Shock and awe pedagogy!

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Galen of Pergamon (130–200 A.D.) was an accomplished showman and scientist who made enormous advancements in the understanding of the heart, nervous system, and mechanics of breathing. These advancements were often achieved during impressive public “performances” of vivisection on Barbary apes and other living animals. He designed his public “shock and awe” spectacles like mystical shows with the goal of amazing his awestruck audience. He would marvel and astonish his fascinated audience as they witnessed the anatomic and physiological mysteries of living animals. Galen’s spectacular and marvelous anatomic performances looked less like an intellectual class and more like a magic show or perhaps modern bullfight (6). Galen’s “shock and awe” pedagogy has a long and successful, history having persisted for centuries. The success of this unique pedagogy may be attributable in part to a powerful emotional connection. Basic emotions, including shock, anger, fear, and sadness, are shared by all humans. When we experience emotion in our lives, we tend to remember the experience. In fact, the more emotional impact an experience has, the more intensely we remember its details and the more likely it will be stored in long-term memory.

To enhance learning and retention through Galen’s shock and awe pedagogy, we developed a short inquiry-based “virtual” experiment investigating the “alkaline tide” during the gastrointestinal (GI) section of a team-taught, lecture-based graduate physiology course. The GI section was taught using physical models (8, 10), demonstrations (9), and educational games (1, 4, 11) to engage students and enhance learning and retention. This lecture-based, as opposed to laboratory-based, virtual experiment required little additional class time and minimal preparation. This activity was also institutional review board exempted because it was not considered research and had an increased alkalinity of his urine, whereas the rat receiving the “protein solution” had an increased alkalinity of his urine, whereas the rat receiving the “protein solution” had an increased alkalinity of his urine, whereas the rats receiving the “protein solution” had an increased alkalinity of his urine, whereas the rats receiving the “protein solution” had an increased alkalinity of his urine, whereas the rats receiving the “protein solution” had an increased alkalinity of his urine, whereas the rats receiving the “protein solution” had an increased alkalinity of his urine, whereas the rats receiving the “protein solution” had an increased alkalinity of his urine, whereas the rats receiving the “protein solution” had an increased alkalinity of his urine, whereas the rats receiving the “protein solution” had an increased alkalinity of his urine, whereas the rats receiving the “protein solution” had an increased alkalinity of his urine, whereas the rats receiving the “protein solution” had increased alkalinity of his urine, whereas the rats receiving the “protein solution” had increased alkalinity of his urine, whereas the rats receiving the “protein solution” had increased alkalinity of his urine, whereas the rats receiving the “protein solution” had increased alkalinity of his urine, whereas the rats receiving the “protein solution” had increased alkalinity of his urine, whereas the rats receiving the “protein solution” had increased alkalinity of his urine, whereas the rats receiving the “protein solution” had increased alkalinity of his urine, whereas the rats receiving the “protein solution” had increased alkalinity of his urine, whereas the rats receiving the “protein solution” had increased alkalinity of his urine, whereas the rats receiving the “protein solution” had increased alkalinity of his
Based on their horrified expressions and groans of disgust and revulsion, as well as the level of discussion, it was clear that students were engaged and learned about the digestive processes by participating in this virtual experiment. To this day, students comment that they understand and will never forget the “alkaline tide.” In this context, it is important to remember that the teachers’ first responsibility to their students is to focus on learning. However, appropriate “shock and awe pedagogy” that is relevant to the instructional material attracts and sustains attention and provides a brief break that lightens the mood and makes the learning process more enjoyable, memorable, and impressive. In addition, this demonstration, by engaging students and provoking discussion, may increase interactions between students and peers and students with teacher, all of which increases attention and motivation while reducing anxiety and stress.

Galen’s anatomic demonstrations on living animals may constitute the first attempts at “shock and awe pedagogy.” The demonstrations’ spectacular cognitive and emotional impact produced an amazed audience (6). The emotional impact of Galen’s anatomic performances enhanced the learning experience because the shock value created a memorable experience. We used Galen’s approach and believe we obtained similar results. Accordingly, this “experiment” with revelation of the “illusion” became a catalyst for discussion and study and to this day provokes comments and conversations of how tasting urine was once the number one way to diagnose pathology and forecast the future. We had never used this shock and awe demonstration before we unveiled it in the winter of 2016. However, we have used a variety of demonstrations previously (2, 3, 5, 10, 12) and can state unequivocally that none of these earlier demonstrations have received the same dramatic response. Thus the success of this pedagogy may open the way to similar memorable pedagogical experiences that are common to medical education.

DISCLOSURES
No conflicts of interest, financial or otherwise, are declared by the authors.

AUTHOR CONTRIBUTIONS
H.L.L. and S.E.D. conception and design of research; H.L.L. and S.E.D. performed experiments; H.L.L. and S.E.D. interpreted results of experiments; H.L.L. and S.E.D. drafted manuscript; H.L.L. and S.E.D. edited and revised manuscript; H.L.L. and S.E.D. approved final version of manuscript.

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