

Engaging a global community of learners and practitioners in the care of the critically ill child

Authors

Jeffrey Burns^{1,2,*}; Sarah O'Brien^{3,†}; Rebecca Burns^{4,‡}

Abstract

The traditional methods of education, while once revolutionary, are failing to keep pace in the twenty-first century. OPENPediatrics™ has created an interactive, virtual training and knowledge exchange platform to enhance the quality of pediatric critical care. It has the potential to revolutionize the post-graduate medical education model. Designed by experienced physicians at Boston Children's Hospital, in collaboration with IBM Interactive, it offers asynchronous interactive learning and various avenues for knowledge sharing outside the walls of individual institutions. It is creating a digital, global community, based on adult learning principles, provided at no cost to the user.

Keywords

medical education; e-learning; global education; pediatrics; internet-based learning; adult learners; critical care medicine

Clinical need and innovation

Innovation is usually driven by clinical need but often by something else, too — serendipity. About ten years ago, I had to begin resuscitating a little girl. I will call her J.R., though that is not her real name. It was a Sunday night about 9:00 PM, and she was critically ill. Despite our best efforts, she was not responding and I feared that she was going to die. I remember her mother grabbing my arm and saying "Please don't let my daughter die." We tried a few other procedures, procedures that I attempted on her in ways that I had not done before. And they worked. In fact, J.R. gave us hard-won lessons, but those lessons cannot be easily transcended beyond the individual hospital walls. This hard truth after we helped J.R. is what drove the project we named OpenPediatrics™.

Several years after we were able to help J.R., I was asked to assist a physician in Guatemala City. The United States government and agencies often call me when there is a young American travelling overseas who becomes critically ill. In this case, I was asked to help a five-year-old girl from California, who was in Guatemala City with her family. She became critically ill, ironically, with the same disorder that J.R. had suffered from years earlier.

¹ Program Director, OPENPediatrics™, Boston, Massachusetts

² Chief of Critical Care, Boston Children's Hospital and Associate Professor of Anesthesia, Harvard Medical School, Boston, Massachusetts

³ Communications Associate, OpenPediatrics at Boston Children's Hospital, Boston, Massachusetts

⁴ Communications Associate, OpenPediatrics at Boston Children's Hospital, Boston, Massachusetts

* Email: Jeffrey.Burns@childrens.harvard.edu,

† Email: sarah.obrien@childrens.harvard.edu,

‡ Email: rebecca.burns@childrens.harvard.edu

Submitted: 23 July 2014

Accepted: 20 August 2014

Cite this article as:

Burns J, O'Brien S, Burns R. Engaging a global community of learners and practitioners in the care of the critically ill child, *Innovations in Global Medical and Health Education* 2014;3 <http://dx.doi.org/10.5339/igmhe.2014.3>

This is an open access article distributed under the terms of the Creative Commons Attribution license CC BY 4.0, which permits unrestricted use, distribution and reproduction in any medium, provided the original work is properly cited.

I worked with my colleague, Dr. Ricardo Mack, in Guatemala City, to develop a treatment plan for this little girl. We communicated and shared information through the only means available to us: a crude telecommunications link. Though this link allowed us to interact, I could not see the patient's information as clearly as I wanted and it was not easy for me to communicate treatment ideas. Although I had experience treating this same condition, the limitations in our ability to communicate made it extremely difficult for me to extend the lessons to Guatemala that J.R. taught me. Ultimately, through ongoing efforts both here in Boston and in Guatemala, the treatment plan worked and this little girl lived.

Three months after taking care of Dr. Mack's patient in Guatemala, I was called to the front desk and saw a father standing there. He smiled at me but I worried because I did not quite recognize this family. The man quickly turned and whispered something, and a sweet little girl came running up to me. Without words, she high-fived me. Her father looked me in the eyes and said, "Dr. Burns, this is the little girl you helped from Guatemala City. This is Nina. Thank you for giving us our daughter back."

While we had the knowledge to treat Nina, we barely succeeded in saving her life. Her case emphasized to me that the medical field needed to find a way to use existing technology to scale knowledge much more often and more efficiently.

The current paradigm

Post-graduate medical education faces a number of increasingly disruptive forces. Work hour restrictions for trainees and increased pressures on physicians to assure safe and efficient care have decreased the opportunities for experiential learning, which serve as the foundation of the hospital-based apprenticeship model.^{1,2} With decreased opportunities for clinical experience and instruction time, it is imperative that post-graduate medical education undergo a significant transformation, particularly in the complex field of Critical Care Medicine.

The current post-graduate medical education paradigm is based on the model put forth in the 1910 Flexner report.³ This hospital-based apprenticeship model, which once revolutionized the educational system, is

now failing to meet the health needs of the modern world, despite the increase in technologies for knowledge exchange, and improvements in the ability for health care providers to connect with each other globally.^{4,5}

At present, medical education is confined within the walls of institutions. Learners must come within the walls to obtain knowledge from experts in hospitals, through didactic lectures and bedside teaching. While didactic lectures and hands-on practice at the bedside are necessary features of medical education, both have challenges that are incompatible with present medical advancements. The need to come within the walls to learn inherently denies access to medical knowledge to those who live and work far from elite medical institutions. The current paradigm, which prevents the spread of knowledge beyond these walls, contributes to the current disparities in health worldwide. Even for those that are able to come within the walls, due to time constraints and extensive curricula, didactic lectures often fail to provide learners with more than an introduction to basic concepts. Likewise, experiential bedside learning provides essential hands-on practice but is inherently random. Residents and fellows are trained to treat the illnesses that present during their time on a specific ward or unit, but miss those diseases and problems that arise when the trainees are not on duty, providing unequal exposure to diseases that are common and limiting experience with uncommon conditions. Duty hour constraints worldwide are exacerbating this problem.² Thus, it is rare that trainees have access to a full range of practical educational experiences.

While the challenges facing both the learner and educator are expansive, recent developments in the field of education offer comprehensive solutions. Unprecedented opportunities for technological innovation and increased awareness of adult learning theories have set the stage for a paradigm shift in medical education. Residency, fellowship and continuing education models must be re-imagined, to incorporate these new advances and better suit the modern learner.

What worked well for 100 years after Flexner is now a paradigm that is paradoxically bottlenecking the release, scaling, and collaboration of knowledge.

The kernel of an idea

Shortly after taking care of Nina in Guatemala City, I went home one afternoon and saw my teenage son playing a video game. This game was multi-player and allowed him to play with other gamers anywhere around the world. My son was playing with four of his friends but also on a team was a player from Germany.

The entire January 2, 2009 issue of "Science" was devoted to gaming. While I do not believe that digital platforms are going to cure all the world's problems, their innovative potential is fascinating.

What is that game that my son played doing? It is backed by powerful analytics. It understands if players have been lost, and like a good mentor, or a good teacher, it reroutes them. Who is controlling the pace of navigation? The users, the learners. They are not being paced by a teacher. They are being paced at a rate that is comfortable for them. They are learning fast, and they move fast. They take the time they need to learn a concept, and then they repeat it. The game is endlessly patient; it will go over and over a concept. It will explain it a hundred times or a thousand times.

While gaming is often associated with leisure, many industries are now utilizing the principles found in video games to encourage learning. This concept of serious gaming combines the high fidelity of simulator training with principles of the entertainment industry, to better engage the learner. As a result, it promotes critical thinking in the learner, facilitates knowledge gains and increased retention, and has the potential to foster multicultural exchange.⁶ Serious gaming has been proven to be as effective, or more effective, at improving trainees' skills and knowledge retention than traditional education in many areas of medical education, including nursing, primary care education, and triage training.^{7,8} The success of serious gaming can be attributed, in part, to increased student interactivity. This feature serves to engage the learner, as the active involvement is particularly attractive to the adult learner.⁸ The creative and entertaining basis of serious gaming offers a successful platform by which educators can employ adult learning theory, cognition, and pedagogical principles to offer an interactive method of education.⁹

Beyond its basic function of imparting knowledge, gaming is useful for its ability to encourage problem solving. The nature of "chance," a critical aspect of gaming design, allows users to test out multiple solutions in their attempts to reach their goal. They encounter immediate feedback, in the form of success or failure, which encourages problem-solving and active learning. Serious games do not simply impart lessons based on repetition; research has shown that the learner is able to develop skills that transfer to real-life scenarios beyond those depicted by the game.¹⁰ Additionally, increasingly popular multiplayer games have the ability to unite learners from around the world. In multi-player games, students must work together to reach a goal, thus improving teamwork skills and exposing learners to multiple points of view.

Because of its dynamic interface, serious games are aptly suited for self-paced practice and adjunctive learning outside of the hospital. As with simulations, serious games provide learners with the opportunity to practice high-risk techniques without risk to the patient. Additionally, multi-player serious gaming has the potential to connect learners across the globe, allowing them to "play" and amass knowledge with one another. The development of accessory learning modules via serious games will allow students to better learn communication skills and procedural techniques.

The needs of pediatric care

In my world and in most of our clinical activities, infrastructure, vaccinations, preventing disease before it occurs, and patient care is the space in which we find ourselves (Figure 1). This is our hierarchy of needs. But if you look at how we have evolved as a profession, we are spending far less time seriously trying to coalesce, harness, and scale those important lessons that we have learned.

Due to these shortcomings in the medical paradigm, over one billion people worldwide lack access to health services or trained health workers. Additionally, in 2006 the World Health Organization (WHO) found a global shortage of 4.3 million trained health workers. The current medical education system has remained stagnant, failing to keep pace with a rapidly expanding and increasingly interconnected population. There is a tremendous



Figure 1. The needs of pediatric care.

training gap when it comes to advanced medical knowledge and patient care, and this is especially true for pediatric patients. The tragic ramifications of the worldwide shortage of clinicians sufficiently skilled in the care of critically ill children is magnified by the fact that nearly 10 million children under the age of five die each year across the globe from preventable causes.

Expertise on how to treat these children exists, making the need to scale this knowledge by transforming medical education greater than ever. Despite this, we remain bound by the walls of our institutions. We must make more serious attempts to scale our knowledge.

OpenPediatrics™

OpenPediatrics™ responds to this challenge by fusing world-class medical expertise, the latest in information technology, and the power of the Internet to create an interactive virtual training and knowledge exchange platform designed to enhance the quality of care provided to critically ill children throughout the world. After a year long beta-testing, the first version of OpenPediatrics™ was launched April 1, 2014. OpenPediatrics™ (Figure 2) is a free, interactive, digital learning platform designed to provide medical education to and promote knowledge sharing among clinicians in all resource

settings worldwide. OPENPediatrics has the potential to revolutionize the existing post-graduate medical education model. Those using the online platform will find free access to academically rigorous and peer-reviewed educational materials that encourage active learning and information exchange.

I worked with experienced clinicians at Boston Children’s Hospital, and collaborated with experts from the Harvard Graduate School of Education, MIT’s OpenCourseWare, the Harvard School of Public Health, and the Harvard Kennedy School of Government to develop the conceptual foundation of the program’s content. The content was developed based on David Kolb’s theory of adult education, which suggests learning is more effective when content is presented in four distinct learning steps: concrete experience, reflective observation, abstract conceptualization, and active experimentation. Users will experience this educational model through four main features of the OpenPediatrics™ Platform: World Shared Practice Forum, Guided Learning Pathways, Groups, and The Library.

In its simplest stage, it is making experts available to anyone, anywhere, anytime. And not only does the expert explain but also uses the concepts of simulation. The opportunity to exchange knowledge with colleagues around the world occurs continually on OpenPediatrics™.

The site itself contains a breadth of educational content, housed in The Library. This content consists of educational videos that can be didactic lectures, procedural demonstrations, or surgical lessons. The Library also includes a number of medical calculators that can be used by clinicians at any time. The site utilizes advanced simulation technology, demonstrated best by the virtual mechanical ventilator, which we developed in collaboration with Genuine Interactive, a design firm based in Boston, Massachusetts. This mechanical ventilator is an online simulation that guides users through a demonstration of how to use all the different features of a mechanical ventilator, and then gives users a space to practice with a ventilator in simulated patient cases (Figure 3). Utilizing this simulation technology, OpenPediatics™ has created an online space where clinicians can learn how to employ critical technology in a safe environment before they have to use this technology on a live patient.

Outside of The Library, we host a World Shared Practice forum on our site. This World Shared Practice Forum is a monthly video lecture delivered by a physician or nurse on a critical issue in pediatric care. This forum connects a global community of care, allowing healthcare teams from around the world to communicate via a discussion forum, comment on and ask questions about the content,

and gain knowledge of international best practices. This function facilitates asynchronous learning and knowledge exchange across geographic borders and time zones by allowing users to add their thoughts at any time, anywhere, throughout the life of the video. Currently, we have received comments and participation from colleagues in over 75 countries.

By encouraging clinicians from around the world to comment, we are promoting the sharing of best practices in pediatric care, allowing our users to learn from one another, outside the walls of their individual institutions. This method of learning is, importantly, not just a passive, one-way transfer of knowledge. It is a knowledge exchange. The interactions among users through the World Shared Practice Forum allow us to leverage the accrued wisdom of clinicians around the globe to improve the practice of clinicians who treat critically ill children.

Another key feature of the site is our Guided Learning Pathways (Figure 4), designed to allow medical education leaders to “flip the classroom” or utilize a “blended learning” strategy. While there is no doubt that the existing mentorship model must continue to play a role in critical care education, an emerging theory in higher education, called blended learning, offers a unique solution to create a new model of educational delivery for the twenty-first

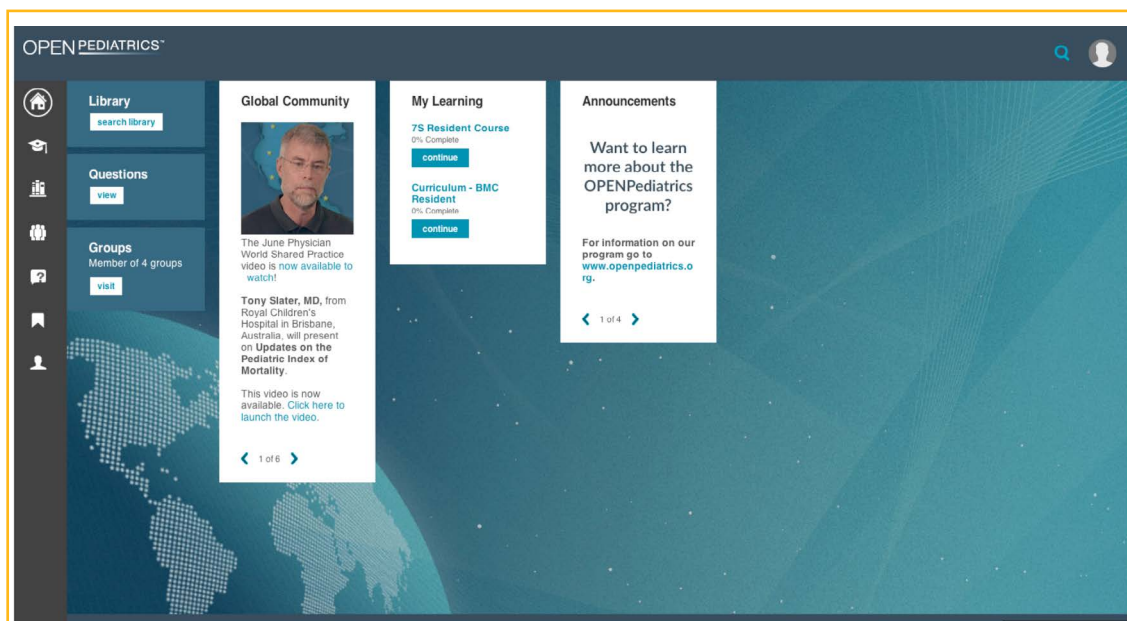


Figure 2. OpenPediatics™.

century. Blended learning seeks to incorporate the benefits of asynchronous online material into the standard curriculum, thus allowing the traditional apprenticeship model to be enhanced by learning activities that can cover topics that would not be encountered or not covered in great enough length in the traditional model.

We are using OpenPediatics™ to facilitate this educational model at Boston Children’s Hospital. While rotating through our Medical Surgical Intensive Care Unit, a pediatric resident no longer has to attend the standard didactic lecture held in a conference room at a set time. For the last 30 years, the paradigm dictated that a resident was on rotation for one month, and from 7:30 AM until 8:15 AM, he or she would sit through a didactic presentation. The group of residents would change every month, and thus every month, a senior faculty person would be giving the very same talk, all over again, on basics.

Now, using OpenPediatics™, we have created a digital component for our entire curriculum. While completing their one month rotation through the ICU, pediatric residents complete the didactic lecture portion of their rotation online through the Guided Learning Pathway we created. This learning pathway contains video lectures that provide them with

the didactic education they would normally have received each morning of their rotation. Putting the didactic, classroom-based educational components online allows residents to complete this curriculum in their own time, freeing up their time in the ICU for hands-on, experiential learning. This also provides more time for practical instruction by the senior faculty member, who does not have to repetitively give the same introductory lesson to a new group of residents each month.

Our residents utilize critical thinking skills and are also pulled through the concept of mastery learning. Within the Guided Learning Pathways, each video lesson has an associated post-test, and learners must earn a score of at least 80 percent or higher before they can advance to the next lesson. If they do not pass, they must work through a series of hints and retake the test. This method draws upon Bloom’s theory of Mastery Learning.¹¹ It offers a mechanism for learners to augment their own hands-on clinical education with additional and/or supplemental materials and resources, and no matter what intrinsic learning style or pace, to master a subject before moving on to the next. By allowing learners to master the basic concepts outside the classroom, at their own pace, instructors can better utilize class time, to review more complex topics and encourage active problem solving.



Figure 3. Simulated patient cases.

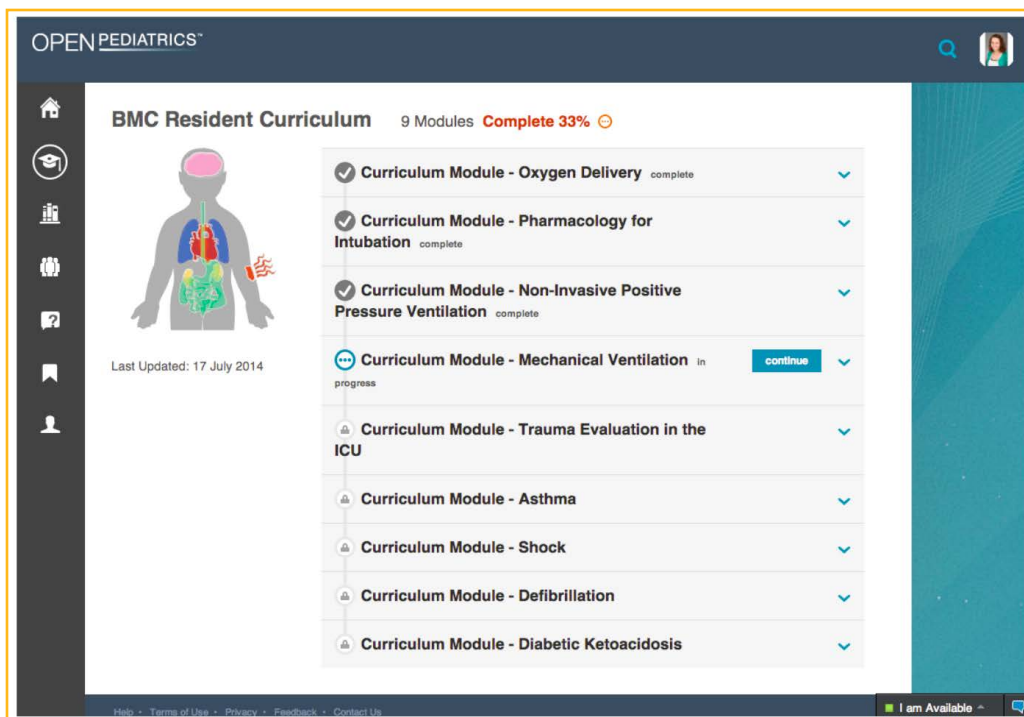


Figure 4. Guided learning pathways — The Flipped Classroom.

Additionally, after studying a module in the curriculum on OpenPediatics™, residents are able to go to the bedside and apply that knowledge. This is the blended classroom at its best.

Beyond the structured educational component of the program, OpenPediatics™ includes social collaboration tools to allow users to foster communities and connect with global colleagues. Users can create or join groups related to specific subspecialties, geographical locations, or medical interests. In these groups, users can share documents, upload resources, and exchange ideas with global colleagues through a discussion forum. The site also includes chat capabilities and video conferencing tools to allow users to communicate in real-time with any other user of OpenPediatics™.

Conclusion

OpenPediatics™ is changing the existing medical educational paradigm by offering asynchronous, interactive learning and various avenues for knowledge sharing outside the walls of select institutions. After a little more than a year of

being up and running, OpenPediatics™ serves users in over 100 countries, across six continents. We recently added Kuwait, Mauritius, and Bosnia and Herzegovina, and it is astonishing to have experienced this kind of growth in so short a time.

Where will we be in six years and 89 days? Why that amount of time? That is roughly the time that has passed since the advent of the iPhone. Digital platforms for knowledge exchange are an inevitable part of our future. The question for us as a profession is: how will we incorporate these digital platforms to best enhance medical education?

These platforms and other technological innovations are being widely utilized in the worlds of general education, aviation, and military training, and yet in the field of medical education we find ourselves still bound by the walls of our individual institutions. The needs of the world increase every day. We must more effectively share and exchange knowledge in order to meet these needs. The means to teach and learn across boundaries are at our fingertips, but we need to grasp them now and start utilizing these tools.

References

1. Chudgar SM, Cox CE, Que LG, Andolsek K, Knudsen NW, Clay AS. Current teaching and evaluation methods in critical care medicine: Has the accreditation council for graduate medical education affected how we practice and teach in the intensive care unit? *Crit Care Med*. 2009;37(1):49 – 60.
2. Drolet BC, Christopher DA, Fischer SA. Residents' response to duty-hour regulations—a follow-up national survey. *N Engl J Med*. 2012;366(24):e35. doi: 10.1056/NEJMp1202848
3. Flexner A. *Medical Education in the United States and Canada Bulletin Number Four* (The Flexner Report). New York, NY: Carnegie Foundation for the Advancement of Teaching; 1910.
4. Frenk J, Chen L, Bhutta ZA, Cohen J, Crisp N, Evans T, Fineberg H, Garcia P, Ke Y, Kelley P, Kistnasamy B, Meleis A, Naylor D, Pablos-Mendez A, Reddy S, Scrimshaw S, Sepulveda J, Serwadda D, Zurayk H. Health professionals for a new century: Transforming education to strengthen health systems in an interdependent world. *Lancet*. 2010;376(9756):1923 – 1958.
5. Cooke M, Irby DM, O'Brien BC. *Educating physicians: a call for reform of medical school and residency*. Vol 16: Wiley. com; 2010.
6. Rowles CJ, Brigham C. Strategies to promote critical thinking and active learning. *Teaching in Nursing: A Guide for Faculty*. 2nd ed. St Louis, MO: Elsevier; 2005:283 – 315.
7. Knight JF, Carley S, Tregunna B, Jarvis S, Smithies R, de Freitas S, Dunwell I, Mackway-Jones K. Serious gaming technology in major incident triage training: A pragmatic controlled trial. *Resuscitation*. 2010;81(9):1175 – 1179.
8. Royse MA, Newton SE. How gaming is used as an innovative strategy for nursing education. *Nurs Educ Perspect*. 2007;28(5):263 – 267.
9. Greitzer FL, Kuchar OA, Huston K. Cognitive science implications for enhancing training effectiveness in a serious gaming context. *J Educ Resour Comput*. 2007;7(3):2.
10. Fletcher J, Tobias S. Using computer games and simulations for instruction: A research review. Paper presented at: Proceedings of the Society for Advanced Learning Technology Meeting 2006.
11. Bloom BS. Learning for mastery. Regional Education Laboratory for the Carolinas and Virginia; 1968.

Reprinted in full from Innovations in Global Medical and Health Education. 10.5339/igmhe.2014.3 under the terms of CC BY license. Free to read version available under a CC BY license from <http://dx.doi.org/10.5339/igmhe.2014.3>