Not Another Boring Resident Didactic Conference

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Abstract:

Background: The Accreditation Council for Graduate Medical Education (ACGME) requires that residency programs in emergency medicine plan at least five hours of didactic experiences per week. Instructional methods should include small-group techniques, problem-based learning, or computer-based instruction. Despite recommendations from the ACGME, many programs' conference didactics continue to include primarily lecture-based instruction.

Methods: The authors describe instructional methods that promote active learning and may be superior to traditional lecture-based education.

Results: These methods include: varying instructional methods, case-based learning, team-based learning and the flipped classroom, audience response systems, simulation, "wars," oral boards, escape rooms and scavenger hunts, expert panel discussions, debates, clinical pathological cases, and leaderboards. The authors discuss how these methods can be implemented to make emergency medicine didactic conferences more varied and interactive for learners.

Conclusions: While there is minimal research on the efficacy of these methods in graduate medical education, many have shown to improvement engagement of learners and to be effective in undergraduate medical education. Further research will be needed to determine if long-term learning outcomes can be improved with these strategies.

Introduction:

The Accreditation Council for Graduate Medical Education (ACGME) requires that residency programs in emergency medicine plan at least five hours of didactic experiences per week.[1] Instructional methods

should include small-group techniques, problem-based learning, or computer-based instruction.[1] Individualized interactive instruction can account for up to 20% of planned didactic activities.[1] Despite recommendations from the ACGME, it can be tempting for conference planners to default to the traditional, inexpensive and easy-to-plan instructional design of didactic lectures.

Instructional methods that promote active learning may be superior to traditional lecture-based education.[2-5] Bloom's taxonomy breaks down educational objectives into a framework that includes remembering, understanding, application, analysis, evaluation, and creation. [6] Educators should aim to incorporate high level Bloom's objectives[7,8] into their didactic sessions.

There is a lack of literature regarding best practices for overall residency didactic planning. There have been previous articles discussing engaging teaching techniques for the millennial learner.[9-11] As well as numerous articles on utilization of the flipped classroom in graduate medical education.[12,13] However, our review of the literature did not find any articles on best practices or recommendations for implementing these techniques within a didactic curriculum.

During this review, the authors discuss a variety of ways to better engage learners during didactic conferences, encouraging learners to apply and analyze concepts, rather than simply "remember" them. The following "tips" are suggestions and examples from the authors' institutions, to improve learner engagement in weekly didactic conference. Given the lack of literature on best practices for didactic curriculum planning, these recommendations are based on a logical approach combining existing literature on individual techniques and best practices, as well as author experience at two educational sites to create recommendations for engaging didactic planning. These techniques have been implemented at the University of California, Irvine with the emergency medicine residency didactic curriculum. A curriculum was developed using Kern's model and a needs assessment based on previous didactic evaluations and resident feedback. We then utilized the Model of Clinical Practice of EM[14] to determine subject areas and planned the curriculum with varied methods and matched methods for various topics to maximize engagement and learning based on the literature and practices discussed below.

The authors of this paper collectively have more than 35 years of experience in graduate and undergraduate medical education. Dr. Wolff has a Master of Health Professions Education (MHPE) and extensive experience in interactive teaching techniques with numerous publications on best practices for active learning. She has served as an associate program director for a pediatric emergency medicine

fellowship and is now a fellowship director for a medical education fellowship. Dr. Boysen-Osborn has a Master of Health Professions Education (MHPE) and has 5 years of experience as a program director with 3 years of experience as an associate program director and completed a fellowship in education. Dr. Wiechmann has served as the Associate Dean of Clinical Sciences and the Associate Dean of Educational Technologies at the University of California, Irvine for four and six years, respectively, and has extensive experience in educational technologies and innovation. Dr. Boysen-Osborn and Dr. Wiechmann are co-directors of a fellowship in multimedia design and education technologies for emergency physicians. Dr. Toohey and Dr. Wray collectively have five years of experience as associate and assistant program directors, and both have completed fellowships in education and received Masters of Arts in Education with an emphasis in multimedia design and technology.

***Use a variety of instructional methods on any given conference day*.** It is important to consider one's learning objectives when deciding which instructional strategies to use.[15] For example, communication skills are best learned with role playing and/or standardized patients; [16] procedure skills are best learned through simulation and task trainers; [17] and small group learning works well for case-based learning and visual diagnosis. Lectures may provide a consistent message to a large audience, but lecture length should be shortened to maximize engagement. [18] Asynchronous learning and individualized interactive instruction (III) allow learners to go at their own pace, which may improve learner retention. The authors discuss several strategies below and it is our opinion that instructional methods should be varied throughout a conference day in order to best keep learners' attention. [19] For example, a five-hour conference day may include two 30-minute lectures, a 90-minute team-based learning (TBL) didactic, a 60-minute multi-station visual diagnosis challenge and debrief, a 45-minute interesting or morbidity and mortality case discussion, and the remaining conference replaced by III and a reading quiz.

Start simple, use case-based learning when possible. Case-based learning is well-established within medical education as an effective teaching modality as it helps create a deeper understanding of content.[20] There are many ways to expand basic lectures into more interactive case-based learning sessions. At a basic level, creating a series of interesting cases for residents to work through in small groups can be interactive and fun, while developing knowledge-based scavenger hunts (discussed below) or case-based visual diagnoses (where learners go around the room and identify a diagnosis based on images) may be more advanced case-based techniques. An element of competition can be added by timing sessions, using audience response systems or jeopardy style games with buzzers. For

complicated concepts, answers can be reviewed in a large group format following to ensure understanding.

Additionally, interesting cases and images can be used a bridge to weekly conference activities using a diagnosis of the month competition where residents are encouraged to submit descriptions of interesting cases, with the winner announced on a regular basis. Other examples include ultrasound of the week where the ultrasound director can share the most interesting ultrasound from each quality assurance (QA) session.

Expand to teach with team-based learning, small groups and the flipped classroom. One implementation of small group learning that has become popular is the flipped classroom model. [21,22] For this method, the instructor sends materials (e.g. relevant blog posts, articles, etc.) to learners to review prior to the didactic session. This allows for higher-order learning to occur during the didactic session, moving from Bloom's taxonomy levels for remembering to analysis or application.[23] If it is difficult for learners to find time for pre-learning the instructor can select a short resource (such as a paper or video) that can be digested in five to ten minutes at the beginning of the didactic session.

An engaging method to build upon the flipped classroom model is team-based learning, or TBL. A classic TBL includes a flipped classroom element that is named "learner responsible content" (LRC). The in-class session includes a pre-quiz, or individual readiness assurance test (iRAT) based on the LRC, followed by a group readiness assurance test (gRAT) where learners work through the iRAT questions together. [24] Lastly, an instructor/facilitator reviews learning points and clarifies any confusion.

Team-based learning encourages teamwork and communication, improves learning outcomes and examination scores, and develops lifelong learning skills. [15,16] When preparing TBLs, it is important to create a well-prepared answer key so that the didactic session can be reproduced for future learners. Pre-prepared TBLs are available in online journals, such as MedEdPortal and the Journal of Education and Teaching in Emergency Medicine.

***Engage learners with audience response systems*.** Audience response systems (ARS) can be a fun, engaging way to test learners' knowledge through the use of a trivia-style question and answer format. Audience response systems can test learners' knowledge, confirm understanding of a key concept, or solicit feedback or opinions from a group. PollEverywhere®, or Mentimeter® are commonly used in education and have several different question formats including multiple choice questions (MCQs), free text/word cloud, response segmenting/team competitions, rank order questions, and clickable images.

Kahoot® engages learners in a "trivia night" format that gives points for getting a correct answer in the shortest amount of time.

Numerous studies have shown that ARS increase both immediate[25-29] and long-term[25,26,28-32] retention of information in the context of health professions education. Participation in such activities has been shown to be near 100%.[33]

The University of California, Irvine emergency medicine residency program uses ARS to increase engagement and knowledge retention during weekly didactics. At the end of each conference session, a five to ten question Kahoot® quiz is used to assess knowledge and to also reinforce key points of assigned a weekly core content reading. Learners who win the quiz are given a badge on their class leaderboard, which creates a sense of friendly competition.

There are a few logistical considerations and limitations of the use of ARS. As with any technology, there is a learning curve regarding the use of the program and its applications. Most ARS work on a web-based format, which can delay if there is not a strong internet connection. A free version of a software may limit the number of questions they allow instructors to use, the number of learners allowed to respond to questions, or other advanced features such as team competition.

Utilize simulation. Training learners to perform challenging or uncommon procedures is not always possible, cost-effective, or safe. Many skills can be taught via simulation.[34] Simulation tools including manikins, task trainers, computer based programs or discussion and serve as an alternative tool to teach and evaluate residents.[35-37] In creating a simulation opportunity, it is recommended to integrate simulation with similar educational experiences, such as the learner's recent clinical exposure, or during system specific blocks.[38] Simulation provides an opportunity for just-in-time and just-in-place learning as well as frequent and meaningful feedback and can be utilized as an effective way to assess learners.[35,36,38,39]

Cases can be found on online databases, pre-published books or created by residents or faculty.[10] Simulation can be incorporated into weekly didactics with a single case or task trainer or as a simulation conference with multiple cases or task-trainers. Faculty or senior residents can teach skills-based stations, while senior faculty or program leadership can assist or observe the simulation cases as this allows for assessment of learners in addition to immediate meaningful feedback.

Have residents compete in "Wars." Gamification and serious games can enhance learning by increasing learner motivation and engagement. [40] SimWars, a well-known national competition, uses high-fidelity simulations scenarios to challenge resident teams on a variety of clinical cases. This "war" format is

readily adaptable to a conference session given over 90% of programs use simulation as a training method in their programs.[41] To encourage participation and engagement, event coordinators may choose a theme, or encourage teams to have names and/or dress in costume. To start, residents should be divided into teams of four to six and a team leader is selected. Teams compete in eight to ten-minute cases and are given points for meeting critical actions and elements such as team communication, crew resource management, and clinical judgment.

Similarly, SonoGames® or sonoolympics is another engaging way to teach ultrasound in a competition-based format. Typically, the format is a knowledge-based quiz (e.g. identification of images) as the initial round, followed by multiple rounds of hands on ultrasonography challenges. Scores are tallied per round, with categories include image acquisition, interpretation of imaging, incorporation into medical decision making, procedural performance, communication, and teamwork.[42] Creative ideas for stations include Pictionary, blindfolded scanning, scanning with distractions (e.g. being questioned, patient moving, etc.), use of water baths to scan, measuring structures on live patients, and self-scanning activities. While no large prospective studies have been performed on this format, some data suggests that the above formats create skills that are improved through dedicated practice.[43] Observers and instructions may also benefit from these sessions by learning from the decision making and techniques from different providers. Residents have high satisfaction with these sessions, rating such competitions highly.[41]

While games and "wars" can improve learner engagement, they may not be the ideal instructional strategy for some concepts. Instructors must ensure that there is adequate time to debrief, ask questions, and go over answers in between stations or at the end of the competition so that instructors can ensure that learning objectives are met. In order to engage effectively in many educational games, learners must have some basic knowledge or understanding about a topic.

Practice oral boards. The American Board of Emergency Medicine (ABEM) administers an oral board examination to residency trained EM physicians, as one of the requirements for EM board certification.[44] Mock oral examinations are recommended by the ACGME outcome project [45] Previous papers have suggested that oral board practice can be used to assess core competencies[46] including medical, knowledge[47,48] system-based practice,[48,49] professionalism,[48] and communication skills.[50]

Our program provides semi-annual mock oral boards sessions with all residents for assessment and feedback. Cases should be varied to ensure that residents do not repeat cases during their residency. eOral cases can also be integrated into mock oral boards, as ABEM oral board now includes this modality. [51] While it does require a larger faculty involvement and additional training to ensure

consistency, it provides an engaging, high yield activity. Debriefing can cover oral board techniques as well as medical knowledge concepts from the applicable cases. Oral board cases can be found via the CORD website,[52] published in the Journal of Education and Teaching in Emergency Medicine[53] and in various textbooks. Furthermore, CORD now offers eOral cases to programs so residents can become familiar with this format.[54]

Implement escape rooms and scavenger hunts. Escape rooms have increased in popularity in the public over the past several years.[55] Some authors have translated these concepts to learning based escape rooms for use in the classroom.[56,57] Learners must solve educational riddles, logic problems and know or find the answer to questions related to a certain topic in order to escape or move onto the next room. This gamifies a didactic experience and promotes team collaboration and participation in conference.[58,59] The University of California, Irvine emergency medicine residency uses a published toxicology escape room template and apply the same type of puzzles to other topics.[57] There are several possible game types, such as requiring learners to perform a calculation (anion gap, osmolar gap, calculating a risk score (HEART, PECARN, etc) in order to find the combination to a lockbox. In some games, learners must match images, concepts, diagnoses, definitions or cases to find lockbox combinations. Another option is to have questions or cases where learners shade in a matrix containing correct and incorrect answers to identify and match a pattern. There are books and websites on educational escape rooms that provide ideas on other game options.[60]

While escape rooms take significant planning, scavenger hunts may be a budget and time friendly alternative. Scavenger hunts have been shown to engage students while increasing comfort on topics.[61,62] Scavenger hunts can be a more interactive way to review visual diagnoses or case-based multiple choice questions. Multiple-choice or visual diagnosis questions (EKGs, X-rays, common physical exam findings), are printed and posted around a lecture hall or around a building, akin to the clinical images exhibit at the Society for Academic Emergency Medicine (SAEM) Annual Meeting. Learners can solve each case individually or in teams. It is important for instructors to go over each answer at the end of the hunt in order to answer questions and go over key learning points.

Alternatively, scavenger hunts can be used to introduce new interns to the hospital staff (the unit secretary, the nursing supervisor) or find important hospital locations (the charting room, the suture cart, the cafeteria), with stations being strategically placed around the hospital or with staff.

Lead expert panel discussions. Panels are a commonly used method of presenting learners with a variety of perspectives on a topic. Panelists may be given a controversial clinical question, a case with consecutive questions, or a series of cases for which they can respond with their expert opinion. Ideas

of panels may include "orthopedics in the community" (how community versus academic physicians would manage orthopedic cases), management of hypertensive episodes based on specialty (e.g. internal versus cardiology versus emergency medicine), or pediatric emergency cases (with experts in pediatric EM or pediatric intensive care). Panelists can be subject matter experts in varying specialties or from varying hospital systems such as academics versus community. Variation amongst hospital systems, practice environments, and preferred local culture may influence panelists views on topics and provide residents with broad perspectives on topics.

Have residents debate. Debates may improve knowledge transfer, communication, critical thinking, and literature appraisal skills.[63,64] Two groups of residents and/or faculty can be assigned opposing viewpoints on a controversial topic in emergency medicine (e.g. hypothermia for cardiac arrest) and provided with an exemplar article. Each group reviews this article and other related literature to support their article. Groups can be given 10 to 15 minutes to present their viewpoint to the group, followed by 15-20 minute rebuttal. A similar implementation was studied and showed that learners had increased confidence with their ability to find, compare, and retain information from primary literature.[65]

Compete with Clinical Pathological Case (CPC). The Council for Residency Directors in Emergency Medicine (CORD) hosts the Clinical Pathologic Case (CPC) Competition at their annual meeting. [66] These competitions can be easily adapted at the local level. The CPC is a case-based competition where junior learners present an interesting case and senior learners or faculty participants work through a clinical case out-loud to share a rational approach to information gathering and synthesis.

Traditionally, the case presenter (typically a junior resident) takes five minutes to introduce an interesting case, including history, physical, and relevant data to a discussant (generally a faculty member). The case presenter's goal is to provide enough information that the discussant can determine the diagnosis, but not so much that the answer is readily apparent. This information is typically given to the faculty member a few weeks in advance, allowing them time to create a 20 minute presentation that walks through their thought process as they logically examine the information, provided a broad differential, and narrow down their differential. The case presenter will then take ten minutes to present the final diagnosis and discuss the case outcome and any key teaching pearls. In addition to medical knowledge about the interesting case, the CPC may demonstrate how experts employ medical decision making.

To apply to residency didactics a program can select junior residents as the case presenter and senior residents as the discussant. Faculty can participate as the judges of the presentations and provide additional educational pearls at the conclusion of the case.

Create awards, badges, and leaderboards. Awards, badges, and leaderboards may gamify a weekly didactic conference. For example, a program could use a large cork board in the teaching classroom to display badges for each residency class. These boards serve as the centerpiece to highlight resident and faculty academic accomplishments (leadership positions, abstract presentations, manuscript publications), knowledge acquisition (reading quiz, diagnosis of the block, ultrasound of the week winners), and provide positive reinforcement of certain behaviors (patient compliment, on time to conference).

Conclusion While lectures are still a common format for didactic sessions in emergency medicine residency training, educators are increasingly looking for ways to actively engage learners. The techniques described allow faculty and program leadership to make conference more varied and interactive for learners. While there is minimal research on the efficacy of these methods in graduate medical education, many have shown to improvement engagement of learners. Further research will be needed to determine if long-term learning outcomes can be improved with these strategies.

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Table 1. Overview of instructional methods to improve learner engagement in weekly didactic conference.

	What is it?	Where do I start?	What are some tips?
	Case-based learning	Start simple by providing a series of interesting cases for learners to work through in small groups, then progress to more complicated implementations such as case-based visual diagnoses or quiz-show style competitions	Learners can submit cases for a diagnosis of the month competition or leverage ultrasound quality assurance (QA) sessions to identify interesting cases
	TBLs / Small Group / Flipped Classroom	Create a flipped classroom element — Learner responsible content (LRC). In-class pre-quiz based on flipped content — individual readiness assurance test (iRAT). Learners then work through iRAT questions together — group readiness assurance test (gRAT) Instructor reviews and facilitates	Pre-prepared TBLs available in online journals such as MedEdPortal and the Journal of Education and Teaching in Emergency Medicine.

	Audience Response Systems	During weekly didactics, include a 5-10 question quiz to assess knowledge and to reinforce key points of assigned weekly core-content reading	Commercial systems such as PollEverywhere, Mentimeter, or Kahoot are free or low-cost solutions that do not require "clickers" or hardware
	Simulation	Incorporate into weekly didactics with a single case or task trainer or as a "simulation conference" with multiple cases or task-trainers. Simulation groups can be divided based on learner experience or groups with varying experience. Conferences can involve single or multiple cases	Faculty or senior residents can teach skills-based stations, utilizing senior faculty or program leadership during the simulation cases for assessment of learners in addition to immediate meaningful feedback Consider leveraging institutional simulation or skills centers if departmental resources are limited
	Wars and Games	For "wars", divide learners into small teams (4-6 members) that compete in short cases, where points are awarded for meeting critical actions. For "games", have teams compete in an initial round of quizzes, followed by multiple rounds of	National and regional conferences often host a SimWars or SonoGames competition. Consider hosting a regional competition with local programs for collaboration and resource sharing

		hands-on challenges.	
	Oral Boards	Faculty or senior residents can serve as mock examiners using academic offices as testing rooms. Mock examinations can be spread over multiple conferences to utilize a smaller number of examiners	Cases can be found on the CORD website, published in the Journal of Education and Teaching in Emergency Medicine and in various textbooks
	Escape Rooms / Scavenger Hunts	In escape rooms, learners must solve educational riddles, logic problems and know or find the answer to questions related to a certain topic in order to "escape" each challenge. In scavenger hunts, learners compete by solving similar challenges that are placed around the learning space	Look to commercial escape room experiences for ideas for challenges. Retail escape room kits and "how-to" books are also available for purchase. For scavenger hunts, consider using as a tool for new intern orientation.

	Expert Panels	Panelists may be given a controversial clinical question, a case with consecutive questions, or a series of cases for which they can respond with their "expert" opinion.	Variation amongst hospital systems, practice environments, and preferred local culture may influence panelists views on topics and provide residents with broad perspectives on topics
	Resident Debates	Two groups of residents and/or faculty are assigned opposing viewpoints and are given a brief time to present their viewpoint (supported by the literature), followed by a rebuttal.	Considering using controversial topics from the literature
	CPCs	Case presenter (junior resident) takes 5 minutes to introduce the case without easily disclosing the diagnosis. The discussant (senior resident or faculty) uses this information to create a 20-minute presentation that walks the learners through their thought process to determine a their guess at the diagnosis. The presenter then takes 10 minutes to reveal the final diagnosis, discuss case outcomes, and present key teaching points	Case competitions are part of some annual educational meetings and are highlighted in various journals such as the New England Journal of Medicine

	Awards / Badges / Leaderboards	Start simple by mounting a large cork board and brightly-colored awards and badges for each residency class in your didactic space	Think beyond the didactic sessions and highlight any academic accomplishments (leadership positions, publications, presentations) or provide positive reinforcement of certain behaviors (patient compliments, conference attendance, timeliness).

Table 2. Comparison of Complexity and Instructor Support needed by instructional method

Activity	**Level of Complexity**	**Instructors Needed**
Case-based learning	+	Single
Audience Response Systems	+	Single
Awards / Badges / Leaderboards	+	Single
Resident Debates	+	Few
Expert Panels	+	Few
TBLs / Small Group / Flipped Classroom	++	Single
CPCs	++	Few
Simulation	++	Many
Oral Boards	++	Many
Escape Rooms / Scavenger Hunts	+++	Many
Wars and Games	+++	Many