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The Template of Events for Applied and Critical Healthcare Simulation (TEACH Sim): A Tool for Systematic Simulation Scenario Design

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A Tool for Systematic Simulation Scenario Design

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Summary Statement: Simulation-based training (SBT) affords practice opportunities for improving the quality of clinicians' technical and nontechnical skills. However, the development of practice scenarios is a process plagued by a set of challenges that must be addressed for the full learning potential of SBT to be realized. Scenario templates are useful tools for assisting with SBT and navigating its inherent challenges. This article describes existing SBT templates, explores considerations in choosing an appropriate template, and introduces the Template of Events for Applied and Critical Healthcare Simulation (TEACH Sim) as a tool for facilitating the formation of practice scenarios in accordance with an established evidence-based simulation design methodology. TEACH Sim's unique contributions are situated within the landscape of previously existing templates, and each of its component sections is explained in detail.
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Key Words: Healthcare simulation template, Simulation template, Simulation-based training, Systematic training design, Simulation development, Simulation scenario design, Standardized simulation template.

Medical education is imperative to ensuring healthcare providers have the requisite knowledge, skills, and attitudes (KSAs) to provide quality healthcare.[1] Following its success in industries such as aviation and the military,[2,3] simulation-based training (SBT) is now used in healthcare as a mechanism for improving patient care and safety.[4] Indeed, the popularity of SBT as a strategy for teaching healthcare KSAs is demonstrated by its use in disciplines such as anesthesiology,[5–7] emergency medicine,[8–12] radiology,[13] pediatrics,[14] nursing,[15–17] and trauma.[18] Simulation-based training is an instructional technique for garnering expertise through the provision of structured, practice-based learning experiences.[4,19–21]

The success of SBT is facilitated by the thoughtful development of simulation scenarios purposefully designed to meet critical needs and assessment tools that can be used to guide delivery of specific and poignant feedback.[22,23] Unfortunately, the development and implementation of simulation scenarios are no easy tasks. They require attention to and orchestration of a number of pedagogic elements and practical considerations so that finished scenarios are feasible, relevant, and capable of achieving their intended purposes. As such, many instructional designers rely on templates to guide simulation development and/or implementation and to document finalized scenarios. Simulation templates are models for building and/or delivering a SBT lesson plan. Although no template is a substitute for experience and careful planning, well-developed templates can help users organize their thoughts and avoid oversights during development and implementation. Thus, templates may make the design and delivery process smoother and have the added benefit of documenting the major scenario pieces.

The purpose of this article is to present the Template of Events for Applied and Critical Healthcare Simulation (TEACH Sim), a tool created to assist in the development of pedagogically based clinical simulation scenarios. We begin by exploring the landscape of previously existing templates. Such an examination will orient the reader to the variety of available templates and facilitate discussion of TEACH Sim's unique contribution to this area. Lastly, we describe TEACH Sim's individual sections so that it may be more accessible to users.

Previous Templates

It is not the objective of this article to provide an exhaustive history and comparison of all extant templates. Instead, we contrast a representative collection of templates readily available in the published literature or online with the aim of providing readers a cursory introduction to healthcare simulation templates. We hope by doing so readers will be able

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to make their own educated judgments about the various strengths and weaknesses of simulation templates. We focus our examination on easily accessible templates and do not include any proprietary templates in our sample. We believe a focus on readily available templates is a more useful approach because it does not limit readers from using or adapting any of the tools we present, should they so desire. Table 1 presents the selected templates and features.

The selected templates incorporate a number of features into their design. We categorized these features into 6 themes via thematic analysis. To complete this analysis, we reviewed the selected templates, listed features characteristic of each, sorted similar features into clusters, and assigned labels to the resultant themes. We were then able to compare the templates across features. In doing so, we assumed each template was designed to be completed in the order in which its components are presented. Thus, some features (e.g., describes purpose before content) were categorized based on the template layout and may not reflect the template author's original intention. The first theme we extracted is accessibility, which describes the source(s) where the template may be obtained or accessed. All 5 templates in our sample are available online and 2 are published. The second theme, generalizability, captures whether the template is intended for certain participants or simulators. Some templates are oriented toward particular healthcare disciplines or simulators, whereas others are applicable to a broad range of disciplines and simulators. The third theme is participant information. The features in this category refer to data related to targeted learners and scenario confederates. For instance, a template that details participation prerequisites lists any previous coursework, experience, and/or KSAs the learner needs for the scenario to be appropriate, whereas a template that distinguishes scenario cast members describes the roles confederates and/or learners will play while in the scenario. Participant information is useful for introducing the important players to individuals unfamiliar with the scenario. The fourth theme, instructional methods, captures the pedagogic practices adopted in each template. These features set the instructional foundation for the scenario and relate to theories of adult learning. For example, developing

TABLE 1. A Comparison of the Features of 5 Healthcare Simulation Templates

	Template					
Template Feature	**CSASST**	**HPSSDPCT**	**SDT**	**SIGSST**	**TSPD**	**TEACH Sim**
Accessibility						
Published			Book		*Simul Healthc*	Under review
Online	X	X	X	X	X	
Generalizability						
Specific to a type of simulator		Mannequin	Mannequin		Mannequin	
Specific to a discipline	Nursing		Nursing			
Participant information						
Describes targeted learner audience	X	X	X	X	X	X
Details participation prerequisites	X		X			X
Distinguishes scenario cast members	X	X	X	X		X
Instructional methods						
Identifies learning objectives	X	X	X	X	X	X
Classifies learning objectives by specificity or priority	X			X		X
Explicitly links learning objectives to content						X
Associates teaching points with specific events	X				X	
Develops an assessment plan		X			X	
Prepares debrief or guided study plan	X	X	X	X	X	
Design strategy						
Describes purpose before context	X	X		X	X	X
Affords modifications to scenario complexity			X			
Scripts events	X		X	X	X	X
Scripts cues to transition between events	X		X		X	X
Identifies expected participant actions	X		X	X	X	X
Documents pilot testing	X			X		
Supporting details						
Provides references	X		X		X	X
Describes associated didactics			X		X	
Identifies supporting documents					X	
Generates a case summary	X			X	X	X
Provides equipment or prop options	X		X	X	X	X
Labels type of simulator needed	X		X	X		X
Describes learning location	X		X	X		
Depicts patient data	X	X	X	X	X	X
Details simulator and equipment set-up	X	X	X	X		

CSASST, California Simulation Alliance Simulation Scenario Template[39]; HPSSDPCT, Human Patient Simulation Scenario Development Patient Case Template[40]; SDT, Simulation Design Template;[41] SIGSST, Special Interest Group Simulation Scenario Template[42]; TSPD, Template for Simulation Patient Design.[43]

an assessment plan and preparing debriefing adhere to the well-accepted tenets that adult learning is improved with feedback and the opportunity to discuss their performance.[24,25] The fifth theme, design strategy, encompasses template format characteristics and approaches to scenario development. For instance, some templates prompt users to identify the cues of the event transitions that move the scenario forward, whereas other templates do not require such triggers to be pinpointed. The final theme, supporting details, captures additional information useful in understanding or administering the scenario but that is supplemental to scenario content. A number of possible features might be included in this category. Examples of those we observed include: provides equipment or props options, describes learning location, and describes patient data. Some templates list potential support options, whereas other templates require users to brainstorm the details on their own.

Upon examination of Table 1, a few commonalities are observed. Every template specifies the scenario's learning audience, requires that instructional designers define the scenario learning objectives, and describes patient data. The prevalence of these 3 features is unsurprising, but it does provide compelling evidence favoring their importance to the development and delivery of successful SBT scenarios. Evidently, the 3 most critical things to know when using SBT are as follows: (1) who will be trained, (2) what they must learn, and (3) how it will be learned.

Another common template feature is scripting events representing the scenario plotline. Scripting events imposes structure, which is necessary for the standardization of the scenario across use. At a minimum, detailing events provides instructors with an idea of how the scenario should flow. At a maximum, well-defined events enable measurement of how well learning objectives are met. Thus, the predominance of templates recommending scripted events is not unexpected, as events compose the scenario storyline.

Choosing a template is, ultimately, a matter of preference and need. As such, a template's strengths and weaknesses are relative to the user. We hope the information provided here and in Table 1 helps interested readers choose a suitable template.

Why Use TEACH Sim?

TEACH Sim contributes to the present template landscape in 2 ways. First, TEACH Sim corresponds with an evidence-based SBT design methodology. Second, in accordance with this methodology, TEACH Sim encourages written documentation of the relationships among the instructional elements of the scenario. Interestingly, none of the templates we reviewed seem to correspond to a specific development methodology. This is not to imply that users of these templates are not adopting a rigorous SBT design approach of their own volition or that the templates are not useful in rendering highly effective scenarios but rather to point out that the templates themselves do not seem to be structured in such a way that would directly guide systematic SBT development. Alternatively, TEACH Sim was created and structured to align with an accepted SBT methodology, the Simulation Module for Assessment of Resident Targeted Event Responses (SMARTER).[21] SMARTER is a peer-reviewed, event-based approach to training (EBAT)[26–28] design and measurement technique specifically intended for clinical contexts.[21] EBAT techniques create learning opportunities by identifying and introducing events within practice exercises that provide known opportunities to observe specific KSAs of interest.[27] Because of its foundation in science and application to clinical contexts, SMARTER was adopted as the framework underlying the organization of TEACH Sim.

TEACH Sim was developed with input from an interdisciplinary team of training and learning experts working in conjunction with simulation and medical experts and has been used to facilitate systematic scenario design. Systematic merely means that training is intentionally conducted to meet a known need through the specification of learning objectives, precisely controlled experiences to achieve those objectives, criteria for performance, performance evaluation, and feedback.[25] Approaching design systematically results in a standardized and structured learning experience[23] that is advantageous for learning compared with minimal guidance.[22] In fact, multiple empirical investigations and reviews have established solid evidence in favor of structured, guided learning.[29,30] Consequently, when aiming to impart meaningful, long-term change as opposed to no or even negative learning, adherence to a systematic methodological approach to simulation is recommended.[31]

It is important to note that although assessment is a critical aspect of simulation and learning,[32,33] it is beyond the scope of TEACH Sim to assist in the development of scenario measurement tools or the implementation of finished scenarios. TEACH Sim is specifically a scenario design template and, as such, ensures that event-based KSA performance opportunities are deliberately constructed so that corresponding measurement tools may be easily developed. There are a number of approaches to performance measurement and tool development.[34] For more information on measurement and tool development, we direct readers to work by Salas and colleagues.[35,36]

Although not surprising, none of the templates we identified prompt the user to formulate explicit linkages between scenario learning objectives, events, learner actions, and teaching points. This may be a result of the varied applications and purposes of SBT, which can be used to enhance KSAs, provide practice opportunities, assess performance formatively or cumulatively, facilitate feedback, and orient novices to simulators. It may also indicate that most templates were designed primarily as implementation agents rather than design guides. Alternatively, templates may not emphasize strategic alignment of scenario elements because it is time consuming and labor intensive to do so. Yet, the science to SBT development described earlier articulates a clear process for creating scenarios.[21] This literature contends that when simulation is aimed at education, assessment, or feedback, effective and instructionally sound SBT is developed by linking vital competencies with the scenario content (i.e., what happens during the scenario) and context (the situation in which the content occurs).[21,25,37] Remembering multiple pieces of information at once is cognitively taxing, so some users, particularly novices to SBT design, may be interested in a

template that encourages written connections between all of the scenario elements as a way for them to identify potential gaps or incidents unrelated to the learning experience. We attempt to appeal to such users by presenting TEACH Sim (Appendix 1).

We recommend using TEACH Sim because it serves as a tool for building structured lesson plans for engaging in any form of SBT, whether high or low fidelity, by walking users through the SMARTER design methodology.[21] Of course, no template can actually "force" a user to adopt a given design approach. The instructor is free to choose how he or she will design a SBT scenario; however, the instructor is also ultimately responsible for SBT success, and one would be wise to adhere to an evidence-based methodology. TEACH Sim exists to assist instructors wishing to follow the SMARTER approach to organize and document their thoughts during scenario development. As part of the development process, TEACH Sim facilitates in determining how, where, and when the scenario unfolds, which makes the design process smoother for the learner as well as the facilitator.[38] Consistent use of a template ensures that students have the same experience across multiple uses of a simulation scenario.

To gain the greatest benefit from using TEACH Sim, users are encouraged to progress through its sections completely and linearly. Doing so will help users adopt the SMARTER design methodology. Next, we briefly describe the contents of TEACH Sim (Text, Supplemental Digital Content 1 http://links.lww.com/SIH/A159 for richer detail and more information regarding how to effectively use TEACH Sim).

OVERVIEW OF TEACH SIM

TEACH Sim is composed of 7 major sections: (*a*) scenario overview, (*b*) learner(s), (*c*) learning objectives, (*d*) scenario context, (*e*) KSAs, (*f*) scenario development, and (g) ancillary information. The purpose of the scenario overview section is to serve as a reference guide for the scenario. TEACH Sim begins following the SMARTER methodology with the learner(s) section. Identifying who the simulation is intended to train is the first step in the scenario design process and is why the learner(s) section is labeled with a "1" in TEACH Sim (Appendix 1). When instructors clearly know who the training audience will be, they can create scenarios tailored to those individuals' needs. Thus, the second step in the scenario design process is to specify learning objectives that match the needs of the particular learners identified. This section is the scenario foundation because all proceeding aspects of the scenario will be rooted in the learning objectives. Formally defined, "learning objectives are the specifications of what the scenario is intending to instruct."[21] Simply stated, they are what the learners are expected to know, think, and/or do after training has concluded.

The third step in TEACH Sim as well as the SMARTER methodology is to select a scenario context, which is the clinical situation in which the scenario will take place. We define context differently from content. Whereas we conceptualize the context as the clinical backdrop to the scenario, we define content as the events and learner actions that happen against that backdrop. It should be noted that although it may be tempting to begin scenario development with an interesting case study, building a scenario to fit a clinical context can undermine the value of the scenario as a learning tool. By beginning with a context in mind, instructional designers risk creating scenarios that are inappropriate for learner needs. Therefore, it is best to first identify learning objectives and match the clinical context to these aims.

The fourth step is to identify context-specific KSAs. Knowledge, skills, and attitudes represent what learners must know (i.e., knowledge), be able to do (i.e., skills), and/or feel (i.e., attitudes) to demonstrate proficiency on the learning objectives.[21] This underscores an important point regarding the match between learning objectives and KSAs. Because a systematic approach to scenario development requires consistency of purpose across SBT development stages, the product of each stage must build on the last. Therefore, to meet the specified objectives of training, at least one KSA must be identified for each learning objective.

The fifth step is to craft the content of the scenario. TEACH Sim includes the scenario development table to assist users in creating guided practice opportunities. Instructors can use the table to organize their thoughts as they draft and refine events and associated learner responses. However, the scenario development table goes a bit further by prompting users to consciously think about the linkages among KSAs, associated learning objectives, and scenario events. Doing so should help users identify overlooked learning objectives and KSAs or recognize misalignment between the written events and scenario objectives. When used appropriately, the development table can help instructors ensure that the finished scenario is appropriate for meeting planned learning objectives and practicing the KSAs that signal competency with training material.

The final section of TEACH Sim, ancillary information, does not correspond to a step in the SMARTER design methodology. Its presence is to help the user document important information associated with the scenario. As such, it may be used and filled out as the user progresses through each of the 5 numbered sections (learners to scenario development) in TEACH Sim.

Limitations of TEACH Sim

Like most templates, TEACH Sim is not without limitation. However, as is also true of other templates, its limitations are somewhat in the "eye of the beholder." What may be a nuisance to one user may be helpful to another. In light of this, we would like to point out a few aspects of TEACH Sim that we believe some users may perceive as unfavorable. First, because TEACH Sim was specifically designed as a development template, it is not oriented to scenario implementation. That is, its structure may not be the most intuitive or useful during the implementation of the scenario. For instance, if one wanted to use TEACH Sim to implement a high-fidelity mannequin scenario, he or she may need to add information regarding mannequin baseline setup requirements.

Second, the scenario development table is very linear in nature, so it does not clearly show the contingent relationship between events and learner responses to previous

events. There are often a number of ways that learners could (correctly or incorrectly) respond to a given event, and sometimes, these responses change how the rest of the scenario unfolds. In these circumstances, it is wise to have scripted contingency plans so that no matter how the learner behaves while in the simulation, the scenario events make sense. A flowchart easily allows readers to see what would happen in the scenario should a learner behave a certain way, but converting this diagram to a table format can obfuscate the plotline if there are many contingencies. That is not to say that one could not replicate different contingency plans in the scenario development table. For instance, a user could create a labeling schema that would connect contingent events to previous learner responses. However, some might see this as a limitation of TEACH Sim.

CONCLUSIONS

TEACH Sim is a template for creating medical simulation scenarios founded on the SMARTER approach.[21] As such, it assists systematic development of simulation scenarios that meet learning objectives through scripted events aimed at eliciting learner responses and corresponding KSAs. Finished scenarios offer standardized learning and practice opportunities that can be supported by performance measurement and diagnostic feedback. Although there exist a number of other easily accessible healthcare–oriented templates that assist with SBT design, documentation, and delivery, we believe that TEACH Sim meets a critical gap in the SBT literature as a science-based tool suitable for both expert and novice users. We encourage anyone interested in using a healthcare SBT template to consider TEACH Sim but ultimately select a template appropriately suited to their needs.

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APPENDIX

The Template of Events for Applied and Critical Healthcare Simulation

Scenario Overview			
Scenario Title			
Original Author(s)			
Scenario Purpose			
[Insert brief explanation of what this scenario aims to train]			
Date(s) of Development		**Approximate Time Duration**	
Original:		Set-up & Preparation:	
Revised:		Run Simulation:	
		Debrief:	
		Total:	

1. Learner(s)
Specify the learner(s) for whom this scenario was designed. You may also include information about any prerequisites they should have completed prior to participation.
E Post graduate year 1 (PGY 1) residents
1.
2.

**Add additional rows as needed*

2. Learning Objectives	
Define the learning objectives (i.e., statements explaining what learners are expected to know and/or be able to do after training is concluded). Learning objectives should be specific, action-oriented, and measurable. *Note:* The learning objectives listed below will also be recorded on Table 5: Scenario Development	
E	Demonstrate caring and respectful behaviors when interacting with patients and their families.
1.	
2.	
3.	
4.	
5.	

**Add additional rows as needed; A maximum of 5 Learning Objectives per scenario is recommended*

3. Clinical Context
Provide a short description of the scenario's clinical context. Make sure it is appropriate for training the Learning Objectives in Table 2. *Note:* Many contexts may be appropriate for training the learning objectives.
Example: Unanticipated Difficult Airway in an Emergency Department

4. Knowledge, Skills, and Attitudes			
List the context-specific Knowledge, Skills, and Attitudes that indicate the associated Learning Objective is met. At least one KSA should be identified for each Learning Objective from Table 2. *Note:* The KSAs listed below will also be recorded on Table 5: Scenario Development			
#	**KSA**	#	**Associated Learning Objective**
E	Answers patient and family questions fully and patiently.	E	Demonstrate caring and respectful behaviors when interacting with patients and their families.
1.			
2.			
3.			
4.			
5.			

**Add additional rows as needed; No more than two KSAs per Learning Objective is recommended*

5. Scenario Development				
Use this table to script the Scenario Events and identify acceptable Learner Response(s) to each event. Ensure that each event is written to capture at least one targeted KSA and associated Learning Objective. Events must consist of a *trigger* (an incident that elicits a learner response). Events may also include *contextual information* (background information requiring no learner behavior) designed to push the scenario storyline forward or increase scenario complexity. *Note:* The KSAs and Learning Objectives listed here should be identical to those recorded in Table 4				
Case Stem				
[Insert any introductory information for the scenario]				
Event #	**Event**	**Learner Response(s)**	**KSA(s)**	**Learning Objective(s)**
Ex.	Grandmother will ask, "Doctor, what is wrong with my grandbaby?"	The resident calmly explains the patient's critical status and clearly describes the medical condition.	Answers patient and family questions fully and patiently.	Demonstrate caring and respectful behaviors when interacting with patients and their families.
1				
2				
3				

**Add additional rows as needed*

Ancillary Information					
Patient Profile					
Last Name:		First Name:			MI:
Gender:		DOB:		Ht:	Wt:
Physical Exam					
BP:	Temp:	HR:	RR:	O_2 Sat:	
Pain:					
General:					
HEENT:					
Resp:					
Heart:					
Abd:					
GU:					
Ext:					
Skin:					
Neuro:					
History of Present Illness					
Review of Systems					
CNS					
Cardiovascular					
Pulmonary					
Renal/Hepatic					
Endocrine					
Heme/Coag					
Musculoskeletal					
Integument					
Developmental HX					
Past Medical History					
Past Surgical History					
Family History					
Social History					
Vaccines					

Medication Allergies

Food/Other Allergies

Current Medications

Drug	Dose	Route	Frequency

Modality

- ☐ High Fidelity Simulator
- ☐ Standardized Patient
- ☐ Role Play
- ☐ Low-mid Fidelity Mannequin
- ☐ Hybrid (Blended Simulator)
- ☐ Other: _____

Scenario Cast Members

Learners

- ☐ Physician(s): _____
- ☐ Resident(s): _____
- ☐ Respiratory Therapist(s): _____
- ☐ Nurse(s): _____
- ☐ Technician (e.g., Emergency Medical): _____
- ☐ Other: _____ _____

Confederates

- ☐ Family Member(s): _____
- ☐ Physician(s): _____
- ☐ Resident(s): _____
- ☐ Respiratory Therapist(s): _____
- ☐ Nurse(s): _____
- ☐ Technician (e.g., Emergency Medical): _____
- ☐ Other: _____

Scenario Support Staff

- ☐ Observers/Raters
  - ☐ Number Required: _____
- ☐ Simulator Technician
- ☐ Curriculum Instructor

Equipment Props

- ☐ Airway Equipment
  - ☐ BVM
  - ☐ OPA & NPA
  - ☐ Non-Rebreather Mask
  - ☐ Oxygen Source
  - ☐ Suction
  - ☐ Laryngoscopy Blade(s)
  - ☐ Laryngoscopy Handles(s)
  - ☐ Endotracheal Tube(s)
    - Size(s): _____
  - ☐ Stylet
  - ☐ Syringe(s)
  - ☐ Securing Device
  - ☐ EtCO2 monitoring device
- ☐ Lab Reports
  - ☐ CBC
  - ☐ Chemistry
  - ☐ Cardiac Profile
  - ☐ Coagulation Profile
  - ☐ Type and Cross
  - ☐ ABG
- ☐ EKG Machine
- ☐ Medical Equipment
  - ☐ Ventilator Machine
  - ☐ BIPAP Machine
  - ☐ IV Pumps
  - ☐ Ultrasound Machine
  - ☐ Bronchoscope

- ☐ Colorimetric end-tidal CO2 detector
- ☐ Supraglottic Device
  - Type:_____
- ☐ Video Laryngoscope
- ☐ Bougie

☐ Difficult Airway Cart

☐ Vascular Access
- ☐ Peripheral IVs
- ☐ IOs
- ☐ IV and Tubing
- ☐ IV Fluids

☐ Catheter:_____

☐ Monitoring Devices
- ☐ Cardiac Monitor
- ☐ Blood Pressure Cuff
- ☐ Pulse Oximeter
- ☐ Arterial Line
- ☐ CVP
- ☐ Temperature Probe

☐ Defibrillator

☐ Blood Components:
- ☐ PRBC
- ☐ Platelets
- ☐ FFP
- ☐ Colonoscopy Scope
- ☐ Hospital Bed/Stretcher

☐ Medications (Name & Dose)
- ☐ _____
- ☐ _____
- ☐ _____

☐ Patient ID Band/Allergy Band

☐ Back Board

☐ NG Tube

☐ C-Collar

☐ Hotline (Phone)

☐ Form(s) (e.g., DNR):
- ☐ _____
- ☐ _____
- ☐ _____

☐ X-Ray(s):
- ☐ _____
- ☐ _____
- ☐ _____

☐ EKG: _____

☐ Moulage:_____

☐ Other:
- ☐ _____
- ☐ _____
- ☐ _____

References