist of both individual skills practice as well as team-based patient centered problem solving.

#### 7. Enrollments and Users

- All medical students will eventually complete this module during their surgical rotation in their third year of medical school. This will equate to 20-25 students every 8 weeks for a total of approximately 150 students per year.

#### 8. Module Length

- The E-module will take 30-45 minutes to complete and will be learner paced. The simulation session will take 90 minutes to complete. The module will be used 6 times throughout the academic year (once for each cohort on the service) during week 2 of their surgery clerkship.

#### 9. Degree of Distribution

- This module will be designed for local use only, during the Surgery Clerkship at the University of Nebraska Medical Center.

#### 10. Module Design Timeframe

- The skills lab including placement of various lines occurs during the second week of the surgical rotation. E-module development will begin in late May/early June with a plan for completion before the beginning of the 2022/2023 academic year.

Development of clinical scenarios for the simulation portion of the module will be ongoing and can begin now.

- May 1: Development of clinical scenarios  
June 1: Begin development of E-module  
July 1: First draft of clinical scenarios and E-module completed. Review by Department of Surgery faculty and clerkship director  
July 15: Faculty comments and review complete

July 30: Final draft of clinical scenarios and E-Module complete, student testing begins

August 7: Student review and module testing complete

August 15: Final edits based on student feedback finished, module ready for implementation into the curriculum

#### **11. Level of Human Resources**

- The module will be developed in entirety by myself, utilizing the support of UNMC's E-learning lab. I will also develop the clinical scenarios. An expert in the field (board certified critical care surgeon) will be needed to review the content for accuracy, as will the surgery clerkship director and assistant director.

#### **12. Instructional Delivery Resources**

- The E-module will be provided via a link on Canvas (UNMCs LMS). The simulation portion of the content will be held at the Davis Global Center. Currently, the clerkship already utilizes this for their skills labs. The mannequins and various types of lines are already available through the DGC as well. Because the students will also be running through proposed scenarios, I estimate that they will need 1-2 extra of each type of line per simulation, although some of the practice kits are reusable and, therefore, would not require further supplies.

#### **13. Budget**

- Utilization of the resources available in UNMC's E-learning lab is free to students and faculty/employees at UNMC (of which I am both). Fair compensation for the developer's time will be considered.

#### **14. Usability Testing**

- Usability testing will require minimal resources. All content will be reviewed for accuracy and ease of use/application by the clerkship advisory team and an expert in the field (Critical care surgeon). Once the module has been developed, it may be tested on a small group of student volunteers; their feedback will be considered, and adjustments made as needed prior to publishing the content to the LMS

#### **15. Nature of Content**

- The content in this module is quite stable. Indications for and methods of placing different lines are well established in the literature. The only time a module may need to be updated is if the university changes the type of central line or access kit they stock, which is infrequent.

## LEARNER SITUATIONS AND CHARACTERISTICS

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### 1. Education level and Target Population

- Target population includes third year medical students who are completing their surgery clerkship rotation.
- Education level includes graduation with a bachelor's degree and completion of the first two years of medical school; a small number of students may have higher levels of education including a master's degree or a PhD as well.

### 2. Gender Distribution

- The gender distribution of students in the UNMC medical school classes is roughly evenly distributed between men and women.

### 3. Experience

- These students will all have completed the first two years of medical school at UNMC, therefore they will all have had some exposure to the basic science principles and fundamentals of vascular access covered in this module. In addition, some students may have worked in other health care careers prior to medical school (nursing, phlebotomy, EMT, etc.) and therefore may have more extensive knowledge or experience with some of these devices, however, this is a minority of students.

### 4. Attitudes & Motivation toward Content

- Learner attitudes and motivation towards learning this content will vary from student to student. Those who are interested in a surgical career are likely to be more motivated, as these are procedural tasks that are often indicated in surgical patients. Also, those interested in any type of critical care position (either through surgery, anesthesia, emergency medicine, or internal medicine) may be interested, as these skills will directly apply to their future careers. Those more interested in outpatient/clinical medicine may be less motivated, as it will have minimal application towards their future goals.

While not a significant portion of their end of rotation Shelf exam, there may be portions of this module that come up in test questions. Those who are extrinsically motivated by grades may be more motivated to learn the content. In addition, some of these students will be rotating on services such as trauma, liver transplant, or surgical critical care where these skills are directly relevant to their patients, and therefore may increase learner motivation.

### 5. Preferred Delivery System, Instructional Settings & Strategies

- This module is a hybrid course with some e-learning and some in person skills-based and team-based tasks. These learning formats are all familiar to the students as they have been utilized extensively throughout the first two years of their training – with particular emphasis on increased online learning during the COVID pandemic.

## PORTION 1

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### TEACHING LEARNING ACTIVITY 1: ONLINE PRESENTATION (E-LEARNING MODULE)

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#### 1. Activity Name

- Basics of Vascular Access in a Surgical Patient

#### 2. List and Summary of Principles & Tips for the activity

- This E-Learning course will be the first of a two-part module on principles of vascular access in a surgical patient. The principles addressed in this module will be common indications, complications and management, and an overview of the basic steps for placing each of the different devices.

The online E—Learning module will be available to students throughout their rotation on the surgical clerkship for review and reference, but it will be expected that the students have completed the module during the week of their scheduled simulation session, and before the session begins on that Friday morning. The module will include multimedia such as photographs and diagrams of foundational content, as well as videos of the proper steps of each type of arterial or venous line. The module will be designed adhering to the principles of design for multimedia learning, including (but not limited to) concepts of contiguity, modality, and redundancy to maximize user engagement without creating cognitive overload or including extraneous materials (Clark & Mayer, 2016). During video portions of the module, pauses will be included after critical procedural steps to emphasize their importance and allow for the user to progress through the module at their own pace. There will also be occasional questions the students are required to answer as they progress through the module to reinforce important foundational concepts. These questions will not be graded, but instead will provide meaningful feedback to the learner about why a certain answer is correct/incorrect.

#### 3. Planned Length of activity

- The module will be designed so that a student can work through it in no more than 30-45 minutes. However, they will have access to the module throughout their 8-week rotation on the clerkship and therefore will be able to reference it at any point and spend more time on it if needed. In addition, the module will include links to additional or more in-depth resources for eager learners who want to gain knowledge beyond what is expected of them at their level of training.

#### 4. Activity Goal

- The overall goal of the E-learning activity is for students to review several types of arterial and venous access lines, including common indications, complications, and management principles of each. In addition, the module will introduce students to the basic procedural steps of placing each line to prepare them for the second part of the module later that week.

#### 5. Teaching and Learning Objectives

After completing the E-learning activity, students should be able to:

- List at least two indications for each of the following types of vascular lines:
  - Peripheral IV
  - Arterial Line



- Internal Jugular or Subclavian Central Line
- Name one common complication for each type of vascular line and describe appropriate management of the complication.
  - Peripheral IV
  - Arterial line
  - Internal jugular or subclavian central line
- List the basic procedural steps for placement of each of the following lines:
  - Peripheral IV
  - Arterial line
  - Internal jugular central line
  - Subclavian central line

#### **6. Activity Specifics**

- The E-learning activity will include a combination of text (when appropriate), graphics and real-life photographs, and videos to highlight the basics of vascular access in a surgical patient. The module will be organized into segments so that each line is worked through in its entirety before proceeding to the next line, starting from the most basic and progressing to more involved procedures (peripheral IV -> arterial line -> subclavian line -> internal jugular line). The module will begin by introducing the line and discussing common uses and indications for placement. The module will then discuss common complications associated with the line or with line placement and review briefly how each complication would be managed. Education about each type of line will end with a video of this line being placed with thorough narration of each step. Progress through the module will be controlled entirely by the student, and even the video segments will have brief pauses after critical steps (for example, checking that the wire is in the internal jugular vein rather than the carotid artery prior to dilating the tract and placing the catheter) for added emphasis and student reflection.

#### **7. Activity Assessment Summary**

- Assessment will be formative. After completing the module, the students will complete a 10-question multiple choice quiz covering the content they just studied. They will be provided with feedback immediately after submitting the quiz regarding their answer choices, with brief explanations for correct and incorrect responses.

#### **8. Roles and Key Responsibilities**

- I will be responsible for creating the module in its entirety utilizing Articulate storyline, however I will need the expertise of someone from UNMC's E-Learning lab to help with specifics of using the software to create specific aspects of the module. Creation of the videos for each procedure will require a video camera which can also be provided by the E-learning lab.

Once I have finished the module, I will need the clerkship direction and assistant director to review the content for accuracy and level-appropriateness for the learners. I will also ask a critical care surgeon to review the content and provide feedback.

#### **9. Publishing Plans**

- After it is created, the module will be published to Canvas, UNMC's LMS, in the MS3 Surgery Clerkship course.

#### **10. Time Constraints**

- I anticipate that the most time will be spent learning to use the Articulate software and developing the videos for each procedure. The activity should be completed prior to the beginning on the 2023 academic year so that it is ready for student use.

#### **11. Technology Constraints**

- A laptop with Articulate software installed will need to be checked out from the E-learning lab, as my current laptop will not support this software. Access to the LMS is not a constraint, as the clerkship already utilizes Canvas for their course materials.

#### **12. Budget**

- As a student and employee of UNMC, access to the E-learning lab and Articulate software is free. There may be a small cost associated with the use of models and resources to film videos at the Davis Global Center. I do not anticipate any other development aspects to require funding.

#### **13. Usability Testing**

- Prior to implementing this activity into the surgery clerkship, I will ask multiple faculty members and current medical students to complete the module to ensure all aspects function as intended, as well as provide feedback on the module. Specifically, I would ask for comments on relevancy and accuracy of the content, ease of navigation through the module, amount of content per section, and clarity of information.

#### **14. Works cited or References**

Clark, R. C., & Mayer, R. E. (2016). *E-Learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning*. Chichester: Jossey Bass Wiley. ISBN: 978-1-119-15866-0 (Hardcover); ISBN: 978-1-119-15868-4 (e-book)

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### ASSESSMENT FOR TEACHING AND LEARNING ACTIVITY

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#### **1. Name of Assessment**

- Vascular Access Quiz

#### **2. Type of Assessment**

- Formative

#### **3. Question Summary**

- 10 questions, all multiple choice; 5 relating to indications or complications and management; 3 relating to “next steps” of the procedure; 2 relating to “what went wrong” with photos of incorrect procedural steps

#### **4. Timing & Location**

- Located in Canvas on the same page as the module link, to be taken immediately upon completion of the module. There will be no limit to the number of attempts a student can make.

#### **5. Purpose**

- Immediate assessment of the knowledge that the learner gained by completing the module. For research and improvement purposes, I could also collect data on student scores on the quizzes/how many times they took the quiz to see if it correlated with their assessment scores for activity #2.

#### **6. Format**

- Self-assessment quiz created in Canvas

#### **7. Congruency**

- Assessment is congruent with course objectives in that each question is directly linked to a single course objective and will be congruent with Bloom’s taxonomic level. There will be a mix of basic first order, comprehension questions as well as second or third order questions relating to the content.

#### **8. Scoring**

- All questions will be worth 1 point each. Students will be able to take the quiz as many times as they want to achieve their desired score (ideally 10/10).

#### **9. Feedback**

- After completing the quiz, the students will be immediately provided with their score (#/10). Each question will then include a brief explanation of the correct answer, as well as explanations for why each incorrect answer is wrong. This will allow them to reflect/review content that they originally missed prior to attempting the quiz again.

#### **10. Rubric**

- No rubric is indicated, as this is a quiz format. Students will receive the grade (#/10) associated with their highest quiz score.

#### **11. Directions**

- Directions will be clear and concise, as this format is something that all the learners are already familiar with from other courses. The beginning instructions will state that each question is worth 1 point and that students may take the quiz as many items as they wish, with their final grade being the highest score they achieved.

#### **12. Design & Appeal considerations**

- The assessment will be built into Canvas for the students to access. It will be important to include photographs that are high quality and are very clear in highlighting which step of the procedure and/or what is being done incorrectly. Some photographs may need to be accompanied by a caption for increased clarity. Text will be arial size 14 and proper anatomical language will be used in the questions when appropriate.

#### **13. Tracking & Storage of data**

- Tracking of student scores and number of attempts can take place in Canvas for future review and correlation with assessment #2 scores.

#### **14. Development & Peer review**

- The quiz can be built into the LMS, Canvas, which the students already use on this clerkship. Quiz questions will be reviewed by the clerkship director and associate director for accuracy and relevancy to the course. Students who test the module can also take the quiz and review for clarity in question writing.

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### STORYBOARD FOR TEACHING AND LEARNING ACTIVITY

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#### **1. Activity Name**

- Basics of Vascular Access in a Surgical Patient

#### **2. Amount of Storyboard**

- See storyboarding document. Examples of content are provided highlighting aspects of one of the lines – (indications, complications, procedural steps). An example of an intra-module comprehension question is also included with feedback examples for correct and incorrect answers. In addition, there are 3 sample questions provided from the assessment portion, one highlighting indications/complications, one highlighting “next steps” and one highlighting “what went wrong.”

#### **3. Vocabulary, tone, and language elements- Description**

- Tone will be informative and friendly when moving through the first two parts of each line. The tone will be informative and will become more serious during the video portion, especially when emphasizing the more critical steps of the procedure. Clear, anatomical language and vocabulary will be used when appropriate; terminology that may be new to the learner will be defined.

#### **4. Use of Design Principles and Tips – Description**

While attempts were made to incorporate as many of the 12 tips as possible, the ones that are emphasized and most evident in the project are summarized below:

- Tip 1: Reduce extraneous load as much as possible. This is accomplished by using a consistent design throughout the module including navigation and resources buttons located in the same place on every slide. Only essential information and text are present on each slide, and additional information is accessed via clicking on images or links rather than displayed all at once.
- Tip 2: Manage intrinsic load – topics are grouped by type of line and arranged in order of increasing complexity so that learners are able to grasp basic concepts of vascular access prior to having to learn complicated, multi-step procedures in the higher risk lines.
- Tip 3: Create opportunities for retrieval practice – questions built into the module and then the multiple choice quiz immediately following allow for retrieval practice throughout the activity.
- Tip 4: Space retrieval practice over time – this is something that is utilized more by combining both activities in this module. The E-learning activity allows for initial exposure to the material that they will complete, and then sometime later that week will revisit the material and work with it in a different format to build on the information acquired in this activity.
- Tip 9: Create learning environments that are psychologically safe – given that the questions built into the module are not graded, there is no risk of added anxiety to the learner. In addition, the post-module quiz has unlimited number of attempts which allows learners to focus on mastering the content and focuses on the process of learning and improvement rather than immediate perfection.
- Tip 11: create authentic experiences for workplace learning – although this will be emphasized more in activity #2, the videos incorporated into this activity are clearly high-fidelity videos showing models with accurate anatomical features and equipment that the organization uses in real patients in the hospital. This helps create the most authentic experience possible for this learning format.

#### **5. Typography – Description**

- Arial font, no smaller than 18 point for image captions or 22 point for labels and other text for easy readability

#### **6. Media and materials – Description**

- For the first portion of the module narration, graphics, and photographs will be utilized and labeled with text appropriately. When describing procedural steps, a narrated video will be utilized, with on-screen prompts incorporated to help identify anatomical structures or equipment for the procedure kit.

#### **7. Transcripts and Accessibility considerations – Description**

- The module will be available for access via Canvas for viewing. Transcripts will be made available for student access should they choose, as well as optional closed captioning

#### **8. Logical Progression and Navigation – Description**

- The module will progress in the following manner:
  - General Introduction
  - Introduction to peripheral IV
  - Indications for peripheral IVs
  - Common complication #1 of peripheral IV and management of complication
  - Common complication #2 of peripheral IV and management (etc.)
  - Return to General Introduction page
  - Progress to introduction for arterial line
  - Indications for arterial line (etc.)
- Students will progress through each line in order of increasing complexity of knowledge as well as procedural steps. The order is as follows:
  - Peripheral IV
  - Arterial line
  - Subclavian central line
  - Internal jugular central line

#### **9. Interactivity/Interactive elements functionality - Description**

- Students will navigate through the module via “previous” or “next” buttons on the bottom of the screen. They will have complete control over the pace in which they work through the module.
- Resources for more in-depth content will be provided as direct links where applicable to on-screen content
- Each section (each procedure) included in the module will include two questions built into the progression of the module. Answers to questions will be immediately provided to the student as well as feedback about why the answers are correct.

#### **10. References or Works Cited**

- Clark, R. C., & Mayer, R. E. (2016). *E-Learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning*. Chichester: Jossey Bass Wiley. ISBN: 978-1-119-15866-0 (Hardcover); ISBN: 978-1-119-15868-4 (e-book)
- Gooding, H. C., Mann, K., & Armstrong, E. (2017). Twelve tips for applying the science of learning to health professions education. *Medical teacher*, 39(1), 26–31.

## PORTION 2

### SIMULATION ACTIVITY

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#### 1. Activity Name

- Peripheral IV, Arterial Line, and Central Line Simulation

#### 2. List and Summary of Principles & Tips for the activity

- The special topic for this activity is simulation. The simulation activity will be the second portion of the student's module on vascular access in a surgical or critically ill patient. After completing the E-module, students should be familiar with the basics of the four types of lines we will cover in this simulation. The activity will begin by having the facilitator review the 4 procedures and their critical steps, as well as demonstrating the proper equipment for the students to see up close in real life. The students will then practice these steps themselves on the provided models, with facilitator and peer guidance using the procedural checklists to ensure they are practicing the appropriate sequences.

Tips for success will include thoroughly addressing the steps outlined in Harrington & Simon (2021) including creating facilitator scripts, detailed lists of set up information for the staff in the simulation center to ensure all equipment is available and provided detailed case scenarios. A brief pre-brief of the purpose for the students as well as a debrief to discuss aspects of the case are important and should be given adequate time allotment in the scenarios as well. Finally, a dry run will need to take place before implementing it into the student curriculum to ensure all activities can be completed in the allotted time and to identify any gaps or missing pieces of information that were previously overlooked.

#### 3. Planned Length of activity

- This activity will take place over the course of 90 minutes on a Friday morning during the students' routinely scheduled skills labs. The first 15 minutes of the activity will be spent reviewing the steps for placing each type of line, with all materials present and available for identification. The next 45 minutes will be spent with the students rotating through the different models so that they each get the opportunity to place each type of line themselves. The final 30 minutes will be spent with students broken into two groups. A faculty member will lead them through the three developed clinical scenarios and the students will decide together which type of access is appropriate for the patient and then practice the chosen procedure on the models. One of the clinical scenarios will have a post-procedural complication that the students will be required to identify and describe appropriate management.

#### 4. Activity Goal

- The goal of the simulation activity is to reinforce the concepts the students learned in the E-learning activity, allow them to practice the steps of each procedure themselves, and then apply that knowledge to simulated patient scenarios.

#### 5. Teaching and Learning Objectives

After completing the simulation activity, students should be able to:

- Demonstrate proper technique for placing each of the following, without missing any critical steps:
  - Peripheral IV
  - Arterial line
  - Subclavian central line
  - Internal jugular central line
- Identify the appropriate type of vascular access to use in different patient scenarios
- Recognize and treat the following common complications:
  - IV infiltration
  - Hematoma
  - Line infection
  - Pneumothorax
  - Arterial puncture

## 6. Activity Specifics

- This activity will take place during the already regularly scheduled simulation/skills labs the students attend every Friday morning. The students will be broken into groups of 4-6 and a facilitator will be present in each room to help guide the session as well as answer any student questions and provide feedback. As stated above, the first 15 minutes will be spent reviewing the procedures already covered in the E-learning activity, with the facilitators demonstrating the equipment to the students in person so they can become more familiar with it. The students will then pair off and rotate through models designed for them to practice placing each type of line, again with facilitator guidance as well as the stepwise procedure checklists provided. This will last approximately 45 minutes. During the last 30 minutes, the each group will further be broken down into 2-3 students each and they will run through three (out of six) of the provided clinical scenarios. This will again include one student completing the placement of the indicated line for the scenario on the model with the guidance of the other student(s) in the group. Finally, one of the three scenarios will have a post-procedure complication that the students will need to recognize and state the appropriate management.

For example, a trauma patient in a cervical collar becomes hemodynamically unstable and requires placement of a central line for administration of vasopressors and the students choose to place a subclavian line. Unfortunately, with the degree of hypovolemia, access was difficult to obtain and a post procedural chest xray obtained shows a moderate sized pneumothorax. The students should recognize the pneumothorax on CXR and appropriately state that a chest tube is indicated. (Procedural steps for chest tube placement is out of the scope of this module, and will be covered in a different simulation.) Therefore, they will only be required to state that the patient needs a chest tube and the simulation can then end.

## 7. Activity Assessment Summary

- Formative assessment that will take place in real time: A checklist of procedural steps in the correct order will be provided at each simulation station for each procedure. Students will work in pairs during the 45 minute session so that the person not practicing the procedure can help the proceduralist if they forget a step. During the 30 minute clinical scenarios, assessment will be completed by the faculty

facilitator time with corrective guidance if students get stuck or make the wrong clinical decision as well as constructive feedback on procedural technique.

#### **8. Roles and Key Responsibilities**

- I will be responsible for creating the clinical scenarios; there will be a total of 6 scenarios, two of which will have post-procedural complications that the students must identify and manage. The clerkship director and associate director will be responsible for reviewing the scenarios for content accuracy and appropriateness for clinical level.

During the skills lab, staff from the Davis Global Center will be responsible for setting up the stations with the proper equipment (lists and set up provided by myself). At least three faculty members should be present to help guide the students through the steps of each procedure and offer real-time feedback on student technique, and two of them will be required to stay and guide the groups through the clinical scenarios for the last 30 minutes of the session.

#### **9. Publishing Plans**

- As this is a real-time simulation scenario, publishing of the actual content is not planned. However, I may utilize data from these two activities to determine if the E-module improves student understanding of the content and to identify if there are any areas in the module that need to be improved. In that case, portions of the simulation design and clinical scenarios would be described in the manuscript for publication.

#### **10. Time Constraints**

- The scenarios will need to be fully developed and tested before the 2023 academic year so that it can be implemented into the clerkship curriculum. I do not foresee there being issues with time, as development of these scenarios requires minimal technology and can begin now. The scenarios will need to be tested to ensure that they can all be completed in the 30 minute time allotment.

#### **11. Technology Constraints**

- The Davis Global Center already has all the models and equipment required for each procedure available for use. The clerkship already utilizes their simulation labs every Friday morning and therefore no further technology or infrastructure will be required to implement this activity. Minimal computer technology may be required during initial development of the scenarios (for gathering of imaging, ensuring best practices are followed, etc) but this is something any laptop or desktop computer can accomplish.

#### **12. Budget**

- The surgery clerkship already utilizes the models, rooms, and equipment sets required for this activity. There may be a small cost associated with purchase of 1-2 extra kits for each type of line given the added clinical scenarios, however many of these kits are reusable in a simulation scenario, so the number of extra kits would be minimal.

#### **13. Usability Testing**

- Evaluation level after implementation of the activity should be low, especially if content had already been reviewed by multiple faculty members prior to completing the activity for the first time. The important content to pay attention to in evaluation is whether we were able to complete all the activities in the allotted time and



whether the students were able to move through the clinical scenarios with minimal prompting from the facilitator. If one or neither of these happen, adjustments will need to be made accordingly.

#### 14. Works cited or References

Harrington DW, Simon LV. Designing a Simulation Scenario. [Updated 2021 Oct 1]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-.

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### ASSESSMENT FOR SIMULATION ACTIVITY

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#### 1. Name of Assessment

- Simulation checklist

#### 2. Type of Assessment

- Formative assessment

#### 3. Question Summary

- Formal questions will not be utilized in this activity. Instead, at each procedure station there will be a checklist of the proper steps and the order in which they should be completed. Students will have a peer observe while they complete the procedure and guide them utilizing the checklist if they miss steps or don't know what the next step is. In the clinical scenario portion, a patient will be presented to the group and the students will need to decide among themselves which type of access line is appropriate, and decide how to manage a complication if it occurs.

#### 4. Timing & Location

- The assessment will take place in real time throughout the course of the simulation activity.

#### 5. Purpose

- The assessment should provide real time feedback to the learners on performance, so that they develop proper techniques, avoid mistakes or missed steps in procedures, and understand how to apply this to patient care for the remainder of their careers. In addition, performance results could be used in research and module improvement, as discussed in activity 1.

#### 6. Format

- Real-time, verbal feedback from a peer or group facilitator

#### 7. Congruency

- Assessment is congruent with course objectives in that each question is directly linked to a single course objective and will be congruent with Bloom's taxonomic level.

#### 8. Scoring

- This activity will not be directly graded, although the topics will be covered as part of their Shelf exam at the end of the rotation. The simulation will help prepare them to answer questions about vascular access on this exam.

#### 9. Feedback

- Feedback, as discussed, will be given in real time either by a peer or facilitator. During the first part of the activity, a peer will be available with a checklist and will stop and correct a student if they miss a step or perform a step out of order. During the second part, a faculty facilitator will give feedback about whether the group

accurately identified the type of access the simulated patient requires and, if one occurs, appropriately managed the complication.

#### **10. Rubric**

- As this assessment is not formally scored, there will be no rubric. However, checklists will be utilized by the students as a “self-assessment” for them to make sure they are completing all the necessary components. An example checklist for placement of a central line will be provided in the storyboard for reference.

#### **11. Directions**

- Faculty facilitators will provide directions regarding the different portions of the workshop at the beginning of the activity, and throughout the workshop as needed. Facilitators will be directly available if questions arise during the simulation.

#### **12. Design & Appeal considerations**

- Materials for the simulations including procedure kits and appropriate models are available at the Davis Global Center. Checklists for procedures will be formatted clearly and will be bulleted. Any imaging used for the clinical scenarios (such as xrays or photos of complications) will be high quality printouts and will utilize an entire letter-sized paper for each image.

#### **13. Tracking & Storage of data**

- Facilitators may collect data regarding how the students performed on the clinical scenarios (correct procedure choice, identification of a complication, correct complication management) for use in the possible research and E-module improvement as discussed in activity 1.

#### **14. Development & Peer review**

- As stated above, we already have access to models and procedure kits for the simulation. Development of the clinical scenarios is the main portion of this project that still needs work. Scenario development can begin now, and we should have plenty of time to finalize them and test before the new academic year. Expert faculty will be needed for peer review to ensure accuracy of content and that content is appropriately challenging for a third-year student.

## STORYBOARD FOR SIMULATION ACTIVITY

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### **1. Activity Name**

- Peripheral IV, Arterial Line, and Central Line Simulation

### **2. Amount of Storyboard**

- Representative photos of one of the procedure set ups are included, showing the models and the kits the students will be using. A procedure checklist will be available for reference as well. Finally, a draft of a patient scenario is included with relevant clinical information (vital signs, exam, etc.). The scenario also includes a complication that the facilitator may choose to include as part of the activity (one of the three scenarios the students work through will have an associated complication); for this scenario relevant patient complaints, physical exam findings, and imaging studies are included. These photos are what will be shown to the students during the simulation.

### **3. Vocabulary, tone, and language elements- Description**

- As this is a simulation exercise and faculty will be facilitating this in real time, there isn't a documented narrative script. However, the faculty will be reminded to use

clinical and anatomical vocabulary and to otherwise use very direct and specific language when helping students through procedures to be as clear as possible. The tone will be welcoming and inviting, but more serious when emphasizing critical portions of a procedure. Finally, when giving feedback to the students on their performances, the tone will be non-judgmental.

#### **4. Use of Design Principles and Tips – Description**

- Tip 1: Reduce extraneous load whenever possible – As this is a simulation exercise and not an online exercise, the ways to reduce extraneous load are slightly different. One method will be the use of the checklists to guide students through each procedure if they get stuck so that they don't have to continually work to pull them from memory, especially since this is likely the first time they have practiced these techniques in person.
- Tip 2: Help learners manage intrinsic load – as many learners may not have practiced or even seen these tasks in real life, the activity is set up with multiple guides and facilitators to help. In addition, the complexity of tasks will increase as they move through each portion of the simulation activity, with the most complex task (clinical scenarios) presented last, and in a collaborative setting with peers.
- Tip 3 and 4: Retrieval practice – as discussed in activity 1, there will be multiple run throughs of each procedure during the activity, as well as prior exposure the students had to the content with the E-learning activity completed prior to the simulation activity. This creates many opportunities for review and retrieval practice of tasks.
- Tip 5: Prepare learners to transfer knowledge to new settings – the learners will apply the knowledge in these activities in increasingly more life-like situations; starting with learning about them in an E-learning module and watching videos, to reviewing steps, to practicing the tasks independent of patient situations to then practicing the tasks with clinically relevant scenarios with simulated patient encounters, so that they have been exposed to the material in multiple ways before having to do it in real life.
- Tip 6: Engage learners in deliberate practice – in being given the opportunity to try out each technique multiple times, they learners are simulating the exact steps they would go through in a real-life patient scenario.
- Tip 11: Create authentic experiences for workplace learning – while real life patients will not be used in this lesson, real life scenarios that can be high stakes will be. It is emotional dealing with an unstable patient and being asked to perform a procedural in this situation is stressful no matter how many times it has been practiced. Creating a “high stakes” simulated scenario can help students face these emotions in an environment where mistakes don't adversely affect outcomes is crucial to applying these skills to on-the job situations.

#### **5. Typography – Description**

- Checklists will be typed in arial font no smaller than 16 point for viewing ease. Checklists will be contained to a single page, so larger fonts will be used when possible for simpler procedures.

#### **6. Media and materials – Description**

- Procedure checklists will be available at each station, in a protective sleeve to prevent damage throughout the simulation. Images will be included when appropriate. Images for clinical scenarios will be printed from a high quality printer

to be as clear as possible for ease of student interpretation. All images will be fitted to take up as much of a standard letter sized paper as possible.

**7. Transcripts and Accessibility considerations – Description**

- As there are no hard (or electronic) copies of information that the students will bring with or take home from the simulation, these considerations are minimal. Facilitators will be given the clinical scenario information prior to the session, as well as have access to the checklists the students will use so that they are prepared for the material that they will cover in person. For accessibility, we will need to ensure a large enough space is used so that students can spread out and have enough room to work without getting in each other's way.

**8. Logical Progression and Navigation – Description**

- As with the E-module, the beginning review of the four different procedures will be conducted in order of complexity (peripheral iv -> arterial line -> subclavian line -> internal jugular line). Logistically, there are not enough modules and is not enough time for the students to progress through the actual procedures themselves in this manner, so they will have to divide between all four procedures and rotate to the next station every 10-12 minutes. However, the design of the entire 90-minute workshop does progress in a manner of increasing complexity (verbal review as a group of each task -> practicing each task themselves -> applying the task and their knowledge to simulated clinical scenarios).

**9. Interactivity/Interactive elements functionality – Description**

- The entire design of this activity is hands on and highly interactive. Students will have the opportunity to use the procedure kits that we use in real life in operating rooms and in critical care settings. In addition, the clinical scenarios will be interactive between student groups, with facilitators and with the simulation equipment.

**10. References or Works Cited:**

Gooding, H. C., Mann, K., & Armstrong, E. (2017). Twelve tips for applying the science of learning to health professions education. *Medical teacher*, 39(1), 26–31.

Harrington DW, Simon LV. Designing a Simulation Scenario. [Updated 2021 Oct 1]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-.

## PEER REVIEW SUMMARY AND SELF-REFLECTION

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### 1. Peer Review Summary

- I shared my project with another student who is involved in instructional design and health care education. Overall she was impressed with the project, and felt I had done a good job with design and assessment techniques for each activity. She commented that she liked the flow of the E-module, and the idea of including check point questions throughout. She suggested including more questions for the more complex procedures such as the central lines while only maybe including one question about peripheral IV insertion, as much less time will be devoted to this in the module.

One area she suggested I could improve was in the storyboarding for the simulation activity. Although she is familiar with the procedures outlined in the module, she has never seen a simulation session for student education with them. So, initially she was unclear exactly how the students would move through the different activities. For this reason, I added two slides illustrating how the room and the tables will be set up. In addition, she provided suggestions for light boxing of images and content as well as navigational tips for the module for activity #1.

### 2. Self-reflection Statement

- As someone who has never designed a course of lecture myself before, this was a very new experience for me. In my previous teaching roles, I have had some freedom to design slides or lecture with whatever resources I want, but the content has always been provided to me. I enjoyed being able to start from scratch and really think about what content is most important for my learners at the level they are in their training and how best to represent such content. Along the way, the feedback I received from the course instructor and my peer reviewers helped me think more in depth about the same idea – what do I need to teach and how can I best do so for my learners? I do truly plan to implement this instructional design plan for the third year surgery clerkship, and have already discussed with the clerkship director my ideas. This summer, I will take a course to learn how to utilize the module development software so that I can create the first portion of this plan to be uploaded to canvas for the students. Future enhancement of the plan will come with peer review and trial and error after both portions of the design are implemented.

In addition, I plan to utilize the same concepts to redesign some of the other skills labs that the students complete during their time on the clerkship as many of these have the same performance gaps and educational needs as the vascular access skills. For example, the students also complete a skills lab on chest tube placement, breast exam and biopsy, bowel anastomosis and fundamentals of laparoscopic surgery skills. Many of these skills have non-existent, poorly done, or outdated videos that are provided to the students prior to attending lab, so many of the students do not utilize them and come unprepared. I would like to take each of their labs and model them off of the structure of this IDP for vascular access.

## MEDIA LIST

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- See documents in media folder for the following:
  - Storyboarding Activity #1
  - Storyboarding Activity #2
  - Checklist for Internal Jugular CVC placement steps