MEDICAL SCIENCE EDUCATOR



A GUIDE FOR TRANSITIONING ACTIVE LEARNING SESSIONS INTO AN E-LEARNING FORMAT FOR HEALTH PROFESSIONS EDUCATORS

INTERNATIONAL ASSOCIATION OF MEDICAL SCIENCE EDUCATORS

A Guide for Transitioning Active Learning Sessions into an e-Learning Format for Health Professions Educators

Amber J. Heck, Sandeep Bansal, Michael Bernas, Courtney Cross, Chase Crossno, Eric B. Gonzales, Swapan Nath, Veronica Tatum, Kelly Pagidas, Jennifer Allie

TCU and UNTHSC School of Medicine

Jennifer Allie - https://orcid.org/0000-0002-3061-2361 Sandeep Bansal - https://orcid.org/0000-0002-5123-657X Michael Bernas - https://orcid.org/0000-0002-6749-2551 Courtney Cross - https://orcid.org/0000-0001-5345-9614 Chase Crossno - https://orcid.org/0000-0001-9798-3565 Eric B. Gonzales - https://orcid.org/0000-0001-8596-9053 Amber J. Heck - https://orcid.org/0000-0002-0758-2950 Swapan Nath - https://orcid.org/0000-0001-9576-1758 Veronica Tatum - https://orcid.org/0000-0003-4923-8821 Kelly Pagidas - https://orcid.org/0000-0002-6186-4561

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Correspondence should be addressed to: Jennifer L. Allie, PhD, MPA Associate Professor, Medical Education TCU and UNTHSC School of Medicine Fort Worth, TX 76102 j.allie@tcu.edu

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PREAMBLE

Now more often than ever, health professions educators are transitioning face-to-face educational experiences into e-learning formats. This shift requires educators to learn the fundamentals of e-learning design and delivery, and to quickly identify and master the technologies to best support engagement and learning in the virtual environment.

The transition also presents challenges in retaining the basic principles of common active learning modalities in the virtual environment. In making transitions to e-learning at our home institution, it became apparent that there is no one-size-fits-all approach. Rather, depending on the educational modality deployed, there are nuanced. Therefore, resources for health professions educators on converting previously face-to-face active learning educational sessions into engaging and effective e- learning sessions are needed.

The target audience for this guide includes health professions educators who wish to deliver active learning educational experiences in an e-learning environment. This guide is not intended to be an exhaustive resource for e-learning or the active learning modalities discussed within. We encourage faculty who are not familiar with the theories and application of various active learning strategies in medical education to review the resource lists provided here. The focus of this guide is to provide considerations and strategies for the preparation, delivery, and assessment in an e-learning environment, of the primary active learning educational modalities common to health professions education curricula, including:

- Problem-based learning (PBL)
- Case-based learning (CBL)
- Team-based learning (TBL)



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INTRODUCTION TO ACTIVE LEARNING

Active learning is generally defined as any teaching method that engages learners as active participants in their own learning process. For learning to be effective, we need learners do something and think about what they are doing.

Active Learning Facilitation

A key concept in active learning is that the educator no longer acts as the "sage on the stage", but rather "the guide on the side", as they focus their attention on creating a learning environment that also supports development of the skills required to act in the workforce and become a life-long learner. As a result, the educational environment becomes less "teacher-centered" and more "learner-centered". In this paradigm shift, the educator's content knowledge alone is no longer sufficient to achieve the desired learning outcomes. The educator must also understand how learning happens, gain knowledge in pedagogy, and develop their facilitation skills.

The Flipped Classroom

A fundamental component of active learning is the flipped classroom. The flipped classroom refers to an instructional strategy that challenges educators to reconsider the traditional method of instructor-led lecture, where the primary method of delivery of new content is the passive, one-way exchange of information from educator to learner. Instead, in the flipped classroom, learners engage with new content prior to a session, freeing up valuable class time for active learning. In this model, the educator assumes their new role as the content expert facilitator, guiding the learners in understanding the relevance and real-world application of the material through carefully constructed active learning activities.

Active Learning Modalities

In health professions education, three active learning modalities have achieved widespread acceptance, with institutions and educators across the world adopting them and singing their praises. These are: problembased learning, case-based learning, and team-based learning. Each of these approaches to active learning has demonstrated effectiveness and fulfills the criteria of getting learners engaged in their own learning process. Individually, each of these modalities requires different resources and the implementation of different strategies.

Implementation of these instructional modalities is challenging enough in face-to-face settings. When delivered in an e-learning environment, further challenges exist, requiring additional consideration, planning, and faculty development efforts by the e-learning educator.

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INTRODUCTION TO E-LEARNING

E-learning, also called online learning, virtual learning, or distributed learning, has been part of higher education since the late 1980s. E-learning uses computer and internet assisted technologies to deliver content and facilitate instruction via a virtual learning environment.

Blended Learning

E-learning can be synchronous, in which learners engage with instructors and class materials at the same time in the same virtual space as their peers, or asynchronous, in which learners engage with content, instructors and their peers in a self-paced manner. Blended learning, also referred to as hybrid learning, combines synchronous and asynchronous learning. In an e-learning environment, this generally includes asynchronous independent elements, such as self-paced reading assignments, in combination with more structured synchronous elements, such as instructor-led activities delivered via video conferencing. As such, blended learning supports the flipped classroom approach that is so commonly applied to active learning.

| Synchronous e-Learning | Asynchronous e-Learning | |
|--|---|--|
| takes place in real-time with the instructor and learners in the same virtual space | learners engage with content and their instructor or peers independently | |
| e.g., live-streaming lectures, video conference assisted discussions, online live chatting, etc. | e.g., review of videos, readings, podcasts, and engaging with discussion board forums | |

Synchronous vs. Asynchronous Learning

The major pedagogical advantage of blended learning over strictly synchronous or asynchronous e- learning is that it provides opportunities for both independent and collaborative learning. Educators may benefit from the

change in perspective, which promotes rethinking and redefining learning activities, materials, and resources. Institutions and programs may benefit by increasing student reach and accessibility of content experts and patients to contribute to the instruction.

Challenges in e-learning may include increased costs to purchase technology, provide support staff, and train educators. Educators may be faced with challenges based on learner biases. Educators must

develop compelling interfaces and materials that capture learner's attention, but are not distracting. However, learners may not tolerate extensive training on technology, and may have developed habits for reading online such as skimming and navigating quickly from one resource to another. Additionally, when separated by distance, it is more difficult for educators to gauge the learner's needs and self- discipline. Perhaps the most important challenges we must consider are those that hamper learner accessibility, such as skills, knowledge, and access to technology. Learners who are not comfortable with e-learning may fall behind and find it difficult to catch up.

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THE E-LEARNING ENVIRONMENT

The climate of the online learning environment is established through consideration of many factors, which are impacted by both the educator's and learners' actions. However, educators play the primary role by determining and communicating the content and establishing the technology-mediated process.

Levels of Interaction

In addition to deciding what may occur synchronously or asynchronously, faculty must address and plan for the levels of interactions that exist in the e-learning environment: 1) interactions between learners and content (learner-to-content); 2) interactions between learners (learner-to-learner); 3) interactions between learners and educators (learner-to-instructor); and 4) interactions between learners and online and digital learning platforms (learner-to-interface).



Levels of Interaction in e-Learning

These levels of interaction are critical considerations for achieving optimal learning outcomes and ensuring that learners in virtual learning environments can engage with challenging content in meaningful ways, engage with their fellow students (providing both social support and social construction of knowledge), and engage with the respective experts (educators).

Sense of Community

Cultivating a sense of community may be more difficult in an e-learning environment, but is crucial since learners may experience a lack of motivation, engage less, and feel alienated and isolated without a sense of community. When learners feel they are part of a learning community, they are more likely to participate freely and openly in discussion, debate, and reflection. Educators can create a sense of community by attending to the three elements of a community.



The Elements of a Community of Inquiry

In this model, cognitive presence refers to the connection between the academic content and engaging of the mind, during the-learning experience, which usually results in deep, meaningful learning. Social presence refers to the ability of the learners to interact socially, emotionally, and collaboratively with other learners through the method of online communication. Teaching presence refers to the role of the educator in the design and facilitation of the e-learning experience. Teaching presence is the vital element in creating a community of inquiry in an e-learning environment, as the online educator exercises the teaching skills and experience in academic discipline, for selecting content, setting climate, and supporting learner-to-learner and learner-to-educator discourse.

Teaching Presence

Teaching presence is determined by three factors: design, facilitation, and direct instruction. Good teaching practices which are effective in face-to-face environments can be applied to an online experience as well. These include:

- Taking interests in learners and learning environments
- · Aligning instructional methods and available resources with intended learning outcomes
- Demonstrating communication and facilitation skills that are conducive to learning
- Communicating intended learning outcomes, timelines, and expectations
- Encouraging teamwork and collaboration
- Having a good understanding of the principles and practices of self-directed learning and motivating learners to embrace it.
- Promoting higher order thinking and the construction of knowledge through active learning
- Providing opportunities for formative assessment and timely feedback
- · Establishing a method to monitor learner achievement of the intended learning outcomes
- Demonstrating respect for diversities of learners and learning styles

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FACULTY DEVELOPMENT

Faculty development is key to the success of any health professions program and when transitioning an active learning modality to e-learning, modifications to existing faculty development options, and new options aimed at addressing faculty barriers to e-learning, may be necessary.

Knowledge of Pedagogy

Successful design and facilitation of active learning using methods such as problem-based learning, case- based learning, and team-based learning requires extensive knowledge of the modality and access to the necessary resources. Faculty must have a foundational understanding of the learning theory upon which the method is grounded, how to create and organize learning objectives and outcomes that support session design, how to identify or design the materials and session activities, how to facilitate the process in-session, and how to assess performance, seek feedback, and make improvements..

Knowledge of Content

Teaching, in any setting, is a complex skill that must be flexibly applied within a dynamic environment. Traditionally, developing skill in teaching has focused on application of knowledge in two domains: subject matter knowledge and knowledge of pedagogical strategies. By combining skill in these two domains, teachers can effectively present the content in ways that are understandable to learners.

Knowledge of Technology

In e-learning, a third domain exists: knowledge of technology. Therefore, teaching in an e-learning setting requires thoughtful integration of the educator's knowledge of content, pedagogy, and technology. In an inperson classroom setting, content generally guides the selection of pedagogical methods and the supporting technology. However, in an e-learning setting, the technology may

influence decision making surrounding pedagogy and content. Therefore, quality teaching in e-learning requires an in-depth understanding of the transactional relationship between content, pedagogy, and technology. To address this, Mishra and Koehler created the Technological Pedagogical Content Knowledge model (TPACK). It describes the intersections between each type of knowledge. When all three types of knowledge are applied, educators facilitate the development of essential knowledge and skills through the application of good learning theory supported by 21st century technology.



The Technological Pedagogical Content Knowledge (TPACK) Model

Barriers to Faculty Success in e-Learning

In addition to the types of knowledge necessary to succeed in an e-learning environment, faculty will require support in overcoming institutional and personal barriers. These may include:

- Limited access to devices such as smartphones, laptops, and tablets.
- Lack of prior experience with technology such as learning management systems, video- conferencing software, collaboration software, cloud-based storage, and communications software.
- Lack of experience with utilizing technology support services offered by the institution .
- Strong personal preferences for teaching in a face-to-face environment.
- Personal opinions about the effectiveness of online learning.

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PRACTICAL CONSIDERATIONS IN SELECTING E-LEARNING TECHNOLOGIES

When appraising and adopting technology to support e-learning, there are many considerations. Educators should first examine existing resources for e-learning at their home institution. They should work closely with their institutional academic technology and/or instructional design team to identify and appraise these resources. However, the availability of technology should not drive the learning.

The Usability of Technology

To assess e-learning technology, we can adapt best practices from the software development world. Developers assess any online interface according to usability principles, or the five basic attributes that influence user-to-interface interactions.

| The Principles of Usability | | |
|-----------------------------|---|--|
| Learnability | How easy is it to learn how to use the technology and gain proficiency? | |
| Rememberability | How well can learners remember how the technology works? | |
| Efficiency in Use | How fast can the learner complete the task? | |
| Reliability | How often will learners be hindered by errors? | |
| Satisfaction | How will learners feel about using the technology? | |

Technology's Impact on Cognitive Load

When assessing any e-learning technology, educators should attend to cognitive load challenges and consider whether the technology enhances or detracts from learners' preparation, engagement, and learning.

| The Effects of Technology on Cognitive Load | | | |
|---|-----------------|--|---|
| Cognitive Load Intrinsic Load | | The inherent complexity or difficulty of the content | Immutable by technology |
| | Extraneous Load | The unnecessary load imparted by instructional design | Can be increased when technology is too complex or difficult to use |
| | Germane Load | The beneficial load imparted through the effective handling of information | Can be increased when technology efficiently aligns with the task |

In transitioning to an e-learning environment, educators should partner with their information technology team to assess and craft language on the minimum technology that is required. All learners must have access to computers with audio, web cameras, and high speed-internet access. For all technology used in e-learning, training and resources must be provided for learners and educators to ensure accessibility and comfort with all software and systems prior to implementation.

Learning Management Systems (LMS)

The experience the learner has interacting with the online interface is a key component driving their perceptions of the e-learning environment. To create a clear and easy to navigate online learning experience, institutions must identify and adopt a Learning Management System (LMS). The LMS is a software program used to organize and administer all aspects of the learning program, including communications, assessment, and educational content. When selecting the right LMS, e-learning educators should assess whether the software supports the asynchronous engagement of learners with both content and other learners.

Videoconferencing Platforms

In addition to the LMS, a multi-modal video conferencing platform is required for blended e-learning. Active learning activities often require learners to engage which each other in smaller groups. Therefore, it is necessary that the video-conferencing software support small group breakout rooms.

Before the first session using the new video-conferencing software, provide instructions to learners on navigating the platform, including instructions on how to ask for help if they have any technological issues or content questions when they are in breakout rooms. In sessions where breakout rooms are used, identify an experienced person to stay and monitor the larger room. This will ensure that learners and educators are able to solicit help and navigate back to the room in the event that they are dropped.

Small Groups in e-Learning

For optimal virtual engagement, consider six or fewer learners per small group. Where not already dictated by the modality, consider assigning learner roles such as leader, timekeeper, scribe, and spokesperson. If possible, post group assignments and roles for learners before the session. Before each session begins, assign learners to their breakout rooms and ensure the distributions are correct. Provide clear communication on the activity, technology, and expectations before learners enter breakout rooms, to ensure that time in small-group activities remains focused on the task at hand, and not on administrative clarifications. Transitions into and out of break out rooms take time and effort, so plan accordingly by allowing for extra time and considering the additional cognitive load that transitions may place on the learners.

Online Software

When delivering active learning within health professions programs online, additional software is needed to support active synchronous learning, including the presentation of clinical scenarios, learner activities, and assessment. Work with the institution's instructional designers to identify and critically evaluate these resources. When selecting new software for in-session activities, we suggest avoiding using any software that requires learners to sign up, outside of an institutional license.

Accessibility

The accessibility of software and online learning materials is important. Consider adding alternative text, narrating, and disseminating slides before a synchronous session, to accommodate learners with hearing or visual challenges. The psychosocial impact of your educational practices is important too.

Consider the effect of requiring learners to display video. Educators and learners should balance the benefits of sharing video with the concerns of learners' psychological safety, and concerns of sharing their home environment during times of stress and crisis.

Educator Best Practices

The way educators present themselves in the e-learning environment has a major influence on their perceived presence and authority. During synchronous e-learning, educator video should remain on. Educators should ensure that they have adequate lighting, are centered in the video screen, and remove any environmental distractions that may be visible to learners. Educators should consider investing in headphones with a microphone. Wearing headphones will reduce the amount of ambient noise, enhancing the quality of learner engagement. Educators should mitigate environmental distractions that are unique to e-learning by turning off notifications and setting unneeded software on "do not disturb" mode. To ensure seamless delivery with less distraction, educators should schedule technology rehearsals to field test all software prior to implementation.

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e-Learning Design and Delivery

Using technology to teach online impacts the logistics of instruction. Further, increased distance between learners and educators impairs the ability to communicate in informal ways. Here, we share recommendations based on experience that aim to prepare health professions educators to mitigate common pitfalls experienced during e-learning delivery in advance of the e-learning session.

Facilitation

While the role of the educator as facilitator within the active learning pedagogy should be maintained, additional considerations are necessary when delivering this modality online. In the e-learning classroom, additional effort is required to promote learner engagement and collaboration. When designing presentation materials and activities, facilitators should consider additional prompts to encourage questions, comments, and reactions from learners in the e-learning environment. It is difficult to gauge the reactions of learners in the e-learning classroom; therefore, facilitators must plan additional time to pause and solicit learner questions, contributions, and requests for clarification.

In the e-learning environment, facilitating with other educators can be more difficult. When not in the same room, facilitators cannot react based on each other's nonverbal cues and body language. Side conversations and check-ins are more difficult as they must occur through online chat or text messaging. Before entering the e-learning session, all facilitators should be aware of their roles and responsibilities for facilitating the content and the process. Assigning process-oriented roles to facilitators for online learning is helpful. These may include session-lead, timekeeper, and chat monitor.

Prior to the Session

Educators should arrive at synchronous sessions hosted online early for a pre-session check-in. We suggest scheduling this check-in meeting 30 minutes prior to the session. During the meeting, review the session timelines and facilitator roles. Remind the timekeeper of the schedule, and suggest prompts to keep the learners and facilitators moving forward. Reiterate and confirm with the chat monitor the strategy for

addressing comments and questions in the chat. Troubleshoot any technology issues, and articulate your backup plans in the event that learners or facilitators experience technology issues during the session. Ensure that any required materials are accessible to learners, and that any hyperlinks are functioning. Attend to any small group logistics such as assigning learners to breakout rooms. Lastly, open the presentation materials and share them on the screen.

Communication

In e-learning classrooms, communication may be impaired due to online distractions and effects of engaging in multiple, simultaneous tasks on executive function. When delivering e-learning, set the stage first. Review the session agenda with the learners. Remind learners of the goals of the session, and the educational modality, and encourage them to discuss and ask questions. Establish e-learning session etiquette and ground rules. Consider addressing topics such as muting your microphone unless you are talking, how to use the chat and how it is monitored, expectations for displaying names and using video, and rules for engagement in small and large group activities.

Small Group Breakouts

When using breakout rooms, it is necessary to provide clear directions on what learners are to do and use while in the breakout room. Immediately prior to opening the breakout room, provide clear instructions and outline expectations. Display these on the screen and go over them verbally. Provide the instructions in written form to learners by posting them on the LMS, so that they can access them while in the breakout room. Allow learners time to test their access to the materials and ask any questions on the activity before entering the room. Lastly, remind learners of how to ask for help if they have technology issues or questions on content while in the breakout rooms.

Closure

Plan for additional time at the end of the session to wrap-up and answer any questions. Review the session objectives and make connections between these and the session activities, making clear to the learner exactly when and how they achieved the objectives during the session, and allowing them an opportunity to reflect on their learning. Consider including a summary slide and emphasizing any key take-aways. Post the presentation materials and any additional resources to the LMS, and remind learners of how to access these before they leave the session.

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E-LEARNING AND ASSESSMENT

In the e-learning environment, the use of assessment technology is necessary and the technology selected must support assessment of the intended learning outcomes. Educators should provide ample opportunities for assessment in both synchronous and asynchronous e-learning environments.

Formative and Summative Assessment

E-learning assessment can be formative or summative and exist synchronously or asynchronously. In any setting, it must be clearly articulated to learners whether an assessment is formative or summative.

When designing formative e-learning assessments, educators must consider whether the technology selected enhances or detracts from student learning. When designing summative e-learning assessments, educators must consider whether the technology selected truly supports the assessment of the intended learning outcomes, without detrimental effects to learner motivation or cognitive load. We encourage educators to work with their institutional assessment and evaluation teams to identify best practices and available technology to support assessment.

| Formative and Summative Assessment for e-Learning | | |
|---|--|---|
| | Formative | Summative |
| Purpose | Identify learning gaps and improve learning | Collect evidence of student knowledge and/or skill |
| Timing | During asynchronous and/or synchronous activities | At the conclusion of the activity/ module/course/phase |
| Techniques in e-Learning | Discussion, observation, feedback, quizzes/ knowledge checks, reflections | Tests, projects, presentations |
| Supportive Technology | Videoconferencing software with break- out rooms, learning management systems, audience response systems, digital learning platforms, online quiz or game applications, collaboration software | Learning management systems, assessment programs |

Technology is key to support assessment in the e-learning classroom. Some examples include learning management systems, online digital learning platforms, audience response systems, and assessment software programs.

A variety of strategies can be used when incorporating formative assessment into e-learning. Knowledgechecks may be used, both asynchronously before or after a session, or synchronously as part of the session activities. To do so, consider the use of polling software, online quiz and game applications, and survey or quiz functions within the LMS.

Assessing Learner Involvement

Participation and engagement are often assessed in learning. In the e-learning environment, this may include learner contributions in synchronous large or small group discussions, or asynchronously in online collaboration settings such as a discussion board. If educators choose to assess participation and engagement in an online setting, they must consider how these are impacted by the e-learning environment. Educator and learner expectations should be managed and assessment rubrics should be evaluated and adapted to ensure consistency and fairness across groups in a virtual platform.

Incorporating Feedback

Feedback is a key component of the assessment cycle. Opportunities to receive and act on feedback helps learners achieve the desired learning outcomes. E-learning may limit opportunities for feedback that

exist in the face-to-face environment, so educators should make efforts to provide additional, structured opportunities. Feedback can be delivered verbally by the facilitator to the large group or to individuals via one-one video-conferencing meetings, or learner-to-learner during small group activities.

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E-LEARNING TROUBLESHOOTING

When working with technology, malfunctions and failures will inevitably happen. Here we will address some common scenarios in e-learning that require troubleshooting.

Who do educators contact if troubleshooting is required during a session?

Appoint an emergency contact, such as a course director, academic coordinator, or administrator, and ensure that facilitators can connect to them quickly via mobile or short-message service. The emergency contact can join the session and ensure learners continue with the process, or communicate to the learners if the session will be ended or rescheduled.

What if educators are "dropped" during a session?

If educators are dropped during a video-conferencing session and cannot rejoin with video, they should join in by phone. Make sure dial-in numbers are provided via email and on the event within the academic calendar.

If resources allow, institutions may also want to consider including other faculty or staff in a session, who are on standby to resume facilitation in the event that scheduled facilitators are not able to re- connect.

Finally, facilitators can post asynchronous videos, notes, or summaries of any content or activities not covered. In addition, consider using online discussion threads or hosting virtual office hours to offer opportunities to discuss the content with the facilitator who was dropped.

What if a learner is "dropped" during a session?

If learners are dropped during a video-conferencing session and cannot rejoin with video, they should join in by phone. Make sure dial-in numbers are provided via email or LMS communications and on the event within the academic calendar.

If the learner is unable to rejoin or can only join by phone, facilitators may consider providing asynchronous materials and/or scheduling office hours to review missed session material. Additionally, learners should be encouraged to reach out to peers to share notes and take-aways.

What if audio or video are "lagging"?

Sometimes a web camera will deplete Internet bandwidth, making communication challenging. Remind educators and learners that if their internet connection is slow or lagging, they should temporarily turn off their video stream and only maintain the audio stream.

What if the video-conferencing software is not functioning?

Contingency plans should be made, in consultation with administration, in the event of service unavailability of the video-conference platform. Facilitators should be made aware of plans in advance, and be provided with the emergency contact information. Emergency contacts can put plans into action quickly by contacting learners and educators via email or LMS communications.

What if breakout rooms are not functioning?

When breakout rooms are not functioning, shift to large group facilitation, or consider the use of mobile or short message communication for small group discussions. Educators should plan for such contingencies during planning meetings prior to the session, and ensure session materials are developed to support this.

What if online educational software is not functioning?

When technology such as audience response systems, digital learning platforms, quizzing or gaming applications, or online collaboration software, is not functioning during a synchronous session, educators should implement a contingency plan. Educators should discuss these alternatives prior to the session during planning meetings. Examples include creating word processing or PowerPoint versions of session activities. These documents should be easily accessible to all facilitators through cloud-based storage, and can be disseminated to learners via video-conferencing software features, email or LMS communications.



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E-LEARNING ACTIVE LEARNING MODALITIES

In the following sections we provide educators with checklists for use when planning for the transition of a specific active learning modality into an e-learning session. For the purposes of this guide, we have focused on the primary active learning educational modalities common to health professions education curricula:

- Problem-based learning (PBL);
- Case-based learning (CBL); and
- Team-based learning (TBL).

Of note, we would like to convey that all of these modalities, herein adapted for e-learning, can be utilized to create opportunities for active learning in any health professions discipline. This includes those most challenging to transition to a virtual format, such as anatomical sciences, communication skills, and clinical skills. Finally, we have provided a blank template form that can be used by educators making the transition to e-learning as a planning document to outline their own thoughts and considerations related to learner interactions, preparation, delivery, assessment, technology, and troubleshooting.

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PROBLEM-BASED LEARNING (PBL)

Problem-based learning (PBL) is learner-centered teaching modality driven by realistic, interdisciplinary, clinical cases delivered in a progressive disclosure model. It is based on constructivist learning theory, or the idea that learners actively construct knowledge rather than passively absorbing it. In PBL, learners must identify what they already know that is relevant to the case, and what they need to know in order to construct new knowledge or accommodate new ideas. PBL also promotes teamwork and the social construction of knowledge, as learners provide differing perspectives and apply personal experiences and prior knowledge to a shared problem.

PBL Design

The general objectives of PBL are to:

- Promote clinical reasoning, critical thinking, problem formulation, and problem solving.
- Develop interpersonal communication, teamwork, and collaboration skills.
- Promote the acquisition, organization, dissemination, and evaluation of new and prior knowledge.
- Promote transdisciplinary, cognitive integration and application of knowledge.

PBL utilizes small groups and combines synchronous and asynchronous components, over two or more sessions. Synchronously, the group reasoning process is purposefully facilitated by trained educators, often called tutors, who do not provide guidance on content. As groups form, they derive their own ground rules for interactions. During the first encounter, each learner is assigned an individual role. The learners are provided with a clinical case that is disclosed piece by piece, progressively. As they encounter each new piece of information, they document their reasoning process on a white board according to categories such as: learning cues, hypotheses, and progressive learning issues. The small groups perform all actions, step by step (as described in the Table below), toward nesting the actionable learning objectives. Asynchronously, between sessions, learning is self-directed and driven by the student-derived actionable learning objectives. Learners are challenged to identify and evaluate their own learning resources. During the second encounter, the learners present the reformulated problem with new insights, and each contribute to discussion and application of their knowledge to the clinical problem. The learners apply the critically appraised, new information, and frequently, close the loop with the patient, addressing and building consensus on the unanswered questions on the cause and causal mechanisms, from the first encounter. Finally, they reflect on their performance and set learning goals. Through the process, learners engage in multiple learning steps.

| | The Steps in Problem Based Learning (PBL) |
|----|--|
| 1. | Identify the problem. |
| 2. | Explore pre-existing knowledge. |
| 3. | Generate hypotheses and possible mechanisms. |
| 4. | Identify learning issues. |
| 5. | Self-study. |
| 6. | Re-evaluation and application of new knowledge to the problem. |
| 7. | Assessment and reflection on learning. |

e-Learning for Problem-Based Learning (ePBL)

The PBL experience can be transformed into an optimal virtual experience by setting expectations and engaging learners. To the extent possible, the techniques and strategies used in e-learning PBL should remain consistent with those used face-to-face, in order to preserve the constructivist approach. The selection or

creation of PBL scenarios (problems) does not need to alter in the e-learning environment. The focus remains on the careful curation of appropriate scenarios to ensure achievement of the desired learning outcomes. However, the e-learning format can provide additional opportunities for the incorporation of rich-media and simulation.

ePBL Technology

In designing e-learning, the ways that the learner interacts with the content, the educator, the other learners, and the online interfaces must be more carefully considered. All synchronous interactions with the content, educator, and other learners occurs through the use of video-conferencing software, so the selection of this software is one major consideration. The other consideration is group size. Evidence has demonstrated that a smaller group size is associated with increased measures of self-directedness.

Therefore, we suggest assigning 6 or fewer learners per group.

Asynchronously, learners will interact with each other using video-conferencing software, communication methods such as apps or text messaging, or collaboration software through the use of discussion boards, shared folders, or whiteboards. The selection of resources here is largely dependent upon the preferences of the learners, but facilitators should advise and provide feedback on the methods used.

ePBL Facilitation

In PBL, facilitators serve a critical role in guiding the group process. The steps to ePBL facilitation will remain largely the same, with some further considerations for the e-learning environment. Therefore, facilitators must be well-trained in the process and their role within it. When transitioning to e-learning, there are additional considerations that must be addressed. Traditionally, PBL facilitators apply the time-tested "scaffold and fade away" method, being mindful of "coaching rather than teaching" to

foster collaborative learning. In an e-learning environment, the facilitator should use a more "hands-on" approach to ensure effective participation and engagement by all learners in peer-to-peer conversations. When preparing facilitators for e-learning, handbooks, guides, and training materials must be updated to clarify any changes to the process and the facilitator roles. Further, facilitators must be well trained in the technology, to the extent that they can "coach" the learners.

ePBL CHECKLIST

The checklist below is provided to guide educators in identifying key considerations during the planning and delivery of PBL in an e-learning environment.

| Key Considerations in ePBL | Checklist Item | Completed |
|-------------------------------|---|-----------|
| Preparation | Orient facilitators to their roles and responsibilities in the facilitation | □ Yes |
| | of e- Learning PBL. | 🗆 No |
| | Train facilitators in the virtual platform and software needed to | 🗆 Yes |
| | facilitate the session. | 🗆 No |
| | Prepare facilitators to instruct learners on the technology and | □ Yes |
| | e-Learning PBL process. | 🗆 No |
| | Develop a facilitator guide for each case, with suggested prompts to bein them guide inquiry in the e-learning environment | |
| | Field test the technology used to synchronously reveal the progressive | |
| | disclosures. | |
| Technology | Select software that allows facilitators to easily reveal the case | 🗆 Yes |
| | through progressive disclosures. | 🗆 No |
| | Select a video-conferencing software that supports learner screen- | 🗆 Yes |
| | sharing. | 🗆 No |
| | Identify collaboration software for synchronous interaction, such as | 🗆 Yes |
| | whiteboarding, and asynchronous interaction, such as a discussion board. | 🗆 No |
| | Identify a mechanism to disseminate the intended student learning | Yes |
| | objectives, such as the institutional learning management system (LMS). | 🗆 No |
| Delivery | Provide facilitators with the electronically formatted PBL scenario | 🗆 Yes |
| | before the session, and ensure they can access. | 🗆 No |
| | Meet virtually with facilitators to review the intended learning | 🗆 Yes |
| | outcomes, discuss facilitation strategies, and articulate troubleshooting plans, prior to each session. | 🗆 No |
| | Provide clear and timely instructions to learners for all technology, | 🗆 Yes |
| | both verbally in-session, and as written instructions posted to the LMS. | 🗆 No |
| | Plan time to ensure that all learners are able to access and use any | 🗆 Yes |
| | collaboration software. | 🗆 No |
| | Instruct groups to define their expectations for e-learning etiquette | 🗆 Yes |
| | when establishing their ground rules. | 🗆 No |
| Assessment | Update assessment rubrics to include criteria applicable to the | □ Yes |
| | | □ No |
| | Adapt and upload rubrics to assessment software to be accessed and | |
| | | □ No |
| Trouble- Shooting | Create and distribute a copy of the case in a word processor format to | □ Yes |
| | be used if the disclosure software falls. | □ No |
| | Plan for a transition to asynchronous learning if the video- conferencing software fails or malfunctions. | Yes No |

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CASE-BASED LEARNING (CBL)

Case-Based Learning (CBL) is a student-centered active learning modality that promotes application of knowledge to realistic clinical scenarios using inquiry-based methods. Guided by a content expert facilitator, learners engage with their peers to apply key foundational basic science concepts within a clinical decision-making context. CBL requires learners to do more than memorize the facts, it promotes thoughtful and active engagement in critical thinking and cognitive integration.

CBL Design

The general objectives of CBL are to:

- Promote cognitive integration through the application of the foundational and clinical sciences together to clinical case scenarios.
- Promote long-term knowledge retention beyond memorization by connecting facts to their meaning.
- Promote critical thinking and clinical reasoning through processing, analyzing, and evaluating information revealed within the structure of a clinical narrative.

There is no consensus on the definition of CBL. However, it is often described as a method of inquiry- based learning, a broader term which refers to using questions, problems, or scenarios to encourage learners to analyze, ask questions, and share ideas. One thing that can be agreed upon is that CBL exists somewhere on the continuum between structured and guided learning. Generally, CBL requires four components.

| | The Components of Case-Based Learning (CBL) |
|----|--|
| 1. | An authentic clinical case. |
| 2. | A minimal amount of key foundational information presented. |
| 3. | An activity that engages the learner in inquiry related to the case. |
| 4. | A content expert facilitator guiding the discussion to achieve |
| | learning outcomes. |

One additional component should be considered to best utilize the synchronous learning time. To engage in inquiry-based learning, learners must have the foundational knowledge required to answer a question or solve a problem. If learners do not arrive to the session with that knowledge, it must be presented alongside the case. Therefore, a flipped classroom approach is often a necessity.

e-Learning for Case-Based Learning (eCBL)

The objectives of CBL can be achieved in an e-learning format through advanced planning and the development of engaging resources. The components of CBL do not change in the virtual environment, though the steps and resources used for implementation of CBL will need to be modified slightly when transitioning to an e-learning format. The utilization of digital learning platforms can promote engagement through formative assessment questions and activities such as polling, quizzes, and games, and collaborative learning activities such as categorization or mind-mapping.

eCBL Technology

A flipped classroom approach to e-Learning CBL requires asynchronous and synchronous components. Since asynchronous, pre-work assignments for face-to-face CBL are usually delivered through an online interface, the learner's interaction with the content before the session is largely the same.

Synchronously, CBL in an e-learning environment is conducted using video-conferencing software. All interactions between learners occur synchronously using this software. Learner-to-learner interactions occur primarily in small groups, while the interactions between the educator and the learners occur when the entire group is together, so the software must support both breakout rooms and large group discussion. After the

session, interaction between the learner and educator can occur through the use of online discussion boards or posting of resources and presentation materials. The amount of technology used in a single CBL session can vary greatly. In addition to the video-conferencing software, facilitators may use interfaces to deliver clinical case scenarios and inquiry-based learning activities. When introducing new technologies in CBL, educators should assess for accessibility and consider the effect of learning new technology during a session on the cognitive load of the learner.

eCBL Facilitation

Facilitators of CBL must be trained in the flipped classroom approach and active learning methods. In addition, a conceptual understanding of how methods of inquiry promote the construction and retention of knowledge will enhance the facilitator's effectiveness and promote buy-in.

Facilitators must be content knowledge experts. Sessions can be facilitated by one or more educators. All facilitators included in a session should have a clearly defined role in addressing the content and directing the process. Process-oriented roles may include session leader, small group observer or facilitator, chat monitor, or timekeeper. To optimize timing, transitions, and application time, we suggest including no more than three large-group content-expert facilitators in a given ninety-minute session.

In small groups, educators may play the role of passive observer, content facilitator, or process facilitator. When the goal is to guide learner interactions within breakout rooms, more facilitators may be needed. Small group size has the potential to enhance learner involvement, so we suggest dividing learners into groups of no more than 6. Educators should also consider limiting the time in small groups to less than 10 minutes to prevent fatigue and limit the opportunity for discussion to go off-topic.

eCBL CHECKLIST

The checklist below is provided to guide educators in identifying key considerations during the planning and delivery of PBL in an e-learning environment.

| Key Considerations in eCBL | Checklist Item | Completed |
|-------------------------------|--|-----------|
| Preparation | Assign clear and specific roles to educators for the facilitation of the | 🗆 Yes |
| | session, such as session lead, timekeeper, and chat monitor. | 🗆 No |
| | Establish a method for addressing comments and questions from the | 🗆 Yes |
| | chat, with planned pauses during the session. | 🗆 No |
| | Estimate the time required to complete each activity, and make | 🗆 Yes |
| | modifications to reduce the time learners spend in breakout rooms. | 🗆 No |
| | Create a session timeline that details the time allotted for each | 🗆 Yes |
| | activity and discussion, and considers the time needed to join and leave breakout rooms. | 🗆 No |
| | Clarify the role of the facilitator in breakout rooms as passive | 🗆 Yes |
| | observer, process facilitator, or content expert. | 🗆 No |
| Technology | Select video-conferencing software that provides a seamless breakout | 🗆 Yes |
| | room function. | 🗆 No |
| | Explore available digital learning platforms to identify methods such | |
| | as polling, quizzing, gaming, and collaboration. | 🗆 No |

| Delivery | Meet virtually with facilitators to review roles, discuss facilitation strategies, and articulate troubleshooting plans, immediately prior to | 🗆 Yes |
|-------------------|--|-------|
| | the session. | 🗆 No |
| | Post a student version of the presentation, with materials and | 🗆 Yes |
| | instructions for activities, for learner reference while in breakout rooms. | 🗆 No |
| | Establish ground rules for e-learning etiquette at the start of the | 🗆 Yes |
| | session to provide guidance on the use of video, audio, and chat. | 🗆 No |
| | Direct learners to assign roles such as leader, scribe, or timekeeper, | 🗆 Yes |
| | when they enter breakout rooms. | 🗆 No |
| | Provide clear verbal and written instructions on all technology | 🗆 Yes |
| | immediately prior to its use. | 🗆 No |
| | Ensure that learners are able to access and use any software or | 🗆 Yes |
| | resources when they begin an activity. | 🗆 No |
| Assessment | Incorporate formative assessment opportunities through the use of | 🗆 Yes |
| | interactive digital learning platforms to enhance learner engagement. | 🗆 No |
| Trouble- Shooting | Plan to run out of time, and only include activities that can easily be | 🗆 Yes |
| | transitioned to a large group setting at the end. | 🗆 No |
| | Draft large-group facilitation prompts for all small group activities, to | 🗆 Yes |
| | be used if breakout room functionality fails. | 🗆 No |

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TEAM-BASED LEARNING (TBL)

Team-Based Learning (TBL) promotes critical thinking, problem solving, and social construction of knowledge through a series of prescribed learning activities. TBL is sequenced in a way that promotes learner maturation across the module by gradually increasing the level of higher order thinking and collaborative learning that is required to complete an activity. Advanced preparation is required to participate meaningfully in the activities, driving learner preparedness, and the group members stay together across an entire course or module, encouraging team formation.

TBL Design

The general objectives of TBL are to:

- Promote individual and cooperative learning through formative assessments and application of knowledge to contemporary problems.
- Develop interpersonal communication, teamwork, and collaboration skills.

The Team-Based Learning (TBL) Collaborative defines TBL as "an evidence based collaborative learning teaching strategy designed around units of instruction, known as "modules," that are taught in a three- step cycle: preparation, in-class readiness assurance testing, and application-focused exercise." Each step in the cycle has multiple components.

| The Three-Step Cycle of Team-Based Learning (TBL) | | | |
|---|--|--|--|
| Step | Activity | Outcome | |
| Learner Preparation | Learners complete assigned prework readings or activities. | Learners meet learning objectives identified by the educator. | |
| In-Class Readiness | Learners complete the RAT individually (iRAT) and submit. | Learners self-assess their prior knowledge. | |
| Assurance Testing (RAT) | Learners complete the RAT in teams (tRAT), agreeing upon an answer to each question before submitting and revealing the answer choice. | Learners engage in peer teaching and consensus building, and receive immediate formative feedback. | |
| | Learners have the opportunity to formally appeal any answers they got incorrect. | Learners self-assess and use the resources to justify their answer choices. | |
| | Facilitators debrief RAT questions based on tabulation of the RAT scores. | Difficult concepts are prioritized and clarified. | |
| Application Focused Exercises | Teams are presented with a problem or challenge and team members must agree upon the best answer or solution. | Learners collaborate to apply and integrate knowledge and build consensus. | |
| | Teams present their answer or solution within the larger group, where discussion and debate occurs across teams. | Learners critically evaluate the problem and their own knowledge and conclusion through facilitation. | |

RATs generally include between 5 and 20 lower-order multiple choice questions derived from the learning objectives found in the pre-work. Application focused exercises in TBL are generally developed with the "4S" criteria in mind.Z

| The "4S" Criteria in Team-Based Learning (TBL) | | |
|--|--|--|
| Significant Problem | The problem must be meaningful enough to motivate learners and complex enough to require collaboration. | |
| Same Problem | All teams are assigned the same problem to collaborate on in small groups, and then justify their conclusions in the larger group. | |
| Specific Choice | The problem must require the team to reach consensus on one clearly-defined and specific answer, deliverable to the larger group. | |
| Simultaneous Reporting | All teams reveal their specific answer choice to the larger group at the same time, to promote public accountability and establish a starting point for discussion and debate. | |

e-Learning for Team-Based Learning (eTBL)

In the e-learning environment, utilization of team-based learning (TBL) presents multiple benefits over other e-learning modalities. The variety of activities, pace of learning, and application of knowledge to relevant and interesting problems promotes continued learner engagement despite the distance and distractions. Therefore, to the extent possible, the three-step cycle of TBL should be maintained in the e- learning setting. In order to adhere to the three-step process of TBL in an e-learning environment, some additional considerations are necessary. Consider implementing the following steps when constructing an e-learning TBL, in addition to your normal process.

eTBL Facilitation

In TBL, it is necessary to build in extra time to accommodate the learners as they determine the sequence and pace of the discussion. This is even more true in an e-learning format, where barriers to engagement and the use of technology may also contribute to delays. Allocate additional time for RAT and application questions. Consider adding an extra 30 seconds for each RAT question and 5 minutes for application questions, divided between breakout room time and debrief time. Prior to the session, determine strategies to prompt the learners and other facilitators when needed to manage time.

Managing time, developing effective learning activities, and selecting the most appropriate technologies are key to maintaining the TBL format and achieving the desired learning outcomes in an e-learning environment.

eTBL Technology

In TBL, learners engage meaningfully with the content, their peers, and the educators. TBL requires a flipped classroom approach, incorporating both asynchronous and synchronous components, necessitating the use of multiple forms of technology. To reduce the number of new technologies the learners will encounter, utilize your institution's current learning management system (LMS), to the extent possible to support the TBL activities.

Asynchronously, learners engage with the content in a similar manner to what occurs in face-to-face TBL, namely, through assigned pre-readings delivered via an online interface. The majority of interactions between learners will occur during synchronous small group breakouts where learners collaborate on RAT and 4S activities. Though teams stay together over time, learners may also collaborate or reflect using communication tools and software outside of class.

Learner-to-educator interactions are mostly synchronous and limited to large group discussion. This emphasizes the need for video-conferencing software that is reliable, accessible, and provides multiple options for communication such as microphones and chat. Asynchronous interaction between educators and learners can also be encouraged through the use of a discussion board.

TBL offers multiple opportunities for formative and summative assessment, which should be maintained when transitioning to an e-learning setting. When selecting the types of technology learners will interface with

during e-learning TBL, it is encouraged to adopt a technology for use across an entire module or course. Due to the variety of learning activities in TBL, multiple software programs may be required to deliver preparatory materials, RATs, 4S activities, and evaluations. Each time a new technology is introduced, the learner dedicates cognitive effort to learning the new technology, which may compete with their capacity to work with the content.

eTBL CHECKLIST

The checklist below is provided to guide educators in identifying key considerations during the planning and delivery of TBL in an e-learning environment.

| Key Considerations in eTBL | Checklist Item | Completed |
|-------------------------------|---|-----------|
| Preparation | Assign clear and specific roles to educators for the facilitation of the | □ Yes |
| | session, such as session lead, timekeeper, and chat monitor. | 🗆 No |
| | Establish a method for addressing comments and questions from the chat, with planned pauses during the session. | 🗆 Yes |
| | | 🗆 No |
| | Create a session agenda, specifying the time for each TBL component and providing extra time to transition in and out of breakout rooms. | 🗆 Yes |
| | | 🗆 No |
| | Generate instructions for submitting and addressing RAT appeals through email or online submission through the LMS. | 🗆 Yes |
| | | 🗆 No |
| | Field test all materials and software to be used, and troubleshoot any technology issues. | 🗆 Yes |
| | | 🗆 No |
| | Orient to learners on the eTBL process and provide opportunities | 🗆 Yes |
| | for learners to test access and ability to use technology, prior to implementing eTBL in the curriculum. | 🗆 No |
| Technology | Select software or statistical methods that are easy to use for RAT tabulation during the session and provide real-time graphical reports. | 🗆 Yes |
| | | 🗆 No |
| | Select software for the RAT that offers the options to both hide the correct answer for iRAT and reveal the correct answer for tRAT. | 🗆 Yes |
| | | 🗆 No |
| | Select the technologies to support simultaneous reporting of each 4S activity, which may include screen sharing or collaboration software. | 🗆 Yes |
| | | 🗆 No |
| Delivery | Post instructions and guidance on any new technology and how it will be used in the session, alongside pre-work postings. | 🗆 Yes |
| | | 🗆 No |
| | Meet with facilitators to review the agenda, timeline, and facilitator | 🗆 Yes |
| | roles, and troubleshoot technology, immediately prior to the session. | 🗆 No |
| | Establish ground rules for e-learning etiquette at the start of the | 🗆 Yes |
| | session to provide guidance on the use of video, audio, and chat. | 🗆 No |
| | Provide clear verbal and written instructions on all technology | 🗆 Yes |
| | immediately prior to its use. | 🗆 No |
| | Ensure that learners are able to access and use any software or resources when they begin an activity. | 🗆 Yes |
| | | 🗆 No |

| Assessment | Update peer-to-peer assessment and faculty assessment rubrics to include criteria applicable to the e-learning environment. | 🗆 Yes |
|-------------------|---|-------|
| | | 🗆 No |
| | Adapt and upload rubrics to assessment software to be accessed and used by learners and facilitators. | Yes |
| | | 🗆 No |
| Trouble- Shooting | Plan to proceed from iRAT to discussion and appeals, and use Socratic | 🗆 Yes |
| | questions to facilitate 4S questions instead of 4S activities, if breakout rooms do not function. | 🗆 No |
| | Plan to rely on learners to identify which RAT questions to discuss if the automatic tabulation method fails. | 🗆 Yes |
| | | 🗆 No |
| | Plan to collect responses to 4S questions using the video-conferencing | Yes |
| | chat feature, or an online collaboration board, if simultaneous reporting technology fails | 🗆 No |
| | | |

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PLANNING FOR THE TRANSITION OF YOUR ACTIVE LEARNING MODALITY TO E-LEARNING

This template serves as a planning resource and guides educators in identifying their own key considerations during the transition and delivery of an active learning modality in an e-learning environment.

| Key Considerations for My Session | Checklist Item | Completed |
|--------------------------------------|----------------|-----------|
| Preparation | | □ Yes |
| | | 🗆 No |
| | | Yes |
| | | 🗆 No |
| | | 🗆 Yes |
| | | 🗆 No |
| Technology | | Yes |
| | | 🗆 No |
| | | □ Yes |
| | | □ No |
| | | □ Yes |
| | | 🗆 No |
| Delivery | | □ Yes |
| | | 🗆 No |
| | | □ Yes |
| | | 🗆 No |
| | | □ Yes |
| | | 🗆 No |
| Assessment | | □ Yes |
| | | 🗆 No |
| | | □ Yes |
| | | 🗆 No |
| | | □ Yes |
| | | 🗆 No |
| Trouble- Shooting | | □ Yes |
| | | 🗆 No |
| | | □ Yes |
| | | 🗆 No |
| | | □ Yes |
| | | 🗆 No |