JADE

Journal of the Academy of Distinguished Educators

Can Educational Technology Transform Learning Outcomes?

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A Note from the *JADE* Editorial Board Chair

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This issue of the *Journal of the Academy of Distinguished Educators (JADE)* asks the question: Can educational technology transform learning outcomes? There's no doubt that access to technology has changed the way students — who came of age in the internet era — navigate their academic experience. Today's students can choose to attend college online, on campus (or a combination of the two); they can complete their assignments on any number of devices, and many courses include digital publications of textbooks. Of course, the impact of technology in higher education is not limited to the student experience; technology has also changed the way faculty understand and embrace their roles as educators. But while many in higher education have been eager to adopt new learning technologies as teaching tools, the value of educational technology in improving learning outcomes remains a matter of debate. For educators, the question arises, *Do we adopt educational technologies because everyone else is doing it, or because we are convinced that the use of technology in teaching is really more effective than more traditional methods?* In the following pages, you will hear from three individuals with expertise and experience in this area who make the case that the answer is more nuanced than it may at first appear.

Clay Shirky is vice provost for educational technologies at NYU. In this role, he designs, develops, and enhances all academic aspects of technology-based teaching and learning, University-wide. In his article, "Principles of Humility in Educational Technology," he offers a thoughtful analysis of the uses of educational technology in the higher education environment, basing his argument for "humility" on the premise that "Learning results from what the student does and thinks and only from what the student does and thinks. The teacher can advance learning only by influencing what the student does to learn."

Anthony Palatta, chief learning officer for the American Dental Education Association, leads and implements strategic initiatives designed to improve teaching and learning, including through the use of technology in teaching. In his article, "In the Way of Learning," he emphasizes the importance of educators' ability to adapt their mindsets to facilitate a form of active learning in which students discover knowledge through a process of engagement and reflection rather than by having it transmitted to their brains by a faculty member.

The final article, "How Educational Technology Can Help Support Sound Pedagogical Approaches and Practices," by Lillian Moran, senior educational technologist at NYU Dentistry, suggests a path forward based on an analysis of who, what, how we teach, whether it is all aligned, and how academic institutions can cultivate a "growth mindset culture."

I want to thank all the authors for sharing their views and expertise in such a thought-provoking manner, and I thank the members of the *JADE* editorial board for their input and suggestions. We hope that you enjoy this issue of *JADE*. ■

Principles of Humility in Educational Technology

By
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Educational technology will become a component of substantially all undergraduate and graduate education. This is not triumphalism so much as an observation about long trends; digital tools are spreading into education because they are spreading into everything. Although these tools are becoming ubiquitous, their arrival has been erratic. Email existed for twenty-five years before it became a normal part of academic life; digital projection took decades to supplement whiteboards and blackboards; for all the current excitement about virtual or augmented reality, no one knows when or in what form they will become useful. The inevitability of educational technology, coupled with the variability of its integration, argues for humility in implementing new tools. We should be humble as we try to implement change, partly because of the unpredictable way technology matures, and partly because of the nature of our particular institutions.

No one knows how higher education works. This is not despair so much as a summation of existing research. Even after enormous time and effort studying how students achieve competence, there are very few unambiguous links between academic inputs and student learning. As Pascarella

and Terenzini put it in their decades-long literature review, *How College Affects Students:*

> *When student precollege traits were controlled statistically, only three variables had statistically significant, positive associations with standardized measures of achievement across at least two independent samples: frequency of student-faculty interaction, degree of curricular flexibility, and faculty members' formal educational level. It is important, however, to underscore that the magnitude of these associations was quite small and perhaps of questionable practical importance.*

Despite all of our work on teaching strategies, assessment strategies, grading strategies, and the like, when we measure individual interventions, they are almost all 'small and perhaps of questionable practical importance." Yet when we study the overall life outcomes of college graduates, they excel on nearly every measure — employment, health, income, longevity. Higher education improves our students' lives, reliably and significantly, but no one has isolated what it is we do that creates that improvement.

It's complicated even trying to figure out what college improves. Pascarella and Terenzini cluster research on the effects of college into seven vectors, only one of which is "Achieving competence," the characteristic most associated with formal instruction. Others, like learning to manage emotions, or developing identity, purpose, or integrity, have no obvious locale or input, yet are clearly important effects in both undergraduate and graduate instruction. Many adults, reflecting on moments of personal transformation during their years of study, observe that these moments were rare, occurred in unpredictable settings, and often took place outside the classroom.

This is the great curiosity of higher education. We have a system that benefits our students. It is stable and repeatable — we offer classes and issue degrees every year, and many schools have done so for centuries — and society continues to value them. Despite this, we have only a general idea of how and why we produce the value we do. Meanwhile, the design of our current practices, such as the structure of courses and semesters and majors, have been more evolved than planned. In this environment, those of us interested in using technology to improve education face the obvious dilemma: if we don't know exactly how our institutions produce value, it can be hard to know where to modify our current practices. Given this lack of an instruction manual, we should at least operate with a set of principles about when and how to use technology to educate.

Any such principles should start with the core truth of learning, best expressed by Herbert Simon: "Learning results from what the student does and thinks and only from what the student does and thinks. The teacher can advance learning only by influencing what the student does to learn." Far from being something we can buy, educational technology is — only — something we can offer. Whether any given tool ends up being educational is a matter for faculty to attempt, and students to validate. (The general case is that *teaching* is only something we can offer, but *learning* is never guaranteed. Technology does nothing to change that.) In addition, a tool does not need to be labeled "educational" to aid

learning — when we survey students about the tools they find helpful, Google, Wikipedia, and YouTube frequently top the list.

> It would be better if faculty were to abandon the label educational technology altogether, and talk instead of the experiences we want our students to have. The way educational technology can help a student learn is no different than the way books or projects or labs or problem sets can help: **by influencing what the student does or thinks.**

Given all this, it would be better if faculty were to abandon the label educational technology altogether, and talk instead of the experiences we want our students to have. The way educational technology can help a student learn is no different than the way books or projects or labs or problem sets can help: by influencing what the student does or thinks. Faculty never talk like this, of course, because we're so familiar with existing practices, We don't tell students "I want you to have the experience of reading a book" — or doing a problem set, or writing up the results — but that's what the activities in a course are. Indeed, per Simon, that's *all* those activities are: experiences that might influence the students. An assignment is an experience. A syllabus is an ordered list of experiences. The course is the sum of the actual experiences. If we start thinking this way, it becomes easier to imagine principles for when and how to use technology.

The first principle is obvious: *We should only use technology if it usefully affects what the student does or thinks.* Digital tools are not inherently engaging — the vast majority of websites and mobile apps ever launched failed. Likewise, EdTech companies (so-called only because they sell technology to educational institutions) cannot put education in at the factory. Only faculty can weigh the possible advantages of using any new tool in our classes.

The second principle balances novelty and continuity: *We should add new experiences liberally, but remove old ones cautiously.* Just because new activity might be useful does not mean that the old ones have become useless. This is true of technologic change generally; new tools almost never replace old ones all at once. Even after email appeared, the fax hung on for signed documents, and so on. Our students will be better off if we add new activities alongside existing ones, not least because we will need a comparative basis to say what's working and what's not.

Next, when we are using new technologies, *we should maintain a varied diet of activities.* Existing classes offer students a mix — listening to lectures, reading, writing, in-class discussion, small group work, and so on. Faculty are so accustomed to these, we don't even notice when we switch from lecturing to QA to moderating student conversation, but the hallmark of a good class is having more than one kind of engagement on offer, sometimes at the same time. We have to preserve this variability with our new tools. No technology, whether VR or group-created documents or online conversation, is so good it can be the sole experience students have.

In this varied diet, *we should preserve human contact.* We now know, from the decade-long MOOC experiment, that there are a number of people who, if given high quality materials, can create an incredible education for themselves. That number is around 2%. Everyone else needs human contact, for motivation and for focus. Another of Pascarella and Terezini's findings is that "the extent to which peers and student groups are seen as friendly and supportive and to which faculty are seen as approachable, helpful, and encouraging that have the most important positive implications" for student benefit from college. That does not change with digital tools, because we are the same analog people. Digital tools should support contact between student and teacher, and among students, because all education should support those things.

Finally, we need a meta-principle, because no one gets this right the first time. *We should keep talking about our choices.* Every major success in integrating technology into complex human settings takes time and constant adjustments — the technology gets modified to fit the people, even as the people adapt to the technology. The twin risks of implementing new technology are hubris and complacency — either congratulating ourselves on our success in advance of testing, or being satisfied with whatever results we get. The only way to guard against these is to build in the opportunity to talk about what works and what doesn't, with our peers and our students.

These principles are not an argument for proceeding slowly. They are an argument for proceeding incrementally. A professor can test many small changes (technological and otherwise) over the course of a semester, and this style of experimentation allows for rapid expansion or removal of new techniques, even within a single semester. Incremental implementation also saves everyone from the risks of 'all or nothing' efforts. When faculty, departments or institutions commit to sudden, wholesale change, the ability to learn from that change is reduced, not increased. The sudden adoption of Udacity courses in San Jose State in 2013 was so disastrous that the entire program was scrapped. San Jose went back to status quo ante, and Udacity exited higher education entirely. No one benefitted from the aggressive implementation — least of all the SJC students, who failed their math courses in record numbers. (Don't try all or nothing development if you can't stand getting nothing.)

The integration of technology throughout the academic enterprise, including in our classes, will not be optional, it will not be minor, and it will not be quick. Every institution is going to work through these changes over time, because the reimagining required is too pervasive to relegate but too complex to get done all at once. Faculty work in large, complex institutions whose inner workings are often somewhat mysterious, even to us; we will inevitably end up crossing the river by feeling for stones. We should approach the integration of new technologies into our practices with those realities in mind, and proceed with humility as we sort out what works from what doesn't. Implementing these changes will humble us anyway, so we might as well proceed with that in mind. ∎

In the Way of Learning

By
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Several years ago, I was invited to co-teach a one-day course with several faculty members at a US dental school. We were each responsible for providing a 15-minute presentation. After each presentation, the students, who were seated at round tables of six, were given several questions to ponder. As I moved around the room and visited different tables, I learned something I've never forgotten:

I was in the way. Of learning.

Thinking the students would be thrilled to have direct access to my expertise, I sat down with the first group engaged in conversation. I was welcomed by silence as if I were a giant mute button. I shared a brief overview of the points I wanted to make and provided some direction toward the responses I expected — what I hoped they would learn. There were no questions. They replied that they would let me know if they needed me. As soon as I stood up and moved to the next table, the student discourse came back to life.

I was in the way. Of learning.

As I stood in the class not knowing what I should be doing, I saw a student looking toward me. She kept smiling at me while gently nodding her head. Finally, someone who valued my knowledge! When I approached her, I quickly learned what she wanted from me was not my expertise but to move out of her sight path as I was blocking her view of the screen on which several references were being displayed.

I was in the way. Of learning.

Up until that time I had perceived faculty as the conduit between knowledge and the student. Knowledge existed within me, and my role was to transmit most, if not all of it, to the minds of students. One could visualize this as a simple consecutive path: Knowledge-Faculty-Student. Little did I realize that I was in the way of learning.

Educators have access to abundant new technologies that can improve learning for our students: active learning, simulation and modeling, clicker systems, adaptive learning, collaboration software tools, and flipped classrooms. These technologies have proven to be quite effective in providing faculty with new tools that improve students' ability to engage more deeply with the course material, collaborate with each other, and appeal to the multiple learning styles that best suit each student. But are students really learning better?

According to an article titled "A Newer Education for Our Era," in *The Chronicle of Higher Education,* not really. The question faculty should be asking is not what our students are learning, but what we are learning — the faculty and the academic institution — about learning? The point is that until our current learning paradigm is transformed, whichever new technology we add to the mix will most likely not reach its full potential and neither will our students. It's not that we are failing our students. Most faculty come to dental education with a wealth of knowledge, professional experience, and seasoned intuition, but they are hampered by teaching skills based on the way they were taught.

Today's learning environment demands a new approach to education. The explosion of data since the advent of the internet and the digitization of knowledge cannot be underestimated. Ninety percent of today's data was generated in only the past two years and with the expansion of the internet of things (IoT) and artificial intelligence (AI) into our work and personal lives, data are being created at an exponential rate. So what will be our profession's response? Increased lecture time? Longer semesters? A five-year predoctoral dental education program?

I doubt that any of these approaches will suffice. An incremental increase in education hours can never keep pace with the exponential growth of information. Eventually something must give. Perhaps that "something" is our perception of our role as teachers, choosing instead to visualize our new role as learning facilitators and simply moving "out of the way" of learning. To do so, the very culture we were trained in will require reform.

How many of us still present information to students on PowerPoint slides crammed with important information we know our students must learn, including those important, yet rare health anomalies we find utterly fascinating? It's

a habit hard to break. Yet educational research tells us that students learn more effectively via experiential learning — a form of active learning in which students discover knowledge through a process of engagement and reflection rather than by having it transmitted to their brains by a faculty member. A flipped classroom is one method of delivering experiential learning. The faculty member uses her wealth of learned knowledge and experience to determine which learning materials the student can utilize to best understand the subject matter, such as textbooks, videos, and journal articles. Students consume the materials on their own time and at their own pace, often using technology such as a smart phone or digital pad. During class time, the faculty member provides questions for small groups of students to consider and respond to while she *moves out of the way* of learning and allows students to engage directly with the material in a collaborative format.

Do you require students to take multiple-choice exams that necessitate substantial security and in which material must be memorized? If you do, most likely you are not assessing student learning but only memorized facts or excellent guessing techniques and clever mnemonic devices. Today's students have no need to memorize facts to be successful in their careers. The digitization of knowledge coupled with the convenience of handheld devices provides us with real time access to any data we need to know. What students do need are the skills that will make them future ready — critical thinkers with strong communication skills whose minds are resilient and able to adapt to a constant flow of new information. Students

must learn *how to learn* and faculty can guide them on that path by rethinking our position in the learning environment.

> Educational research tells us that students learn more effectively via experiential learning — a form of active learning in which students discover knowledge through a process of engagement and reflection rather than by having it transmitted to their brains by a faculty member. A **flipped classroom** is one method of delivering experiential learning.

Our patients are far more interested in what we know now and not what we learned years ago in school. They value us as lifelong learners who do not regurgitate what we have memorized but instead use critical thinking skills in the moment to understand them as individuals. This means developing our students' ability to perform at a higher order level of thinking, predominantly the ability to analyze and evaluate patient information leading to the creation of innovative ideas that allow us to readily adapt to the fast changing world of constant new data. We need our students to be empathic good listeners who can communicate effectively utilizing multiple communication styles and formats and across all cultures. Students should understand the person-centered care approach to improving oral health, viewing dentistry as a critical com-

ponent of overall health and that we practice in collaboration with other health professionals.

For academic dentistry to deliver these competencies to our students, our learning environments, including our physical and pedagogical position and role in that environment, must reflect these aspirational goals. This begins with faculty adjusting their mental models. Until then, new technology applied with an old mindset will not suffice in preparing our students for the future of healthcare delivery and success in their careers that will extend another 40-plus years into the future.

Are you in the way of your students' learning? If so, you are absolved, as this is how we were taught to teach. But we can change and become facilitators of learning by rethinking our position in the learning environment and embracing learning theory. Faculty cannot do this alone. They require institutional support in the form of faculty development opportunities, financial and time resources, and collaborative support among the leadership and faculty at each academic dental institution. Dental schools and programs can also collaborate with each other.

By establishing a professional learning community in which our academic dental institutions share effective practices, dental educators and their students can benefit from this "ecosystem of learning," an opportunity we should explore. If our students are to move up the learning taxonomy pyramid toward robust critical thinking skills coupled with the ability to be effective communicators, we as faculty must also take this journey, and then lead them on it. ∎

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This article represents the opinions of the author and not necessarily those of the American Dental Education Association.

How Educational Technology Can Help Support Sound Pedagogical Approaches and Practices

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The Association for Educational Communications and Technology (AECT) defines the implementation of educational technology as "the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources."[1] The practice is one of continual growth as new evidence-based teaching and learning approaches emerge, new technologies are developed, and institutional needs change. Learning analytics, augmented and virtual reality, personalized and adaptive learning — there is no shortage of content for higher education articles touting, or disputing, the latest and greatest emerging educational technologies and trends, and/or their potential impact on teaching and learning. The only consensus is that the landscape appears to be in constant flux, which can leave faculty feeling overwhelmed by questions: *What if I change my teaching style; is the work worth it? Will it work? Will it be replaced by something better next week, next month?* While these are all valid questions, I would like to suggest that the educational technology itself is not a silver bullet; it is an approach that should enhance sound pedagogical approaches and practices.

Such approaches can be summed up by asking five core questions, namely: 1) who we are teaching, 2) what we are teaching, 3) how are we going to teach, 4) is it all aligned, and 5) who is going to support us?

Who are we teaching?

Sound pedagogical practice encourages instructors to identify where a student is in his/her learning, gaps in their knowledge, and/or any misconceptions they may have about a given topic. This is at the core of good teaching practices and is not limited to our current student demographic. Utilizing frequent formative assessments and feedback loops can provide both the faculty member and the student with a better understanding of where they are in their learning progress. Educational technology can facilitate these opportunities through quizzes in a learning management system, student-response systems, and/or personalized content review systems.

A second key consideration regarding who we are teaching is an understanding of learner abilities. Our current generation of learners live in an on-demand society — online shopping, watching, drop-in medical appointments, etc. — so it is not surprising that they have come to expect a level of flexibility and convenience in their education. However, the level of technology savviness displayed by these digital natives has resulted in various myths,[2] including an expectation that these learners are 100% comfortable with learning in an online environment. Educational technologies can facilitate blended and online learning, but support is needed to

help learners — and the faculty who are teaching blended and online courses — to navigate the online environment in order to reach the desired pedagogical objective(s).

What we are teaching?

As experts on a topic to which faculty members have dedicated their professional lives, it is easy to believe that learners should be as passionate about the intricate details of a topic as they are. But this belief runs the risk of distracting from the core of what the learner needs to know about a given topic. We must ask ourselves what is 'need to know' versus 'what is 'nice to know' about the topic at hand; what are the three to five core concepts we want learners to take away from each lesson; what is the best delivery medium (e.g., text, animation, video, etc.) for each concept; and are the concepts presented in a logical sequence? These key questions posed during initial phases of the educational technology process can often identify areas for improvement and result in a clearer, more logical experience for learners.

How are we going to teach?

Harvard professor and father of the flipped classroom, Eric Mazur, frequently opens his talks with the story of when he stopped asking what he was going to teach his students, and started asking how he was going to teach them.[3] He realized that his previous teaching approach mainly involved the passive transfer of information, i.e., what he was going to teach, and resulted in a lack of meaningful learning and retention. In search of ways to encourage such

meaningful learning, he incorporated more active learning strategies into his teaching. The flipped classroom is an active learning strategy, and involves learners becoming familiar with new material outside of class, in an online environment, freeing up in-class time for practice and the application of new knowledge. Educational technology can facilitate the delivery of the online portion, allowing for more free time in class for active learning strategies such as case-based teaching, problem-based learning, and group discussion.

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A second key consideration regarding how we are going to teach is the ability to identify pitfalls and misconceptions that may be experienced by novice learners. To do so, we must establish a strong foundational knowledge-base for the learner and explicitly build upon that foundation by linking new content to existing knowledge, allowing for a level of mastery of foundational knowledge which in turn allows for deeper cognition. Foundational knowledge can be designed and delivered through the use of educational technology, including personalized learning systems, and referred back to as often as needed by novice learners.

Is it all aligned?

From a pedagogical perspective, alignment refers to the clear and logical connection among three key aspects: course content, delivery of that content, and the assessment of a student's understanding of that content. If an assessment is not clearly aligned it is almost impossible to evaluate where the root cause of a breakdown in student understanding may be. For example: Are students not performing well on a question in the mid-term because the question is unclear, the content wasn't covered in sufficient depth to answer the question, the delivery method was not optimal, or there was a lack of scaffolding from novel to complex aspects of a topic? Without this fundamental alignment, an evaluation of the impact of any change in the way the course is taught, or of the use of a new educational technology, is virtually impossible.

Who is going to support us?

How do we as an institution cultivate what Carol Dweck calls a growth mindset culture[4] of "I'm a good teacher, but I want to be great!"? As many who have engaged with the process of educational technology will attest, it is a commitment of both time and effort for all involved that has fundamentally changed how they teach for the better. But what additional support struc-

tures could we provide to facilitate this growth mindset and teaching and learning exploration? Perhaps additional funding, or stipends, or course release? Perhaps integrating experimentation and innovation in teaching into the tenure and promotion process? We need to cultivate, encourage, support, and reward for the additional time, resources, and effort which go into improving the teaching and learning experience at our institution. This, in turn, would allow us to produce evidence-based research on the *Scholarship of Teaching and Learning (SoTL)*[5], which could improve our understanding of the potential of specific educational technologies to enhance the field of teaching and learning as a whole. ∎

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