COMMITTEE ON TRAUMA

INSTRUCTOR COURSE MANUAL | 11th Edition

Advanced Trauma Life Support® (ATLS®)

Standardized Trauma Care
When Seconds Count



ACS ATLS Advanced Trauma Life Support
American College of Surgeons

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1

Introduction and Overview

OBJECTIVES By the end of this chapter, you will be able to:



1. Discuss the mission of the ATLS Instructor Course.
2. Describe the concepts taught in the Instructor Course and what participants will learn.
3. Recognize specific requirements for successful Instructor Course completion.



1 Introduction and Overview

CHAPTER STATEMENT

The ATLS® Instructor Course is one of the key contributors to the quality and outcomes of the ATLS Courses for clinicians.

This manual is intended for those preparing to begin their Instructor Course, as well as for existing ATLS faculty seeking to revisit or enhance understanding of education principles.

The knowledge and skills acquired in the ATLS Instructor Course will not only enable you to effectively facilitate ATLS Courses but will also enhance your ability to undertake clinical teaching in the future. The principles of the ATLS Instructor Course are grounded in the best medical education evidence and are applicable across various educational settings.

Welcome new Instructors! Thank you for your commitment to trauma education and this vital program in trauma care.

ATLS INSTRUCTOR MISSION

ATLS Instructors have a specific mission espoused by these three principles:

1. **Stand** behind the ATLS concepts
   The ATLS concepts are at the center of ATLS teaching and training. Instructors need to endorse the ATLS way of taking care of the trauma patient in the first hour, as well as the ATLS educational principles and course format. The Instructor 's commitment to the ATLS concepts affects the participants' experience and success in the course.

2. **Walk** with the learner
   The educational principles at the heart of the ATLS Courses consider the learner at the center of a process. The Instructor will adapt their actions to meet the learners where they are, and tailor teaching to help them progress to the next level. Facilitating learning is something you do with the learner, not to the learner.

3. **Support** the team-teaching process
   Teaching in ATLS Courses is done as a team, in which there is sharing of the duty to help the learners progress in their learning of the important principles of trauma care. The idea of a team extends to not just fellow Instructors but also to the administrative Course Coordinator and team that supports the faculty and learners.

INSTRUCTOR COURSE GOALS AND OBJECTIVES

The overall aim of the ATLS Instructor Course is to prepare new Instructors to facilitate the ATLS Courses. The specific objectives are to:

1. Identify the roles of the Course Director, Course Coordinator, and faculty in an ATLS Course
2. Describe how the ATLS Course incorporates adult education concepts
3. Apply key adult education concepts within the ATLS Course
4. Perform as an ATLS Instructor, incorporating contemporary adult education principles, and facilitate learning throughout all components of the course
5. Describe the importance of constructive feedback to optimize learning
6. Demonstrate appropriate feedback in simulated conversations
7. Review the principles of assessment and clarify the faculty role when assessing a learner's performance
8. Discuss the principles of simulation
9. Recognize and utilize appropriately the different forms used in the Instructor Course

ATLS COURSES

The ATLS Course is aimed at preparing providers for managing trauma patients in the first hour. Traditionally, this course had been 2.5 days duration, however the 10th edition introduced a hybrid course which includes learning prior to a 1- or 1.5-day course. The comparison of the two courses (traditional versus hybrid) is depicted in **Figure 1-1**.

The ATLS Course relies on the following concepts:

- Standardized curriculum (teach one way—the "ATLS way")
- Context ("first hour" of trauma care)
- Skills (one, safe method)
- Interactive teaching
- Feedback on performance
- Assessment of learning

The ATLS Instructor Course prepares individuals to teach ATLS Courses – traditional, Hybrid, and Refresher. It should be noted that Instructors for the hybrid course are required to successfully complete the Instructor Course and serve as an Instructor Candidate in a traditional course.

The approach of the Instructor Course is closely aligned with the pedagogy used in the ATLS Course (pre-reading, Interactive Discussions, and hands-on experience of specific skills with feedback). Under the guidance of an Educator and experienced Instructors, the Instructor Course participants will acquire an understanding of the educational principles and put them into practice during practical training sessions to be optimally prepared for their role as an ATLS Instructor/facilitator.

■ **Figure 1-1:** Comparison of ATLS Courses: Traditional and Hybrid.

	TRADITIONAL Course	HYBRID Course
Pre-work at home:		
Take the pretest	✔	✔
Read the ATLS Course Manual	✔	✔
View required videos	✔	✔
Complete required online modules	✖	✔
In-person work:		
Interactive Discussions	✔	✖
Skills Stations	✔	✔
Written Posttest	✔	✔
Initial Assessment Patient Scenarios	✔	✔

New Instructors are also encouraged to familiarize themselves with the MyATLS App. This application has been specifically developed to complement the ATLS Courses, and highlight principles and skills. The MyATLS App will be referred to throughout this manual where its application is relevant to the instruction.

INSTRUCTOR COURSE EXPECTATIONS

To qualify as an Instructor Candidate, the following is required:

1. Come prepared to the Instructor Course having read this manual and any other assigned readings
2. Attend the entire Instructor Course
3. Participate actively in all elements of the Instructor Course
4. Apply contemporary adult education principles
5. Support fellow participants
6. Exhibit professionalism including being punctual and prepared for the course

APPENDIX 1

GLOSSARY OF TERMS

The following glossary is provided to assist you in navigating new terms and concepts relevant to being an ATLS Instructor. These terms are used throughout this Manual and we encourage you to become familiar with them to assist you in your role as an ATLS Instructor.

ATLS Roles

Faculty - The term faculty refers to the clinicians that instruct the ATLS Courses. They can be surgeons, emergency physicians, anaesthetists, intensivists, pediatricians, etc. They are clinicians with passion, interest, and expertise in trauma that give their time to ensure the principles of ATLS are promulgated across the globe to help improve the outcomes of trauma patients. Faculty can refer to those teaching in an ATLS Course or an Instructor Course. Faculty includes Instructors, Course Directors, and ATLS Educators.

Instructor - An Instructor is someone who serves as part of the faculty of a course.

Facilitator - Becoming a facilitator is the goal of all ATLS Instructors. The term describes someone who actively helps the learner identify and personalize goals and uses questioning to gain information from the learners and helps them apply their knowledge.

Mentor - A mentor is someone who supports the learner in their growth through one-on-one coaching, learning support, and guidance. Some ATLS Courses assign faculty to one or more participants during the provider course as a mentor for the duration of the course.

Course Director - The Course Director is an experienced ATLS faculty member who has been endorsed to be responsible for the conduct of an ATLS provider/Instructor Course. There is a Course Director for both the provider course and the Instructor Course, and they are responsible for ensuring the course is conducted according to ATLS policies and principles (including the Instructor mission). They are a role model for other faculty and provide support to new Instructors in their early courses. A formal pathway exists for how faculty can become Course Directors.

Student/Learner - Student and learner are terms used to describe the doctors that attend an ATLS provider course. They are learners of the ATLS principles but come with their own experience and knowledge gained from their clinical practice. They are in the role of attending a course to acquire and practice knowledge, skills, and attitudes. Learner is the term used more within educational literature.

Participant - The term participant is used interchangeably with learner. Some ATLS Courses refer to the learners as participants. The term is also used generically to refer to those in attendance to learn at both the ATLS Course and Instructor Courses.

Provider - In ATLS, the term provider is used to describe someone who is providing trauma care. Some countries refer to the student course as a provider course, alluding to this role of the students as providing trauma care to a patient.

Coordinator - The Coordinator in ATLS plays a very important role. They are the person responsible for ensuring the logistics of the course run smoothly. They have the responsibilty of supplying the venue with equipment and resources necessary for the smooth running of an ATLS Course.

Educator - ATLS has a professional medical Educator responsible for conducting the Instructor Course along with the Course Director. The Educator also audits ATLS Courses to provide faculty with feedback on their teaching and plays an important role in the quality assurance of ATLS Courses.

Instructor Candidate - In ATLS an Instructor candidate refers to someone who has successfully completed the Instructor Course but has not yet delivered an ATLS Course as an Instructor. An Instructor candidate progresses to full faculty status upon Course Director approval once they have completed their first course.

Learning

Learner-Centered - In this approach to learning, the aim is to help individuals be internally motivated and develop the capability of self-directed and self-regulated learning.

The learner is involved in determining the learning objectives, planning the learning opportunities, and in exploring and reflecting throughout the learning activities.

Scenario-Based Learning - Scenario-based learning (SBL) involves providing the learners with a clinical real-life trauma scenario where they face a sequence of problem-solving choices. As learners navigate the scenario, they discover principles and develop critical competencies, with information and reference modules presented when required or requested.

To contextualize their learning, questions are asked related to the specific case to draw upon knowledge of the learners and help them understand the ATLS principles.

Scenario-based teaching is a key focus of ATLS, emphasizing both interactive discussions and Skills Station.

Monitoring Learning

Assessment - Assessment is the process of making a judgement about the level of knowledge, skills, and/or attitudes of a learner. Some countries use the term evaluation to describe the assessment of a learner and discuss formative and summative evaluation. However, the term assessment is more commonly used in regard to the learner and evaluation of the educational program. This terminology will be used in this manual.

Formative Assessment - This assessment is provided throughout the ATLS Course, is ongoing in nature, and designed to promote learning by developing learners' knowledge and performance. It is aimed at providing information to assist the learner in attaining their goals.

Feedback - Feedback is a type of formative assessment aimed at assisting the learner to actively reflect on their performance. In this type of assessment faculty provide specific and timely information to assist learners to achieve goals. It involves a two-way conversation between the learner and the faculty.

Summative Assessment - Summative assessment is an evaluation performed at the conclusion of a learning experience, with the purpose of ranking the learners' performance against a standard. In ATLS, there are three summative assessments:
- The Skills Stations
- The initial assessment test
- A multiple-choice test

Evaluation - An evaluation is undertaken at the conclusion of both the ATLS Course and Instructor Course to gauge the learners' level of satisfaction with the instruction they have received. This information is important to identify areas of improvement for future courses.

Simulation

Simulation - The term simulation is defined as: "the artificial representation of a real-world process to achieve educational goals via experiential learning."

Simulation may involve the use of actors, learners, manikins, or part-task trainers to mimic the real-life situation. In ATLS, simulation is used in the Skills Stations to practice skills and in the Initial Assessment stations to practice the xABCDE principles of ATLS.

Part-Task Trainer - A part-task trainer is a model designed to allow the practice of a specific skill or part of a task. An example of this is the airway manikin, which helps participants learn the technical skill of intubation.

Fidelity - Fidelity is the term used to refer to the realism of either a manikin or part-task trainer, or a training experience/situation, such as simulation. The higher the fidelity, the more realistic the equipment or situation is to real life in terms of physical, psychological, and environmental elements.

Moulage - Moulage refers to the art of creating lifelike substances or tissues (e.g., injuries, wounds, or fluids) to assist in improving the fidelity (realism) of a simulation.

SP(s) - Standardized simulated patient(s) or actors.





2

Adult Learning

OBJECTIVES By the end of this chapter, you will be able to:

1. Define learning.
2. Describe learning theories, identifying their highlights and the areas where they complement each other.
3. Recognize the importance of the learner´s existing knowledge, as well as the influence of factors such as motivation, reflection, social context, and emotions in the process of learning.
4. Identify different learning behaviors exhibited by participants, and to what extent Instructors can influence them, moderate their cognitive load, facilitate information processing, and promote the development of expertise through a facilitated learning experience.
5. Explain that learning theories can be blended in an adult learning model that considers the learner´s and Instructor´s roles and responsibilities at different phases of the learning cycle, providing the rationale for the ATLS Course structure and methodology.



2 Adult Learning

CHAPTER STATEMENT

Adult learning principles provide rationale behind the structure and methodology of the 11th Ed. ATLS® Courses, as well as the roles and responsibilities of both the learner and the Instructor.

WHAT IS LEARNING?

Learning is a complex phenomenon that can be synthesized as a process of acquiring attitudes, knowledge, and skills that together enable a person to know or do something new or different. Learning is one of the most powerful modifiers of human behavior and performance that exists.[1] Learning can also be defined as the social process of constructing and internalizing a new or revised interpretation of the meaning of one's experience as a guide to action. If we expand on this definition, promoting transformative learning involves helping adults to elaborate, create, or transform their meaning schemes (beliefs, feelings, interpretations, and decisions) through reflection on their content, the process by which they were learned, and their premises (background, social context, and consequences).

The learning process should be perceived as a continuum throughout life, characterized by different highlights, expectations, and strategies at different stages. It is important to remember in all postgraduate medical education that the learners have already completed a university degree and other postgraduate studies and have clinical baggage. Therefore, each of our learners will have their own individual constraints, experiences, expectations, and preferences.

ADULT LEARNING THEORIES

Adult learning theories are related to several pedagogical, social, philosophical, and psychological theories, but none of the individual theories fully explains what happens throughout the lifelong learning career of a healthcare professional. Each of these theories has its strengths and at the same time is incomplete without the others.

A short review of these theories and a model that synthesizes them can help to understand the rationale behind the structure and methodology of the 11th Ed. ATLS Course, as well as the roles and responsibilities of both learner and Instructor.

Since there is an overlap among learning theories, it can be useful to review them from a historical perspective in an attempt to answer some relevant questions related to adult learning, before blending them into an adult learning model.

KEY CONCEPTS OF ADULT LEARNING PRINCIPLES

Before the second half of the twentieth century, the human mind was considered a tabula rasa (blank slate) at birth that had to be filled. All acquired knowledge was to be obtained from experience of the senses, and repetition strengthened the learning.

Behaviorist learning theories focus on individual experience, based on the paradigm that a stimulus in the environment leads to a change in behavior, and that a reward can consequently be used to ensure an appropriate response to a stimulus.[2,3] At the same time, cognitive learning theories focus on the mental and psychological processes involved in learning, not on behavior.[4] As both behaviorist and cognitive learning theories focus on individual experience, they make teachers responsible for creating, planning, and providing learners access to experiences to facilitate learning.

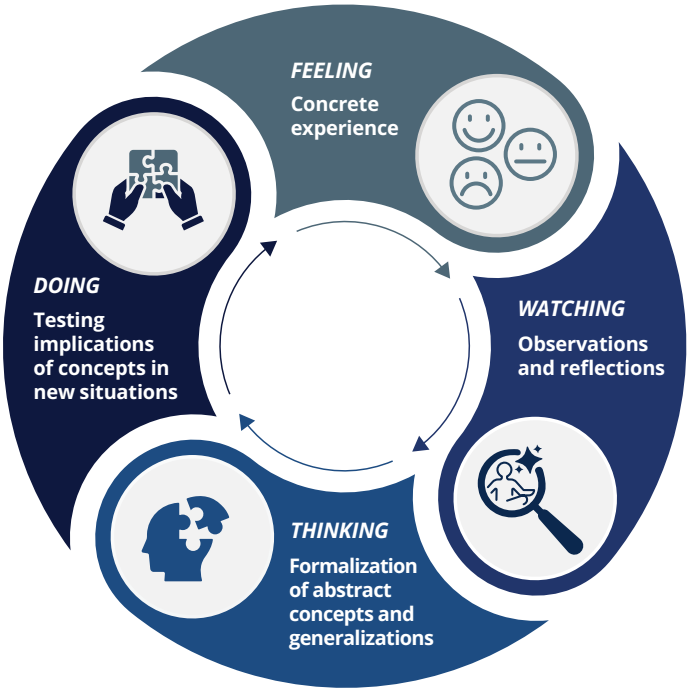
Toward the end of the twentieth century, some authors' observations suggested that adults learn differently from children, so andragogy was postulated as a more adequate term than pedagogy. Knowles identified six characteristics in which adult learners differ from child learners:[5]

- The need to know (Why do I need to know this?)
- The learners' self-concept (I am responsible for my own decisions)
- The role of the learners' experiences (I have prior experiences which I value, and the others should recognize)
- Readiness to learn (I need to learn because my circumstances are changing)
- Orientation to learning (Learning will prepare me to manage new situations)
- Motivation (I learn because I have reasons to)

THE IMPORTANCE OF REFLECTION

Reflection on individual experiences leads to action and change.[6-8] Reflection and feedback are used as powerful tools to develop both knowledge and skills. In Lewin/Kolb's Experiential Learning Model (■ **Figure 2-1**) of experimental learning, the learner has a concrete experience, upon which they reflect. Through their reflection they are able to formulate abstract concepts and make generalizations. They subsequently consolidate their understanding by testing the implications of their new knowledge in new situations. This then provides them with a new concrete experience upon which the cycle continues.[9]

■ **Figure 2-1:** Lewin/Kolb's Experiential Learning Model.



Kolb D. Experiential Learning. Englewood Cliffs, NJ: Prentice-Hall; 1984.

THE INFLUENCE OF SOCIAL CONTEXT ON LEARNING

While constructivist theories consider learning to be the process of constructing new knowledge on the foundations of previous knowledge, social constructivist theories focus on the way that the learning community supports learning.[10-12] The two crucial elements in social theories of learning are context and community.[13,14] Learners can only acquire new knowledge if they can link it in with existing knowledge. Learning and thinking are social activities, and thinking is influenced by the setting in which learning takes place. Therefore, a learner's experience is influenced by the context and the community. Discussion between individuals will increase the amount of knowledge exchanged, and hence the more diverse a learning group is, the more likely the individuals within the group are to learn.

LINKS BETWEEN PRIOR KNOWLEDGE AND LEARNING

Following constructivist theory, transformative learning theory was developed to explore the way in which critical reflection can be used to challenge the learner's beliefs and assumptions and the way in which new knowledge becomes integrated into existing knowledge.[1,15-18] In this approach, the dissonance between the prior experience/knowledge of the individual, and a concrete experience used as a catalyst/trigger, provides the learning opportunity. Meaningful learning occurs when connections are made between new and existing information and new knowledge is acquired and applied.

ROLE OF TAXONOMIES IN LEARNING AND ASSESSMENT

Taxonomy is a set of hierarchical models that is used to classify educational learning objectives into levels of complexity and specificity.

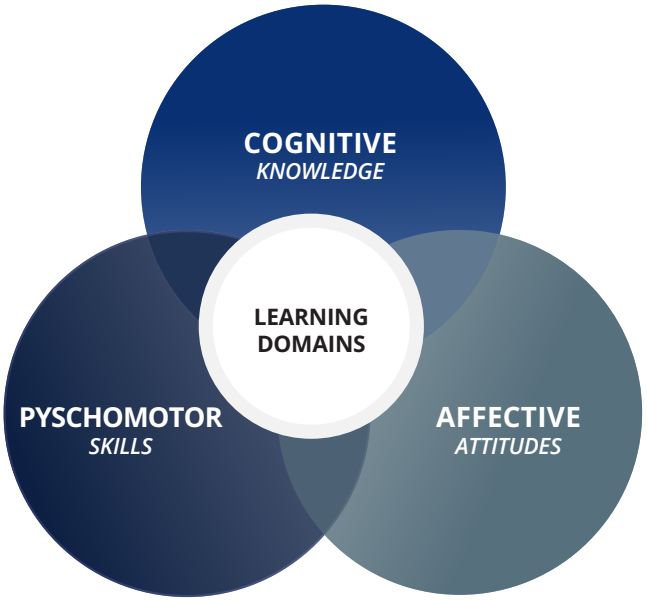
Learning includes acquiring and developing knowledge, skills, and attitudes, and can be categorized into three broad domains. Bloom's Taxonomy defined the cognitive domain (knowledge), the psychomotor domain (skills), and the affective domain (attitudes) (■ **Figure 2-2**)[19]:

- The cognitive domain involves the development of mental skills and the acquisition of knowledge. There are six categories comprising the cognitive domain: knowledge, comprehension, application, analysis, synthesis, and evaluation.
- The psychomotor domain comprises the utilization and coordination of motor skills, and there are seven categories that constitute this domain: perception, set, guided response, mechanism, complex overt response, adaptation, and origination.
- The affective domain involves our feelings, emotions, and attitudes. There are three categories within this domain: receiving phenomena, responding to phenomena, organizing and internalizing values.

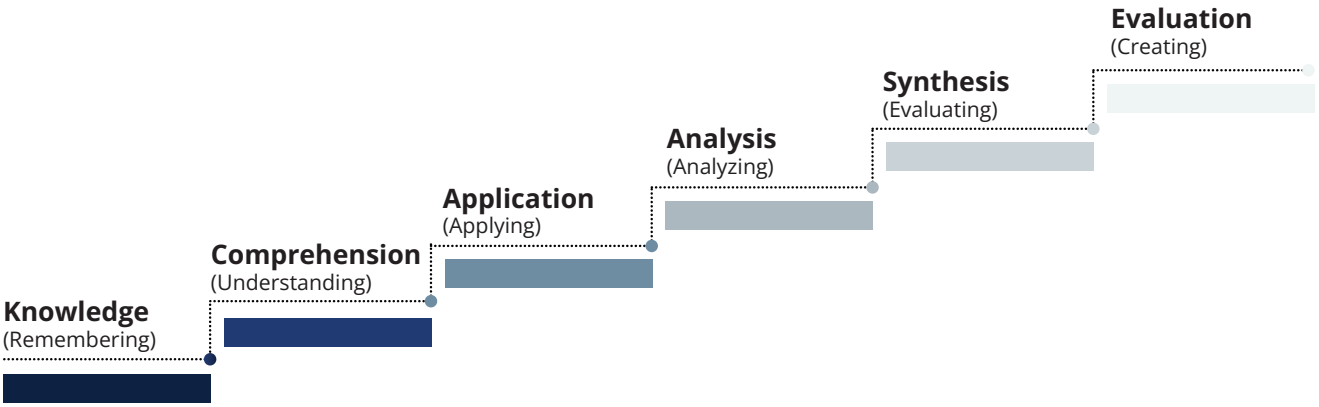
The affective domain is often not specifically addressed during learning, although learning is deeply influenced by emotions. This will be further discussed in a following section: Harnessing the Power of Emotions to Enhance Learning.

Learning goals and outcomes can be categorized using a modified Bloom's Taxonomy.[20]

■ **Figure 2-2:** Learning Domains.



■ **Figure 2-3:** Modified Bloom's Taxonomy and Anderson's Development.



Anderson LW, Krathwohl DR, Airasian PW, Cruikshank KA, Mayer RE, Pintrich PR, Raths J, & Wittrock MC. A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives. New York: Longman; 2001

Bloom's original taxonomy (■ **Figure 2-3**) led to several modifications. Miller's Pyramid[21] (■ **Figure 2-4**) is a framework which is frequently used as a guide for planning and assessing within a medical curricula. This scaffold is useful as a reminder that the outcome of training should be a healthcare professional who shows adequate competence in the workplace (action), for knowledge alone is just the foundation of the pyramid.

■ **Figure 2-4:** Miller's Pyramid.



THE IMPORTANCE OF MOTIVATION IN ADULT LEARNING

Humanistic theories focus on individual development and are more learner centered. In this approach to learning, the aim is to help individuals be internally motivated and develop the capability of self-directed and self-regulated learning. Knowles identifies motivation to learn as the key difference between adults and children and in defining andragogy,[5] has, in association with Kolb´s Experiential Learning Model,[9] laid the foundations for most of the learning and teaching strategies developed for adult learners in recent decades.

Motivational models are based on two critical elements of adult learning: motivation and reflection. As a low expectation of success will result in poor motivation to learn, we have to be able to balance the competing drives of goals and expectations of learning against the time and effort needed to learn. The motivation to learn, as defined by Weiner's Expectancy Valence Theory, incorporates perceived value of success and expectancy of success as modifiers.[22] (■ **Figure 2-5**)

DIFFERENCES IN LEARNING PREFERENCES AND BEHAVIORS

Some authors have noted that learners can show different learning preferences and behaviors.[23,24] While some learners aim to achieve a deep understanding of what they are learning, others prefer to acquire just the facts—a style known as surface learning. Learning behavior can be influenced by the assessment system. Thus, if an assessment system tests for recall of facts, then the successful learner will employ surface learning. If the system rewards deep understanding and reasoning, then the successful learner will aim for that learning behavior. The term *strategic learning* has been used to describe such conduct.

■ **Figure 2-5:** Weiner's Expectancy Value Theory.



Eccles J. Expectancies, values, and academic behaviors. In Spence JT. (Ed.) *Achievement and Achievement Motives: Psychological and Sociological Approaches.* W.H. Freeman; 1983. pp. 75-146.

It has also been noted that learners change in their approach to learning as they progress through their training,[25] recognizing the importance of context and that they, their peers, and the environment are all valuable sources of knowledge and experience, evolving from receiving and understanding knowledge to being co-developers of new knowledge.

The original idea behind the use of learning styles theory is that learners can be categorized into one or more styles according to certain individual learning characteristics (e.g., visual, auditory, kinesthetic, assimilator, or converger). Although it would seem that teaching learners according to their style will result in enhanced learning, there is no scientific evidence to support the use of catering to a learner's specific characteristic.[26,27]

EFFICIENT INFORMATION PROCESSING

Cognitive Load Theory (CLT) suggests the human brain can only process a certain amount of information at one time.[28] According to this theory, cognitive load can be categorized in two types:

1. Intrinsic load: reflects the complexity of the information itself
2. Extrinsic load: indicates the work required to process the information, and is further subdivided into two other categories:

    - *Extraneous load:* refers to the effort required to process new information due to the way in which it is presented
    - *Germane load:* refers to the cognitive work of organizing new information into schemas

Of the two types of cognitive load, **extrinsic load** is most easily controlled by the Instructor. Thus, some basic evidence-based strategies have been proposed to reduce extrinsic load when presenting new material to learners.[29-31]

Extraneous load should be reduced whenever possible to free up space for processing complex information. This can be achieved by:

- Reducing irrelevant information
- Highlighting essential material
- Using visual aids
- Minimizing distracting visual and auditory stimuli (i.e. external noise, chatting during discussions and Skills Stations)
- Avoiding unnecessary disruptions of learning activities

Likewise, **germane load** can be reduced if we use teaching sequences with a progressive structure to assist learners with the creation of schemas of increasing complexity. This can be accomplished by:

- Chunking complex elements into more manageable parts
- Using case scenarios in which we can start with partially worked examples so learners only have to supply a few missing parts, and then progress practicing whole tasks in increasingly realistic settings
- Using multiple varied case scenarios to compare and contrast them, helping learners develop complex schemas which get at the deeper structure of problems, and thereby preparing them to solve clinical problems they have not yet encountered

PROMOTING THE DEVELOPMENT OF EXPERTISE

The term *deliberate practice* has been coined recently to describe how experts in a variety of fields reach their level of expertise through effortful practice, rather than innate talent.[32]

Deliberate practice has three key components:

- The setting of clear learning goals
- Individualized training activities designed and supervised by an Instructor to achieve those goals
- Repeated practice activities which are refined by feedback

The use of learning goals-oriented case scenarios to engage learners within repeated practice activities, including the rehearsal of simulated procedures, is an efficient strategy to promote the development of expertise.

HARNESSING THE POWER OF EMOTIONS TO ENHANCE LEARNING

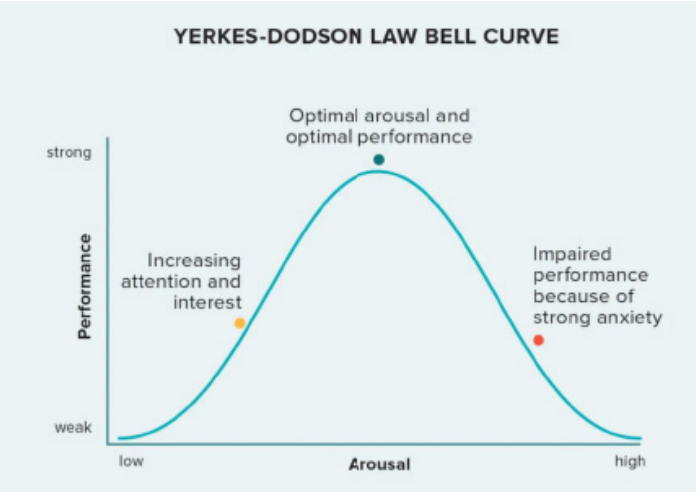
Human emotion is ever present, and the role of emotion on learning in the health professions has been recently reviewed.[33,34] Emotions have been defined as both the physiologic response to our situation (e.g., the stress or arousal response) and the subjective experience of that response as a mood (e.g., excited, happy, sad). According to the *circumplex model*, emotions have both a valence (positive or negative) and a degree of arousal (strong or weak) that together give us important information about the environment.[35]

Emotions affect the likelihood of our attending to new information as well as how memory is stored and later retrieved. The emotional context of learning can enhance the probability that new knowledge is retained by learners. Positive emotional states have been associated with better cognitive performance and thus may be beneficial when we are aiming for deep reasoning. Learners in positive moods may be better positioned to see the global principles underlying a problem, and therefore may more easily transfer learned information to a case scenario. On the other hand, learners in negative moods concentrate mostly on details, sometimes irrelevant, restricting their focus, and they can also display avoidance behaviors.[32]

While there is a long history in the hierarchical medical profession of purposefully using fear and intimidation to motivate learning, with the belief that this strategy can enhance memory, it has been noted that it can also limit problem-solving capabilities.[36] In contrast, there is evidence that feeling safe in a learning environment leads to more creative problem-solving and deeper learning, particularly when we are training teams.[37]

This concept is illustrated by the Yerkes-Dodson Law Curve (■ **Figure 2-6**), which shows that there is an empirical relationship between stress and performance and that there is an optimal level of stress corresponding to an optimal level of performance.[38]

■ **Figure 2-6:** Yerkes-Dodson Law Curve.



Generally, practitioners present this relationship as an inverted U-shaped curve. Research shows that moderate arousal is generally best; when arousal is very high or very low, performance tends to suffer.

Instructors should help to create these positive emotional states by promoting an emphasis on learning and improvement, recognizing the range of emotions experienced by learners through the learning process, and enhancing positive and supportive relationships within the group.

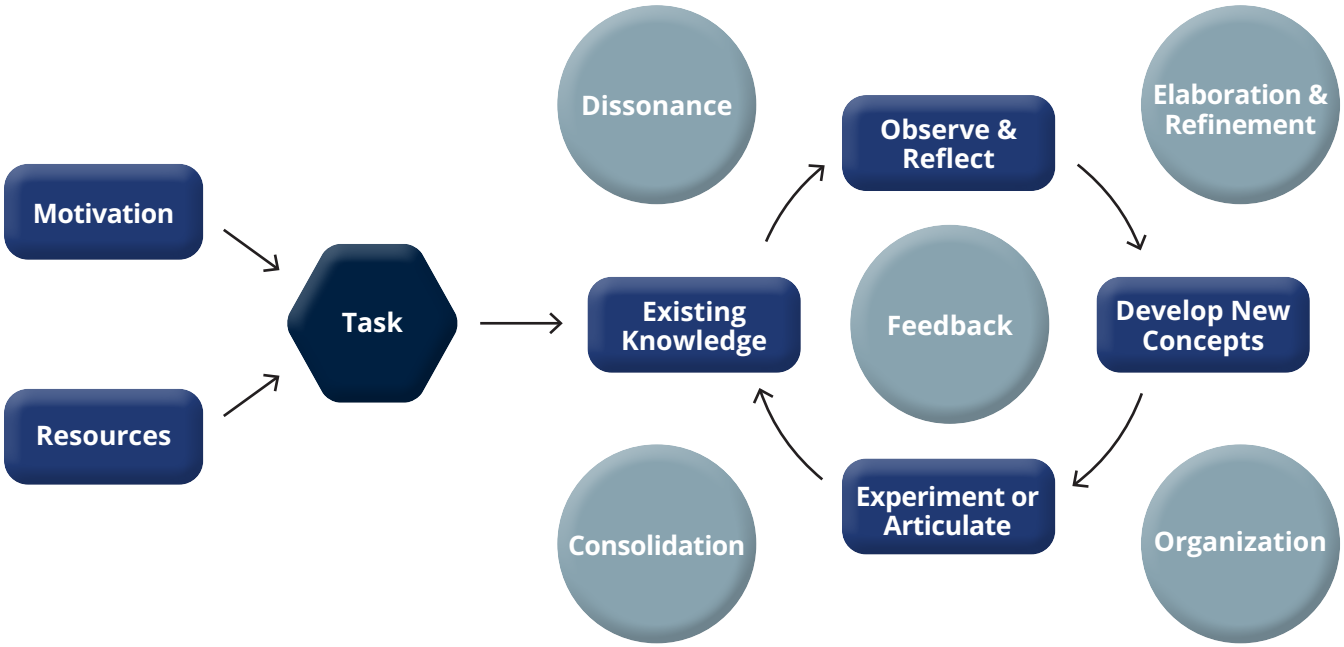
HOW ADULTS LEARN: TAYLOR & HAMDY´S BLENDED MODEL OF ADULT LEARNING

A recent learning model considering different aspects of adult learning theories and their implications for the learner's and teacher's roles has been developed to structure, plan, and deliver efficient learning experiences.[39] This model has been shown to be entirely applicable for understanding the educational approach in ATLS Courses.

All learning starts with the learner's existing knowledge, which will be linked to new knowledge through five stages in the learning experience (■ **Figure 2-7**) (see Appendix 1):

- Dissonance phase
- Elaboration & refinement phase
- Organization phase
- Feedback phase
- Consolidation phase

■ **Figure 2-7:** Adapted Taylor & H. Hamdy´s Blended Model of Adult Learning.



■ **Table 2-1:** Learner´s and Instructor´s Roles and Responsibilities in Taylor & Hamdy´s Model of Adult Learning.

Phase	LEARNER'S role & responsibilities in Taylor & Hamdy's model of adult learning	INSTRUCTOR'S role & responsibilities in Taylor & Hamdy´s model of adult learning
Dissonance	**Identify prior knowledge, skills, and attitudes** • Recognize what is unknown • Recognize personal learning needs • Participate in defining personal learning objectives	**Provide the context in which the learner can learn** • Increase extrinsic motivation through appropriate tasks • Help learners to recognize or reinforce internal motivation • Explore the learner's prior knowledge and experiences • Help learners identify their learning needs and their relevance • Provide relevant learning experiences at the appropriate level for the learner
Elaboration & Refinement	**Think of possible explanations or solutions to the case or problem** • Work out which are the most likely resources to refine the possibilities • Actively participate in the learning activities and experiences • Refine the information into a hypothesis	**Provide examples of connections between new and previous knowledge** • Facilitate connections of new and previous knowledge, which may be specific to each learner
Organization	**Test and re-test the hypothesis** • Organize the information into a meaningful scheme for the learner	**Provide advanced organizers for the learners (structures upon which they can continue to build)** • Facilitate reflection in action through discussion
Feedback	**Articulate the knowledge, skills, or attitudes developed** • Provide feedback to peers and instructors • Accept, and if appropriate, act upon feedback received from others	**Facilitate reflection on the learning experience (in action and on action)** • Provide feedback to the learner • Accept, and if appropriate, act upon feedback received from the learner
Consolidation	**Reflect in the light of prior knowledge** • Reflect on the learning process • Evaluate personal responsibility for the learning • Develop of knowledge, skills, and attitudes	**Facilitate reflection on action** • Provide opportunities for the learner to apply their new knowledge

Permission from Taylor/Francis

CHAPTER SUMMARY

- Learning is a lifelong complex phenomenon that cannot be fully explained by learning theories, each of which has its strengths but at the same time is incomplete without the others.
- All learning begins with the learner´s existing knowledge, upon which new meaningful schemes will be developed through a process influenced by factors such as motivation, reflection, social context, and emotions.
- Learners can exhibit different learning behaviors. These can be influenced by Instructors, who can help moderate their cognitive load, facilitate information processing, and promote the development of expertise through deliberate practice, engaging learners in goals-oriented case scenarios and discussions.
- Learning theories can be blended in an adult learning model that considers learner´s and Instructor´s roles and responsibilities at different phases of the learning cycle, informing the rationale for the ATLS Courses philosophy, structure, and methodology.

REFERENCES

1. Mezirow JE. *Fostering Critical Reflection in Adulthood: A Guide to Transformative and Emancipatory Learning.* San Francisco, CA: Jossey-Bass; 1990.
2. Skinner B. The science of learning and the art of teaching. *Harvard Educ Rev*. 1954;24:86–97.
3. Chomsky N. *Reflections on Language*. New York, NY: Pantheon Books; 1975.
4. Piaget J. *The Origins of Intelligence in Children*. New York, NY: International University Press; 1952.
5. Knowles M, Holton EI, Swanson R. *The Adult Learner: The Definitive Classic in Adult Education and Human Resource Development*. Burlington, MA: Elsevier; 2005.
6. Schön D. *The Reflective Practitioner: How Professionals Think in Action*. London, UK: Temple Smith; 1983.
7. Schön D. *Educating the Reflective Practitioner*. San Francisco, CA: Jossey-Bass; 1987.
8. Duvivier RJ, Van Dalen J, Muijtjens AM, Moulaert VRMP, Van Der Vleuten CPM, Scherpbier AJJA. The role of deliberate practice in the acquisition of clinical skills. *BMC Med Educ*. 2011; 11:101.
9. Kolb D. *Experimental Learning*. Englewood Cliffs, NJ: Prentice-Hall; 1984.
10. Bandura A. *Social Learning Theory*. New York, NY: General Learning Press; 1977.
11. Vygotsky L. *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press; 1978.
12. Wenger E.. *Communities of Practice: Learning, Meaning, and Identity*. New York, NY: Cambridge University Press; 1998.
13. Choi J, Hannafin M. Situated cognition and learning environments: Roles, structures, and implications for design. *Educ Technol Res Dev.* 1995;43:53–69.
14. Durning SJ, Artino AR. Situativity theory: A perspective on how participants and the environment can interact: AMEE Guide No. 52. *Med Teach.* 2011;33:188–199.
15. Mezirow JE. Perspective transformation. *Adult Education (USA).* 1978;28:100–110.
16. Mezirow JE. Transformative learning: Theory to practice. In: Welton MR, editor. *In Defense of the Lifeworld*. New York: SUNY Press; 1995. pp 36–70.
17. Norman GR, Schmidt HG. The psychological basis of problem-based learning: A review of the evidence. *Acad Med*. 1992;67:557–565.
18. Regan-Smith M, Obenshain S, Woodwarth C, Richards B, Zeits H, Small PJ. Rote learning in medical school. *J Am Med Assoc*. 1994;272:1380–1381.
19. Bloom BS, Engelhart MD, Furst EJ, Hill WH, Kratwohl DR. *Taxonomy of Educational Objectives: The Classification of Educational Goals. Handbook I, Cognitive Domain*. New York, NY: *Longmans*, *Green* & Co.; 1956.
20. Anderson LW, Kratwohl DR. *A Taxonomy for Learning, Teaching and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. New York, NY: *Longmans*, *Green* & Co., 2001.
21. Miller GE. The assessment of clinical skills/competence/performance. *Acad Med*. 1990; 63:S63–S67.
22. Weiner B. *Human Motivation: Metaphors, Theories, and Research*. Newbury Park, CA: SAGE; 1992.
23. Newble DI, Clarke RM. The approaches to learning of students in a traditional and in an innovative problem-based medical school. *Med Educ*. 1986;20:267–273.
24. Newble DI, Entwistle NJ. Learning styles and approaches: Implications for medical education. *Med Educ*. 1986;20:162–175.
25. Perry Jr WG. *Forms of Ethical and Intellectual Development in the College Years*. San Francisco, CA: Jossey-Bass; 1999.
26. Martimianakis MAT, Tilburt J, Michalec B, Hafferty FW. Myths and social structure: The unbearable necessity of mythology in medical education. *Med Educ*. 2019. doi: 10.1111/medu.13828 [Epub ahead of print].
27. Newton PM, Miah M. Evidence-based higher education - Is the learning styles 'myth' important? *Front Psychol.* 2017;8:444.
28. Sweller J, Van Merrienboer JJ, Paas FGWC. Cognitive architecture and instructional design. *Educ Psychol Rev*. 1998;10:251–296.
29. Mayer RE. Applying the science of learning: Evidence-based principles for the design of multimedia instruction. *Am Psychol*. 2008;63:760–769.
30. Van Merrienboer JJ, Sweller J. Cognitive load theory in health professional education: Design principles and strategies. *Med Educ*. 2010;44:85–93.
31. Leppink J, Duvivier R. Twelve tips for medical curriculum design from a cognitive load theory perspective. *Med Teach*. 2016;38:669–674.
32. Ericsson KA. Acquisition and maintenance of medical expertise: A perspective from the expert-performance approach with deliberate practice. *Acad Med.* 2015;90:1471–1486.
33. LeBlanc VR, McConnell MM, Monteiro SD. Predictable chaos: A review of the effects of emotions on attention, memory and decision making. *Adv Health Sci Educ Theory Pract*. 2015;20:265–282.

34. Gooding HC, Mann K, Armstrong E. Twelve tips for applying the science of learning to health professions education. *Med Teach*. 2017 Jan;39(1):26-31. doi: 10.1080/0142159X.2016.1231913.
35. Posner J, Russell JA, Peterson BS. The circumplex model of affect: An integrative approach to affective neuroscience, cognitive development, and psychopathology. *Dev Psychopathol*. 2005;17:715–734.
36. Musselman LJ, MacRae HM, Reznick RK, Lingard LA. 'You learn better under the gun': Intimidation and harassment in surgical education. *Med Educ*. 2005;39:926–934.
37. Ashauer SA, Macan T. How can leaders foster team learning? Effects of leader-assigned mastery and performance goals and psychological safety. *J Psychol*. 2013;147:541–561.
38. Yerkes RM, Dodson JD. The relation of strength of stimulus to rapidity of habit-formation. *J Comp Neurol Psychol*. 1908;18:459–482.
39. David C, Taylor M, Hamdy H. Adult learning theories: Implications for learning and teaching in medical education: AMEE Guide No. 83. *Med Teach*. 2013;35:11,e1561-e1572.

APPENDIX 2

TAYLOR & HAMDY´S BLENDED MODEL OF ADULT LEARNING. FIVE STAGES OF THE LEARNING EXPERIENCE.

DISSONANCE PHASE

At this initial stage of the learning activity, the learner's existing knowledge is challenged and found to be incomplete. Before that, the learner should be encouraged to articulate what they already know, as this will help them to link the new knowledge to what they already understand, thereby placing them on the first stage of the learning cycle and determining their personal learning outcomes. The engagement of the learner with the dissonance phase will be influenced by factors such as the nature of the task/activity, the available resources, and the learner's motivation, stage of training, and learning behavior.

As Instructors/facilitators, we must clearly define learning outcomes at each level of Bloom's Taxonomy or its variations (i.e., Anderson's or Miller's). These will form the basis to determine the best way of helping/guiding the learner and assessing their performance.

Adult learners, and ATLS participants in particular, are expected to be self-motivated, but it is the Instructor's responsibility to ensure the learning activity will engage the learner and enthuse them. A learner's motivation can be strongly influenced by the educational environment and their frame of mind toward the tasks, so a learner's energy and enthusiasm can be squandered with poorly thought-out activities or tasks that are either trivial or too difficult.

Physical resources such as space, audiovisual aids, training equipment, or simulated patients should be considered. However, the most precious resource for learning is time. Sufficient time must be allocated for preparation and planning of the activity, as well as for assessment of the learning outcomes. Learners should also have enough time to engage with the learning activity and complete all the tasks. It should be reasonable for the learning outcomes to be achieved within the allocated time, and adequate assessment opportunities should be provided.

Many learners are strategic in choosing learning behaviors. If learners know that they will be tested on their acquisition of facts, rather than on their understanding, they will naturally choose a surface learning approach. If the Instructor is aiming for a deeper level of understanding, then it will be necessary to make sure that the assessment methodology is properly designed.

When we are training doctors to manage trauma patients, it is not enough for them to know the right answers in a theoretical situation; we expect them to understand why they are the right answers, and how they can be determined by variable circumstances. Learners can reach deep understanding through case-based discussions facilitated by the Instructor, thus helping the learner shift from duality to multiplicity.

ELABORATION & REFINEMENT PHASE

In this stage, the learner considers a number of possible explanations for the new knowledge or solutions to a problem (elaboration), and through completing tasks, discussion, and reflection they refine the new information into a series of new concepts. Connections are made between the new and previous knowledge, so everything is learned in the context of what is already known.

The elaboration and refinement phase is internal to the learner, but it can be guided and facilitated by the Instructor with the appropriate learning activities and resources.

ORGANIZATION PHASE

In this stage the learner tests the new hypothesis against what they already know, trying to fit the new knowledge, developing, or restructuring their ideas, and organizing new information in meaningful schemes. This is a complex process that involves the learner reflecting in action.

The Instructor should guide the process, providing them with scaffolding (framework of the program, table of contents, learning objectives) and facilitating critical reflection through discussions.

FEEDBACK PHASE

The feedback phase has proven to be the most crucial. In this stage, the learner articulates their newly acquired knowledge and tests it against their peers' and Instructors' opinions. They will use the feedback they receive to reinforce their schema or to reconsider it from a different point of view.

Feedback implies that the learner is able to articulate what has been learned, explaining or using the new knowledge. Following this, the strengths and weaknesses of their action will be pointed out by their peers and/or the Instructor.

Feedback is more effective when the learner is challenged constructively without being given the correct answer, but instead being guided through critical reflection.

Any effective assessment system should provide learners with clear indications of what they are doing well and what could be done better and must include a guide for improvement. For this reason, feedback is best given in frequent small doses. Offering frequent low-stakes assessment instead of infrequent high-stakes assessment promotes the development of meaningful, achievable learning goals.

Feedback should also include reflection on the learning cycle, balancing positive points and elements that need improvement.

CONSOLIDATION PHASE

During this last stage, the learner reflects upon the learning cycle and what they have learned while taking into consideration what was known before, not only in terms of increasing their knowledge base, but also in terms of the learning process (reflection on action).

In this phase, the learner considers the extent to which they took personal responsibility for their learning and their possibilities for future development.

The Instructor should guide reflection on action toward a deeper understanding of the learning process, aiming to reinforce the learner´s capability of self-directed and self-regulated learning.



3

The ATLS Structure—Environment, Set, Dialogue, and Closure

OBJECTIVES By the end of this chapter, you will be able to:

1. Identify the role of environment, set, dialogue, and closure in the ATLS Courses.
2. Describe the role of each element in facilitating learning.



3 The ATLS Structure—Environment, Set, Dialogue, and Closure

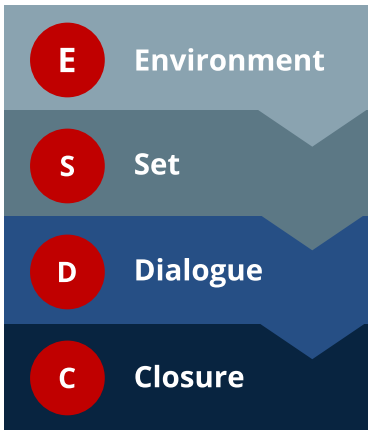
CHAPTER STATEMENT

The structure of the ATLS® Course is modeled to maximize learning opportunities and the transfer of learning from the course to clinical practice.

INTRODUCTION

The ATLS Course uses a structure underpinned by adult learning theory in order to facilitate learning.[1-5] Each ATLS educational encounter includes four essential organizational elements: environment, set, dialogue, and closure (ESDC). This structure is relevant to all components of ATLS: the Interactive Discussions, the Skills Stations, or the Initial Assessment simulation scenarios. The general aspects of each element are described below.

■ **Figure 3-1:** ATLS Structure.



ENVIRONMENT

It is the Instructor's responsibility to create a positive teaching and learning environment which includes the physical, facilitator, and learning environment.

PHYSICAL ENVIRONMENT

Several factors need to be considered in the physical environment:

- Temperature: The facilitator should have the ability to adjust the room temperature to ensure optimal comfort, such as ensuring good ventilation if the room lacks air conditioning.
- Background noises: Disturbances should be minimized to maintain attention, such as conversations occurring outside the room that can be heard inside.
- Visual comfort: The facilitator should optimize visual comfort by avoiding direct sunlight on the screen, minimizing glare with window coverings, preventing darkness, and keeping doors closed if they open onto busy hallways.
- Seating: The layout should encourage interaction. A U-shaped arrangement allows participants to see both each other and the facilitator, promoting engagement.
- Resources: The facilitator should identify and prepare the necessary resources for the session, ensuring they are available and functioning properly beforehand. For example, is a whiteboard needed and are there working pens? Are the presentations or x-rays loaded and ready to be projected? Is the equipment for the Skills Station available and in good condition?

FACILITATOR ENVIRONMENT

The facilitator must master the teaching environment by thoroughly reviewing:

- Content - Familiarize with the student course manual, additional literature, and clinical scenarios.
- Teaching Format - Ensure audiovisual equipment, Skills Station equipment, evaluation and assessment forms, and schedules are in place and functional.
- Learning Objectives - Understand the learning objectives and plan time management accordingly.
- Participants' Backgrounds and Goals - Learn about participants' backgrounds and goals to foster positive relationships and target questions effectively.

LEARNING ENVIRONMENT

To create a positive learning environment, the facilitator should maintain a positive emotional context throughout the session.

- Discussing expectations, inviting questions, and engaging in collaboration creates a positive learning environment.
- All participants must feel safe to answer questions, engage in discussions, and practice skills.
- Effective use of ATLS slide presentations is crucial for facilitating Interactive Discussions:
  - The slides provide case scenarios and discussion questions to facilitate the discussion of ATLS principles and keep the group on the track of the learning objectives.
  - The facilitator should not read directly from the slides. Proper preparation before the session provides familiarity with the scenario progression and the discussion questions. Supplemental questions may be required.
  - Adjuncts such as a whiteboard or flipchart can also be used to further facilitate the discussion where appropriate.

SET

The session introduction consists of four main components:

1. The facilitator captures the learners' attention by introducing the session content, connecting it to their prior experiences, and highlighting its relevance to them.
2. The facilitator establishes roles and responsibilities with the learners by discussing the session's conduct, outlining the functions of both learners and the facilitator, and specifying when questions may be asked. This approach provides clarity and helps create an effective learning environment.
3. The facilitator clearly conveys the specific learning objectives of the session to the learners, helping them focus and setting realistic expectations.
4. If not done earlier, the facilitator should identify the learners' prior experience and be prepared to adjust the pace and complexity of the discussion accordingly. This enables the facilitator to incorporate learners' experiences appropriately throughout the session and direct questions to individuals with specific experience or interest. Establishing a connection to prior learning, whether from previous ATLS sessions or other learning experiences, enhances the learning process.

DIALOGUE

Once the context has been established and the learners' attention captured, the facilitator moves to the central part of the lesson: the dialogue component. Here, the facilitator leverages adult learning principles to create opportunities that encourage reflection, motivation, and engagement while providing feedback. Learners are expected to actively participate, with the facilitator guiding the session using various interactive strategies, including pre-prepared supplemental key questions. The facilitator ensures the content is sequenced logically and flows directly from the objectives presented during the introduction.

Time management is an essential skill for the facilitator to master. It is helpful if the Course Coordinator or another Instructor assists with time management by providing signals to update the facilitator throughout the session.

The Interactive Discussions, detailed further in Chapter 4, are structured around trauma patient scenarios and stimulus questions for participants to answer. Facilitators should avoid answering these questions themselves or turning the session into a didactic lecture. If participants struggle to answer a stimulus question, the facilitator should break it down to elicit responses. For example, if the question is, "How do you assess whether this patient has a patent airway?" and the expected responses are not forthcoming, the facilitator might ask, "What bedside monitoring could be used?" The ATLS slides include additional example stimulus questions in the slide notes sections.

In the Skills Stations, the dialogue revolves around case scenarios where participants identify the necessary treatments for the patient's condition, and relevant skills are taught within this context (see Chapter 5). In the Initial Assessment scenarios, the dialogue involves participants practicing the xABCDE sequence of ATLS on a moulaged patient while receiving feedback from the Instructor.

CLOSURE

Closure serves to consolidate the key points of the session, so sufficient time should be allocated for it. Neglecting this component risks the learner missing the essential take-home messages. The following steps help ensure an effective closure:

1. **Question:** Ask the participants if they have any concerns or need clarification. Invite questions on the content discussed, but do not introduce new topics at this point. It is crucial to address questions and concerns before summarizing to ensure the final message is not overshadowed by an answer to a tangential question.
2. **Summarize:** Once all learner concerns have been addressed (or time is up), the facilitator should summarize the key points, reemphasize critical content, and link it to the objectives and other parts of the course. Summarizing after questions allows the facilitator to control the key take-away messages for the participants.
3. **Future Learning Opportunities:** The facilitator can suggest further learning opportunities and resources (e.g., MyATLS) to consolidate the session's content, either within the ATLS Course or through self-directed learning opportunities when participants return to their workplaces.
4. **Terminate:** Clearly terminate the session to facilitate the transition to the next part of the course. This can be done by thanking the audience or inviting participants to take a break.

CHAPTER SUMMARY

- The structure of environment, set, dialogue, and closure (ESDC) forms the ideal organizational structure for successful interactive delivery of ATLS Course content.
- Conscious preparation and application of the ESDC structure will result in an effective and enjoyable encounter for both learners and Instructors.
- Allowing participants to be involved in and assume ownership of their learning as much as possible, is a best practice.
- Ownership and continued application in practice fosters mastery of ATLS knowledge and skills.

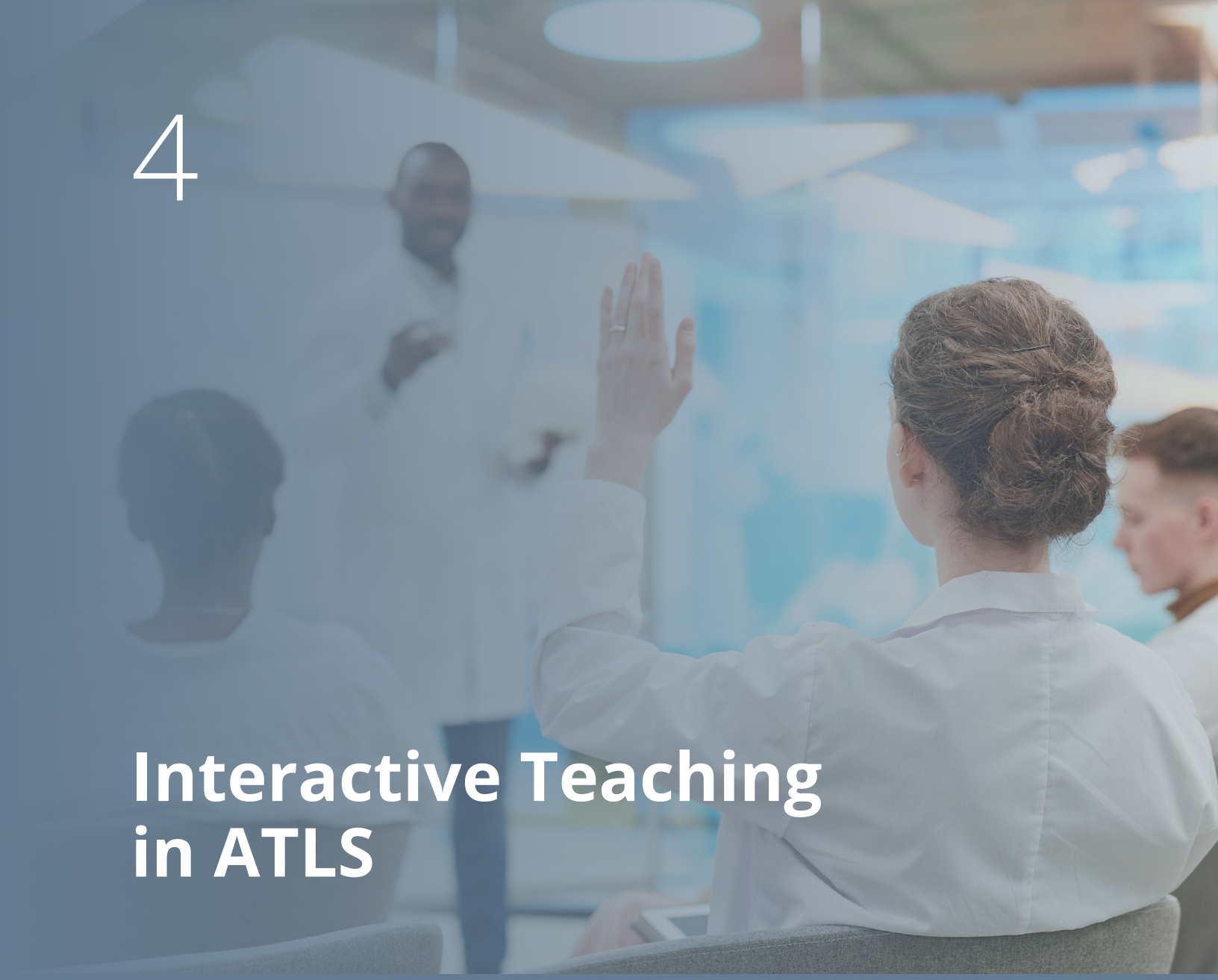
REFERENCES

1. Harris D. Lectures. In: Peyton JWR, editor. *Teaching and Learning in Medical Practice*. Rickmansworth, UK: Manticore Europe Limited; 1998. 193-207.
2. Lake FR, Ryan G. Teaching on the run tips 3: Planning a teaching episode. *Med J Aust*. 2004; 180:643-644.
3. Lake FR, Ryan G. Teaching on the run tips 2: Educational guides for teaching in a clinical setting. *Med J Aust*. 2004;180:527-528.
4. Gordon J, Hazlett C, Ten Cate O, et al. Strategic planning in medical education: Enhancing the learning environment for students in clinical settings. *Med Educ*. 2000;34:841-850.
5. Bullock I, Davis M, Lockey A, Mackway-Jones K. *Pocket Guide to Teaching for Clinical Instructors*. Hobeken, NJ: John Wiley & Sons, Inc., 2015.



4

Interactive Teaching in ATLS



OBJECTIVES By the end of this chapter, you will be able to:

1. Define interactive learning and teaching.
2. Discuss the factors involved in managing interactive sessions.
3. Explain scenario-based learning.
4. Assert the interactive approach in ATLS.
5. Describe the facilitator's role in managing group dynamics.



4 Interactive Teaching in ATLS

CHAPTER STATEMENT

Active engagement of learners energizes the classroom, promoting partnership between facilitators and learners in the teaching and learning process. This aligns with adult learning principles that emphasize problem-centered, experience-oriented, goal-driven, and dynamic environments.

INTRODUCTION

The ATLS teaching methodologies, based on learning theories discussed in Chapter 2, aim to promote learning through contemporary pedagogical approaches. This chapter will explore two key methods:

1. Interactive Discussions
2. Scenario-Based Learning

Experiential learning and interactivity enhance the learner's ability to apply knowledge and skills, forming the ATLS Course's fundamental approaches. This involves the active participation of all learners to enhance their learning.[1,3-5]

Active learning methods encourage learners to engage in activities that apply information, sharpening critical thinking,[4] which is fundamental to developing analytic reasoning.[4-6,9,15] The ATLS Interactive Discussions provide ideal opportunities for active learning, and well-crafted scenario-based discussions make learning more personally relevant and interesting. The interaction between learners and the facilitator leads to a greater understanding and transfer of learning to clinical practices and guides the discovery of new learning through reflection. Meaningful and relevant learning requires well-prepared facilitators who teach with a focus on the learner. Interactive learning, demonstrated to be superior to didactic teaching, improves academic success and promotes inclusion. Learners become more engaged, retain information, and are more satisfied.

Interactive teaching is superior to didactic teaching when considering academic success and promoting the inclusion of learners, who at times have been treated as outsiders in the classroom.[5,11]

Interactive teaching involves:[10,11]

- Encouraging and expecting learners to participate
- Using questions to stimulate discussion
- Emphasizing the value of answers
- Giving participants hands-on experience
- Engaging participants in their learning
- Working together (facilitator and learners) to meet objectives
- Building on existing skills
- Acknowledging a range of learning styles
- Cultivating transferable independent learning
- Using teaching aids to gain and retain attention

Evidence shows that learner engagement in problem-solving and applying knowledge leads to better acquisition and retention of knowledge and skills outside the individual teaching/learning interaction.

INTERACTIVE DISCUSSIONS IN ATLS

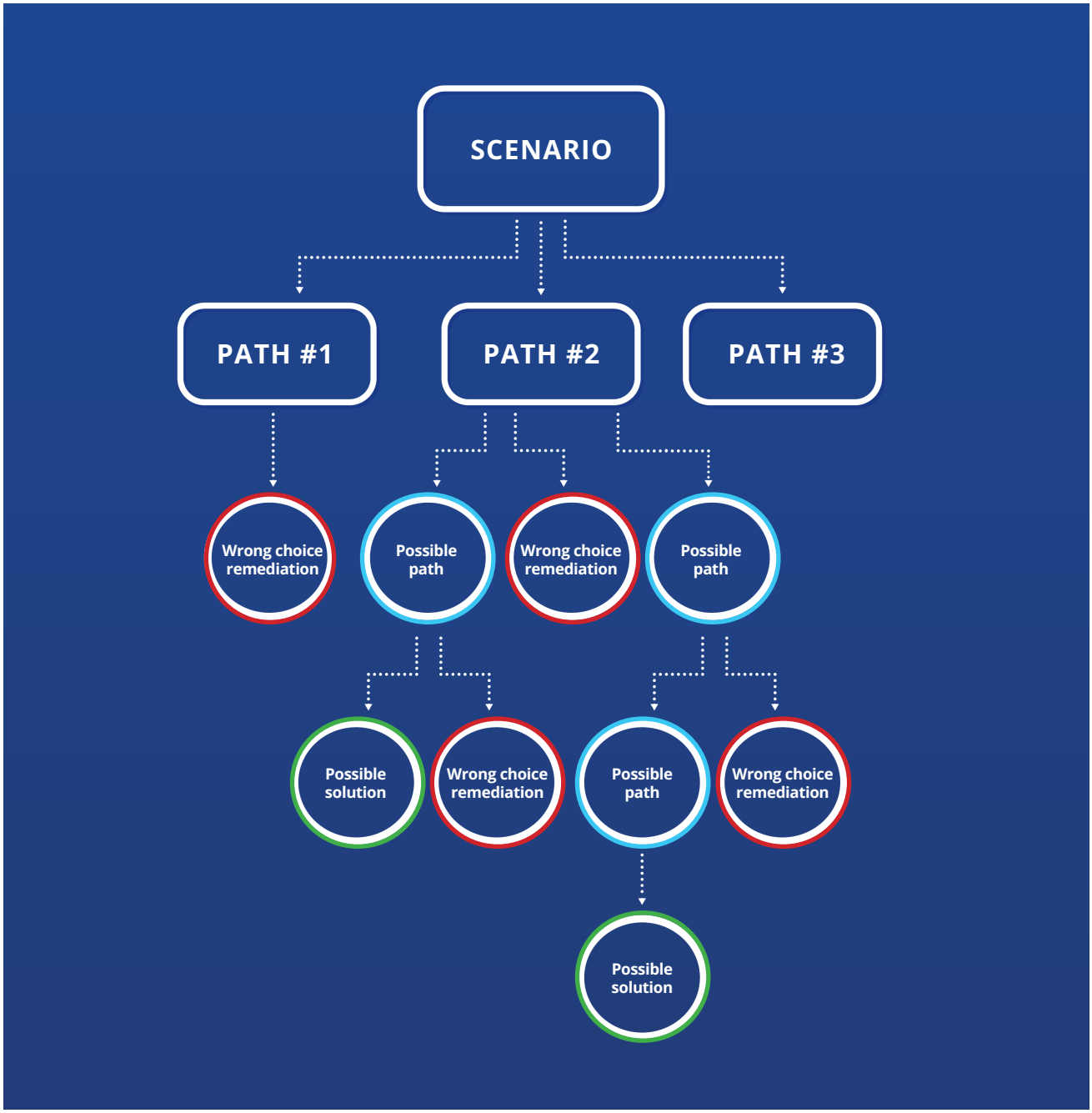
A major change in The ATLS 10th Edition was the introduction of interactive group discussions, which replaced interactive lectures. The ATLS Interactive Discussions use a specific trauma patient scenario to support active learning strategies. The scenarios unfold and are supported by stimulus questions to challenge learners to make decisions and apply the knowledge they have acquired from reading the ATLS manual. This change required a shift from the traditional lecture which required a facilitator to deliver content, to the Interactive Discussion format, prompting active learner engagement to further develop the knowledge gained from the manual.[8,10]

This new interactive teaching approach requires a team effort. Learners are not passive receivers of information; they need a solid and responsible preparation before the course, including a thorough understanding of pertinent content, clear guidelines, and goals to participate in the Interactive Discussions. It is therefore essential that learners come prepared to the ATLS Course, having read the manual so that the Interactive Discussions can build on the knowledge they have gained from this reading, and start to apply it through decision-making in real case scenarios.

SCENARIO-BASED LEARNING

Scenario-based learning (SBL)[12] provides an excellent framework for active learning by utilizing authentic contexts. This draws on the principles of situated learning theory and situated cognition, which propose that learning and knowledge acquisition are most effective when situated within the context in which they will be used. In SBL, learners are presented with real-life scenarios where they face a sequence of problems and action choices that affect subsequent events, mirroring the decision-making process in real-life trauma care. As learners navigate the scenario, they discover principles and develop critical competencies, with information and references presented in context when required or requested. Even if a learner makes mistakes throughout the scenario, learning still occurs, making SBL a form of experiential learning where knowledge is applied rather than merely recited. **Figure 4-1** illustrates an example of an SBL model, showing how a scenario branches into various possibilities based on the learner's decisions.[14]

■ **Figure 4-1:** SBL Model. Scenario-based learning simulation example.



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WHERE IS SCENARIO-BASED LEARNING INCORPORATED IN THE ATLS STUDENT COURSE?

ATLS incorporates scenario-based learning (SBL)[8,12] in Interactive Discussions, Skills Stations, and Initial Assessment evaluation stations. Learners have the opportunity to apply the knowledge gained from the ATLS manual and Interactive Discussions in a practical setting during Skills Station rotations, using the ATLS model for teaching discussion, demonstration, and psychomotor skill practice. The ATLS scenario-based teaching (SBT) process also familiarizes learners with the environment of the Initial Assessment teaching and evaluation stations at the end of the course, providing numerous feedback opportunities based on their patient assessments, interventions, and prioritization of treatments.

Scenario-based teaching (SBT)[12] offers several benefits: 1) encourages active learning; 2) makes learning more personally relevant and interesting through interaction between learners and the facilitator; 3) results in a greater understanding of the content;

and 4) promotes the transfer of new skills and knowledge to clinical practice. Additionally, SBT engages collaborative and group functioning, which are essential skills in team-based trauma care. ATLS incorporates various learning modes, such as listening, talking, reflecting, seeing and doing, which, when combined, enhance the overall learning experience.[2,12,16]

HOW DOES SCENARIO-BASED LEARNING IMPACT LEARNING?

ATLS Instructors facilitating Interactive Discussions and scenario-based learning should recognize their role extends beyond being information sources. They need to be learning facilitators and mentors, teaching with a learner-centered perspective that motivates learners and encourages them to appreciate learning as a lifelong pursuit. ATLS Instructors should facilitate participants getting to know each other, sharing ideas and opinions, reinforcing objectives by identifying misunderstandings, emphasizing problem-solving and knowledge application, relating subject matter to facilitator or learner experiences, and exploring and discussing attitudes about ATLS core content.

This model requires a team effort. Learners are not passive information receivers. Learners must come prepared for the course, with a thorough understanding of pertinent content, and clear guidelines and goals to participate in each phase of the course—Interactive Discussions, Skills Stations, and Initial Assessment evaluation stations.

ESSENTIALS FOR FACILITATING AN INTERACTIVE DISCUSSION

An effective Interactive Discussion facilitator:

- Prepares content and methodology of assigned topics by carefully reviewing resources to achieve learning objectives
- Prioritizes discussion objectives and maintains control to avoid tangential topics while allowing learners to voice opinions on scenario management
- Helps unveil inconsistent mental models (clinical reasoning) through guided questions, assisting learners in exploring their reasoning and identifying mismatches with ATLS principles
- Keeps the discussion on topic to minimize non-useful or beneficial personal encounters arising from participant responses
- Adjusts questions to challenge learners at appropriate levels based on their current knowledge and experience, fostering learning from both facilitator and peers
- Asks thought-provoking questions to unravel motivating values, experiences, and potential misconceptions underlying challenges in adopting ATLS content and principles
- Contributes ideas and facts without taking sides during controversies while reinforcing ATLS content
- Avoids dominating the discussion and prevents others from dominating
- Strives to be objective, patient, stimulating, and restrained rather than opinionated, anxious, dull, or dogmatic
- Allows for silence and reflection
- Encourages everyone to participate, maintaining a collegial classroom environment and lively discussion
- Provides clear closure to the Interactive Discussion, reminding participants of the accomplished objectives

POTENTIAL CHALLENGES AND SOLUTIONS OF INTERACTIVE LEARNING

The interactive teaching style is effective but demands more flexibility and discussion control from the facilitator.[16] Instructor, learner, and group factors need to be considered to effectively lead the discussions. Each learner will participate differently in the interactive SBT discussions. Preexisting knowledge and experience, attitudes, level of pre-course preparation, group relationships, and motivation are a few factors that will impact an individual's engagement and participation. The ATLS Instructor Course aims to help prepare the facilitator to manage learner factors with enhanced facilitation skills.

FACILITATOR FACTORS

Thorough preparation for an ATLS interactive SBT session is mandatory to ensure a positive learning outcome for all participants. Preparation allows the facilitator to focus on the learning experience of the group (group dynamics) and the individual learners (learning process) instead of struggling with the content. The confidence that a facilitator gains by mastering the content will be transmitted to the group, in turn helping the facilitation process. Time management is more successful with thorough preparation and by focusing the discussions on the objectives and the core material (the "ATLS way," the first hour of treatment, and so on). In the Interactive Discussions, the facilitator must elicit the content from the participants, rather than delivering the content to them.

MAINTAINING CONTROL OF THE DISCUSSION

There may be learners or events that inhibit the group discussion process either in the classroom or during the Skills Stations. The facilitator is responsible for managing the discussion and ensuring that the learning objectives are achieved.[2,7] Control can be maintained or regained by careful use of questioning; use of nonverbal behaviors, such as eye contact and body positioning; and reminding participants of the expectation of a supportive learning environment.

ENCOURAGING PARTICIPATION

The facilitator of Interactive Discussions should provide the opportunity and encourage all learners to participate. The facilitator should not be immediately alarmed if there is silence following a stimulus question. This silence may be an indication that the participants are thinking. Generally, wait 10 seconds before posing a follow-up or exploring question such as, "What are you thinking?" or "Let's start thinking out loud and together."

SUPPORTING QUIET LEARNERS

Learners who are 'quiet' and nonverbal may benefit from encouragement to join in the discussion. This can be due to many reasons. The facilitator should offer them a chance to be actively involved without pressuring, which could be counter-productive and emotionally disengage the participant from learning. One method is to address such learners by name, comment on their importance or expertise (specialty, training location), and ask for their opinion.[2] For example, "Dr. Jones, you were the chair of a similar study in your hospital. Can you outline some of the problems the study identified?" This method demonstrates that the facilitator recognizes Dr. Jones' comments are important to the group and provides the learner with the opportunity to speak from experience. If necessary, the facilitator can stimulate further participation from Dr. Jones by asking additional questions. If you are unfamiliar with the learner's background you can ask a nonthreatening question such as "Dr. Jones - have you had any experience with a patient similar to this one?". Even with a yes/no question the learner is drawn into the discussion. If the answer is yes, you may follow up with an additional question, such as "Can you tell us about it?". Usually, a reticent learner continues to participate after making an initial contribution. The "quiet" learner may speak softly and unclearly, struggling to find the right words to express a thought, or have difficulty in readily conveying ideas. The facilitator can help this learner by giving time and showing patience, repeating the idea(s), summarizing the point(s) to the group, and protecting the learner from embarrassment.[2]

REDIRECTING TALKATIVE LEARNERS

The learner who talks too much will monopolize the discussion and prevent others from achieving the full benefits of SBL. The facilitator needs to redirect the conversation and invite others to participate. Options for directing the discussion include asking for a response from a specific part of the room (right/left, front/back, and so on), asking for a volunteer (and not choosing the talkative learner), and asking for a volunteer with a different background or experiences than the talkative learner. The facilitator should not embarrass the talkative person, as that will negatively impact group dynamics.

Types of talkative learners the facilitator may encounter: [2,13]

- The learner who is always quick to answer and has the right answer to every question. Although well prepared and high performing, this learner prevents others from practicing reasoning skills. This behavior can be controlled by directing the question specifically to another participant, asking for several opinions, asking for a "vote", exploring reasons for agreeing or disagreeing, and using the learner to summarize the discussion. The enthusiasm of a high-performing learner should be maintained, ensuring that the learner knows they are appreciated, without negatively impacting the education of the remainder of the group.
- The "rambling" talker loses focus on the topic and uses too much of the time allotted for discussion. This type of learner can be controlled by interjecting when the learner pauses to take a breath, by rephrasing the learner's comments, and redirecting the discussion to the stated objectives (e.g., "That is an interesting topic. However, that is outside the content for the ATLS Course or outside the objectives of this session."), or by asking direct questions of other learners.
- Side (second) conversations represent another type of talkative-learner challenge for ATLS Instructors. While the conversations may be related to ATLS content, they are distracting to the rest of the group. The facilitator can control side conversations by addressing the learner(s) by name and asking them to share the comment with the group or asking a new direct question related to the scenario.

MANAGING NEGATIVE LEARNER EMOTIONS (AFFECT)

Learners may display emotions or behaviors that disrupt the group discussions and disturb the learning of their peers. Examples of disruptive behaviors include expressing disagreement or arguing with the ATLS principles, overemphasizing personal expertise, demonstrating inflexibility, or expressing grievances with processes or systems. Instructors should avoid making presumptions about the reasons for the behavior; rather, they should use their facilitation skills to redirect and focus the discussion ensuring that the learning objectives are achieved. This may be accomplished by acknowledging experience or variations in opinions, reiterating ATLS principles, and encouraging peer moderation. A private conversation outside the group discussion environment (during a break) between the learner and the Course Director (and/or Instructor) can assist in managing persistent disruptive behaviors.

PITFALLS WHEN USING SCENARIO-BASED TEACHING

- The SBT sessions should remain interactive and not be converted into a lecture. Hence, as a rule of thumb, if the facilitator is speaking more than one-fifth of the time *(1/5 or more than 12 minutes in an hour)*, the session is at risk of losing interactivity and instead turning into a lecture.
- Time management is extremely important. Skillful, effective facilitators are aware of the time constraints as well as the need to cover relevant content. Attention to pacing throughout the session will avoid some learners not participating or learning. The ATLS Instructor must be well prepared to manage time constraints, ensuring all content is covered and all learners are engaged and learning.
- Good questions are needed to maintain and guide the session, and to assess the learners. The Instructor needs to be in charge, focusing on the session objectives. It is important to have a plan if there is no response to the stimulus questions, and if the discussion wavers off point. The facilitator needs to ask additional questions to elicit knowledge from the participants, and those additional questions should cause critical thinking.
- The facilitator should avoid answering a question posed and morphing the discussion into a lecture. Learners must be engaged throughout.

CHAPTER SUMMARY

A learner-centered, scenario-based, and interactive teaching style is the most effective educational technique for facilitating learning. These methods are applied throughout the ATLS Courses. Active learning methods modify the role of the teacher from the transmitter of information to the organizer and facilitator of the educational process. Instructors should focus on encouraging the learners' active engagement with new knowledge and concepts, their problem-solving, and experimental and practical training. Learners should be encouraged to take initiative and develop ownership of their learning. The ATLS interactive pedagogies encourage interest in the topic, promote efficient acquisition of material, model positive patterns of conduct, develop high motivation, foster team spirit and freedom of expression, and nurture the development of complex lifelong learning competencies.[12]

The ATLS Course actively engages interactive SBL to motivate and inspire learners, achieve learner cognitive engagement, and foster learning. In addition, interactive teaching is beneficial for Instructors, as they are better equipped to assess learner mastery of subject material. Two-way communication enables teachers to make in-lesson adjustments in processes and approaches to meet the session objectives. The Instructor-learner interaction transitions from a didactic recitation of facts to a conversation. Thus, SBL is similar to the common case discussions clinicians have every day in the healthcare environment. Two-way teaching dispels learner passivity, and when more learners are engaged, Instructors are also more likely to enjoy their teaching.[16,17]

REFERENCES

1. Anderson LW, Krathwohl DR, Airasian PW, et al. *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives.* New York, NY: *Longmans, Green* & Co; 2001.
2. American College of Surgeons Committee on Trauma. Instructor Course Manual, 8th edition.
3. Argyris C, Schon DA. *Organizational Learning: A Theory of Action Perspective*. Boston, MA: Addison-Wesley; 1978.
4. Bell BS, Kozlowski SW. Active learning: Effects of core training design elements on self-regulatory processes, learning, and adaptability. *J Appl Psychol*. 2008;93(2):296-316.
5. Braxton JM, Jones WA, Hirschy AS, & Hartley III HV. The role of active learning in college student persistence. *New Directions for Teaching and Learning*. 2008(115):71-83.
6. Chi M, Wylie R. The ICAP framework: Linking cognitive engagement to active learning outcomes. *Educ Psychol*. 2014;49:2019-2243.
7. Christensen CR. "The Discussion Teacher In Action: Questioning, Listening, and Response." In Christensen CR, Garvin DA, Sweet A (Eds.). *The Artistry of Discussion Leadership*. Boston, MA: Harvard Business School Press; 1991. pp. 153-172.
8. Cook DA, et al. Comparative effectiveness of instructional design features in simulation-based education: Systematic review and meta-analysis. *Med Teach*. 2013;35(1):e867-e869.
9. Freeman S. et al. Active learning increases student performance in science, engineering and mathematics. *Proc Natl Acad Sci U S A*. 2014;111(23):8410-8415.
10. Haidet P, et al. A controlled trial of active versus passive learning strategies in a large group setting. *Adv Health Sci Educ*. 2004;9:15–27.
11. Harden RM, Laidlaw JM. Be FAIR to students: Four principles that lead to more effective learning. *Med Teach*. 2013; 35(1):27-31
12. Kindley R. 2002. Scenario-based e-learning: A step beyond traditional e-learning. ASDT online magazine learning circuits. http://docslide.us/documents/ kindley-rw2002-scenario-based-e-learning-a-step-beyond-traditional-e-html.
13. Lave J, Wenger E. *Situated Learning: Legitimate Peripheral Participation*. Cambridge, UK: Cambridge University Press; 1991.

5

Questioning Techniques in ATLS



OBJECTIVES By the end of this chapter, you will be able to:

1. Explain the different types of questions and their application in the ATLS Course.
2. Prepare and analyze the need for different questions depending on the scenario.
3. Describe different questioning techniques, including response strategies and pitfalls.



5 Questioning Techniques in ATLS

CHAPTER STATEMENT

Questioning is one of the most frequently used and powerful teaching strategies across levels and settings in medical education. When effectively executed, questioning can elicit positive outcomes in learner participation, concentration, and understanding of content.[4] When used incorrectly, questioning can leave learners feeling singled out and not in a position to learn, or worse, threatened or humiliated.[8]

REASONS FOR ASKING QUESTIONS

One characteristic shared by most outstanding teachers is the ability to engage students in productive discussions. Good discussions make learning more personally relevant, more exciting, and certainly more interesting. Discussions also make it easier for students to fit new content with what they already know, thereby leading them to a greater understanding of the content and its applications to their clinical practices. A good discussion is usually prompted by a question and asking the right question at the right time is a skill. Developing this skill requires an understanding of basic principles, practice, and conscious effort.

Asking and answering questions is a key ingredient in the learning process and effective teaching, and using a variety of questions in the classroom can serve many different purposes.[18] Nevertheless, Instructors need to consider that questioning is not just about asking questions, but that it is also a crucial skill to facilitate the learning process by:

- Involving the students by encouraging interaction.
- Gaining and maintaining attention, guiding the students out of passivity.
- Assessing levels of understanding by asking students to verbalize their understanding of what they have learned. It's the easiest way to determine if the Instructor is being understood.
- Increasing the level of cognitive complexity (according to Krathwohl's Taxonomy) by asking more complex questions.
- Increasing understanding by exchanging different views and doing something with what they are learning.
- Increasing learning from each other. It is almost always possible for the teacher to learn from the students and for students to learn from each other.

To fulfill the different reasons for asking questions, the Instructor needs to use different types of questions. These questions should be diversified by the levels of questioning and divided into the six levels of questions in the cognitive domain by using Bloom´s Taxonomy.[1,2,4,8]

QUESTIONS THAT TARGET COGNITIVE LEVELS

The cognitive domain can be stratified into different levels. Each of those levels can be addressed by certain types of questions. By default, the tendency is to ask questions only on the lowest cognitive level (i.e., remembering), which is insufficient within ATLS Courses. Special effort must be made by the Instructor to prepare questions for the other levels. **Table 5-1** shows how questions can be structured according to each level of Bloom's Taxonomy.[1,2,8]

The following (■ **Table 5-2**) provides examples of questions that target various cognitive levels, in the ATLS context.

■ **Table 5-1:** Levels of Questions Asked. Taken from Pylman & Ward. Medical Teacher 2020.8.

Table 1. Levels of questions asked.

←Lower order thinking			Higher order thinking→			
Revised Bloom's Taxonomy level	Remembering	Understanding	Applying	Analyzing	Evaluating	Synthesizing & Creating
Descriptive anchors	Foundational principles; recall facts: identify; list; name	Understanding results; follow guidelines; explain; interpret; illustrate	Concrete steps; apply; demonstrate; use	Organize meaningful patterns; analyze; compare and contrast; predict	Justify and defend decision; critique; judge	Construct; develop; propose; plan; manage; generate
Representative undergraduate medical education questions	What is pulse pressure?	How do diuretics work?	What components of the physical exam might demonstrate abnormalities related to hypertension?	What are possible reasons for hypertension?	Why do you think so?	How would you manage...?
Representative graduate medical education questions (e.g. surgery)	Se our landmark here? What is that called?	Where do you think we should put our camera port?	Why don't we take your hook cautery and open this spot here?	Where are you going to go after you clear that duct?	Why would you do that?	What is your plan for...?

*Adapted from Table 1 in Barrett et al. (2017) and EVMS (2019)

Pylman S, Ward A. 12 tips for effective questioning in medical education. *Med Teach.* 2020;42(12):1330-1336.

■ **Table 5-2:** Examples of Questions with ATLS Content that Target Various Cognitive Levels.

KRATHWOHL'S Taxonomy	SIMPLIFIED taxonomy	Examples
Remembering	**Remembering**	*What is shock?* → Asking for facts that can be answered by pointing to the answer in the book
Understanding	**Applying/Understanding**	*Why is this patient in shock?* → Asking for an explanation in the learner's own words regarding content learned
Applying	**Applying/Understanding**	*How would you treat this patient in shock?* → Asking for application to a practical case
Analyzing	**Applying/Understanding**	*What class of shock is this, and why?* → Asking the learner to analyze a new situation and explain the findings
Evaluating	**Applying/Understanding**	*What complications might result from this shock state?* *How do you prevent and manage them?* → Asking for the learner to reflect on, weigh, or prioritize different options and to express founded preference
Creating	**Evaluating**	*What other approaches might you take to manage this patient in shock?* *What causes you to think about alternative management strategies?* → Asking the learner to create new solutions and approaches that were not discussed before

It is also important for the Instructor to change the level of the question depending on the evolution of the discussion. Some choices in attending to the cognitive levels of the questions include the following:

- Ask for facts. This is good for ascertaining students' knowledge base, but it seldom promotes discussion.
- Ask for impressions or applications. This requires the students to do something with the information they have received.
- Ask why. This gives insight into the students' levels of understanding.
- Ask for opinions. This is a way of showing that the Instructor values what students bring to the discussion.
- Ask for personal experiences. This allows students to put learning into personal contexts.
- Ask for preferences. This gives the students a chance to express the value they place on what they are learning.
- Ask students to solve a problem. This requires synthesis, the goal of the ATLS Course.

Failure to change the level of questioning will result in less learning and frustration for some learners. The goal is to move the learner up the taxonomy from knowing to applying and ultimately to problem-solving (creating). This is particularly important in a course such as ATLS, in which the goal is to support the application of knowledge and skills outside the course and see learners applying the ATLS principles to the management of trauma patients in their work environments. The Instructor aims to influence the affect of the learner in a way that the ATLS principles are valued, adopted, and retained.

Other aspects of questions that need to be considered are:

- First-order questions—stated in the sequence of disclosure of information provided in the teaching and learning activities
- Uncovered questions—questions that can gradually reveal students' knowledge
- Open-ended questions—a form of independent inquiry questions that seeks to assess students' abilities and knowledge
- Convergent questions—closed questions
- Divergent questions—questions that can generate a lot of thinking abilities among students[4]

CONVERGENT AND DIVERGENT QUESTIONS

The ATLS Instructor will be well served by understanding two major types of questions: convergent and divergent.[2,11]

- **Convergent questions** are closed questions—that is, questions with specific and usually factual answers.
- **Divergent questions** are open questions; they require insight, creativity, independent thinking, and/or different perspectives on a given topic.

Convergent questions usually aim at lower levels of cognition (remembering) and do not usually require comprehension or higher cognitive thinking. They are useful for a discussion based on acceptable or known facts. This type of question asks generally for a discrete length of response (e.g., yes/no, a small number of facts in a list); they will shorten the discussion, as a common agreement on the correct answer is easily achieved.

Divergent questions aim at higher cognition (applying, analyzing, evaluating, creating), generally require thoughtful consideration, and often rely on past experiences or pre-existing knowledge on which to build. Divergent questions require usually complex and longer answers; they are useful for sharing different ideas and opinions and stimulating problem-solving skills.

STRATEGIC USE OF CONVERGENT AND DIVERGENT QUESTIONS

In the ATLS Student Course, a mix of convergent and divergent questions is often helpful. It is important to understand which type of question to ask, to ask the question correctly, and to give students opportunities to respond. Sometimes the use of a convergent question may establish known facts that will lead to a more active discussion through a series of divergent questions that follow.[3]

The following questions are examples of a mixture of convergent and divergent questions that are useful in this course:

- Is this patient in a coma? (convergent)
- Why, or why not? (divergent)
- What is the patient's Glasgow Coma Scale score? (convergent)
- Will you intubate the patient? (convergent)
- Why, or why not? (divergent)
- How will you treat this patient? (divergent)
- What principles governing increased intracranial pressure does this patient represent? (divergent)

The strategic use of both types of questions is effective. The ATLS Instructor needs to avoid asking a divergent question when he or she expects a convergent answer. For example, "What else can be done for this patient?" is a divergent question that may lead to many diverse responses. However, "What is the next step to manage this patient's airway problem?" is a more specific and convergent question.

A series of convergent questions, one after the other, is often interpreted as a type of "oral quiz" to evaluate pre-existing student knowledge. If the purpose is to evaluate pre-existing knowledge, then using a series of convergent questions is appropriate. (Although this is usually not necessary in an ATLS Course). Interactive dialogue and discussion are better generated by a carefully crafted series of divergent questions with a few convergent questions to keep the discussion focused.

One method of generating discussion through a question is to ask for a case example: "Who recently saw a patient in severe shock? What were the patient's clinical signs?" will more effectively lead to discussion than "What does the ATLS manual say are the clinical signs of shock?" To regain control of the interaction and refocus the discussion, the Instructor can ask a convergent question.

DIRECTING THE QUESTIONING

The choice of questions is also influential in managing student situations, and the Instructor needs to choose his or her questions with this in mind. Some choices in deciding how to direct the questions include the following:[3]

- Ask a question and then name the student. This may lead to embarrassment for the student who is not paying attention or who does not know the answer. If an Instructor wishes to use this technique, they should offer an option for the student who doesn't know the answer to avoid embarrassment; for example, allow students to discuss the answer with the person next to them.
- Name the student and then ask the question. This may be less threatening than the previous choice, depending on the nature of the question and the questioning style of the Instructor.
- Ask a question and choose a volunteer. The answers are usually better, but the Instructor needs to draw everyone into the discussion.
- It is important to ask questions in a way that does not embarrass students.

ONCE A QUESTION IS ASKED:

- Give students time to answer. Students require some time to understand the question and formulate the answer. Give a few seconds for students to think (5 seconds is usually enough).
- Look at the student who is answering and be attentive. Maintain eye contact with the student—it is more engaging and often makes the student feel that the Instructor is more interested in their answer.
- Respond with appropriate gestures. The Instructor may use appropriate gestures (e.g., nods, smiles) to indicate acceptable responses to questions.
- Acknowledge and comment on every response. Every response from every student should be acknowledged with an appropriate comment that directs the questioning so that the student and the rest of the class can recognize whether the response is correct, incorrect, or requires clarification.
- Paraphrase the student's response. If the student's response is not exactly what the Instructor expects, paraphrasing it may help to provide clarification.
- Provide clear, unambiguous feedback.

QUESTIONING TIPS

The following twelve tips will help Instructors to be effective and purposeful as they plan, ask, and analyze questions in the classroom or clinical settings.[8]

■ **Table 5-3:** Questioning Tips.

TIPS	Explanation
Ask questions to scaffold learning.	Scaffolding is a dynamic process that requires the Instructor to be able to identify the knowledge gap faced by a learner, and then offer support for the learner as they move toward a more advanced understanding; that is, the Educator must consider the learning objective and the learner's current level of knowledge.[9]
Understand the roles of open and closed questions in learning.	Instructors should use open-ended and closed-ended questions in their teaching. Each serves a purpose and each potentially helps learners meet different objectives.
Use all levels of questioning.	All levels of questions need to be asked at various times, and it is up to the Instructor to decide which level of questioning will best support learners in reaching the objective. The Instructor needs to help the learner to reach their objectives, making sure that the more knowledgeable and proficient the learner becomes, the questions should move toward higher-order thinking questions.
Ask questions as a model of clinical reasoning.	Clinicians ask questions of patients as they investigate symptoms looking for a diagnosis. Therefore, they need to model their learners' professional behavior and ways of thinking. Instructors need to use questioning to model and scaffold the development of clinical reasoning
Probe, don't 'prod' by creating psychological safety.	Prodding refers to the intent of the questioner to humiliate, cause discomfort, or malignantly illuminate knowledge gaps. Instructors must be careful in differentiating between Socratic teaching and prodding by creating an atmosphere of respect and making sure their learners know how they will be probed by asking appropriate level questions; allowing enough time for answers; allowing answers such as "I don't know" or asking help from others; by prompting when learners don't know the answer to help them make connections to what they know; by using verbal and nonverbal communication to show support; and correcting (privately, if possible) in a compassionate manner that clearly identifies gaps in knowledge or skill, without causing humiliation or resentment.
Break away from the Initiate-Respond-Evaluate (I-R-E) pattern.	Even though the Educator tends to respond positively and reassuringly, it is advisable they prompt and probe further and invite other learners' responses by asking learners to co-construct the evaluation; by asking for further explanation; by asking learners to agree or disagree; and/or by building on the learners' response by making clinical reasoning explicit.
Allow learners to discuss in pairs before answering questions.	When learners are actively participating, they learn more than when they merely listen. Instructors can engage learners to work in pairs, for peer discussion enhances understanding even when in a discussion group none of the participants know the answer. When working cooperatively, learners are able to identify misconceptions or gaps in knowledge; they can think out loud about their understanding; but mainly they are given the opportunity to teach the information to another person.
Give learners think-time after asking a question.	Instructors are often tempted to fill the silence with hints, their own answers, or a response from a quicker responding learner. However, research in this area shows that waiting at least 3 to 5 seconds after asking questions, and more time for English language learners, offers important benefits such as, among others, an increase in the complexity and cognitive level of learner responses, more learner-to-learner interactions, a decrease in learner confusion, more confidence, and higher achievement.
Know when to stop questioning.	At times when learners are not able to answer questions posed, Instructors may ask another learner to help answer; ask learners to research the theme and report back; state and explain part of the answer; and/or state and explain the entire answer. Instructors should not always assume learners did not prepare, but should also, cautiously, step in to answer the whole question.
Listen to learner responses.	Instructors need to pay attention to learners' responses in order to build the following question and further their understanding. Instructors need to listen so that they can respond to the learners' emotional as well as content needs. They need to make sure learners understand the concept; they need to know the level of understanding the learner's response reveals; whether or not there was a misconception, or if the question was too difficult, or if the Instructor needs to teach the section again or just move forward; or if the learner was able to justify their response. When the Instructor really listens to the responses of the learners and not only looks for the right answer but for what actually the learner's message is, the Instructor will be able to leverage the responses for further teaching moments.
Ask questions for a written response.	Using this method of collecting and analyzing written responses that will not be evaluated or graded (formative assessment) but instead will be used for the purpose of planning future training, Instructors will be able to gauge understanding or see the thought processes of individual learners or the class as a whole.
Analyze the questions asked.	Analyzing questioning involves recording sessions and listening to the recordings for question analysis. This may not be suitable in the clinical setting, but other ways to collect questions for analysis may be found. This analysis must be done according to levels of questioning (Bloom's Taxonomy); use of the IRE pattern [Initiate (Educator), Respond (learner), Evaluate (Educator)] responses; probing; quality of learner responses; and use of think-time.

TYPES OF QUESTIONS

Good teachers use a variety of different types of questions to engage their students in a constructive and effective discussion.[2,3,5,6,10]

As an ATLS Instructor, use the following chart and write your own ATLS content questions following the examples provided. This exercise will help you evaluate your skill in writing questions purposefully.

■ **Table 5-4:** Types of Questions.

Criterion	Type	ATLS Example
Cognitive level	**Lower order**	*What does the A stand for in the xABCDE algorithm?*
	Higher order	*Does this patient have a tension pneumothorax?*
Structure	**Structured**	*What are the components of the Glascow Coma Scale (GCS)?*
	Open-ended (Unstructured)	*Does this patient need to be transferred?*
Convergence vs. Divergence	**Convergent**	*What are the patient's vital signs?*
	Divergent	*Why does this patient need fluids?*

Taken and adapted from Questioning Techniques: Guidelines & Best Practices by Michal Kasprzak. Copyright © 2022 Teaching Assistants' Training Program, University of Toronto.[6]

OTHER TYPES OF QUESTIONS

■ **Table 5-5:** Other Types of Questions.

Type	ATLS Example
Evaluative	*How do you decide when to activate the massive transfusion protocol?*
Assumption Challenging	*How confident are you in removing this patient's cervical collar based on this patient's clinical findings?*
Relational	*How does the GSC score help you decide whether to intubate a patient or not?*
Diagnostic	*Is this patient in shock?*
Action	*You have given this patient fluids, and there is no change in the blood pressure; what do you do now?*
Cause-and-Effect (or Connective)	*If this patient has a cervical spine lesion, how can this affect B "Breathing"?*
Extension	*How does this patient's cervical lesion relate to C "Circulation"?*
Hypothetical	*You are treating a patient on the side of the road and you suspect a cervical spine injury. All you have in the trunk is a blanket and newspaper; how do you stabilize the patient's cervical spine?*
Summary	*What are the key features of xABCDE that we have discussed today?*
Comparative	*What are the advantages and disadvantages of using mannitol vs. hypertonic saline?*

Taken and adapted from Questioning Techniques: Guidelines & Best Practices by Michal Kasprzak. Copyright © 2022 Teaching Assistants' Training Program, University of Toronto.[6]

QUESTIONING PITFALLS

The following are some pitfalls to avoid when asking questions:

- Lengthy questions. Succinct questions are more focused and easier for students to answer.
- A question within a question. Ask one question at a time.
- Embarrassing or ambiguous questions. These often result in negative reactions.
- Overuse or underuse of particular students. The goal is to involve everyone.

CHAPTER SUMMARY

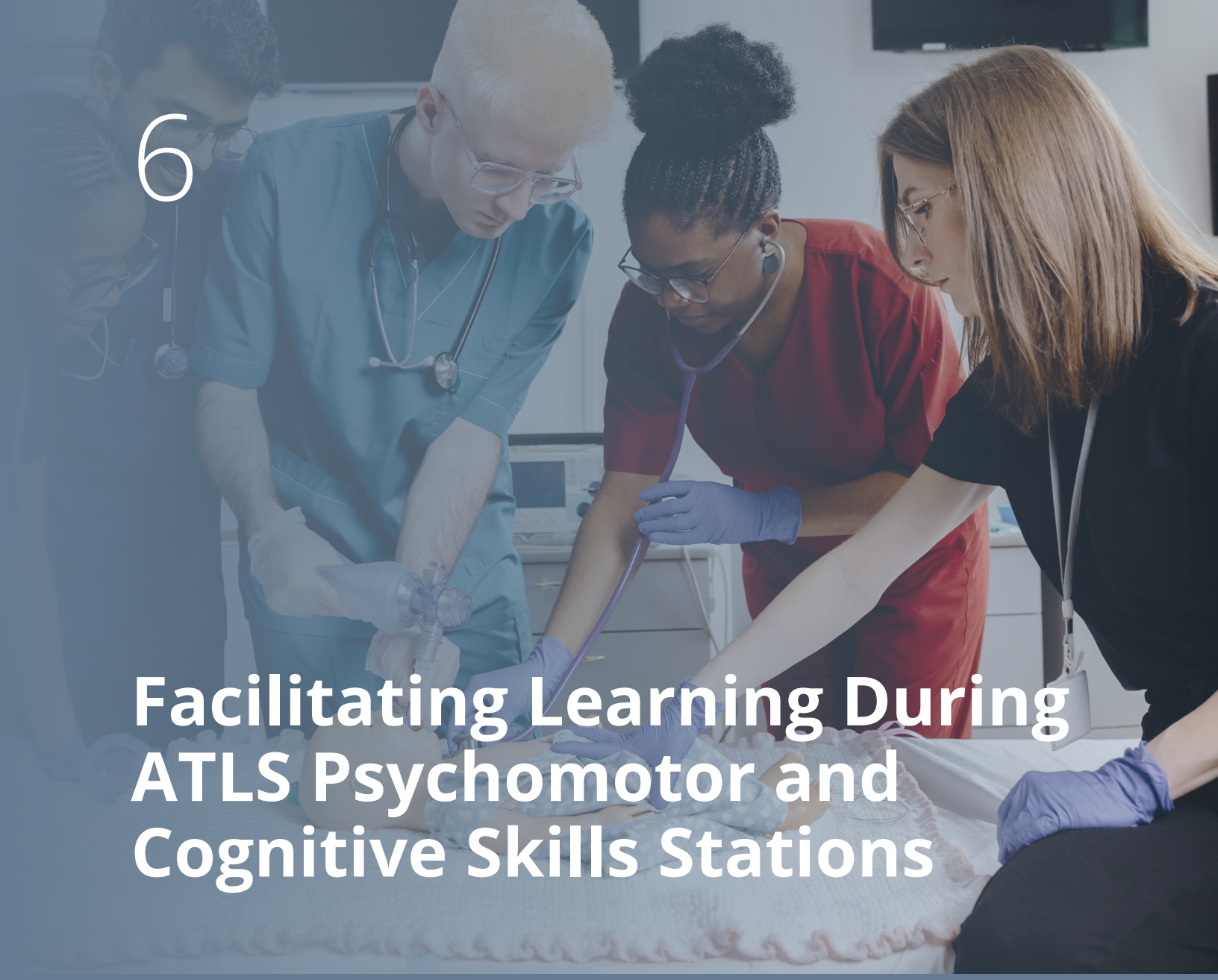
Questioning in teaching and learning is critical to mastering knowledge. Instructors need to focus on questioning techniques in the teaching and learning process to nurture students' interest in learning and promote learners' application of new knowledge and skills.

Questioning techniques increase motivation and promote students' ability to think critically and creatively. These techniques help students engage actively in the teaching and learning process and stimulate mastery of higher-order thinking skills.

The Instructor is responsible for both ensuring adequate coverage of content. and maintaining control of the content delivery throughout the discussion that emanates from the questioning.

REFERENCES

1. Anderson LW, Krathwohl DR, Airasian PW, et al. *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives.* New York, NY: *Longmans*, *Green* & Co; 2001.
2. Bloom BS, Engelhart MD, Furst EJ, Hill WH, Kratwohl DR. *Taxonomy of Educational Objectives: The Classification of Educational Goals. Handbook I, Cognitive Domain*. New York, NY: *Longmans*, *Green* & Co.; 1956.
3. Christensen, CR. The Discussion Teacher In Action: Questioning, Listening, and Response. In Christensen CR, Garvin CD; Sweet A(Eds.), *The Artistry of Discussion Leadership*. Boston, MA: Harvard Business School Press; 1991. pp. 153-172.
4. Cho YH, Lee SY, Jeong DW, Im SJ, Choi EJ, Lee SH, Baek SY, Kim YJ, Lee JG, Yi YH. Analysis of questioning technique during classes in medical education. *BMC Med Educ*. 2012;12(1):39.
5. Cotton, Kathleen. "Classroom questioning: School improvement research series." *Portland, OR: Northwest Regional Educational Laboratory* (2003).
6. Kasprzak M. Questioning Techniques: Guidelines & Best Practices**.** In: *Teaching Assistants' Training Program*. University of Toronto; 2022.
7. Owen L. Understanding the new version of Bloom's Taxonomy: A succinct discussion of the revision of Bloom's classic cognitive taxonomy by Anderson and Krathwhol and how to use them effectively. Available at: https://quincycollege.edu/wp-content/uploads/Anderson-and-Krathwohl_Revised-Blooms-Taxonomy.pdf. Accessed February 11, 2025.
8. Pylman S, Ward A. 12 tips for effective questioning in medical education. *Med Teach*. 2020;42 (12)1330-1336.
9. Van de Pol J, Volman M, Beishuizen J. Scaffolding in teacher–student interaction: A decade of research. *Educ Psychol Rev*. 2010;22(3):271–296.
10. Walsh JA, Sattes BD. *Quality Questioning: Research-Based Practice to Engage Every Learner*. Thousand Oaks, CA: Sage Publications; 2005.
11. Woolfolk AE, Winne PH, Perry NE. *Educational Psychology*. Toronto: Allyn & Bacon, Inc; 2003.



6

Facilitating Learning During ATLS Psychomotor and Cognitive Skills Stations

OBJECTIVES By the end of this chapter, you will be able to:

1. Describe the differences between ATLS psychomotor skills and ATLS cognitive skills.
2. Identify levels of procedural performance and the goal performance level for participants in an ATLS Course.
3. Describe the ordered stages of skill instruction, including their rationale, value, and neurobiological support.
4. Review the application of an unfolding scenario in an ATLS Skills Station.
5. Describe the application of the environment, set, dialogue, and closure model to facilitate a Skills Station.
6. Review challenges in skill instruction and be able to identify methods to surmount these challenges.
7. Identify the responsibilities of an ATLS Instructor when facilitating a Skills Station.



6 Facilitating Learning During ATLS Psychomotor and Cognitive Skills Stations

CHAPTER STATEMENT

Adept Instructors employ thoughtful planning, understanding of motor learning, assessment of the learner's current proficiency, and a structured approach to facilitate effective and efficient psychomotor and cognitive skill acquisition.

The order of psychomotor skill training is conceptualization, visualization, verbalization, and practice with feedback (know, see, say-say, do/review).

For cognitive skill training, visualization (see) may be omitted, and the order is conceptualization, verbalization, and practice with feedback (know, say-say, do/review).

The ATLS® Course skill sessions follow the ATLS structure of environment, set, dialogue, and closure.

INTRODUCTION

A cornerstone of high-quality care for the injured patient is the ability to perform efficient and effective resuscitative skills. The ATLS Course, from its inception, provides instruction and practice opportunities in a variety of life-saving skills. Well-trained Instructors who are familiar with the principles and neurobiology of motor learning and who apply a deliberate teaching method are essential to a learner reaching the course's educational goals and acquiring ATLS skills.

This section of the manual will discuss material related to facilitating Skills Stations that are core components of the ATLS Course. There are two types of skills in the course: psychomotor procedural skills and cognitive skills. Psychomotor procedural skills encompass the mental and motor activities required to complete a manual task.[1] These procedures require discrete motor actions, such as intubation, chest tube insertion, and pelvic binder application. Procedural skills include cognitive elements as well, such as the therapeutic goals of the procedure, indications, contraindications, pertinent anatomy, and appropriate tools. For the purposes of teaching the ATLS Course, psychomotor procedural skills are related to, but distinct from, primarily cognitive skills which do not have a predominant motor action. Examples of cognitive skills are reading a radiograph, calculating a Glascow Coma Scale (GCS) score, and evaluating a neurologic examination.

PROGRESSION OF SKILL ACQUISITION (FROM NOVICE TO EXPERT)

Just as acquisition of didactic knowledge can be organized hierarchically, such as in Bloom's Taxonomy and Miller's Pyramid (Chapter 2), progressive development of skill aptitude can be conceptualized as passing through multiple levels.[2] These stages do not have distinct boundaries and represent generalized categories of ability. Understanding the learner's position along an acquisition continuum assists the facilitator in delivering optimal personalized instruction. Three common organizational structures are described: Dreyfus and Dreyfus,[3,4] Simpson,[5] and the Zwisch (Zwischenberger) scales.[6]

TAXONOMIES

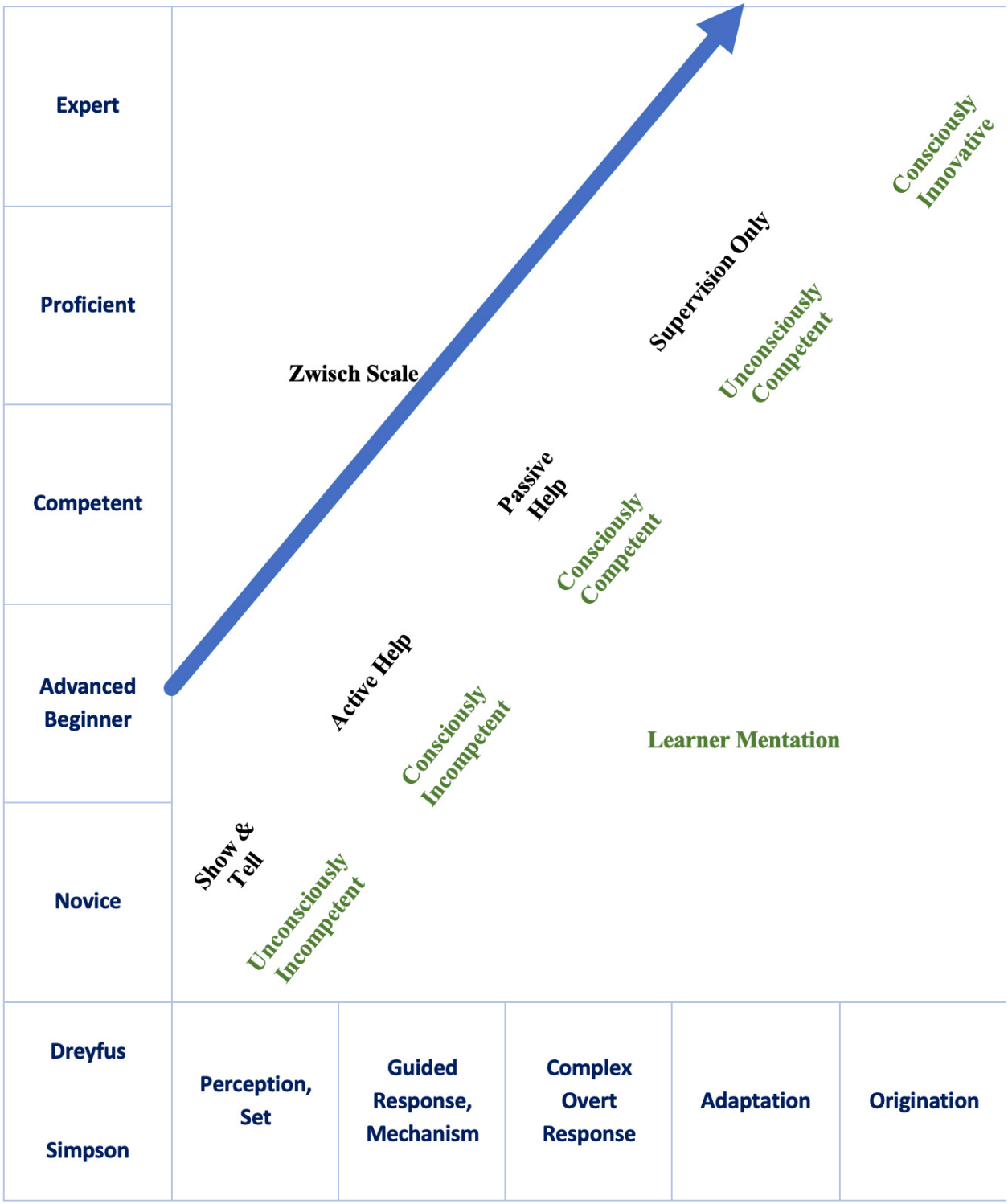
The Dreyfus and Dreyfus model is one of the more common systems utilized to describe stages of both motor and cognitive skill acquisition. Dreyfus[3,4] described five progressive stages: Novice, Advanced Beginner, Competent, Proficient, and Expert. Simpson's[5] seven-stage psychomotor taxonomy includes: Perception, Set, Guided Response, Mechanism, Complex Overt Response, Adaptation, and Origination. More recently, a four-level "Zwisch"[6] scale was created from a model developed for describing intraoperative surgical resident performance. The "Zwisch" levels are: Show and Tell, Active Help, Passive Help, and Supervision Only. (See ■ **Figure 6-1.**)

At the introductory proficiency level, Dreyfus Novice, the learner has an understanding of the basic "rules" of the skill such as the purpose of medical instruments and the steps of a procedure. However, the learner is unable to perform the task. This phase is equivalent to combining the first two Simpson stages: Perception (unconscious sensory cues preparing for action) and Set (knowledge and desire to perform). A comparable Zwisch performance evaluation is "Show and Tell" where the faculty performs and explains while the resident observes. At this level the learner is unconsciously incompetent; they do not know what they do not know. Nevertheless, the learner desires and is prepared to learn. In an ATLS context, the learner has not performed or attempted the procedure, but has read the manual, is familiar with the procedure, and may have seen the procedure via video or in real life. Many if not most course participants enter the course at this level.

Progressing in training, the learner passes into the Advanced Beginner (Dreyfus), Guided Response/Mechanism (Simpson), or Active Help (Zwisch) level. They are able to follow explicit instructions and mimic the Instructor. This represents a learner's earliest attempts to perform the mechanics of the task. The learner's activities are characterized by imitation, trial, and error. The learner begins to develop consciousness of how much progress is needed. They are consciously incompetent.

As proficiency increases, the learner becomes able to progress through the entire procedure with declining amounts of assistance. Adequate performance is achieved through high levels of continuous conscious effort. The learner is consciously competent and has grown into the Complex Overt Response (Simpson), Competent (Dreyfus), Passive Help (Zwisch) phase. At this point, the learner has achieved adequate proficiency to perform the pro-

■ **Figure 6-1:** Comparison of Skill Hierarchy Classifications. Proficiency increases in the direction of the arrow, from lower left to upper right. Modified from Sawyer et al.[1a]



cedure, albeit with relatively high cognitive load and inefficiency. This is the ideal goal level for participants in the ATLS Course. They are to complete every core skill with adequate proficiency. However, for every learner to reach this level depends on the complexity of the skill, practice time, their previous experience, or previous ability.

Following further practice and experience, practitioners develop increasing levels of automaticity. They become unconsciously competent, able to perform with less intentional effort to recall the specific steps (rules) of the task. This is the Proficient (Dreyfus), Adaptation (Simpson), Supervision Only (Zwisch) phase. Adaptability develops and motor functions are altered for case-specific circumstances. The internal model for the task matures, allowing improved prediction of results and an ability to adjust when the model is not met.

Dreyfus' Expert level is well described by Simpson's term, Origination. The skill has become so well mastered that new techniques, approaches, and steps are developed. Conscious innovation is present. New devices, modification of current devices, and different treatment paradigms are examples of progression to the highest levels of proficiency. This is illustrated by the development of minimally invasive surgery which initially mimicked "open" procedures. A proliferation of new instruments and techniques has changed the basic conduct of many common operations.

FUNCTIONAL NEUROLOGIC CHANGES DURING DEVELOPMENT OF EXPERTISE

Functional brain imaging in normal and injured volunteers has produced fascinating information regarding learning. When a new motor skill is developed, more than the motor cortex is involved. The frontal lobe, motor cortex, cerebellum, and occipital lobes are active. As more senses are activated, learning becomes more effective. Information is "tagged." More functioning neurons create a fuller mental image and improved recall.[7] Locations and relative levels of cortical activity correlate with the development of expertise. At early stages of psychomotor skill acquisition, the learner demonstrates awareness, concentration, and visual attention. This results in less precise (more random) movements.[8] Cerebral imaging of novices performing laparoscopic procedures confirms a high degree of activity in the frontal (thinking) region with relatively less activity in the motor regions.[9]

Practice of a defined motor activity, such as rapid finger movements or a piano key sequence, results in enlarged motor pathways and a reduced neurologic activation threshold.[10, 11] Within 6 hours after completion of a practice session, even though performance is unchanged, the brain begins to re-organize, shifting activity from the frontal cortex to the motor and cerebellar regions. Further re-organization occurs during sleep.[7, 12] Through this redistribution, frontal resources are released for information processing of new material. Functional brain imaging of laparoscopic surgical experts compared to novices demonstrated a substantial reduction in frontal cortical activity and a higher motor strip activity.[9] This shift in cortical resources to the motor strips may account for some of the characteristics of experts.[13] Cognitive assets become available for advanced procedural problem-solving and other activities by experts. Their brains modify to accurately perform the task without cognitive overload.

FACILITATED ACQUISITION OF SKILLS

INSTRUCTOR/LEARNER MINDSET

Medical procedural training has evolved at a rapid rate over the past decades. Observation and practice on "real" patients are now supplemented by simple and advanced simulation. Augmented and virtual reality are at the developmental forefront of simulated medical training. Although techniques can be learned through the apprenticeship model, "See one, Do one," a guided step-wise instruction by a skilled facilitator is more efficient, more effective, and provides increased patient safety.[14-18]

Effective procedural skill training is best facilitated by Instructors who understand the principles and neurobiology of motor skill development. When a skill is presented to complete novices, the Instructor should begin with fundamental principles and not assume prior knowledge or experiences.[19] This "mental set" by facilitators is critical for ATLS learners who may not have witnessed a trauma resuscitation, who may have very limited practical experience, and who may not have seen a procedure performed optimally.

An expert who functions as an Instructor may be challenged trying to remember the thought processes of a novice. Experts have developed an internal model of the skill and the expected haptic feedback. Their cerebral map has moved from the frontal cortex to the motor strip and cerebellum. An effective expert Instructor will consciously analyze their motor cortex activity and translate information back to the frontal cortex for dissemination. Experts also tend to "chunk" a procedure. For example, a surgeon frequently breaks an operation into various stages, such as: gaining access, dissecting, resecting, reconstructing, and closing. A chess expert describes opening, midgame, and endgame. The expert as facilitator needs to break these chunks into discrete steps while maintaining an ability to communicate the organizational value of the "chunks" to the learner.[20]

Instructors may overestimate the skills and knowledge of the learner, reluctant to "insult the intelligence" of the learner. However, as mentioned by Kneebone, "the key issue is not intelligence but experience and psychomotor skill. Do not overestimate the complexity needed in basic skills training. Seemingly obvious techniques, properly taught and regularly reinforced, are more important than overly sophisticated ones."[19] If learners are treated with respect, they will value the educational experience.

A learner's motivation and their ability to successfully learn a psychomotor skill are correlated. Learners who focus during demonstrations and explanations and perform dedicated practice are more likely to successfully complete the procedural learning activity.[21] Unmotivated participants, those who "go through the motions," are unlikely to accomplish the skill session goals.[13] Therefore, it is important for the Instructor to create a positive and encouraging learning environment.

PEYTON'S STEPWISE APPROACH

One of the most widely studied and employed methods for teaching procedural skills in medicine is Peyton's Four-Step Model. The sequential four steps consist of demonstration, deconstruction, comprehension, and performance.[22]

1. **Demonstration** - The instructor performs the skill at a normal pace without comments to the learners. Learners observe.
2. **Deconstruction** - The instructor performs the procedure a second time at a slower rate while providing a verbal description of the steps and of expected proprioceptive and visual feedback.
3. **Comprehension** - The instructor performs the procedure a third time. During this third repetition, the learner provides a verbal explanation of each step while the instructor follows the learner's directions.
4. **Performance** - The learner performs the procedure while being observed by instructor. Instructor feedback is provided at this stage.

George and Doto's paper added a fifth, preparatory, step termed Conceptualization.[23] This step is implied as a prerequisite in Peyton's model. Their manuscript is a review of the ATLS method and is frequently cited. Feedback is included in the Performance step of Peyton. In some descriptions, feedback is separated into a discrete step due to its documented critical influence on learning.

The stepwise method of Peyton has been compared to "See One, Do One" and modified 4-step models. Its effectiveness and superiority have been validated in multiple studies.[18, 24, 25, 27-30]

Compared to standard two-step instruction (demonstrate with description followed by practice), Peyton's method was associated with decreased time of first independent performance, improved procedural professionalism, and improved patient communication.[29] Removal of Peyton's Deconstruction and/or Comprehension steps is potentially possible with "simple" procedures (needle puncture cricothyroidotomy, CPR) but valuable for more complex isolated procedures.[24-27] Although Peyton's method was originally described for 1:1, teacher:learner interactions, it is effective in small-group situations as well.[24,31]

A progressive model of psychomotor procedural skill instruction is proven to be the most effective method for novices learning a new psychomotor skill. Each step has neurobiological effects that increase learning. In the ATLS Course, the model includes conceptualization, visualization, verbalization by both Instructor and learner, and practice with feedback. These can be remembered as know, see, say-say, do/review.

STEPS FOR FACILITATING ACQUISITION OF A PSYCHOMOTOR SKILL IN ATLS

■ **Figure 6-2:** Steps for Facilitating Acquisition of a Psychomotor Skill in ATLS.



1. Conceptualization, Contextualization, Know, Organize

Prior to performing a procedure, learners must understand the clinical context surrounding its application including indications, therapeutic goals, pertinent anatomy, pertinent equipment, and patient communication. Before teaching, Instructors need to examine their own organizational structure (chunks) and be prepared to break the task into component parts while assisting learners in developing their personal organization (mental model) of the skill.

When and How: This step is best performed by the learner as self-study prior to the ATLS skills session and during interactive sessions prior to the Skills Station. Within the skill session, clinical context will be provided by the scenario. A brief review of the context may be completed prior to visualization. Commentary regarding equipment, patient communication, and team function is best conducted during the verbalization step.

2. Visualization, Model, See

Observing a motor task performed in a proficient manner from start to finish, while demonstrating necessary team interactions without commentary is essential to the development of competency.[19] Observation creates a mental image of "what can be" for the learner. The learner sees the speed and efficiency of the activity. For example, watching an adept athlete hit, kick or throw a ball, or watching an expert musician play an instrument or sing, creates a mental model and training goal. The Instructor can model team and patient interactions. Mirror neurons are triggered.[32] Observing others perform activates the learner's premotor and parietal cortexes, preparing the brain to mimic and subsequently

perform.[33] The absence of verbal commentary is important. The learner's brain can focus on motor movements, without processing sound and haptic inputs.[20] As described earlier, novices utilize a high degree of frontal processing during skill learning. A verbal commentary splits the learner's attention between multiple inputs.[20] Narration at this phase introduces a potential for cognitive overload of taxed working memory, interrupting the development of a congruent mental model.[34]

When and How: Visualization, the "see" stage, can be performed as a live demonstration by the facilitator during the Skills Station. Alternatively, a video is equivalent to live demonstration.[35] The video should be played with sound off and no facilitator commentary. Review of a video by learners prior to physical attendance in the ATLS Course may increase the time available for further practice and feedback during the course. Pre-course video study allows the learner to control playback (pause, slow, rewind) which may improve skill acquisition.[36] Visualization is omitted during instruction of some cognitive skills (see below).

3. Verbalization, Describe, Say-Say

In the first "say" of verbalization, following visualization, the facilitator simultaneously performs (or manages video playback) and explains individual procedural steps, team interactions, patient instructions, and any other declarative material deemed critical to the task. Specific instructions regarding the expert's visual focus (gaze training) and expected tactile experiences (haptic training) improve performance, ability to handle distractions, and eventual development of automaticity.[37] Potential common errors and learner questions are addressed.

In the second "say" of this step, the learners recite skill instructions back to the Instructor, either directing the Instructor while the Instructor performs the procedure or while the video (without sound) is presented again. Although seemingly time consuming from the Instructor's perspective, learner verbalization before performing the procedure themselves is crucial to optimal learning, contributing significantly to instructional success and patient safety.[20,25,38] Novice learners tend to prefer the opportunity to "say" the procedure.[39] Verbalization by the learner has significant benefits for the Instructor as well. The facilitator has an opportunity to "eavesdrop on the learner's thinking," [40] performing a needs assessment of the learner's current knowledge of steps, ordering, timing, and providing corrections where necessary.[20]

Procedural proficiency is associated with an accurate mental image. Mental rehearsal occurs during both the "see" and "say-say" steps. Mental repetition stimulates the same motor cortex that is active during physical execution of the skill.[10, 41] Mental practice alone, without physical practice, will improve performance and is extensively used by athletes and musicians.[42] It improves surgical skills, other medical procedures, and nontechnical outcomes.[43, 44] Nicholls et al. stated, "A contemporized psychomotor skill-teaching model must include verbalization or self-declarative instruction … prior to skill performance."[20]

- When and How: In ATLS Instructor verbalization occurs in the Skills Station. Instructors typically teach skills in small groups (2-4 learners). After the Instructor demonstrates and explains the procedure, the learners verbalize the steps prior to physical performance. There are several methods to accomplish learner verbalization.
- Stepwise rotation of roles: The first learner guides the Instructor through the skill. Then, the first learner performs the task while the second learner recites the steps. The second learner then performs the skill while the third learner verbalizes. This process continues until all learners have performed the task successfully. A challenge with this method is maintaining engagement by group members who are not either verbalizing or performing.

After the Instructor has explained the procedure, the entire group works together to guide the Instructor through the skill, or the group narrates over a video. In this group method it is important for the Instructor to confirm that every learner has verbalized and can explain the complete task correctly.

4. Practice and Feedback, Do/Review

Following verbalization by both the facilitator and the learners, the participants need practice time. Practice is the cornerstone of mastering a skill.[45, 46] Practice induces functional cerebral changes that enhance performance.[11] As learners perform the procedure they should verbalize their actions, allowing the Instructor to follow their thought process. This promotes participant learning and allows enhanced specific facilitator feedback. In ATLS, this also represents an opportunity to practice the skill of task description, which is required for learners to pass the Initial Assessment portion of the course.

When and How: Feedback and correction should be provided by the facilitator in real time. However, overloading the learner with verbal corrections may inhibit learning.[20] Therefore, attempt to limit verbal interruptions to correct only critical errors, including preparation and patient positioning matters (e.g., cervical spine immobilization during intubation and logrolling for exams and pelvic binder placement). Sometimes subtle important movements and haptics are difficult or impossible to explain with words alone. If appropriate, culturally and otherwise, nonverbal feedback may be provided by guiding the learner's hands or adjusting body position. This can benefit development of correct proprioception, particularly for skills such as ultrasound.[20] As mentioned previously, feedback regarding attention and gaze is very beneficial. To successfully complete the course, each learner must perform every ATLS skill.

DIFFERENCE BETWEEN PSYCHOMOTOR AND COGNITIVE SKILLS

Certain critical skills in ATLS do not have a predominantly motor component, for example, initial assessment, calculation of GCS score, and evaluation of radiographs. In these cognitive skills, instruction is still improved by employing a structured approach. Some cognitive skills, initial assessment and secondary survey, are well facilitated using all steps (know, see, say-say, do/review). Particularly, visualization (the "see" step) has high educational value. However, for certain cognitive tasks, visualization is not useful. For example, little learning occurs while watching an unnarrated evaluation of a radiograph or silently observing the calculation of a GCS score. Therefore, for certain cognitive skills, the visualization step is not performed.

CHALLENGES WITH KNOW, SEE, SAY-SAY, AND DO/REVIEW

- **Time Management:** Progressing through all the steps of skill instruction appears time-consuming from the Instructor's perspective. However, providing repetitions of proper performance creates a stronger and accurate model of the task. Thus, time invested in initial instruction is less than the time spent in error correction. From a functional neurology perspective, it is easier to create accurate motor pathways and mental imagery during initial exposure than it is to break inaccurate models to subsequently create the correct image.
- **Learner Reluctance to Participate:** Some learners are inhibited by more technically proficient participants. Such a learner might benefit from a reminder that all were novices at some time. Encourage practice and reward attempts. Avoid overdetailed correction. Remind the groups that all must complete the procedure. Be prepared to inform the Course Director if additional practice and remediation is suggested
- **Talkative - not doing - Learner:** Some learners may over-discuss nuances of the procedure. Be prepared to focus on the specific ATLS task without engaging in a tangential discussion.

MAINTAINING COMPETENCE

Practice is necessary to maintain proficiency. However, the exact frequency and intensity of maintenance skill practice, booster training, and refresher training in medicine is not precisely known and varies based upon individual experiences. Mental rehearsal and video-based review, which can now be delivered at the bedside, may assist in recall.

THE ATLS SCENARIO-BASED SKILLS STATIONS

The main purpose of the Skills Station is to teach psychomotor and cognitive skills. Every learner must practice and receive feedback (correction and reinforcement). Consistent with other ATLS Course components, Skills Stations are scenario-based to help the learner anchor techniques to a realistic situation. Rather than being learned in isolation, the ATLS skills are integrated into a clinical practice situation. This assists with the development of a mental image for the skill. To ensure learning objectives are met, pre-course planning and application of environment, set, dialogue, and closure are required.

ENVIRONMENT, SET, DIALOGUE, AND CLOSURE IN ATLS SKILLS STATIONS

As mentioned in Chapter 3, facilitating the Skills Stations involves the ATLS structure of environment, set, dialogue, and closure. This approach provides instructional organization and focuses the facilitator on task instruction specific to each learner.

- **Environment**

  The Instructor must be thoroughly familiar with the scenarios and how they relate to the stations' objectives. An appropriate physical environment includes having all necessary equipment as listed in the manual; ability of all learners to see the Instructor, video screens, and task trainers; and the ability for all learners to adequately hear the facilitator.

- **Set**

  The set for skills training occurs in the first few minutes of the station. The Instructor clearly articulates the goal of the station, the importance of maintaining a hands-on approach, and performs a brief needs assessment of the learner's experience with the planned skills. This assessment aids the Instructor in determining the learner's pre-existing skill proficiency. Prior to presenting the first scenario, the facilitator explains that each learner will have primary responsibility in a scenario and informs learners that each is expected to interact.

- **Dialogue**

  Through use of stimulus questions within a scenario, the facilitator guides the participants in assessment and management of the patient. Specific to each Skills Station, the scenarios unfold in discrete steps and rapidly arrive at a stage where the best treatment decision involves a procedure. At this point, dedicated procedural instruction occurs, focused on the specific skill(s) that are indicated in the treatment of the proposed patient. Using know, see, say-say, and do/review, the Instructor leads participants in acquiring the indicated skill, performed in the ATLS-recommended manner. The facilitator observes each learner's performance, provides correction and reinforcement, and ensures all learners actively participate.

  Once every participant has completed all instructional stages for the indicated task, the scenario continues until conclusion, or a different intervention is identified. The pattern of case progression, identification of a skill-based intervention, and acquisition of that skill repeats until scenario conclusion. Multiple scenarios may be required until the facilitator guides the participants in acquisition of every skill that is planned for the station.

- **Closure**

  The Instructor encourages reflection by asking the participants to self-critique, give feedback to each other, and discuss what was accomplished in the session. The Instructor provides feedback about learners' performance and summarizes the major objectives covered during the station.

PSYCHOMOTOR SKILL INSTRUCTOR HELPERS

Due to prior educational and clinical experiences, some learners may arrive at the ATLS Course with existing mastery of ATLS psychomotor skills—demonstrating a degree of competency in some or all of the procedures—for example anesthesia personnel and airway procedures. Other learners may have had limited educational and clinical experiences with the same skills, perhaps never having had opportunities to achieve competency in certain areas. It is necessary, as part of the educational experience of the ATLS Course, that all participants practice and demonstrate all required skills in all Skills Stations. If some learners have already achieved competency prior to the ATLS Course, their roles in the ATLS Skills Stations may be as "Instructor helpers," as long as the Instructor is confident that they have achieved an appropriate degree of skills mastery and are able to demonstrate skills in a fashion consistent with "the ATLS way". If an "Instructor helper" is utilized, the ATLS Instructor must observe each learner sufficiently to provide an accurate evaluation.

INSTRUCTOR RESPONSIBILITIES

Instructors must present the interactive Skills Stations with care and preplanning. It is the Instructor's responsibility to ensure that all learners are taught the core procedures within the time allocated. Facilitators need to be careful that the Skills Stations do not become a mini-lecture or a question-and-answer session rather than a "doing" Skills Station. Instructors should focus on learner performance of the procedures. Effective skill teaching in an ATLS Course requires that the Instructor:

1. Understands the objectives of the station as defined in the ATLS Faculty Manual and performs the skills "the ATLS way"
2. Be familiar with the unfolding case scenarios, stimulus questions, and skills that are required by all learners
3. Understands which tasks employ motor skills and which employ cognitive skills that may omit the visualization ("see") step of skill instruction
4. Be very familiar with all equipment at the station and organize equipment to facilitate effective teaching within the clinical scenarios
5. Practices skills and time management
6. Performs a brief learner needs assessment
7. Presents the station in an organized and cohesive manner utilizing environment, set, dialogue, and closure
8. Does not allow the station to become a discussion station or a lecture with little or no learner action
9. Talks less than one-fifth of the time and facilitates interactivity with the learners through the scenarios and their relationship to ATLS core knowledge
10. Provides adequate opportunity for every learner to practice each required skill at the station
11. Observes and fairly evaluates each learner's performance while providing formative feedback

VIRTUAL PSYCHOMOTOR TRAINING

A full review of remote/virtual psychomotor skill training is beyond the scope of the ATLS Instructor Course and this manual. Investigation of these exciting new techniques is continuing and has accelerated due to the COVID-19 pandemic. Remote and virtual training for some skills is feasible specially in the first two steps of acquisition of psychomotor skills: Conceptualization and Visualization. It becomes quite more challenging for the Verbalization, Practice and Feedback, where the "in-person" teaching and learning experience for both the learners and Instructors is difficult to replicate. It is important to note that the educational program must remain adherent to stepwise instruction, specifically including practice and feedback (do/review).

- **Conceptualization, Know**

  This step has been effectively adopted to a virtual/remote platform and currently exists within the ATLS app, MyATLS.

- **Visualization, See**

  Adaptation of this step is feasible. However, the quality and accuracy of multimedia demonstrations remains variable. While multimedia demonstration of ATLS procedures can be located in the public domain, such multimedia may not provide high audio and video quality. Instructors need to carefully review this material. Personal protective equipment (PPE) and safety measures may not be modeled. ATLS-recommended procedural steps may not be followed. Beneficial multimedia must demonstrate the procedure from multiple angles.

- **Verbalization, Practice, and Feedback**

  These are the most resource-intensive steps to adopt virtually; therefore at present, these steps should continue to be taught in person. As mentioned before, the skills can be reinforced with live repetition, instant correction where needed, and direct live feedback from the Instructor.

CHAPTER SUMMARY

Provision of well-performed and appropriately sequenced resuscitation and evaluation skills is essential for optimal care of the injured patient. The ATLS Course incorporates instruction of these procedures within a scenario-based training format. Skills Stations are organized with environment, set, dialogue, and closure. Stepwise task instruction, utilizing a know, see, say-say, and do/review structure, is an evidence-based method to maximize skill acquisition supported by functional neurology and educational psychology. It is the obligation of the ATLS Instructor to employ thoughtful planning, understanding of motor learning, assessment of the learner's current proficiency, and a structured approach to facilitate effective and efficient psychomotor and cognitive skill acquisition. To successfully complete the ATLS Course, the learner must effectively accomplish each task. It is the Instructor's responsibility to complete an accurate, fair assessment of each learner's performance in each Skills Station.

REFERENCES

1. Foley RP, Spilansy J. *Teaching Techniques—A Handbook for Health Professionals*. New York, NY: McGraw Hill; 1980:71–91.
2. Sawyer T, White M, Zaver P, Chang T, Ades A, French H, Anderson J, Auerbach M, Johnston L, Kessler D. Learn, see, practice, prove, do, maintain: An evidence-based pedagogical framework for procedural skill training in medicine. *Acad Med.* 2015;90(8):1025-1033.
3. Dreyfus SE, Dreyfus HL. *A Five-Stage Model of the Mental Activities Involved in Directed Skill Acquisition*. Operations Research Center, University of California, Berkeley; 1980.
4. Dreyfus SE, Dreyfus HL. *Mind over Machine*. New York, NY: Free Press; 1986.
5. Simpson E. *The Classification of Educational Objectives in the Psychomotor Domain: The Psychomotor Domain. Vol. 3.* Washington, DC: Gryphon House; 1972.
6. DaRosa DA, Zwischenberger JB, Meyerson SL, et al. A theory-based model for teaching and assessing residents in the operating room. *J Surg Ed*. 2013;70:24-30.
7. Sousa DA. *How the Brain Learns*. Fourth Edition. California: Corwin;2011.
8. Uemura M, Tomikawa M, Kumashiro R, Miao T, Souzaki R, Ieiri S, Ohuchida K, Lefor AT, Hashizume M. Analysis of hand motion differentiates expert and novice surgeons. *J Surg Res*. 2014;188(1):8-13.
9. Nemani A, Yücel MA, Kruger U, Gee DW, Cooper C, Schwaitzberg SD, De S, Xavier Intes. Assessing bimanual motor skills with optical neuroimaging. *Sci Adv.* 2018;4(10):eaat3807.

10. Pascual-Leone A, Dang N, Cohen LG, Brasil-Neto JP, Cammarota A, Hallett M. Modulation of muscle responses evoked by transcranial magnetic stimulation during the acquisition of new fine motor skills. *J Neurophysiol*. 1995;74:1037–1045.
11. Karni A, Meyer G, Jezzard P, Adams MM, Turner R, Ungerleider LG. Functional MRI evidence for adult motor cortex plasticity during motor skill learning. *Nature*. 1995;377(6545):155-158.
12. Shadmehr R, Holcomb H. Neural correlates of motor memory consolidation. *Science*. 1997;277(5327):821-825
13. Dunphy BC, Williamson SL. In pursuit of expertise. Toward an educational model for expertise development. *Adv Health Sci Educ Theory Pract*. 2004;9(2):107-127.
14. Kirschner PA, Sweller J, Clark RE. Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educ Psychol*. 2006;41(2):7586.
15. Clark RE, Kirschner PA, Sweller J. Putting students on the path to learning: The case for fully guided instruction. *Am Educ*. 2012;36(1):611.
16. Romero P, Günther P, Kowalewski KF, Friedrich M, Schmidt MW, Trent SM, De La Garza JR, Müller-Stich BP, Nickel F. Halsted's "See One, Do One, and Teach One" versus Peyton's Four-Step Approach: A randomized trial for training of laparoscopic suturing and knot tying. *J Surg Educ*. 2018;75(2):510-515. doi: 10.1016/j.jsurg.2017.07.025. Epub 2017 Aug 8.
17. Grantcharov TP, Reznick RK. Teaching rounds: Teaching procedural skills. *Br Med J* 2008;336(7653):1129-1131.
18. Zamani M, Nasr-Esfahani M, Forghani M, Sichani MA, Omid A. Endotracheal intubation training to medical practitioners: Comparison of the modified 4-step Payton's training method and Halsted's training method in a simulated environment. *J Educ Health Promot*. 2020;9:126.
19. Kneebone RL. Twelve tips on teaching basic surgical skills using simulation and multimedia. *Med Teach*. 1999;21(6):571-575. doi: 10.1080/01421599978988.
20. Nicholls D, Sweet L, Muller A, Hyett J. Teaching psychomotor skills in the twenty-first century: Revisiting and reviewing instructional approaches through the lens of contemporary literature. *Med Teach*. 2016;38(10):1056-1063.
21. Ericsson KA. Deliberate practice and the acquisition and maintenance of expert performance in medicine and related domains. *Acad Med*. 2004;79(10 Suppl):S70-S81.
22. Walker M, Peyton J. *Teaching in Theatre. Teaching and Learning in Medical Practice*. Rickmansworth: Manticore Europe Limited; 1998:171-180.
23. George JH, Doto FX. A simple five-step method for teaching clinical skills. *Fam Med*. 2001;33(8):577-578.
24. Giacomino K, Caliesch R, Sattelmayer KM. The effectiveness of the Peyton's 4-step teaching approach on skill acquisition of procedures in health professions education: A systematic review and meta-analysis with integrated meta-regression. *Peer J*. 2020;8:e10129.
25. Krautter M, Dittrich R, Safi A, Krautter J, Maatouk I, Moeltner A, Herzog W, Nikendei C. Peyton's four-step approach: Differential effects of single instructional steps on procedural and memory performance - a clarification study. *Adv Med Educ Pract*. 2015;6:399-406.
26. Münster T, Stosch C, Hindrichs N, Franklin J, Matthes J. Peyton's 4-Steps-Approach in comparison: Medium-term effects on learning external chest compression - a pilot study. *GMS J Med Educ*. 2016;33(4):Doc60.
27. Greif R, Egger L, Basciani RM, Lockey A, Vogt A. Emergency skill training--a randomized controlled study on the effectiveness of the 4-stage approach compared to traditional clinical teaching. *Resuscitation*. 2010;81(12):1692-1697.
28. Schmidt MW, Trent SM, De La Garza JR, Müller-Stich BP, Nickel F. Halsted's "See One, Do One, and Teach One" versus Peyton's Four-Step Approach: A randomized trial for training of laparoscopic suturing and knot tying. *J Surg Educ*. 2018;75(2):510-515. doi: 10.1016/j.jsurg.2017.07.025. Epub 2017 Aug 8.
29. Krautter M, Weyrich P, Schultz JH, Buss SJ, Maatouk I, Jünger J, Nikendei C. Effects of Peyton's four-step approach on objective performance measures in technical skills training: A controlled trial. *Teach Learn Med*. 2011;23(3):244-250.
30. Ruesseler M, Tomczak M, Thrun M, Pfau S, Marzi I, Sterz J. The influence of the instructional approach on acquiring clinical skills in surgery: A comparative effectiveness study. *J Surg Educ*. 2019;76(1):140-149. doi: 10.1016/j.jsurg.2018.07.008. Epub 2018 Aug 16.
31. Nikendei C, Huber J, Stiepak J, Huhn D, Lauter J, Herzog W, Jünger J, Krautter M. Modification of Peyton's four-step approach for small group teaching - a descriptive study. *BMC Med Educ*. 2014;14:68. doi: 10.1186/1472-6920-14-68.
32. Iacoboni M, Woods RP, Brass M, Bekkering H, Mazziotta JC, Rizzolatti G. Cortical mechanisms of human imitation. *Science*. 1999;286(5449):2526-2528.
33. Buccino G. et al. Action observation activates premotor and parietal areas in a somatotopic manner: An fMRI study. *Eur J Neurosci*. 2001;13:400-404.
34. Leppink J, Heuvel A. The evolution of cognitive load theory and its application to medical education. *Perspect Med Educ*. 2015;4:119–127.
35. Schwerdtfeger K, Saskia W, Schmid O. A prospective, blinded evaluation of a video-assisted '4-stage approach' during undergraduate student practical skills training. *BMC Med Educ*. 2014;14(1):104.
36. Post PG, Aiken CA, Laughlin DD, Fairbrother JT. Self-control over combined video feedback and modeling facilitates motor learning. *Hum Mov Sci*. 2016;47:49-59.
37. Wilson MR, Vine SJ, Bright E, Masters RS, Defriend D, McGrath JS. Gaze training enhances laparoscopic technical skill acquisition and multi-tasking performance: a randomized, controlled study. *Surg Endosc*. 2011;25(12):3731-3739.
38. Gidley Larson JC, Suchy Y. The contribution of verbalization to action. *Psychol Res*. 2015;79(4):590-608.

39. Skrzypek A, Górecki T, Krawczyk P, Podolec M, Cebula G, Jabłoński K, Szeliga M, Nowakowski M. Implementation of the modified four-step approach method for teaching echocardiography using the FATE protocol-A pilot study. *Echocardiography*. 2018;35(11):1705-1712. doi: 10.1111/echo.14128. Epub 2018 Aug 26.
40. Anderson A. Learning strategies in physical education: Self-talk, imagery, and goal-setting. *J Phys Educ Recreat Dance*. 1997;68:30–35.
41. Hanakawa T, Dimyan MA, Hallett M. Motor planning, imagery, and execution in the distributed motor network: a time-course study with functional MRI. *Cereb Cortex*. 2008;18(12):2775-2788.
42. Ruffino C, Papaxanthis C, Lebon F. Neural plasticity during motor learning with motor imagery practice: Review and perspectives. *Neuroscience*. 2017;341:61-78.
43. Wallace L, Raison N, Ghumman F, Moran A, Dasgupta P, Ahmed K. Cognitive training: How can it be adapted for surgical education?. *Surgeon*. 2017;15(4):231-239 doi:10.1016/j.surge.2016.08.003.
44. Collet C, Hajj ME, Chaker R, Bui-Xuan B, Lehot JJ, Hoyek N. Effect of motor imagery and actual practice on learning professional medical skills. *BMC Med Educ*. 2021;21(1):59. Published 2021 Jan 18. doi:10.1186/s12909-020-02424-7.
45. Ericsson KA. Deliberate practice and the acquisition and maintenance of expert performance in medicine and related domains. *Acad Med*. 2004;79(10 Suppl):S70-S81.
46. Sadideen H, Alvand A, Saadeddin M, Kneebone R. Surgical experts: Born or made?. *Int J Surg*. 2013;11(9):773-778. doi:10.1016/j.ijsu.2013.07.001.

7



Formative Feedback and Feedforward as Booster for Learning

OBJECTIVES By the end of this chapter, you will be able to:

1. Define feedback and feedforward.
2. Reflect on the impact you can have on student learning by providing constructive feedback and feedforward.
3. Describe the elements of the Acceptable, Balanced, Constructive, Doable (ABCD) feedback mnemonic for formative feedback in ATLS.
4. Reflect on potential reasons for students struggling with receiving feedback.



7 Formative Feedback and Feedforward as Booster for Learning

CHAPTER STATEMENT

Research shows that feedback is critical for learning. In an ATLS® Course, well-delivered feedback can boost participants' motivation, learning, and performance. As an Instructor, you have a crucial role in providing constructive feedback, especially during Skills Stations and scenario-teaching sessions. Herein, we provide generic principles of effective and appropriate feedback. We add the concept of *feedforward* to feedback as the combination of both will account for a developmental impact on learning after each learning experience.[1] We translate basic principles to practical application within the context of ATLS.

WHAT IS FEEDBACK?

Van de Ridder (2008)[2] provided an operational definition of feedback: "Specific information about the comparison between a trainee's observed performance and a standard, given with the intent to improve the trainee's performance."[2] The feedback described in this chapter is formative as the main focus is on supporting learning. In the chapter on assessment, we will further elaborate on the importance and difference between formative and summative feedback.

Constructive formative feedback helps the learners to:

- Achieve the overall learning goals in ATLS
- Achieve specific learning goals for each session in ATLS
- Reinforce strengths in performance, as this is proven to be effective in developing skill mastery
- Provide specific guidance for further development and improvement wherever necessary
- Gain insight into their own level of competence, compared to the course standards
- Self-evaluate growth during the ATLS Course, with the summative assessment criteria as the reference point

Initially, studies on feedback mainly focused on how to provide feedback, with a variety of feedback models like the Feedback Sandwich or Pendleton's Rules as a result. In more recent research, the importance of the role of the feedback receiver and the context of feedback became clearer. Also, concepts like differences in students' feedback-seeking behavior and the credibility of the person providing the feedback were explored. Overall, this led to a shift to more learner-centered feedback approaches in which learners actively participate to collect information they can use to enhance their subsequent performance. When delivered well, feedback improves learners' skill sets and helps to establish a lifelong learning attitude. In a literature review, Crommelinck[3] concluded that feedback-seeking behavior is valuable for individuals in work and educational settings as it aids their adaptation, learning, and performance.

FORMATIVE FEEDBACK AND FEEDFORWARD IN ATLS

In an ATLS Course, formative feedback is mainly required and provided during the Skills Stations and in the scenario-teaching sessions. In these stations, formative feedback can be provided in two cases:

- While the student practices the skill or treats the moulage patient in an Initial Assessment Station
- After the student has performed the skill or scenario

In the first situation, also referred to as "feedback in action" or "feedback on the run", feedback should be very brief and neutral in wording, to maintain flow and to avoid cognitive overload. The chapter on skills teaching contains more background on the neurobiological processes behind this recommendation.

The second situation is often also referred to as debriefing or "reflection on action." Here the ATLS student and Instructor explicitly break down and look back on the performance, aiming to identify the main take-home learning points for the student to use when faced with similar cases in the future. "Looking forward" is also reflected in the concept of "feedback and feedforward". In feedforward, the focus is coming to an action plan to strengthen and develop clinical performance in the future. To keep it legible, we will use feedback as a concept in the remainder of the chapter, meaning this includes feedforward as well.

There are numerous studies on feedback principles which can be overwhelming for those who have not been regularly involved in feedback discussions with learners. Therefore, the challenge is to summarize and translate the literature into principles that should be regarded and used as standards for Instructors when guiding and providing feedback in the context of ATLS.

Recently, Johnson (2021)[4] described a study on the development of a feedback-quality instrument for clinical workplace learning. As part of this study, they identified 25 items essential for a clinical good-quality instructor to provide -q feedback. Johnson and her colleagues clustered these items into five domains that can be helpful in the context of ATLS as well:

1. Set the scene
2. Analyze performance
3. Plan improvements
4. Foster learner agency
5. Foster psychological safety

Fostering psychological safety and learner agency refers to essential principles to be aware of and "live by" by all ATLS faculty members to create the optimal environment for learning from feedback. We refer to the entire faculty deliberately, as consistency in this approach in all formal and informal sessions in a course is key. By doing so, ATLS faculty put into practice what was described earlier as one of the principles for ATLS Instructors, that is to "walk with the learner". *Setting the scene* refers to elements to

be included in the SET of a practice session, whereas *analyzing performance and planning for improvements* refers to actions an Instructor can take to guide the feedback and feedforward process during the DIALOGUE of skills—or scenario-teaching sessions. Below we will translate and adapt these principles and actions to the specific context of an ATLS Course.

ESSENTIAL PRINCIPLES TO SUPPORT A 'LEARNING FROM FEEDBACK' ENVIRONMENT

■ **Figure 7-1:** Essential Principles to Support a "Learning from Feedback" Environment.

To foster psychological safety in feedback, all ATLS faculty should:	Practice fostering psychological safety while providing feedback by:
Value the learner(s)' perspective	Exploring the learners' perspective and reasoning and demonstrating active listening
Appreciate the learner(s)' contribution	Expressing appreciation for the learner(s)' contribution
Expect mistakes and regard them as learning opportunities	Conveying the view that mistakes and omissions are expected while developing skills, and that they provide opportunities to continue refining skills
Respect the principle that a safe and respectful feedback environment includes: • Careful timing of feedback • Feedback being based on direct observation	**Timing:** • Providing feedback as soon as possible after the learner's performance and by that, providing them with the opportunity to use the feedback in subsequent sessions as soon as possible • Deciding whether some feedback might need to be shared in a 1-to-1 conversation and not in a group (for example, if a learner responds defensively, or persists in disputing ATLS principles) **Direct observation:** To make feedback safe, acceptable, and credible to the feedback receiver, it is crucial that feedback is based on direct observation by the Instructor of the current task at stake. Although this is the case in most practice sessions in ATLS, it is important to keep this in mind and avoid situations where the learner is faced with "hearsay feedback" from other stations or an Instructor commenting on elements of the performance that were not completely or correctly observed.
Respect learner(s)' autonomy	Encouraging the learner to take a turn to lead in the feedback conversation, state their opinion or preference, or contest the Instructors' comments for the purpose of learning
Show compassion	Expressing compassion for differences experienced during training, raised by the learner
Attend to learner(s)' emotion	Responding appropriately to emotions expresses by the learner(s)
Show humility and recognize own limitations	Conveying the view that everyone has limitations, including themselves, such as acknowledging one's own limitations; routine uncertainty during clinical practice when beyond own specialty; own evaluation/opinion contestable; mistakes made while learning; or general limitations like "always more to learn" or "a common mistake"
Value learner(s)' perspective	Encouraging discussions in which both perspectives (learner and Instructor = novice and expert) are shared and thoughtfully responded to
Advocate for the value of self-assessment	Promoting the value of self-assessment with the learner(s)
Encourage the learner(s) to focus on learning rather than trying to cover up limitations	Encouraging the learner(s) to discuss difficulties and ask questions regarding the performance so the Instructor can help the learner to develop solutions
Support learner(s) to "work it out for themselves"	Encouraging the learner to consider the issues and possible solutions discussed in the feedback session

HOW TO GUIDE A FEEDBACK AND FEEDFORWARD SESSION

■ **Figure 7-2:** How to Guide a Feedback and Feedforward Session.

Set the Scene	Expected Behaviors	ATLS Examples
Including the actions below in the SET of the practice session, for and with all participating learners. As the Instructor you should do the following:		
Clarify the purpose of the feedback/debriefing after each performance.	Explaining that the purpose of feedback is to help the learners to improve their performance (on a specific skill set, or in applying xABCDE principles in a patient scenario) and how the feedback will be discussed.	Emphasizing this idea if a learner is very nervous to get started as she/he has very limited clinical experience.
Discuss the session plan so learners know what to expect.	Discussing expectations for the feedback session, taking the learners' perspective into account. May include time available, role of other participants, and so on.	Be specific regarding how many minutes have been allocated for each participant, if there's a particular order you would like to follow, and ensure everyone knows they are required to participate.
Seek learners' priorities.	Exploring what each learner in the group most wants to raise in the feedback session after they performed their skills/scenario.	Using this as the leading question before the practice so the Instructor can focus their attention on observing the element(s) that each learner wants feedback on.
Analyze performance: feedBACK **AFTER an individual learner performed a skill (set) or patient scenario:**		
Invite the performing learner and other participants to step away from the skills setting or moulage patient/model/ task trainer.	Choosing another place in the room to physically 'step away' from actual performance in the skill or scenario is important. Although everyone knows it's a simulated context, to some it feels so new and realistic that it requires an explicit step away to be able to 'open up' for reflection and feedback.	Placing chairs for all participants for the debriefing (as part of your preparation of the environment for this session).
Clarify target performance and reasoning.	Clarifying key features of the target performance with the learner and explaining the reasoning.	Linking to main goal of a specific skill or of xABCDE as a structured way to treat a trauma patient.
Stimulate learner self-assessment.	Encouraging the learner to identify key similarities and differences between the learners' performance and target performance.	"'Breaking down" a learner's performance into "OK, so now let's look back on what happened in A".
Share performance analysis.	Clarifying with the learner similarities and differences between the learners' performance and target performance. Consider focusing on the "development zone" around the learner's current position on the learning curve.	Adjusting the level of feedback to the level of clinical experience. With a less-experienced learner, the focus of the feedback will merely be on stimulating consistency and confidence in the early steps of familiarization with the structured xABCDE approach. A very experienced refresher candidate can profit more from the learning opportunities within an ATLS Course when faced with more complex questions. An example is "and what if …", after which the feedback may be focused more on sharing additional tips and tricks for more complicated cases.

Set the Scene	Expected Behaviors	ATLS Examples
Prioritize comments.	Focusing on a few key points for improving performance including strong points, as emphasizing these too are essential in the process of acquiring or refreshing (new) skills.	Selecting from all potential feedback points: 2-3 key "strength" points and 2-3 key points that would allow for the greatest improvement. Biggest difference to improve next time. Skip all others for now, so as not to overload the learner with the chance that the feedback will not be used. If in doubt, use ATLS goals and principles as golden standard to select what is key.
Clearly phrase feedback.	Explaining feedback and reasoning clearly.	Be SPECIFIC in your feedback, by: "Rewinding the movie": explicitly referring to a specific instance or action during his or her performance and checking whether the learner can recall the situation. Linking feedback to a neutral description of what a learner did: (lack of) action, decision, behavior, or verbalized (option: use quotes) and the consequences if this would happen in reality. Note: Focus on actions, not personal characteristics ("did," not "is").
Plan future actions: feedFORWARD		
Help learners in selecting learning priorities.	Helping learner to select a few, key aspects of the performance to improve (consider learners' requests, or key mistakes of omissions, or next steps).	Ensure this goes beyond generalized remarks such as "I think I'll have to better follow the steps in the skill" or "I want to incorporate this ABCD approach more when I do scenarios like this."
Help learner to develop action plan including how to review their progress.	Helping learner to select specific and practical actions to improve their performance next time and review their progress.	Specifically ask: "Okay, so what do you need/are you going to do to bring this to the next level?" Replies might be relevant in a next Skills Station, next patient scenario, or even after the course, in clinical practice.
Check action plan related to learning goals and whether rationale understood.	Asking the learner to summarize outcomes of this feedback session in their own words.	Specifically ask: "What are your 2-3 take-home points?"

THE ABCD FOR FORMATIVE FEEDBACK IN ATLS

To make it easier for Instructors to remember and apply the most important feedback principles during a course, the Senior Educator Advisory Board (SEAB) developed the ABCD feedback mnemonic for formative feedback in ATLS. Formative feedback in ATLS should be:

A	**Acceptable**	Timely, on task (not person), related to ATLS goals, based on direct observation
B	**Balanced**	Provide maximum of 2-3 key strong points and 2-3 key points (leave the rest)
C	**Constructive**	Aimed at learning for similar cases in the future
D	**Doable**	Specific, feasible within context, adjusted to the level of clinical experience

ON FEEDBACK MODELS IN ATLS

As mentioned before, a series of models for providing feedback has been developed over time. None of these models can claim to be the best; what fits and works, depends on educational goals, context (e.g., time available, Instructor feedback skills), and feedback culture. SEAB acknowledges that in a worldwide program like ATLS, educational contexts and most certainly feedback cultures will differ. SEAB strongly promotes adherence to the basic principles described above. It is the application of these principles that can make or break the learning effect, not the models as such.

A dialogic feedback conversation model between an Instructor (expert) and student (novice), for example, will be common practice in medical education in some, but certainly not all regions and cultures around the world. Furthermore, this approach requires more complex observation and feedback skills. Therefore, we will describe the Pendleton's model for feedback as well, as this may be more suitable in contexts where people are not used to or have less experience in giving and receiving feedback.

Dialogic Feedback Conversation (also described as "learning conversation")

1. If necessary: let student "blow off steam."
2. Start student self-reflection with a question such as "So, let's look back on your performance while managing this patient. How do you think that went?"
3. Follow up with "What is the key issue you'd like to discuss first?"
4. Discuss the issue "closest at heart to the student."
5. Identify (student first) and discuss 1-2 strong points and 1-2 key points to improve upon to take as learning points for similar, future cases.
6. Link to individual learning goals, if possible (identified by the student before their performance).
7. Invite the learner to briefly summarize the key learning points to take forward to the next performance (within context of the course or in clinical practice).

PENDLETON'S MODEL FOR FEEDBACK

There is a variety of descriptions of the Pendleton's rules, with the following as the basic structure:

1. Let performing students "blow off steam."
2. Invite the performing student to identify two main points that went well, according to their initial plan (if applicable).
3. Reinforce points that you as an Instructor identified as strong points as well (without elaborating too long; correct points identified by the learner themself are powerful enough).
4. Add a maximum of 2 strong, specific points based on your observation of the performance if they really add up to the self-identified learning points in step 3. (If you are in a group of students, involve peers in this process first, as observing and giving adequate feedback is a meaningful learning experience for them too. Make sure they do focus on the main and strong points too.)
5. Invite the performing student to identify two main points that could be improved or done otherwise the next time.
6. Reinforce points you as an Instructor identified as points to improve upon or do differently (without elaborating too long; main points identified by the learner themself are powerful enough).
7. Add a maximum of 2 specific points to improve upon for the future, based on your observation of the performance. (If you are in a group of students, involve peers in this process first as observing and giving adequate feedback is a meaningful learning experience for them too. Make sure they do focus on the main points too as well.)
8. Ask the performing student to summarize what they take as the main learning points from this practice session.

The choice of a feedback approach and model is a topic to discuss and decide upon at a regional or national level. Input from Educators and Course Directors from ATLS Courses should be involved to ensure the transfer to ATLS faculties as well. Whatever model they choose, is up to them. As stated, it is most important that all use the feedback principles described in the previous section as a standard for feedback in their ATLS Courses.

Guiding a feedback dialogue is definitely a complex task for an Instructor which needs practice and feedback from others. The reference list at the end of this chapter includes articles on the complexity of providing feedback and future directions in theories and research on feedback-related topics. Do not hesitate to contact your Regional/National Educator and/or SEAB if you are looking for extra background information and good practices.

RECEIVING FEEDBACK... NOT ALWAYS EASY

Receiving feedback is not always easy; being in a demanding course context like in ATLS, where passing the exam often is required for duties in clinical practice, puts people under pressure. For some, this works as a stimulus, while others struggle with being open to feedback and change. What we know from the literature is that almost all people deep down feel insecure and somewhat vulnerable when faced with new groups, experienced experts, new skill sets to master, and high standards to meet. These often unconscious feelings have an impact on initial learning experiences. Feedback, especially during the first sessions in a course, can

make or break these experiences and in response, the openness to feedback during the rest of the course. Providing a constructive learning climate right from the beginning of the course, followed by constructive feedback during all subsequent course sessions is an essential role for the course faculty in order to encourage students to be willing and able to step out of their comfort zone, and be open to learning and feedback.

Yet, despite all attempts to deliver feedback in a constructive way, some people might find it difficult to receive feedback. As an Instructor, it is important to be alert to signals indicating an individual is not open to feedback (yet). Students may show this in a variety of ways:

- Avoiding participation in feedback situations
- Passively listening to the feedback provided
- Showing emotional responses (e.g., arguing with the Instructor, "this is not how it works in real practice")
- Having emotional responses like anger, shame
- Other, more implicit signs of resistance

It is important for ATLS Instructors to reflect on these signals as related to the task and process of feedback and not to you as a person, nor to the student "just being difficult". In most cases, keeping calm and carrying on, using a constructive open approach in reframing the feedback, referring to the common ATLS goals and adjusting the level of feedback to the concerns at the learners' proficiency level, helps to overcome most barriers in receiving feedback. If necessary, a short conversation during a break with a cup of coffee sometimes, does the trick to finding out from where the students' behavior stems. In exceptional cases, where a student repeatedly responds defensively or in another negative way to feedback, consulting the Course Director is encouraged.

CHAPTER SUMMARY

Providing constructive feedback and feedforward is an essential role of ATLS Instructors. It is important to set guidelines for the use of feedback when you set the scene for feedback, analyze performance, help the learner plan improvements, foster learner agency, and promote psychological safety in the skills and scenario teaching. To make it easier to remember the most important feedback principles, keep in mind the ABCDs for formative feedback in ATLS: Acceptable, Balanced, Constructive, Doable. Be alert to signals provided by students who are not open to feedback (yet) and maintain an open approach in handling these situations.

REFERENCES

1. Shrivastava SR, Shrivastava PS. Scope of feedforward in medical education and the role of teachers. *Current Medical Issues*. 2021;19(1):60-61. doi:10.4103/cmi.cmi_139_20.
2. Van De Ridder JM, Stokking KM, McGaghie WC, Ten Cate OT. What is feedback in clinical education? *Medical Education*. 2008;42(2):189-197. doi:10.1111/j.1365-2923.2007.02973.x
3. Crommelinck M, Anseel F. Understanding and encouraging feedback-seeking behaviour: A literature review. *Medical Education*. 2013;47(3):232-241. doi:10.1111/medu.12075.
4. Van De Ridder JM, Stokking KM, McGaghie WC, Ten Cate OT. What is feedback in clinical education? *Medical Education*. 2008;42(2):189-197. doi:10.1111/j.1365-2923.2007.02973.x
5. Johnson CE, Keating JL, Leech M, et al. Development of the Feedback Quality Instrument: A guide for health professional educators in fostering learner-centred discussions. *BMC Medical Education*. 2021;21(1). doi:10.1186/s12909-021-02722-8.

FOR FURTHER READING:

6. Lefroy J, Watling C, Teunissen PW, Brand P. Guidelines: The do's, don'ts and don't knows of feedback for clinical education. *Perspectives on Medical Education*. 2015;4(6):284-299. doi:10.1007/s40037-015-0231-7.
7. Telio S, Regehr G, Ajjawi R. Feedback and the Educational Alliance: Examining credibility judgements and their consequences. *Medical Education*. 2016;50(9):933-942. doi:10.1111/medu.13063.
8. Ramani S, Könings KD, Mann KV, Pisarski EE, van der Vleuten CPM. About politeness, face, and feedback: Exploring resident and faculty perceptions of how institutional feedback culture influences feedback practices. *Academic Medicine*. 2018;93(9):1348-1358. doi:10.1097/acm.0000000000002193.





8

Summative Assessment

OBJECTIVES By the end of this chapter, you will be able to:

1. Differentiate between formative and summative assessments in the ATLS Course.
2. Describe the principles of a fair, valid, and reliable assessment.
3. Reflect on the impact an assessor can have on validity and reliability.
4. Recognize the ATLS Course assessment requirements.
5. Identify the role of the ATLS Instructor as an assessor of Instructors Potentials (IPs).



CHAPTER STATEMENT

Prior to this chapter, the focus has been on the role of an Instructor as a facilitator of learning. However, within the ATLS® Course, the assessment of learning is just as important. Thus, it is important to have an understanding of both the principles of assessment to ensure fair, valid and reliable assessments, and the specific ATLS Course assessment requirements.

WHAT IS ASSESSMENT?

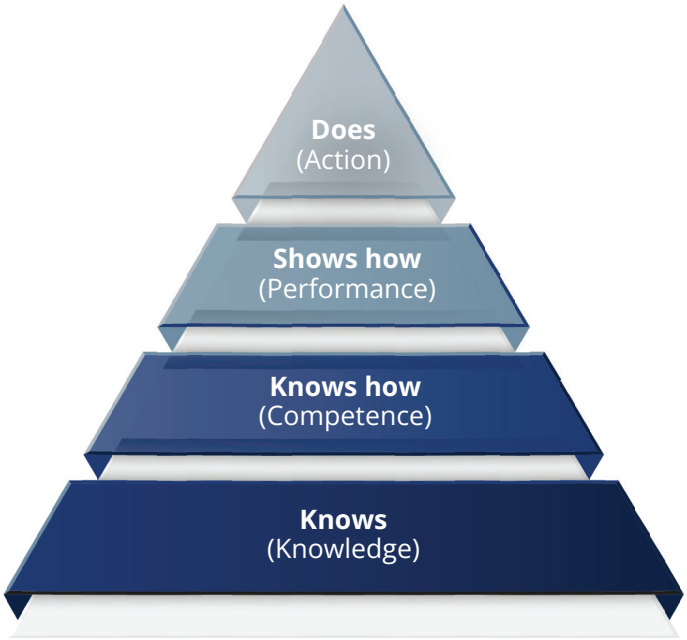
Assessment is defined as the "measurement of learning."[6] It requires the measurement of the learner's performance against defined standards. We know from the literature that assessment drives learning as learners will focus on areas of a course linked to assessment.[4]

There are two types of assessment commonly referred to in the literature:

- **Formative Assessment** – also referred to as an assessment for learning; refers to those assessments undertaken during a course of learning to provide the learner with feedback on their performance against the course goals to facilitate their learning. Feedback has been extensively discussed in the previous chapter on feedback.
- **Summative Assessment** – also referred to as an assessment of learning; refers to those assessments that occur at the end of a period of learning to judge whether a learner has met the required standard. Summative assessments ensure that the minimum standard has been met. **Table 8-1** summarizes the differences between the two types of assessments.

The ATLS Course has both formative and summative assessments throughout and we will identify each of these in more detail later in the chapter. You were introduced to Miller's Pyramid[3] in the Adult Learning Chapter. Assessment can occur at various levels of Miller's Pyramid.

■ **Figure 8-1:** Miller's Pyramid.[3]



Miller GE. The assessment of clinical skills/competence/performance. *Acad Med*. 1990; 63:S63–S67.

■ **Table 8-1:** Differences Between Formative Feedback and Summative Assessment.

		DIFFERENCES BETWEEN FORMATIVE FEEDBACK AND ASSESSMENT	
		FEEDBACK	ASSESSMENT
Shared Principles	Basis	Observation (subjective)	
	Content	Objectives, criteria, expected standards	
Different Principles	Timing	Timely, as soon as possible after performance	Scheduled
	Setting	Informal	Formal
	Scope	Specific knowledge, skill, or behavior	Overall performance
	Reference	Self	Peer-, norm-reference
	Purpose	Improvement of learning	Certify competence, grading, measuring performance

The ATLS Course measures at the "Knows," "Knows How," and "Shows How" levels of Miller's Pyramid. However, the "does" level is not within the scope of the ATLS Course and would need to be assessed when the learner is back in their workplace demonstrating the ATLS principles on real patients. Different assessment tools measure at different levels of Miller's Pyramid. For example, in the ATLS Course, the multiple-choice test assesses the Knowledge-"Knows"; the Skills Stations assess the Competence-"Knows How"; and the Initial Assessment summative test assesses the Performance at the "Shows How" level.

WHY DO WE ASSESS?

The purpose of assessment is to evaluate what learning has occurred and that the learning goals have been achieved. There are several reasons for assessing and these include:

- Drive learning.
- Measure competence.
- Diagnose gaps in participant knowledge, skills, or attitudes.
- Identify effective learning/teaching – are the course objectives being met?
- Provide participants with feedback.
- Measure improvement throughout the course.
- Make the program accountable; reassure the public that the participants have learned the ATLS skills.

It is therefore relevant that the assessments are implemented according to the course requirements which are outlined in this manual.

PRINCIPLES OF ASSESSMENT

It is important to revise the principles of assessment to ensure that ATLS assessments are fair, valid, and reliable. Learners need to be made aware of the assessment requirements of the course. This is necessary for a "fair" assessment. At the beginning of the course, the assessment requirements should be discussed, and learners allowed to ask any questions.

Three important principles of assessment are relevant to the ATLS Courses: validity, reliability, and bias.

- **Validity** refers to the inferences made from the assessment, not the test itself.[5] Validity is concerned with whether the assessment measures what it purports to measure. For example, if the assessment goal is to measure if a learner can do a skill, then the learner needs to demonstrate the skill, not just be able to know the steps of the skill. Validity can be enhanced by techniques such as blueprinting. In the ATLS Course, the multiple-choice questions are blueprinted against the content of the course to ensure breadth and depth of assessment. Validity can be adversely affected by technical flaws, such as spelling mistakes in a multiple-choice test, or incorrect clinical information provided in the Initial Assessment station.
- **Reliability** is another important concept which refers to the ability of an assessment to be replicated given the same or similar conditions. Reproducibility implies that a learner given the same test on two different occasions should get the same result. Reliability is affected by the consistency of applying the test. Interrater reliability refers to the consistency between two assessors (or raters), whereas intrarater reliability refers to the consistency that one assessor brings to the assessment of different learners. The clear marking criteria and standards in the ATLS assessment tools assist with interrater reliability as all assessors are marking according to clear criteria. However, as an individual ATLS Instructor your intrarater reliability is largely up to you and it is important to constantly reflect on your consistency and appropriate use of the assessment tools.
- **Bias** refers to a tendency to favor otherwise equivalent members of one class or group over another. Bias can be conscious or unconscious. Unconscious bias can be defined as "learned stereotypes that are automatic, unintentional, deeply ingrained, universal, and able to influence behavior".[1] There are some types of bias that can adversely affect the validity and reliability of an assessment. Examples of these include:[1,2]
  - **Stereotyping**—Involves forming generalized opinions about how a learner of a given gender, religion or race should appear, think, act, feel, or respond.
  - **First-impression error**—Forming early judgements or letting first impressions (either positive or negative) influence the entire assessment. A mistake or error by a learner early on can have an excessive influence on the conduct of the rest of the assessment and their overall mark.
  - **Halo/horn effect**—Allowing one strong point that is highly valued by the assessor to overshadow all other information. When this works in the learner's favor (positive impression) it is referred to as the halo effect and when it works against the learner (negative impression) it is referred to as the horn effect.
  - **Contrast effect**—Strong learners who are assessed after weak ones may appear even more skilled than they actually are due to the contrast. Every effort should be made to rate each learner against the stated criteria, not against each other.

As an assessor, it is important to be aware of your own biases and the potential for these to impact the assessment you conduct.

WHAT IMPACT CAN THE ASSESSOR HAVE ON THE VALIDITY AND RELIABILITY OF AN ASSESSMENT?

Assessors are a crucial element of the assessment process as they are the ones observing the learner's performance and making judgments against the standard. As an ATLS Instructor, you need to consider the potential impact you can have on the validity and reliability of an assessment within the course.

Table 8-2 outlines some of the potential impacts of Instructors on assessment and what you can do as an individual Instructor to avoid these pitfalls.

■ **Table 8-2:** Instructor Behavior and the Impact on Assessment.

	Instructor behavior	Potential impact on assessment outcome	What you can do as an individual ATLS Instructor
Prior to the course preparation	**Lack of familiarity with assessment forms**	Impact on reliability – if you don't know the assessment forms you can miss elements for one learner and not another (reliability) or not apply the criteria appropriately (validity).	Ensure you have familiarized yourself with all the assessment forms and the rating scale and criteria prior to your first course. If you have any questions, you should discuss with the Course Director.
	Lack of familiarity with expected standard (e.g., Hawk – tough and expecting a standard higher than what is required to pass the ATLS Course; or Dove – nice and everyone passes)	If you don't know the standard, then you can be tougher or more lenient with the marking, which again affects the validity and reliability.	It is important particularly for new Instructors to discuss the standard expected with more experienced ATLS Instructors.
During the course while assessing learners	**Inconsistency** – between how you apply the rating scale to individual learners and how you run the Initial Assessment station, such as giving more clinical cues to one learner compared to another	Reliability is affected if you are not consistent.	Use assessment forms to guide your focus and to have a more objective mindset.
	Bias – it is important as an assessor to critically evaluate your own performance to ensure that bias did not influence your ratings of a learner's performance	Reliability is affected if you show bias against one learner over another.	Being aware of bias is the first step in eliminating it from assessment decisions.
	Poor time management	Validity (if not all of the performance is observed due to your poor time management then the validity of the assessment is affected) and reliability is also affected (if you observe and assess more of one learner's performance than another's).	Ensure you are aware of the timing of each assessment element, and keep a close eye on the time. Course Coordinators may also be able to give you warning times (for example, 5 minutes to go).
	Nonverbal behavior – both positive and negative cues (such as frowning, smiling and nodding, sighing loudly)	An Instructor's behavior with nonverbal cues can affect the learner's performance. This is particularly so for the nervous participant who will pick up on any cue you give them. If you are frowning about something unrelated to the learner's performance, they may think they are underperforming and become more nervous, and their performance deteriorates.	Be aware of your nonverbal cues. Explain to the learner that you will be observing but not providing feedback during the scenario and will not be making a lot of eye contact. Try to maintain a neutral but pleasant demeanor.
	Verbal cues – promising an assessment outcome you can't assure (e.g., "you'll pass the test station with a performance like that")	The learner may become overconfident and underperform in the testing station – affecting their overall assessment.	Keep feedback specific to the performance as per the principles outlined in the feedback chapter. Ensure they know specifically what was done well and why, so that their performance can be reinforced. Avoid promising an outcome of assessment.

Remember that the assessment criteria have been developed by consensus of your peers and individual interpretation of criteria is not appropriate. If you disagree with the criteria, then you can provide feedback to the Course Director; however, at the time of the assessment, it is important to follow the criteria as documented. If you are unclear on anything in the assessment forms, you should clarify with the Course Director prior to the commencement of the course.

ASSESSMENT IN ATLS

As discussed previously, the ATLS Course has both formative and summative assessments. These are outlined in **Table 8-3**.

■ **Table 8-3:** Formative and Summative Assessments in ATLS.

Formative Assessments	Summative Assessments
• Pre-course multiple choice questions (MCQ) test • Interactive Discussions • Skills Stations • Initial Assessment patient scenario practice • Triage scenarios	• Post-course MCQ test • Skills Stations • Initial Assessment patient scenario practice

The Initial Assessment component of the course sees your role change from **facilitator** of learning in the practice station to **assessor** in the test station. In the practice station, you can provide guidance, coaching, and feedback (formative assessment). However, in the test station you need to be an assessor and objectively observe the learner's performance and mark this against each assessment criteria (summative assessment). The assessment forms will be shown to you in your Instructor Course as it is important to be familiar with these and to practice using them before your first ATLS Course. The following table (■ **Table 8-4**) illustrates the change in role from the practice station to the testing station.

■ **Table 8-4:** Practice vs. Testing Initial Assessment.

	Practice	Testing
Role of faculty	Coach and feedback provider	Assessor
Set	Explain teaching aspects	Explain assessment aspects
Dialogue	Provide information; prompt; correct mistakes	Provide information only as needed or requested; do not correct mistakes or prompt
Closure	Feedback by learners and faculty	No feedback is provided at the end of the testing station, and the learners should be advised of this so that they are not expecting it

INITIAL ASSESSMENT TESTING STATION

Due to the important final summative assessment role of the Initial Assessment testing station we will discuss this assessment element in more detail. As with other elements of the course the Initial Assessment testing station requires careful planning. We describe this for you in the Environment/Set/Dialogue/closure structure used for all course elements.

- **Environment**

  The Instructor uses the same clinical scenario as the practice scenario used earlier in the course. The Instructor briefs the patient and nurse and reminds them that this is now an evaluation scenario. Make sure that they understand their roles and that all the required equipment is in place and working order. Sometimes during a practice station the equipment can get mixed up or misplaced – it is important to check not only that the required equipment is back in place but that the patient moulage doesn't need to be 'touched up'.

- **Set**

  Set again begins outside the room in order to have the student's full attention. The Instructor will take no more than 5 minutes to:

  - Explain briefly this is an assessment/testing station and not a practice station.
  - The student (only one) is to assess the patient, prioritize, and deliver the treatments/interventions and determine if and when the patient is ready for transfer to a higher level of care.
  - Identify the situation and the resources (hospital and surgical) that are at the student's disposal. This is usually identified in the scenario. If not, it is often helpful to place the student in a small community hospital with limited resources that require transfer of the patient to a trauma center.
  - Read the case scenario. Ask the student to repeat the information just given to ascertain that he or she understands the scenario and that this is an evaluation.
  - Answer any questions about the scenario that the learner may have.

The Instructor should also remind the student to:

- Engage immediately with the patient upon entering the room and to ignore the Instructor.
- "Think out loud."
- Verbalize and perform a procedure within limitation of the simulation (e.g., no real insertion of a chest tube, intubation).
- To put his or her hands on the patient. Example: If a student asks about breath sounds, the student is directed to listen with a stethoscope and then the Instructor describes the breath sounds.

When the briefing is complete, both the Instructor and student enter the room.

- **Dialogue**

  Tell the student to begin managing the case.

  - The Instructor must provide immediate and appropriate physiologic feedback as the case progresses and as is clinically appropriate such as vital signs and/or the results of interventions.
  - The Instructor is also responsible for providing other information and findings to the student as requested. Because the patient's responses must change to reflect the student's actions, the Instructor must be continually cognizant of the student's activities. If the student is performing satisfactorily and in accordance with the sequence described in the patient scenario, the Instructor should allow the patient's condition to improve.
  - Conversely, if the student makes one or more assessment and management errors, the patient should respond in direct relationship to the severity of the mistake. The Instructor should cue the patient and nurse to change the patient's signs and symptoms as closely as possible to those that would occur in a real-life situation.
  - The patient's physiologic responses to procedures performed by the student are not given until the student simulates and/or relates what is being done to assess and treat the patient. (For example, the Instructor should not answer a student question such as "What are the breath sounds like?" unless the student has used a stethoscope to listen for breath sounds).
  - The Instructor may ask questions to determine the student's reasoning and care progression as appropriate. Remember this is not an oral test with questions and answers – the student is managing the patient in response to the physiologic signs provided by the Instructor.
  - The Instructor needs to ensure appropriate time management. During this station, the student should progress through the Primary Survey, the Secondary Survey, and transfer report.

- **Closure**
  - As this is an evaluation station there is no feedback provided to the student. However, some Course Directors may allow feedback and the Instructor should check with the Course Director. Closure involves thanking the student for their participation in this activity and concluding the scenario. The Instructor should then complete the assessment form based on the specific patient criteria.
  - Some learners will be unsuccessful in their assessment and discussion with the Course Director will be required to determine if they are offered an opportunity to repeat an Initial Assessment. It is important to take detailed notes during your observation of their performance to assist the Course Director in making a decision about remediation.
  - Prior to any repeat it is necessary to provide the learner with feedback on their initial performance to provide them the opportunity to improve. You should also be aware of the learner's heightened emotions following a failed attempt and try to help them remain calm before they retake the evaluation.

COMMON INSTRUCTOR QUERIES WITH THE INITIAL ASSESSMENT TESTING STATION

New Instructors often are nervous about their assessor role and many have questions particularly about the Initial Assessment testing station. **Table 8-5** illustrates some common questions and their answers.

ASSESSING POTENTIAL INSTRUCTOR STATUS

One of the requirements of an ATLS Instructor as an assessor is to determine if a learner is a potential ATLS Instructor. The future and high quality of ATLS Courses depends on its Instructors identifying learners who can become ATLS Instructors. It can, however, be difficult as you will have limited opportunity to see the learners teach. So, what should you look for? Remember the ATLS Instructor mission:

- Stand behind the ATLS concept and educational format
- Walk with the learner
- Support the team-teaching process

Table 8-6 provides some suggested things to look out for which may indicate that the person is going to be willing to embrace this mission.

■ **Table 8-5:** Initial Assessment Testing Station.

Question	Answer
Are all critical treatment decisions (CTDs) important?	The CTDs have been determined by a group of expert peers and set the expected standard for the course. It is therefore not up to an individual Instructor to decide if they are important or not; they need to assess the performance of the learner as they observe it. Feedback can be given at the end of the course to the Course Director if an individual Instructor disagrees with a CTD.
What if a learner fails one CTD but has performed well throughout the course—will they fail?	As an individual Instructor you need to assess the performance you observe at the time of the Initial Assessment patient scenario test and not take into consideration prior performance – this is a form of bias. If you are unsure whether the candidate has been successful or unsuccessful in the station you should discuss your observation with the Course Director.
Do I tell them if they have passed or failed?	Learners are not passed or failed on the performance of the Initial Assessment test station alone – the overall course pass/fail depends on all the summative assessment components. Therefore, pass/fail decisions should not be provided to the learners until the faculty have considered their overall performance and assessment outcomes.
What if the learner is slow in progressing through management of the patient— will they fail?	As an Instructor you need to manage the time as best you can, (e.g., escalate vital signs to indicate deterioration if progress is not being made). This is important to allow the learner to have ample time to progress through the Primary and Secondary Surveys to transfer. If the learner does not achieve all CTDs, they may very well not pass but you want to ensure it is not because you didn't provide adequate information on vital signs to assist progress through the case.
If they do something I don't think they should have done, do I ask them why?	This is not a teaching moment; it is an assessment of the learner's learning during the course. Note the performance that was observed but do not engage in a discussion with the learner during the assessment.

■ **Table 8-6:** Tips to Identifying Individuals Who Will Embrace the ATLS Instructor Mission.

Mission	Examples which indicate support
STAND behind the ATLS concept and educational format.	• Willingness to embrace the ATLS concepts • Active participation in practicing skills the "ATLS way" – not their own way • Not someone who seems to question the "ATLS way"
WALK with the learner.	• Helps out other learners in the Skills Stations • Supportive of others' experience in the Interactive Discussions • Provides good feedback to other learners • Actively helps less-experienced learners who may be having difficulty
SUPPORT the team-teaching process.	• Active participation in all aspects of the course • Helps the Instructors clean up equipment at the end of a Skills Station to prepare for the next group • Not dominating discussions at the expense of other participants

CHAPTER SUMMARY

As an ATLS Instructor, you play a crucial role in maintaining the rigor of the course assessment. In order for fair, valid and reliable assessments to be made, Instructors need to be familiar with the expected standard and the assessment tools, ensure consistency of assessment across learners, and recognize whether an assessment is formative or summative. High-quality instructors regularly reflect on their performance as an assessor and seek feedback to improve. This self-reflection is also necessary to avoid any bias in assessment. New Instructors should seek guidance from Course Directors or other experienced Instructors if there are any questions on the process and or documentation of ATLS assessments.

REFERENCES

1. Backhus LL. Unconscious bias: Addressing the hidden impact on surgical education. *Thorac Surg Clin*. 201;29:259–267.
2. Gingerich AK. Seeing the 'black box' differently: Assessor cognition from three research perspectives. *Med Educ*. 2014;48:1055–1068.
3. Miller GE. The assessment of clinical skills/competence/performance. *Acad Med*. 1990;65(9 Suppl):S63-S67. doi:10.1097/00001888-199009000-00045.
4. Pangaro L, ten Cate O. Frameworks for learner assessment in medicine: AMEE Guide No. 78. *Med Teach*. 2013;35(6):e1197-e1210.
5. Royal KD. Four tenets of modern validity theory for medical education assessment and evaluation. *Adv Med Educ Pract*. 2017;8:567-570.
6. Tavakol M, Dennick R. The foundations of measurement and assessment in medical education. *Med Teach*. 2017;39(10):1010-1015.doi:10.1080/0142159X.2017.1359521.

9

Simulation in ATLS



Image source: Advanced Technical Skills Simulation Laboratory (ATSSL), Cumming School of Medicine, University of Calgary

OBJECTIVES By the end of this chapter, you will be able to:

1. Identify the principles of simulation.
2. Differentiate the types of simulators - Low Fidelity (LF) and High Fidelity (HF).
3. Describe when simulation is used in the ATLS Course.
4. Recognize and apply the simulation guidelines for Instructors.



9

Simulation in ATLS

Image source: Advanced Technical Skills Simulation Laboratory (ATSSL), Cumming School of Medicine, University of Calgary

CHAPTER STATEMENT

Simulation is a key component of the ATLS® Course. It is implemented in a progressive simulation continuum throughout the course. Simulations begin with unfolding scenarios in the Interactive Discussions, followed by Skills Stations training in part-task trainers, an Initial Assessment practice on a simulated patient, and conclude with an assessment conducted in a simulated patient scenario.

INTRODUCTION

Simulation is defined as "the artificial representation of a real-world process to achieve educational goals via experiential learning".[1] In healthcare it can be defined as a technique to mirror or amplify real clinical situations with guided experiences that replicate aspects of the real world in an interactive manner for education and patient safety.[2,3]

Simulation is extensively utilized by the military and the aviation industry. There is a robust set of literature associated with these sectors. Simulation subsequently evolved over time, expanding to satisfy needs in other high-risk disciplines such as nuclear power and healthcare. Simulation-based training (SBT) has been demonstrated to be effective in significantly improving learner confidence in the affective, cognitive, and psychomotor domains.[4-6] It is widely used to train high-performance teams due to its ability to develop and improve teamwork skills.[7,8] Simulation is a proven and powerful method for increasing safety and effectiveness in healthcare.[6,9]

PRINCIPLES OF SIMULATION

- Learning objectives
- Safe learning environment
- Fidelity
- Suspended disbelief
- Feedback

1. LEARNING OBJECTIVES

Simulation, as with any other educational strategy, needs to have specific participant learning objectives. These are essential to determining whether the desired outcomes of simulation-based learning (SBL) have been achieved. Participant objectives promote learning and development of clinical judgment and reasoning with the goal of delivering high-quality and safe patient care.

Objectives written using concepts of cognitive, affective, and psychomotor domains help the participant to become more competent and confident.

Learning objectives used in simulation should include the following points described by Lioce et al. and International Nursing Association for Clinical Simulation and Learning (INACLS).[10,11]

1. Address the domains of learning: Participants can achieve higher levels of learning, such as critical thinking and clinical judgment, when clear, concise, and realistic objectives are written to drive the simulation scenario.
2. Correspond to the participant's knowledge level and experience.
3. Remain congruent with overall program outcomes: Participant objectives should facilitate the development of clinical reasoning to enhance high-quality and safe care. They should include skill performance and effective mastery to increase self-confidence and promote knowledge and application transference.
4. Incorporate evidence-based practice.
5. Be achievable within an appropriate timeframe.

2. SAFE LEARNING ENVIRONMENT

Psychological safety influences learning in SBL. It is linked to participants engaging in self-correcting behaviors with the knowledge that they will not be punished for mistakes.[12,13] There is evidence that increased stress during simulations impairs knowledge recall and decreases clinical performance,[14] while psychological safety is associated with decreased anxiety in stressful situations.[15]

Attributes that have been linked to psychological safe learning include: learner's prior knowledge base, qualities of the facilitator (excellent communication skills, providing respective and constructive feedback, maintaining professional integrity, honesty, flexibility, and adaptability), and the ability to allow learners to make mistakes in a nonjudgmental, consequence-free learning environment.[16] A safe SBL environment should foster collegiality and principles of respect, honesty, and trust. ATLS fosters a safe learning environment, by following these principles such as assessing learner's prior knowledge in the pre-test, and specifically choosing and training Instructors, as it welcomes young colleagues to the ATLS family.

3. FIDELITY

Fidelity refers to the degree of authenticity and realism of a simulation. It can be defined as the extent to which the appearance and the behavior of the simulation matches that of the real environment.[17] It can also be seen as the ability of the simulation to produce reactions, interactions, and responses of the real world.[18]

The conceptualization of fidelity has evolved over time. Rechmann et al. (1995)[19] initially proposed a typology of fidelity that included three dimensions: equipment, environment, and psy-

chological. Beaubien JM (2004)[20] expanded this idea by describing these dimensions: "**equipment fidelity**" refers to the appearance and feel of a simulator; "**environment fidelity**'' is concerned with the cues and other sensory information that are available to the learner in the environment surrounding the simulator; and ''**psychological fidelity**" is the degree to which learners believe in a simulation (i.e., whether they perceive the simulation to be a credible surrogate for an authentic task or problem).

The medical education literature divides fidelity in two main groups:[21,22]

- **Psychological fidelity,** which refers to how closely the situation engages students in the same mental processes experienced in the field. It is considered as the degree to which simulation imitates the psychological factors, including anxiety and distress, that can be experienced in the real clinical environment[14,23,24] It is regarded as an important factor due to the fact that higher levels of psychological fidelity in a simulator may be associated with higher degrees of skill or knowledge transfer.[24] In ATLS the use of a simulated patient, with adequate moulage and the typical sounds of a trauma bay, associated with unfolding scenarios can assist the learner's buy-in to the scenario.
- **Physical fidelity** (also known as engineering fidelity)[25] refers to the extent to which the training device or environment replicates the physical features of the actual task.[17] It can be subdivided into environmental and equipment domains:
  - Environmental: The degree to which the simulator replicates sensory, motion, and visual information from the true environment
  - Equipment: The extent to which the simulator replicates the look and feel of the real system

Creating a space that replicates elements found in a trauma bay such as a crash cart, oxygen mask, pulse oximeter, IV lines, monitors, and having personal protective equipment (PPE) will contribute to increasing the scenario's fidelity.

Haptics is included in both environmental and equipment domains and is used to provide the sense of resistance that would normally be felt in a real situation as objects come into contact with each other. It has been suggested that haptics increases the fidelity of a simulator.[24, 26]

Lavoie et al. (2020)[27] identified eight practical features that can be used to promote fidelity and authenticity in SBT: content drawn from real life; interaction and feedback; performance expectations; preparation of the environment; presence of an actual patient manikin or simulated or standardized patient (SP); logical and adaptive scenarios; sociological fidelity (actions to increase learners' sense that they performed their real professional role);[28,29] and cueing (method of providing learners information during the simulation).[30]

4. SUSPENDED DISBELIEF

Suspended disbelief refers to the simulation participants' ability to believe in the simulation and resist judgement of its authenticity.[31,32] It can be affected by fidelity, psychological safety, fiction contract, emotional buy-in, and assigned meaning. Since we have already discussed the first two factors, we will expand on the following:

Fiction contract: Learners cognitively agree that they will interpret the simulated situation as real. The fiction contract[33] is typically introduced in the pre-briefing of the simulation activity and it is the opportunity to engage learners, set the ground rules, and establish expectations.[34] It serves as an agreement that "facilitators will do their best to optimize the simulated experience and learners will do their best to overlook the unrealistic aspects of the simulation and immerse in the learning experience" that is intended to match that encountered in the real clinical scenario.[35] In the ATLS Course the specifics of the stations are introduced before students enter the Initial Assessment station.

Emotional buy-in: This is achieved when participants experience an emotional attachment to the scenario; for instance, they feel the sense of urgency in a simulated code situation, or hear the pulse oximetry monitor alarm.[32] In order to achieve participant buy-in, the simulation must be clearly relevant and invoke the emotions and beliefs of a real-life event.[32] The ability to accept that which mimics reality is dependent on a participant's state of mind and more likely to occur after emotional buy-in is achieved.[36]

Assigned meaning: Simulation creates an environment for active learning to occur; the student constructs knowledge by attaching meaning to the simulation experience and connecting the knowledge learned to a current or future situation with a patient.[37] Learners assign meaning to simulation experiences based on their perceptions. These perceptions are variable as they depend on individual reactions to the simulations. Likewise, these perceptions are different for learners and facilitators.[36] This is one of the reasons why many universities have included ATLS in their curriculum before the students or residents do their trauma rotation as it prepares them for their near future patient management, making the course very relevant for their knowledge and practice.

5. FEEDBACK

It is important to clarify that here we are referring to feedback related to the principles of simulation, not the ATLS approach which is explained thoroughly in the feedback chapter of this manual.

Feedback is a critical aspect in simulation as it is indispensable to help transform the experience into learning through reflection.[38,39] Feedback should be planned and intentional,[40] regardless of when (during or after the session), how (technique), or by whom (faculty, peers) it is given. The training of simulation faculty in feedback and debriefing techniques is critical for the effective use of simulation and professional development.

For effective outcomes, feedback should focus on three components: Planning, Pre-briefing, and Providing feedback to participants (**"The 3 Ps"**).[41]

- Planning: To incorporate feedback effectively into simulation education, facilitators should determine how and when the feedback will be provided in a manner consistent with the learning objectives for the simulation session. It is important to have the flexibility to examine learner-generated, or ''emergent,'' objectives.[42] These are objectives that are not predetermined but arise during the simulation, such as a knowledge gap or systems issue that should be addressed. It may not always be possible to discuss all objectives, so the facilitator must decide which are the most important for a given session (for example, an ATLS Instructor will need to know the patient scenarios that will be used in your assigned stations, so the critical treatment decisions [CTD] or procedures are not missed).

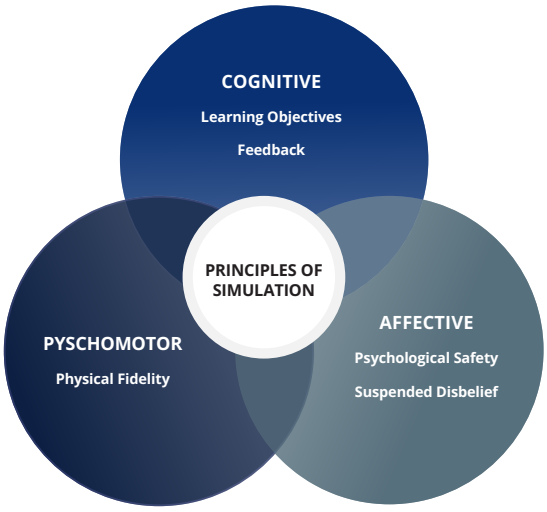
- Pre-briefing: Preparation occurs when rules and expectations are explained to the participants. The environment should be described as nonthreatening, confidential, and "psychologically safe".[42,43] Usually there is some introduction to the simulation environment and the simulators (for instance, Instructors let the students know that they have basic equipment available for them to use such as pulse oximeter, oxygen mask, stethoscope, laryngoscope). As well, it is important that when using standardized or simulated patients (SPs) the students know the rules of engagement with the SPs, in contrast to the rules of engagement if using a manikin.
- Providing feedback: Immediate feedback from actors or simulators, and post-event debriefing, are described.

From actor/simulator during the scenario: Actors can make sounds, comments, and movements to help guide the participants. This is typically explained to the SPs during their training and reviewed with the Instructor of each scenario prior to the ATLS Course. Simulators can be programmed to have various responses, from physiologic response to drug administration and verbal responses, in order to meet learning objectives. Using sensors and visual and audio cues, the simulator is able to indicate to the learners whether they are in the correct anatomic location, using appropriate force, and performing a psychomotor skill properly. These features are an integral component of endoscopic, endovascular, and pelvic simulators. In ATLS different kinds of simulators are used depending on the local resources. Some institutions have the possibility of using more sophisticated simulators that can be completely programmed; others can combine manikins with some apps used to simulate heartbeat and blood pressure, for instance.

Post-event debriefing: Multiple debriefing models have been described in the literature.[42,44,45,46] The general structure for debriefing sessions begins with participant reactions, followed by in-depth analysis, and ends with a discussion of lessons learned and take-home points. It is the responsibility of the facilitator to guide the learners through this process and ensure that they progress beyond the reactions phase.

Figure 9-1 summarizes how the principles of simulation integrate with the cognitive, psychomotor, and affective domains.

■ **Figure 9-1:** Integration Principles of Simulation with Three Domains.



TYPES OF SIMULATORS: HIGH FIDELITY VS. LOW FIDELITY

A simulator refers to a physical object or representation on which the full or partial task is replicated during the simulation.[47] There are currently a wide variety of simulators available commercially designed for use in medical education. They can be classified as part-task trainers (replicate an anatomical part of the body or a specific part (i.e., vessel); computer-based systems (used to model aspects of human physiology and allow interactions through a computer interphase); and virtual reality (presents virtual objects or environments identical to original), which is usually combined with haptics and is very commonly used in laparoscopic and endoscopic training and simulated patients.

Part-task trainers with limited functions that meet only selected requirements for practicing procedural skills, which are referred to as low-fidelity (LF) simulators are commonly used in ATLS. Examples include the airway intubation manikins (■ **Figure 9-2**) and torso simulators used for chest tube insertion (■ **Figure 9-3**).

■ **Figure 9-2:** Airway Task Trainer.



■ **Figure 9-3:** Torso Simulator (Chest Tube Trainer).



Simulators that provide a close-to-reality experience and contain features such as realistic physiological responses, and the ability to communicate and interact with the learner, are referred to as high-fidelity (HF) simulators. HF simulators include realistic three-dimensional procedural simulators, interactive simulators, and virtual reality simulators.[6] Typically used in a simulation suite to be able to use and control the simulation (■ **Figures 9-4 and 9-5**), SPs, which can be considered HF, have been used extensively to teach communication skills and assess technical skills.[48,49] They are also widely used in ATLS.

Simulators must be chosen considering two parameters: first to match the skill or procedure to be taught, and second to match the learning objectives that have been previously identified. The underlying concept is that the skills learned on the simulator can be transferred to clinical practice. The **level of fidelity** required from the simulator depends on the **type of task** and the **stage of training of the learner,** as it will influence the skill transfer.[50] LF simulators are recommended when teaching basic skills to novices.[17] It has been noted that high-fidelity skills transfer can be achieved with simple simulators.[27] Advanced levels of training (for instance, development of fine motor skills requires a simulator to reproduce the movements accurately to avoid the negative transfer of skills)[51] will benefit from HF simulators.

A literature review conducted by Norman et al. (2012)[21] found that high-fidelity simulation (HFS) offers few advantages over low-fidelity simulation (LFS) for learning technical and nontechnical skills. Sherwood et al. (2018)[52] came to a similar conclusion in a meta-analysis that revealed small benefits of HFS versus LFS for knowledge, psychomotor, affective, and nontechnical outcomes. Brydges et al.[53] demonstrated that practicing on simulators of increasing fidelity led to superior transfer of a broad range of clinical skills.

■ **Figure 9-4:** HF Simulation—ATSSL University of Calgary.



■ **Figure 9-5:** ATLS Student's Initial Assessment Using HF Manikins—ATSSL University of Calgary.



SIMULATION IN ATLS COURSE

Simulation is implemented in the following sessions of the ATLS Course:

- Interactive Lecture — Unfolding simulated scenario
- Skills Stations — Unfolding scenario + skills training
- Initial Assessment — Simulated scenario
- Team Training — Simulated scenario
- Final Exam — Simulated scenario

Simulation in ATLS is used to teach technical skills and to teach the overall management of trauma patients. The ATLS manual contains a list of the recommended LFS to be used for skills training. It also recommends the use of both standardized patients and moulage to increase the fidelity of the scenarios.

SIMULATION HAS GAINED MOMENTUM DURING THE COVID-19 PANDEMIC

The World Health Organization (WHO) recommended physical distancing and limited contact with people to control the spread of the virus. Some institutions in the US and Canada reported successful outcomes from implementing the ATLS hybrid course utilizing manikins (LF with moulage or HF) instead of standardized patients (SPs). HF manikins, which are models created by companies specialized in simulation materials, are typically used in a simulation suite at a simulation center, as they require specialized treatment and maintenance. Simulation suites are typically copies of trauma bays or emergency suites, with all of the equipment required to make it look "real" (**Figure 9-5**).

Simulation suites, HF manikins, and the related equipment are quite expensive, and not every location has the budget or resources to create a simulation lab with high-fidelity simulators. Barriers to acquiring HFS that have been identified include cost, faculty training, simulator maintenance, and the availability of appropriate venues. However, these limitations can be minimized by creating a space that, as referenced in the fidelity section of this chapter, has elements commonly used in a trauma bay and using sounds

and visual effects that can increase the learner's buy-in to the scenario. Likewise, LF manikins with appropriate moulage, and even a LF "dummy", can be a good resource. An example is a handmade humanoid dummy called "Vlad" (■ **Figures 9-6 and 9-7**) that is used for the team-building exercise at University of Calgary.

■ **Figure 9-6:** LF Simulator "Vlad"-— University of Calgary.



■ **Figure 9-7:** LF "Vlad " Used in Team Building —University of Calgary.



SIMULATION GUIDELINES FOR INSTRUCTORS

Instructors are responsible for preparing in advance to effectively deliver the course. This includes knowledge of the simulation activities to be conducted and knowing how to use the different simulators. Here are some tips for preparation:

Be familiar with the different types of simulators that will be used in each segment of the ATLS Course at your venue.

If you are using the hybrid course, make sure everyone has high-speed internet. This is also very important if you decide to have an online teaching component via zoom, google teams, skype, and so on.

- Be familiar with the online teaching platforms if you are using them to deliver any component of the course.
- Review the unfolding scenarios.
- Know and practice the skills to be taught.
- Review the part-task trainers and manikins that will be used.
- Review all of the equipment you might need.

If you are using higher-fidelity manikins, be familiar with all of the technological aspects of their optimal functioning.

It is recommended that Instructors spend time prior to the teaching sessions reviewing and conducting a dry run of the scenarios. Preparation is critical to ensuring a successful experience for the learner and the Instructor.

CHAPTER SUMMARY

Simulation is an important teaching method that is integrated throughout the ATLS Course. It has been demonstrated to improve learners' cognitive, affective, and psychomotor skills. When combined with specific learning objectives and conducted in a psychologically safe environment with the proper level of simulators, suspended disbelief, and feedback, simulation results in a highly effective learning experience.

Simulation literature suggests that when choosing the type of simulator to be used in skills acquisition, the key components to consider are the task and the level of the learner. Matching these components appropriately will translate to a positive transfer of skills.[17,54] However, with today's constant evolving technology, budget and resources need to be taken into consideration.

It is critical for ATLS Instructors to understand the principles underlying simulation and apply them correctly when teaching ATLS.

REFERENCES

1. Flanagan B, Nestel D, Joseph M. Making patient safety the focus: Crisis resource management in the undergraduate curriculum. *Med Educ*. 2004;38(1):56-66. doi:10.1111/j.1365-2923.2004.01701.x.
2. AHRQ Fact Sheet. Improving Patient Safety Through Simulation Research : Funded Projects. *Agency Healthc Res Qual*. 2011.
3. Gaba DM. The future vision of simulation in health care. *Qual Saf Heal Care*. 2004;13 Suppl 1(Suppl 1):i2-i10. doi:10.1136/qshc.2004.009878.
4. Taekman JM, Hobbs G, Barber L, et al. Preliminary report on the use of high-fidelity simulation in the training of study coordinators conducting a clinical research protocol. *Anesth Analg*. 2004;99(2):521-527. doi:10.1213/01.ANE.0000132694.77191.BA
5. Nishisaki A, Keren R, Nadkarni V. Does simulation improve patient safety?: Self-Efficacy, competence, operational performance, and patient safety. *Anesthesiol Clin*. Published online 2007. doi:10.1016/j.anclin.2007.03.009.
6. Issenberg SB, McGaghie WC, Petrusa ER, Gordon DL, Scalese RJ. Features and uses of high-fidelity medical simulations that lead to effective learning: A BEME systematic review. *Med Teach*. Published online 2005. doi:10.1080/01421590500046924.
7. Aggarwal R, Mytton OT, Derbrew M, et al. Training and simulation for patient safety. *Qual Saf Health Care*. Published online 2010. doi:10.1136/qshc.2009.038562.

8. Salas E, DiazGranados D, Weaver SJ, King H. Does team training work? Principles for health care. *Acad Emer Med*; 2008;15(11):1002-1009. doi:10.1111/j.1553-2712.2008.00254.x.
9. Rosen MA, Salas E, Wilson KA, et al. Measuring team performance in simulation-based training: Adopting best practices for healthcare. *Simul Healthc*. Published online 2008. doi:10.1097/SIH.0b013e3181626276.
10. The INACSL Board of Directors. Standard III: Participant Objectives. *Clin Simul Nurs*. Published online 2011. doi:10.1016/j.ecns.2011.05.007.
11. Lioce L, Reed CC, Lemon D, et al. Standards of Best Practice: Simulation Standard III: Participant Objectives. *Clin Simul Nurs*. 2013;9(6 SUPPL). doi:10.1016/j.ecns.2013.04.005
12. Aranzamendez G, James D, Toms R. Finding Antecedents of Psychological Safety: A Step Toward Quality Improvement. *Nurs Forum*. Published online 2015. doi:10.1111/nuf.12084.
13. Lyman B, Ethington KM, King C, Jacobs JD, Lundeen H. Organizational Learning in a Cardiac Intensive Care Unit: A Learning History. *Dimens Crit Care Nurs*. Published online 2017. doi:10.1097/DCC.0000000000000233.
14. Harvey A, Bandiera G, Nathens AB, LeBlanc VR. Impact of stress on resident performance in simulated trauma scenarios. *J Trauma Acute Care Surg*. 2012;72(2):497-503. doi:10.1097/TA.0b013e31821f84be.
15. Ignacio J, Dolmans D, Scherpbier A, Rethans JJ, Chan S, Liaw SY. Comparison of standardized patients with high-fidelity simulators for managing stress and improving performance in clinical deterioration: A mixed methods study. *Nurse Educ Today*. 2015;35(12):1161-1168. doi:10.1016/j.nedt.2015.05.009.
16. Turner S, Harder N. Psychological safe environment: A concept analysis. *Clin Simul Nurs*. 2018;18:47-55. doi:10.1016/j.ecns.2018.02.004.
17. Maran NJ, Glavin RJ. Low- to high-fidelity simulation - A continuum of medical education? *Med Educ Suppl*. Published online 2003. doi:10.1046/j.1365-2923.37.s1.9.x
18. Lopreiato JO, Sawyer T. Simulation-based medical education in pediatrics. *Acad Pediatr*. Published online 2015. doi:10.1016/j.acap.2014.10.010.
19. Rehmann AJ, Mitman RD, Reynolds MC. *A Handbook of Flight Simulation Fidelity Requirements for Human Factors Research*. Defense Technical Information Center; 1995.
20. Beaubien JM, Baker DP. The use of simulation for training teamwork skills in health care: How low can you go? *Qual Saf Heal Care*. 2004;13(SUPPL. 1). doi:10.1136/qshc.2004.009845
21. Norman G, Dore K, Grierson L. The minimal relationship between simulation fidelity and transfer of learning. *Med Educ*. 2012;46(7):636-647. doi:10.1111/j.1365-2923.2012.04243.x.
22. Rosen MA, Hunt EA, Pronovost PJ, Federowicz MA, Weaver SJ. In situ simulation in continuing education for the health care professions: A systematic review. *J Contin Educ Health Prof*. Published online 2012. doi:10.1002/chp.21152.
23. DeMaria S, Bryson EO, Mooney TJ, et al. Adding emotional stressors to training in simulated cardiopulmonary arrest enhances participant performance. *Med Educ*. 2010;44 (10):1006-1015. doi:10.1111/j.1365-2923.2010.03775.x.
24. Alexander AL, Brunyé TT, Sidman J, Weil SA. From Gaming to Training: A Review of Studies on Fidelity , Immersion , Presence , and Buy-in and Their Effects on Transfer in PC-Based Simulations and Games. Group. Published online 2005.
25. Miller RB. Psychological Considerations In The Design Of Training Equipment. Distribution. Published online 1954.
26. Meehan M, Insko B. Physiological measures of presence in stressful virtual environments. *ACM Transactions on Graphics (TOG).*; 2002:21(3):645-652.
27. Lavoie P, Deschênes MF, Nolin R, et al. Beyond Technology: A Scoping Review of Features that Promote Fidelity and Authenticity in Simulation-Based Health Professional Education. *Clin Simul Nurs*. Published online 2020. doi:10.1016/j.ecns.2020.02.001.
28. Sharma S, Boet S, Kitto S, Reeves S. Editorial: Interprofessional simulated learning: The need for "sociological fidelity." *J Interprof Care*. Published online 2011. doi:10.3109/13561820.2011.556514.
29. Sadideen H, Wilson D, Moiemen N, Kneebone R. Proposing "The Burns Suite" as a novel simulation tool for advancing the delivery of burns education. *J Burn Care Res*. Published online 2014. doi:10.1097/BCR.0b013e31829b371d.
30. Ahn SE, Rimpiläinen S. Maintaining Sofia - Or how to reach the intended learning outcomes during a medical simulation training. *Int J Learn Technol*. Published online 2018. doi:10.1504/IJLT.2018.092095.
31. Rudolph JW, Simon R, Raemer DB. Which reality matters? Questions on the path to high engagement in healthcare simulation. *Simul Healthc*. 2007;2(3):161-163. doi:10.1097/SIH.0b013e31813d1035.
32. Muckler VC. Exploring suspension of disbelief during simulation-based learning. *Clin Simul Nurs.* 2017;13(1):3-9. doi:10.1016/j.ecns.2016.09.004.
33. Rudolph JW, Raemer DB, Simon R. Establishing a safe container for learning in simulation. *Simul Healthc J Soc Simul Healthc*. Published online 2014. doi:10.1097/sih.0000000000000047.
34. Arafeh JMR, Hansen SS, Nichols A. Debriefing in simulated-based learning: Facilitating a reflective discussion. *J Perinat Neonatal Nurs*. Published online 2010. doi:10.1097/JPN.0b013e3181f6b5ec.
35. Cheng A, Duff J, Grant E, Kissoon N, Grant VJ. Simulation in paediatrics: An educational revolution. *Paediatr Child Health* (Oxford). Published online 2007. doi:10.1093/pch/12.6.465
36. Bauman EB. *Game-Based Teaching and Simulation in Nursing and Healthcare*. New York, NY: Springer Publishing Company; 2012.

37. Rutherford-Hemming T. Simulation Methodology in Nursing Education and Adult Learning Theory. *Adult Learn*. Published online 2012. doi:10.1177/1045159512452848.
38. Yardley S, Teunissen PW, Dornan T. Experiential learning: AMEE Guide No. 63. *Med Teach*. 2012;34(2):e102-e115.
39. Yardley S, Teunissen PW, Dornan T. Experiential learning: transforming theory into practice. *Med Teach*. 2012;34(2):161-164. doi:10.3109/0142159X.2012.643264.
40. Eppich W, Cheng A. Promoting excellence and reflective learning in simulation (PEARLS): Development and rationale for a blended approach to health care simulation debriefing. *Simul Healthc*. 2015;10(2):106-115. doi:10.1097/SIH.0000000000000072.
41. Motola I, Devine LA, Chung HS, Sullivan JE, Issenberg SB. Simulation in healthcare education: A best evidence practical guide. AMEE Guide No. 82. *Med Teach*. 2013;35(10):142-159. doi:10.3109/0142159X.2013.818632.
42. Fanning RM, Gaba DM. The role of debriefing in simulation-based learning. *Simul Healthc*. Published online 2007. doi:10.1097/SIH.0b013e3180315539.
43. Rudolph JW, Simon R, Raemer DB, Eppich WJ. Debriefing as formative assessment: Closing performance gaps in medical education. *Acad Emerg Med*. 2008;15(11):1010-1016. doi:10.1111/j.1553-2712.2008.00248.x.
44. Petranek CF. Written Debriefing: The Next Vital Step in Learning with Simulations. *Simul Gaming*. Published online 2000. doi:10.1177/104687810003100111.
45. Rudolph JW, Simon R, Dufresne RL, Raemer DB. There's No Such Thing as "Nonjudgmental" Debriefing: A Theory and Method for Debriefing with Good Judgment. *Simul Healthc*. Published online 2006. doi:10.1097/01266021-200600110-00006.
46. Eppich W, Cheng A. Promoting Excellence and Reflective Learning in Simulation (PEARLS): Development and rationale for a blended approach to health care simulation debriefing. *Simul Healthc*. 2015;10(2):106-115. doi:10.1097/SIH.0000000000000072.
47. Cooper JB, Taqueti VR. A brief history of the development of mannequin simulators for clinical education and training. *Postgrad Med J*. 2008;84(997):563-570. doi:10.1136/qshc.2004.009886.
48. Chopra V, Gesink BJ, de Jong J, Bovill JG, Spierdijk J, Brand R. Does training on an anaesthesia simulator lead to improvement in performance? *Br J Anaesth*. 1994;73(3):293-297. doi:10.1093/bja/73.3.293.
49. Morgan PJ, Cleave-Hogg D, Guest CB. A comparison of global ratings and checklist scores from an undergraduate assessment using an anesthesia simulator. *Acad Med*. 2001;76(10):1053-1055. doi:10.1097/00001888-200110000-00016.
50. Druckman D, Bjork RE. Learning, Remembering, Believing, Enhancing Human Performance. Washington, DC:National Academic Press; 1994.
51. Gagné RM. Training Devices and Simulators: Some Research Issues. *Am Psychol*. Published online 1954. doi:10.1037/h0062991.
52. Sherwood RJ, Francis G. The effect of mannequin fidelity on the achievement of learning outcomes for nursing, midwifery and allied healthcare practitioners: Systematic review and meta-analysis. *Nurse Educ Today*. 2018;69:81-94.
53. Brydges R, Carnahan H, Rose D, Rose L, Dubrowski A. Coordinating progressive levels of simulation fidelity to maximize educational benefit. *Acad Med*. 2010;85(5):806-812.

APPENDIX 3

Simulation Checklist for Instructors

- ◯ Familiarize yourself with simulators
- ◯ Verify high-speed internet (for hybrid course)
- ◯ Check and know online teaching platform (i.e., Zoom, Google teams)
- ◯ Review unfolding scenarios
- ◯ Know and practice skills to be taught
- ◯ Check task trainers and manikins to be used
- ◯ Check equipment

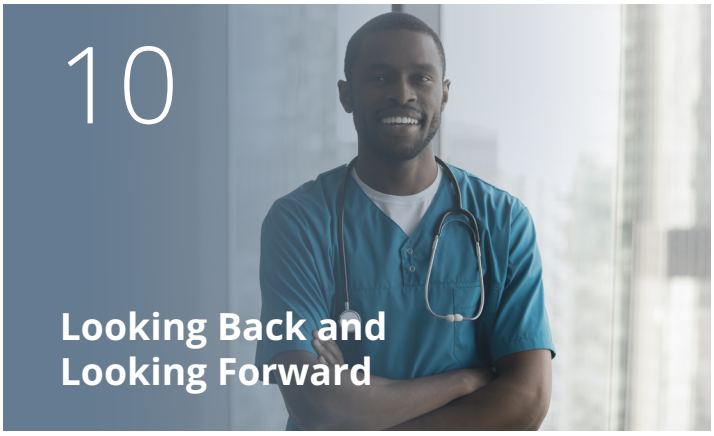
10



Looking Back and Looking Forward

OBJECTIVES By the end of this chapter, you will be able to:

1. Recall the key principles of teaching and learning as they relate to ATLS.
2. Develop a statement on how you will personalize the mission of ATLS facilitators, for instance:
   a. Stand behind the ATLS concepts
   b. Walk with the learners
   c. Support the team-teaching process
3. List 2-3 specific points to apply in your Instructor Course and first ATLS Course as a facilitator.
4. Describe the advantages of review and reflection as a facilitator and teacher.



10 Looking Back and Looking Forward

CHAPTER STATEMENT

As you finish reading the Instructor Manual prior to your Instructor Course, reflect on what you have learned and consider your continual development as an ATLS® Instructor. This will enable the transfer of the learning from this manual to the Instructor Course and your teaching of ATLS Student Courses going forward.

LOOKING BACK

YOUR BEST TEACHERS

This manual started with a discussion on the principles of adult learning and how to promote effective teaching that facilitates learning. Thinking about the best teachers you have ever had, despite the passage of time, you remember them fondly and marvel at how they have left indelible footprints and touched your life. Imagine what advice they will give if you ask them now:

- What are the 1-2 ideas or concepts that guided their teaching?
- What tips will they give you for your first ATLS Course?

PERSONAL LEARNING POINTS

As you ponder on these questions, it is timely to link them with your personal learning points from this manual:

- What are 2-3 key learning points you gained from this manual?
- What is the link between your personal key learning points and the guidance your favorite teacher(s) would have provided?

LOOKING FORWARD

MISSIONS ALIGNMENT

Spending time to reflect on the best teachers and your personal learning points from this manual, it is important that you are align with the mission of an ATLS teaching and learning:

- Stand behind the ATLS concepts
- Walk with the learners
- Support the team-teaching process

The statement begins with verbs (i.e., action words, "stand", "walk" and "support"). Pause and develop a statement on what action—thinking, behaving, or doing—you will adopt to personalize the mission stated above.

Writing the above statement helps you to crystalize your thoughts and make a commitment to start right. When you start teaching, it takes courage to translate your learning points into action that will transform you into an effective facilitator—the three Cs of crystallization, commitment, and courage-in-action.

Once scheduled for your first ATLS Course (and ideally before each course you teach) recall your personalized mission statement and list 2-3 specific action points that you will apply as a facilitator in the upcoming course. For the first course, consider sharing these 2-3 points with your Course Director so they can guide you in this major milestone.

INSTRUCTOR CANDIDATURE

Once you have completed the Instructor Course successfully, you will teach in an ATLS Student Course as an Instructor Candidate under the supervision of senior Instructors. You should deliver an Interactive Discussion, teach the related Skills Station, and teach the Initial Assessment station. The Course Director and senior facilitators will evaluate your performance as an Instructor-Candidate. Upon the recommendation of the Course Director and senior facilitators, you will qualify as an Instructor and be welcomed into the international family of ATLS Instructors.

BEYOND ATLS

Many of the lessons during the Instructor Course can be applied to teaching in other clinical and professional situations from didactic lectures to bedside teaching—presenting as part of Grand Rounds, teaching medical students, teaching residents or junior doctors at the bedside, facilitating learning with a multidisciplinary team, and so on. Ideally, this training and development will be applied in a myriad teaching opportunities that clinical work presents, continuing to elevate the quality of medical education.

THE REFLECTIVE FACILITATOR

REVIEW AND REFLECT

The day before you teach in an ATLS Course, you should review your personalized mission statement and remind yourself of your commitment to:

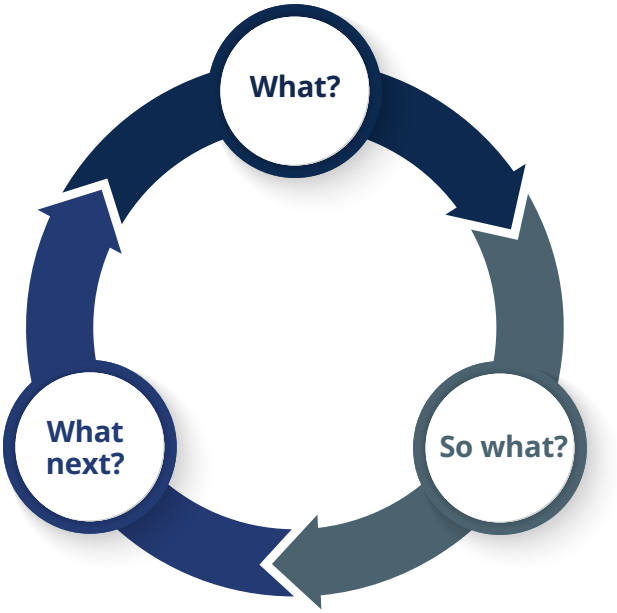
- Stand behind the ATLS concepts
- Walk with the learners
- Support the team-teaching process

Within 1-2 days after you have taught in an ATLS Course, reflect on how you have performed and actualized your commitment. If appropriate, you may want to contact the Course Director or a senior Instructor, to provide feedback.

During the Student Course, you may have observed other facilitators whose facilitation and teaching are exemplary. Consider sending them an email to let them know and ask for tips.

The model of reflection that may be a useful guide (■ **Figure 10-1**).

■ **Figure10-1:** Adaptation of the Rolfe Reflective Model.



Terry Borton's reflective model (1970), as adapted by Gary Rolfe and colleagues (2001). Public domain. Source: Wikipedia via Wikimedia Commons, [https://commons.wikimedia.org/wiki/File:Steph_Rol_Model.jpg?uselang=en#Licensing].

HOW TO USE THIS MODEL

- **"What?"** – Start by recalling and describing 1-2 specific incidents/moments from your teaching in the ATLS Course.
- **"So What?"** – Recall and describe the consequences of these incidents/moments.
- **"What Next?"** – Consider what could be done differently next time you teach; make the commitment to change, and when the time comes, call up the courage to change.
- Repeat by starting with the **"What?"** again.

Active ongoing reflection ensures that you continue to grow and develop as an Educator and effective facilitator of learning. It also ensures that all ATLS Instructors are the best they can be, and that participants are getting high-quality trauma education.