Rethinking Our Approach: Bringing Creativity to EBM through Gaming

Jamie M. Gray, MLS, AHIP
Director for Research & Instruction
Lane Medical Library, Stanford University School of Medicine
Stanford, CA USA

Nicole Capdarest-Arest, MA(LIS)
Clinical Librarian
Lane Medical Library, Stanford University School of Medicine
Stanford, CA USA

ABSTRACT

Introduction: As US medical education shifts towards competency-based education the methods in which we teach information literacy and evidence-based medicine (EBM) need to be reexamined. Our EBM curriculum was created several years ago and had been taught with little revision. A period of transition afforded the library an opportunity to step back and reimagine how that content was being delivered during the inaugural session of what has been a three-part series starting in Quarter 1 (Q1). With a delayed introduction to basic EBM concepts (Q3 vs. Q1), concern arose over how to best address the gap between current and future needs. To address this challenge, we turned to the burgeoning area of educational gaming. Instead of a traditional case-based lecture, the authors developed a game (BINGO) to highlight need-to-know tools and concepts. This activity was then paired with a previously presented case to provide both context and direct application of the student's newly acquired knowledge.

Methods: To reimagine the session, the authors met with the course leads to get logistical and contextual input. Based on experience, feedback, and emerging educational theory, the librarians decided to make the session as student-driven as possible. Utilizing a game provided an opportunity to flip the student learning experience. Instead of receiving a lecture/demo and taking notes, students had the opportunity to engage in team-based learning, using tools already familiar to them (e.g., Google), while identifying new resources and concepts related to EBM/research. Direct application of the game content followed when students were asked to identify and use appropriate resources to a known case. Where students are traditionally focused on solving their cases to get a correct diagnosis, our activity required them to think through and document their search process.

Results: The game itself was well received. From observation, most students seemed actively engaged and eager to compete. The fact that the activity was team-based, timed and incentivized (winning team got to pick prizes from a grab bag) likely helped to drive participation. Prepping the game with a mini-activity, developing a team name, helped to get students in a team mentality. To successfully run this type of activity with two groups of 45, a minimum of four facilitators are needed to handle logistics. Preliminary evaluation data showed the session was well received by students.

Conclusions: Gaming taps into motivations such as belonging and esteem. Using a gamified approach is an effective method to deliver library content that may be perceived as dry or heavily theoretical. The camaraderie and focused

energy gaming brings can generate engagement at the beginning of a session, which can then be carried through to other activities. Short, targeted games (20 minutes or less), lend themselves perfectly to the adult learner's attention span. By pairing a game with more traditional forms of teaching such as case-based scenarios, students have the opportunity to both participate in and apply the learning process.

Relevance: Content innovation: Using innovative approaches such as gaming to teach traditional library information literacy and evidence-based medicine content can be a fresh and pedagogically sound way to engage learners with this material.

Introduction:

Medical education in the United States is currently in the middle of what could be classified as a major rebirth. Most US based medical programs were created around the groundbreaking Flexner Report published in 1910. For more than a century, many school curricula stayed relatively faithful to the report's proposed vision of what medical education should look like until the technology boom changed everything (Prober & Heath, 2012). As the digital age emerged and produced a new type of learner, medical educators had to step back and evaluate not only how to leverage technology for educational purposes, but also incorporate the sweeping changes happening in the healthcare setting such as the proliferation of the electronic health record and, in the United States, implications resulting from The Patient Protection and Affordable Care Act of 2010. In order to move medical education forward, the American Association of Medical Colleges (AAMC) proposed standards to transform medical education from a theoretically based paradigm to one of competence. For this purpose, competence is defined as an ability in a domain or task that integrates multiple components (e.g., skills, values, knowledge, attitudes) that is observable and applicable in the clinical environment to achieve optimal results (Association of American Medical Colleges, 2014; Harris, Snell, Talbot, & Harden, 2010). This move toward competency-based medical education is happening throughout the Western world, with competency frameworks being developed by various organizing bodies (Harris et al., 2010). This shift to a competency-based

paradigm involves identifying specific outcomes in the desired areas of competency, defining performance levels for each competency, developing frameworks for assessing the competencies, and continuous programmatic evaluation to see if curricula are producing desired outcomes. This shift has also been an important step for libraries, as evidence-based medicine (EBM), the information literacy equivalent for medicine, has now become an explicit and measurable expectation for accreditation (Association of American Medical Colleges, 2014) and learning outcomes.

Our evidence-based medicine curriculum at Stanford University School of Medicine (SOM) was created several years ago and had been taught with little revision. The educational leaders for the EBM curriculum at SOM are medical librarians and a clinical expert (also affiliated with the library), who conceive of, develop and evaluate the EBM curriculum, which itself is a component of a longitudinal course for SOM medical students called "The Practice of Medicine" (POM), which incorporates topics such as EBM, nutrition, ethics, and population health. A period of transition in library personnel and educational leadership afforded us an opportunity to step back and reimagine how that content was being delivered during the inaugural session of what has been a three-part series starting in Quarter 1 (Q1). With a delayed introduction to basic EBM concepts (Q3 vs. Q1), concern arose over how to best address the gap between current and future needs. Furthermore, student skills around information literacy may be varied based on their educational background and previous information literacy exposure. Additionally, students were beginning to acquire their clinical

reasoning skills which requires higher level critical thinking, but may not match their current knowledge of medical information resources. We needed a way to introduce a blend of introductory and higher level concepts that could then be directly applied and useful to them in the rest of their coursework. Our approach needed to be engaging, level appropriate and, above all, relevant. To address these varied concerns, we turned to the burgeoning area of educational gaming.

Instead of a traditional case-based lecture, the authors decided to develop a game (BINGO) highlighting need-to-know tools and concepts. This activity was then paired with a previously presented case to provide both context and direct application of the students' newly acquired knowledge. Our attempt to create a discovery-based classroom, leveraging several learner-centered pedagogies within a single session, was directly in line with the current changes happening at our institution and medical education at large. This experiment was our first step into threading a theme of gaming throughout the library's curricular efforts.

Literature Review:

A love for games is nothing new. Gaming has been around in one form or fashion since antiquity. We see this reflected in the variety of games available across markets, cultures and technology. There are dice games, card games, board games, computer games, video games, the list goes on and on. The options for gaming are endless and appeal to both the low tech and high tech user of today.

The use of games in the field of education is quickly on the rise. As education shifts to more learner-centered approaches, how to engage students in a meaningful way is a chief concern amongst those who teach. Instructors want students to acknowledge and feel that they are active participants in their learning (Doyle, 2008; Lumpkin, Achen, & Dodd, 2015). Studies have shown that students who are engaged in their learning perform better and retain what they learned longer (Freeman et al., 2014; Michael, 2006). Students also want to feel that they have some ownership and control over their education (Lumpkin et al., 2015) and the interactive nature of gaming provides just that.

Gaming, when approached right, puts the learner front and center. There has been some discussion around the challenges of gaming in education. According to Hirumi and Stapleton (2009), "[G]ames that over-emphasize educational requirements often fall short of realizing the potential of play, game, and story for creating memorable experiences. Perceived learning requirements and traditional teaching practices may be forced onto the game, undermining the dramatic flow of story and disrupting the riveting interactions of gameplay" (p. 127). It is important to note the emphasis on story and flow here. In their book "Made to Stick" Chip and Dan Heath (2007) tout the effectiveness that stories can have on making messages stay with people (Heath & Heath, 2007). When used appropriately, stories create connection by eliciting something deep within the learner. Pair that with flow, essentially the ability to immerse oneself completely in a task or activity, and you start to develop a sense of how powerful the connection between fun and learning can be (Sillaots, 2014).

The getting it right part can take some strategizing on the part of the educator. A balance must be struck on a variety of fronts, including learning curve, reward, motivation, outcome, and objective. Additionally, the game and the content must match or you run the risk of falling flat on both accounts. But when done successfully, gamification can transform difficult or dry material into something manageable if not appealing (Sillaots, 2014). By pairing gaming with other educational methods such as cases, you can develop a robust learning opportunity appealing to a variety of learners. Gleason (2015) acknowledges this match up in her article on gaming in health science libraries. She observes that, "games also provide goal-oriented learning when they introduce case-based, real world scenarios, which must be successfully completed in order to progress in the game. Case-based, serious gaming is now considered a viable addition to educational programs and should be evaluated further for its effectiveness in medical training, and ultimately patient outcomes" (Gleason, 2015).

Methods:

To help shape the session, the authors met with the course leads of POM and gained logistical and contextual input. These meetings occurred several times between January and March of 2016. The instructional session was scheduled for April 2016. The timing was selected to coincide with the start of students' clinical reasoning curriculum. Based on experience, feedback, and emerging educational theory, the librarians decided to make the session as student-driven as possible.

The decision to pair a game with a case was made for several reasons. Utilizing a game provided an opportunity to flip the student learning experience. Instead of receiving a lecture/demo and taking notes, students would have the opportunity to engage in team-based learning. Students could facilitate discovery with their peers and receive peer feedback. Additionally, the authors felt that since this was the initial introduction many of the students would have to the library, it was important that this experience be fun. Not only was this an educational opportunity, but a relationship-building one as well. Both authors provide direct support to the medical students as librarian liaisons. However, direct application of the game content was also an important component. Case-based learning is a common teaching method within medicine. Tying the game to a case-based scenario, a teaching method students were already familiar with, was also important in developing a connection for students between information seeking and patients. Where students are traditionally focused on solving their cases to get a correct diagnosis, our activity required them to think through and document their search process. This provided a more engaging activity, emphasizing the intricacies of the process rather than a quick answer.

BINGO was selected as our game for several strategic reasons. First, the premise and rules were simple enough that it could be adapted to meet the needs of the session. Second, we could use the structure of the BINGO boards to introduce a broad smattering of library-related information such as library facts, resources, and EBM-related concepts without the game becoming overly

complex. Third, there was minimal cost to create the game outside of staff time and printing of the boards. Fourth, students could each be given a completed answer key at the end of the session reinforce what was covered and keep for future reference. And lastly, once created, the boards and rules could easily be tweaked and used in other teaching endeavors with minimal time and resource output.

The game was designed so that students were using tools with which they were already familiar, while also identifying new resources and concepts related to EBM research. All answers could be found either on the library's website or through a quick Google search. To ensure the BINGO board's clarity, the authors piloted the game with a small group of adult learners. Question adjustments were made based on observation and specific feedback from the testing group. In order to contain the activity to 20 minutes and promote collaboration and team-based learning, it was decided that the game would be a small group activity. Each team would compete to see who could complete their board the fastest. The team that had a fully correct board in the fastest time won and was able select a random prize from a donated grab bag. The full rules of the game are contained in Figure 1.

Given the number of first-year medical students, the class was taught in two back-to-back sessions with approximately 45 students in each class. The instructors lead the session along with an introduction and framing by a clinician course director for context. Due to the size of the session and focus on active

learning, we also had two additional librarians in the room to help facilitate and answer questions. During the session, students were randomly distributed into teams of approximately 6-8. This distribution happened at the beginning of class by handing the students a strip of paper color coded to match each table.

After the introduction by the clinical course director, to jump-start the development of a team mentality, each group was given one minute to brainstorm a team name. Not only did this help to give students a creative break and get them thinking as a group, it also primed each team for competition. After an introduction of the rules of the game, the clock was started and the teams were set loose to complete their boards. All of the instructors, plus the facilitators, walked around to answer questions (all boards contained a "free" ask-a-librarian space). The instructors served as "emcees" not only to keep track of time but also to try and keep the spirit of competition alive. After a winner was declared, completed BINGO boards were distributed to each student to use for the next activity and to take away from the session for reinforcement.

After completion of the game, there was a quick reintroduction of the case and explanation of the case-based activity. Students were given a copy of the clinical scenario along with specific questions to answer using some of the resources introduced during the game. It was emphasized that the process of finding their answer was the most important part of the activity rather than ending up with the correct differential diagnosis. Students had about 15 minutes to complete the activity on their own before completed sheets were collected. The

session wrapped up with a 5-10 minute debrief. All BINGO game boards and case scenario worksheets were collected at end of session.

Following the session all inputted answers on the student-completed BINGO boards and case scenario worksheets were de-identified, compiled and analyzed using descriptive statistics and qualitative description. The Stanford IRB determined that this project was a quality improvement project exempt from review.

Results:

The BINGO game itself was generally well received. Eighty students completed all components across the two sessions. From observation, most students seemed actively engaged and eager to compete. Informal student feedback to instructors was positive (e.g., "I learned about useful resources that I wasn't familiar with before"). Formal evaluation data collected by the SOM confirmed that the session was valued by medical students, with the session receiving above-average ratings. Qualitative feedback included comments such as, "[t]he interactive format was fun and made the material more interesting," "… great that it was in an interactive/game format - most 'information resource' courses are very dry and easy to tune out of," and "[i]t was great that we were able to reinforce the tools we used in the session throughout the quarter. Lane library is now one of my most visited sites!" Some students remarked that the session felt rushed. In the next iteration of this session, the time allotted will be extended by 30 minutes to allow for a more relaxed pace. Other students felt the

session would have been more useful earlier in the curriculum. In the next iteration of this session, it will be moved to Q1 with additional follow-up sessions in Q2 and Q3.

Most groups were able to complete more than 75% of the BINGO board game sheet during the live game, indicating that the competition was close and the random team assignment worked to generate evenly matched teams. In the two sessions, only two teams did not complete more than 75% of the BINGO board. We were unable to determine why these teams were less successful on the task than others. As mentioned above, however, each individual student was given an answer key to the BINGO sheet at the end of the session to serve as a study resource going forward. Therefore, all students left the session with the same takeaways and a completed answer key ensuring those students whose teams did not complete most of the game challenge left with the same information as the more successful teams.

All students across the two sessions also completed all or part of the case scenario questions, which asked them to apply knowledge gained during the BINGO game portion of the session to a case scenario. Sixty-six students (82.5%) completed all components of the case, whereas 14 (17.5%) did not. Students used various resources discovered during the BINGO game to develop a differential diagnosis for the case, with DxPlain (n=61) and/or GIDEON (n=33) being the most popular resources identified to create a differential diagnosis. Most students (n=78) were able to identify three possible diagnoses for the case,

with only two students not able to do so. Similarly, most students (n=77) were able to identify a resource for retrieving biomedical images related to the case. Students also, for the most part, were able to identify at least one resource to find recommendations for current treatment (based on their most likely diagnosis for the case), with the two most popular of those resources being UpToDate (n=51) and PubMed (n=5) [Figure 2]. Seven students did not identify a resource for treatment recommendations.

Use of the library's web portal targeted at medical students increased significantly after the session was delivered in early April 2016, suggesting that introduction of evidence resources via a gamified session has an impact on ongoing evidence usage [Figure 3]. Click counts from the aforementioned portal also showed increased utilization of key library resources mentioned during the session (e.g., DxPlain, GIDEON).

Conclusions:

Using a team-based interactive activity to encourage knowledge seeking and introduce concepts of EBM coupled with an individual exercise to immediately apply knowledge gained can be an approach to introducing EBM theory and resources to medical students. The fact that the BINGO activity used in our sessions was team-based, timed and incentivized (Hamari, Koivisto, & Sarsa, 2014) likely helped to drive participation. Prepping the game with a mini-activity, developing a team name, helped to get students in a team mentality. Distributing an answer key of the BINGO board after the game ensured that each

student left with the same takeaways and resource guide, regardless of how well his/her team performed during the game.

Results gathered from informal and formal student feedback and evaluations as well as analysis of the student assignments indicate that using a gamified approach to introducing information resources and concepts of EBM is effective. Analysis of the assignments showed that most students were able to successfully complete them. From the assignments and student feedback collected, we were unable to ascertain why some students were not able to successfully complete the entire BINGO board or the case scenario questions. We hypothesize that lack of time or understanding of how to use the resources might have contributed to this issue, and for the next iteration of the session we hope to make time and resource explanations more explicit.

For this session, students received task-intrinsic feedback according to whether they were able to successfully complete the BINGO board and the case scenario. More detailed, specific feedback to individual students was not provided for this session, but may be incorporated in the future as part of the group debrief time at the end of the session. Information gathered by the authors from submitted assignments and student feedback will help inform further refinement of this session. For example, it is evident from submitted assignments during this session that UpToDate is already a well-known resource for this level learner. Ensuring that this session and the rest of the EBM curriculum continues

to build on learners' toolboxes for finding medical evidence will be a continuing priority.

Instructors designed the BINGO game board and the case scenario to align with session and course objectives, LCME standards (Liaison Committee on Medical Education, 2015) and AAMC Core Entrustable Professional Activities for Entering Residency (Association of American Medical Colleges, 2014). Learner levels were also taken into account (Ambrose, Bridges, DiPietro, Lovett, & Norman, 2010) when designing the content for the BINGO game board. Piloting the game in advance with a select group of adult learners was helpful in order to ensure that the game was at an appropriate level of difficulty and timed appropriately. To successfully run this type of activity with 2 groups of 40-45 students, a minimum of 4 facilitators are needed to handle logistics.

Gaming taps into motivations such as belonging and esteem (Van Nuland, Roach, Wilson, & Belliveau, 2015; Webb, Simpson, Denson, & Duthie, 2012). Using a gamified approach is an effective method to deliver content that can be perceived as dry or heavily theoretical (Sillaots, 2014; Webb et al., 2012). The camaraderie and focused energy gaming brings can generate engagement at the beginning of a session, which can then be carried through to other activities. Short, targeted games (under 20 minutes) lend themselves perfectly to the adult learner's attention span. By partnering a game with more traditional forms of teaching (case-based scenario) students have the opportunity to both participate in information literacy and EBM knowledge acquisition and apply what was

learned during the game to a case-based scenario. When strategically designed to leverage competitive, collaborative and creative motivations in learners, such an approach can be an effective instructional technique, especially with content that is often perceived as dry or theoretical, such as EBM.

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Figures:

Figure 1

Rules for BINGO game

BINGO Rules

- Each table is a team
- Team wins by correctly filling out the whole sheet = "blackout"
- Each team starts with one answer (distributed)
- Use whatever resources you'd like (e.g., laptop, phone, each other)
- Free space: "Ask a Librarian"
  - If you use this space we will black it out for you; you can use it once
  - If you get the whole board with without using the free space, the free space counts toward blackout
- When your team has blackout, signal by having everyone at your table **STAND UP**
- First table to get blackout with **all answers correct** gets to pick prizes from the **grab bag**!

Figure 2

Information resources used by students to find recommendations for current treatment for case scenario exercise

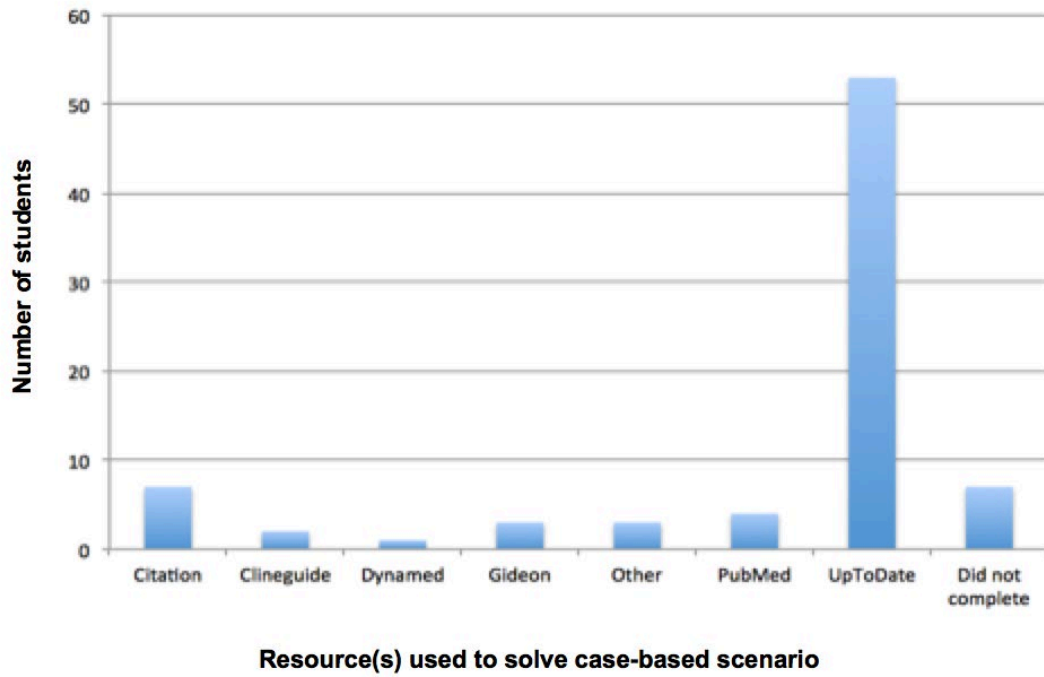Resource(s) used to solve case-based scenario

Figure 3

Trend in student portal use before and after April 2016 information literacy/EBM session

Student portal page views