A PERSONAL VIEW

Benefits behind barriers in physiology education

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Abstract

The COVID-19 pandemic forced academics to switch to online teaching whether they were prepared or not. The speed and enthusiasm with which educators embraced online teaching suggest that challenges can bring benefits. Flipped teaching has been gaining attention among educators because of its ability to engage students in learning. The COVID-19 pandemic pushed educators to adopt this instructional design based on its conduciveness to technology, as well as its blend of both asynchronous and synchronous components of online teaching. Just like Dr. Guyton’s enormous impact on medical education and research in spite of the challenges he faced, we must be creative during this pandemic through innovative teaching methods, which will serve as a gift for the future of physiology education.

Arthur C. Guyton; COVID-19; flipped teaching

A BRIEF HISTORY OF DR. ARTHUR C. GUYTON

The field of education grows as it adapts to challenges, and even more so, with ways in which its leaders respond to adversity. Dr. Arthur C. Guyton is revered in both physiology and medicine for his leadership and contributions to physiology education and research, despite numerous challenges. He was born in Oxford, Mississippi to a highly educated family. His father, Dr. Billy S. Guyton, was a well-known physician, and his mother, Kate Guyton, was a well-respected mathematics and physics teacher. Arthur Guyton followed in his father’s footsteps to become a physician. He desired to be a cardiovascular surgeon but during his final year in clinical residency training, Dr. Guyton contracted poliovirus and became paralyzed in his leg, arm, and both shoulders. While recuperating, he designed the first motorized wheelchair with a “joystick” controller, and he engineered lifting devices that aid the handicapped. Dr. Guyton received a Presidential Citation for these remarkable discoveries (1).

DR. GUYTON’S INCREDIBLE IMPACTS ON PHYSIOLOGY

Dr. Guyton would likely have been an excellent cardiovascular surgeon and a great contributor to the field of medicine, but after his polio illness forced him to abandon his aspirations to become a surgeon, he instead followed his passion for physiology and pursued teaching and research at the University of Mississippi Medical Center. Dr. Guyton made legendary contributions to medical research. His research focused on basic cardiovascular functions, such as the amount of blood pumped by the heart (cardiac output), interstitial fluid pressure, and mechanisms of edema (2). The “infinite gain” theory that was proposed by Dr. Guyton explains the long-term regulation of fluid volume by other systems such as the kidneys (3). He published more than 600 research articles and 40 books, and he received more than 80 accolades for his prestigious work, including the Ciba Award from the Council for High Blood Pressure Research, the William Harvey Award from the American Society of Hypertension, the Research Achievement Award of the American Heart Association, and the Wiggers Award of the American Physiological Society. Moreover, the Royal College of Physicians in London invited Dr. Guyton to deliver a special lecture to honor the 400th anniversary of the birth of William Harvey, who is credited for discovering the circulation of the blood (1).

Still, Dr. Guyton’s contributions to education are perhaps even more extraordinary. Not only was Dr. Guyton a master teacher, he also trained more than 150 scientists. Of the scientists he trained, at least 29 became department chairs, and six of his trainees became presidents of the American Physiological Society. Dr. Guyton is most notably recognized for his Textbook of Medical Physiology, which was first published in 1956, and the 10th edition was released in 2000, just before Dr. Guyton’s death. It is the world’s best-selling medical physiology textbook, and it has been translated into at
least 15 languages. His textbook is a pillar of physiology education, and it continues to educate students around the world.

Dr. Guyton’s desire to serve as a physician was blocked by misfortune, but ultimately, he accomplished his original goal through his children. Astoundingly, he and his wife, Ruth Guyton, raised 10 children, who have all become successful physicians. Although it may not have been immediately obvious, a twist in Dr. Guyton’s career goals from being a practicing cardiovascular surgeon to becoming a medical physiology educator and a researcher turned out to be an indelible gift to the field of physiology. Much like poliovirus caused a pivotal change in Guyton’s pursuits, the novel coronavirus is causing a major turn in higher education.

## COVID-19 AND NEW EDUCATIONAL CHALLENGES

COVID-19 has caused unprecedented challenges that have shaken colleges, universities, and their constituents since the spring of 2020, necessitating an overhaul of the higher education system (4). Educators have faced the tremendous challenge of adapting their teaching methods in response to the COVID-19 lockdown. COVID-19 pandemic has also created unique opportunities to better the education system and to reach more students. Innovative methods, such as the flipped classroom, is an evidence-based tool highly suitable for the current situation.

### The Flipped Teaching Technique

The flipped teaching approach to learning is dedicated to empowering students to have more intimate, meaningful, and personalized interactions with their instructor, and it supports enlivening collaborative work among the students, which ultimately results in a richer, livelier classroom. In contrast to the traditional teaching method, flipped teaching reverses where homework and classwork take place, so the instructor prepares lecture videos and assigns readings and other resources, and makes everything available to the students via an online learning management system (5–11).

### COVID-19 and Flipped Teaching

Although the flipped teaching model was not specifically intended to combat against the uprooting caused by a global pandemic, the benefits of flipped teaching for teachers and students alike are evident. The fallout of the COVID-19 pandemic has forced all educators to embrace online learning. This transition was simple for instructors who had already begun practicing the flipped teaching model because it incorporates both synchronous and asynchronous components of online teaching (4). The pre-class activities that the flipped teaching model used are now referred to as the asynchronous portion and the in-class activities of engaging students are synchronous with the synchronous part of online teaching. The synchronous part of the flipped teaching is critical in connecting with students and fostering teaching presence (12).

COVID-19 has wreaked havoc across the globe; however, the nature of human beings is to adapt to the circumstances, and the education system is a prime example of the creativity, adaptability, and flexibility of the human spirit. When the COVID-19 pandemic displaced students from their academic institutions and necessitated online learning, those educators with competency in technology made transitioning to a virtual classroom simple. The students of flipped classrooms had already been accessing their lecture materials online, and they had previously gained familiarity with the learning management software, as it pertained to their flipped course (4). So, when college campuses came to a screeching halt in March of 2020, the biggest adjustment for flipped classrooms was transitioning the meeting place from an on-campus classroom to a video communications platform such as Zoom. It was a minimally challenging feat, but it offered timely benefits. Every student now has a front-row seat in the comfort of their own home. This is most strikingly beneficial for the large class populations, which had previously been disadvantageous for any student behind the seventh row. Additionally, online communication platforms still allow for meaningful interaction between the student, their peers, and the instructor. The instructor can separate their students into groups using breakout rooms to allow them to do cooperative group work without competing with other groups to be heard. The students can ask questions and get personalized help from their instructor throughout the meeting hour. Ultimately, preparing faculty and students for the flipped classroom has inadvertently prepared them for the institutional changes related to COVID-19.

Guyton’s Medical Physiology textbook has been a tremendous influence on my teaching and learning of physiology, and I was honored to be the recipient of the Arthur C. Guyton award of the year from the American Physiological Society. The news regarding the award was released in February 2020, which had instilled a curiosity in me to learn more about Dr. Guyton’s work. COVID-19 pandemic shook the world in March, and the educators scrambled to shift their teaching to an online platform. I was not only able to handle the situation well since my classes were flipped but was also able to extend help to colleagues within the university and many international institutions in the form of webinars and workshops. The struggles educators are experiencing in switching from the traditional to online teaching due to COVID-19 pandemic led me to connect Dr. Guyton’s challenges with the polio virus to the current situation on the future of physiology education.

## REFLECTION

In summary, a challenge is simply a barrier that separates the challenger from their desired goal, and oftentimes the benefit they receive from surmounting the challenge is far greater than the one they were expecting. For example, Dr. Guyton’s challenge came in the form of the debilitating disease caused by poliovirus, but rising against that challenge allowed him to make invaluable contributions as a successful educator, researcher, and author. Similarly, the novel coronavirus is the stimulus that can change the direction and course of the education system, and although it poses many unique and difficult challenges, it has provided the opportunity to reimagine the practice for educating future physiologists. As Dr. Guyton taught us, the pursuit of science and research will always move forward, and we must adapt to
our circumstances. Flipped teaching is one of those ways to continue educating students and future leaders in physiology. The novel coronavirus may initiate some of the much-needed changes in the education system and center the higher education community’s focus back on the student. COVID-19 is an enormous barrier that educators and students are facing, but the benefit of higher-quality education can be found just beyond that barrier, and if it were not for that barrier, the benefits may never have been found. The challenges Dr. Guyton faced did not stop him and instead, his contributions to physiology education and research have been endless. Similarly, we must be creative during this pandemic through novel teaching methods that would reform teaching and lay a new foundation in physiology education.

REFERENCES
1. Arthur C. Guyton Biography. https://www.umc.edu/UMMC/About-Us/History/Arthur-Guyton/Guyton-Bio.html. Accessed April 10, 2020.
2. The University of Mississippi Medical Center. Dr. Arthur C. Guyton: A Legacy of Achievement. https://www.umc.edu/som/Departments%20and%20Offices/SOM%20Departments/Physiology/Resources/Arthur-Guyton-Archives/Overview.html.
3. Guyton AC. The surprising kidney-fluid mechanism for pressure control—its infinite gain! Hypertension 16: 725–773, 1990. doi:10.1161/01.HYP.16.6.725.
4. Yen T. The performance of online teaching for flipped classroom based on COVID-19 aspect. AJSSS 8: 57–64, 2020.
5. Al-Samarraie H, Shamsuddin A, Alzahrani, AI. A flipped classroom model in higher education: a review of the evidence across disciplines. Education Tech Research Dev 68: 1017–1051, 2020. doi:10.1007/s11423-019-09718-8.
6. Chen K, Monrouxe L, Lu Y, Jenq C, Chang YJ, Chang YC, Chai, P. Academic outcomes of flipped classroom learning: a meta-analysis. Med Educ 52: 910–924, 2018. doi:10.1111/medu.13616.
7. Cheng L, Ritzhaupt AD, Antonenko, P. Effects of the flipped classroom instructional strategy on students’ learning outcomes: a meta-analysis. Education Tech Research Dev 67: 793–824, 2019. doi:10.1007/s11423-018-9633-7.
8. Ellis RA, Steed AF, Applebee, AC. Teacher conceptions of blended learning, blended teaching and associations with approaches to design. Australas J Educ Technol 22: 312–335, 2006. doi:10.14742/aaj.1289.
9. Love B, Hodge A, Grandgenett N, Swift, AW. Student learning and perceptions in a flipped linear algebra course. Int J Math Educ Sci Technol 45: 317–324, 2014. doi:10.1080/0020739X.2013.822582.
10. Olaniyi NEE. Threshold concepts: Designing a format for the flipped classroom as an active learning technique for crossing the threshold. RPTEL 15, 2020. doi:10.1186/s41039-020-00122-3.
11. Tucker B. The flipped classroom: Online instruction at home frees class time for learning. Educ Next 12: 82–83, 2012.
12. Marshall HW, Kostka, I. Fostering teaching presence through the synchronous online flipped learning approach. TESL-EJ 24, 2020.