Technology assisted teaching

Robert Boland MD

Disclosures

- I have no conflicts of interest with any materials related to this presentation. I alone am responsible for the content of this presentation.

I did want to send my greeting from the Academy of Psychosomatic Medicine, who I am representing here.
Our next meeting will be in Palm Springs California, and the theme is
I hope you consider coming to the meeting.

I particularly like this term:

Technology assisted teaching
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technology-assisted teaching, because that’s how I think we talk about
technology. It’s there to assist us, not replace us.
I know the literature is full of studies asking what’s better at teaching, computers or people?

They are usually like this: a teacher divides the trainees into 2 groups, 1 gets “usual teaching” and the other gets some new “innovative” thing. Then they give them a test. And which group usually wins?

The answer of course is: who cares? These studies are so flawed, the only people these convince are the ones already converted.

(Animation) And even if there is an answer, again, I don’t care. I love to teach, and I like doing it in person, with real human interactions. I plan to keep doing it. But I don’t like every bit of it. There are certainly parts of my job that I would gladly punt to someone, or something else, if I could.
And that’s where technology comes in. It can do the stuff that we aren’t that good at, or maybe just don’t want to do.

Technology is at its best when it makes things simpler for us.

But we all know that technology can make things more difficult too. So before we think about how technology can improve teaching, we need to know something about our learners.
So, how are our trainees using technology?

But first, we must understand our population. How are our students using technology?

This is a survey of US residents from a variety of programs who were surveyed. We wanted to understand how they were using smartphones for clinical purposes. All of them have smartphones. Mostly they are using them to access patient information, from the electronic records and to communicate with the staff. A few but much less were using the phones to communicate with patients and to handle their scheduling. Only about 37% used them for treatment planning, meaning using them for information or algorithms to help them make treatment decisions.
We also asked about what prevented them from using their phones more widely. Not surprisingly, the biggest concern was about privacy. They also felt that there wasn’t enough guidance from their teachers on how to use the phones. Some were concerned about the lack of evidence for using technology in patient care, others were worried about liability, and what to do with all the data they would get. A few, but not many were also worried about the cost of devices and programs.

Beyond clinical uses, we were interested to hear how residents were using these devices for their education, which of course is most germane to this talk.
Here we surveyed Harvard psychiatry residents (57) to see what they were using to find information online – they were able to pick more than one resource. You can see that most of them used UpToDate, an online site that reviews medical topics for doctors. Next most popular was PubMed, which is the portal most people in the US use to access primary literature. Nor far behind was Wikipedia, and then various guidelines mostly put out by hospitals, and several other review sites. Least popular were online textbooks. So it is reassuring that more than half of residents use PubMed to look up articles, however by far they are using non-peer reviewed secondary sites, and of course Wikipedia, which although having its value, is not a scientific site.

This is from the same study, and here we asked them what the barriers to using online resources more were. The three most popular choices among the residents were time, the difficulty finding material that was relevant to their practice, and, again, the lack of guidance in how to use online resources from faculty.
What about medical students. Here’s another study I was involved in, this time from Cornell Medical School in New York, where we asked the same questions that we asked the residents but this time to the medical students there (68). We found a similar pattern, with Up to Date, PubMed and Wikipedia being the most popular resources. Online textbooks were somewhat more popular – I suspect this is because some courses require them.

So I take from this that our trainees certainly have the ability to use technology, but most are using it in a limited way both for clinical care and for education. Most interesting to me was their complaints of lack of guidance from faculty – what some told me was that it is hard for them to know what to use when we are using it. Which is a shame because as I already said, I think that technology can really help us to be better educators.
But rather than just ditching it, I thought it might be fun to try something a little innovative. So I created a self-study program using Adobe’s Authorware, which is this complicated, but powerful thing that helped create educational software. It has since been replaced other newer things.

I first became interested in this question years ago, when I created a CD based program to teach psychopharmacology. I made this thing, which combined the text from my lecture with a narration, multimedia and other interactive components and I put it on a CD. Then I told the students, this will be on the test so you have a choice. You can just come to the usual lecture on the subject, you can just study on your own from the textbook, or you can get my CD and use that. But you can only do one. Then we’ll have a quiz.
I later put it on the web, but I wanted on CD first for the experiment so I would know who used it.

The students chose, roughly evenly. I didn’t randomize—I didn’t think I could, this being their class, but—this may sound defensive—but I was comfortable with this being a natural experiment, because, presumably, in the real world, that’s what adult learners do, they self select their educational activities.

68
CD:20
Lecture:20
Own: 28
I’ll tell you more about my experiment but let me give you the ending first: from this experience, I came to a bunch of conclusions that really influenced the way I started to use technology in my teaching.

Here are the 10 things I learned from the experiment:
1. Students can learn from computers. (meaning, it can work).
2. But the kind of knowledge you want them to learn is important: computers are better for lower-order learning. (remembering things)
3. Snazzy stuff is good. (use the bells and whistles - keeps them interested)
4. The better the computer program, the better the results.
5. Better computer programs are more interactive.
6. Practice questions are good for interactivity. (gets them thinking).
7. Putting the student in control of the program is good.
8. Variety is good.
   • In fact, the program worked so well, may if I made it even better I could cut all my lectures, and use the time to do something else.

At least this is what I thought after my little experiment. But that was pretty inadequate data. We wouldn’t rely on something like this to treat our patients, and we can’t let curricular decisions rely on this kind of stuff either (although it amazes me how often we do – have you seen the data for “Problem Based Learning”? But I digress). We need to review data on computers in teaching to make an Evidence Based Decision.
So what does the data say? We don’t know – most of it isn’t in medical journals, it’s in Educational Journals. For me that’s a whole other library way across town (I know what you’re thinking, like I’ve ever set foot in a library in the last 10 years, but you get my point).

So I started to look at these other journals, and there’s a fair amount paper written just on this subject. Most of it focuses on online education. The most influential for me was a metanalysis done by the Department of Education in 2009. I’ve listed some sources above(also, put on slide Milken Exchange, Carnegie Mellon).

I collected a number of these papers, particularly the better the reviews, and put the in a dropbox folder – if you’d like to check them out yourselves, just email me.
So what did I find? First the literature isn’t very consistent on what computer education is. So I restricted my search to looking at computerized, online education, which is the kind most of us are interested in. They’ve been publishing articles about that for about 15 years. During this time, there’s been more than a thousand scholarly research articles. Some are okay, a few are very impressive. Most are crap. You know, the usual flaws: unstructured inconsistent interventions (26%), no experimental, or even quasi-experimental design (45%), no outcomes measures or silly ones (26%). My favorite silly outcome measure is “student preference.” Student preference? I bet they’d prefer to stay home?

When you keep whittling it down like that, you end up with a couple of hundred articles worth reading. So let’s see what these had to say about my own conclusions.
“Students can learn from computers.”

Can students can learn from computers? Meaning does this all really work?

In the DOE metanalysis, a little under 50 (46) studies had enough information to calculate effect sizes. The size of the studies varied widely, but most were modest. There was a large age range, but most were post college, and a lot were medical subjects.

Of these, 28 studies directly compared online learning to face-to face instruction. They found a mean effect of +0.14 in favor of online education. (P < .05)
So this suggests that student learning was about the same whether you used traditional or online teaching, and there was a small but not significant preference for online teaching. For me this is good news: I’m not looking for computerized teaching to be better, I just don’t want it to be worse.

Let’s test some of my other conclusions.

The type of knowledge you’re going for is important: computers are better for low-level learning.

This was more of a conjecture – I didn’t have a big enough sample to do an item analysis. But what did other studies show? Most only look at declarative learning – the ability to recognize and describe something – this is usually evaluated with a multiple-choice test like mine. But some studies did ask people to learn something, say a procedure, and then do it (procedural knowledge), and some studies even taught skills and then observed how the students used those skills to solve problems (strategic knowledge). In every case, if you give the students the information, they will learn it. There was a trend, actually, for better outcomes in the higher order learning groups, and given the small sample size of these studies, that cries out for more research.

Additional info if asked:
Declarative (se = 0.089  Limits 0.017 – 0.365  Q = 1.08)
Procedural  (se = 0.065, Limits 0.166-0.419)
Strategic    (se = 0.158, Limits 0.025 – 0.644)

By “snazzy stuff is good”, I mean all the bells and whistles you can create with computer programs. I like visuals – drawings, photos, animations, and I used a lot of them in my program.

I know they’re silly, but I like picturing things. And I often use animations and such in my teaching. But they take forever to make. Was it worth it?

Well, the evidence says no. When multimedia and text-only programs are compared, they do about the same.

I thought I was playing to the MTV generation – a group who, if I don’t wow with pictures and sounds, their tiny attention spans will focus elsewhere.
But my education theory colleagues say this all makes sense: it’s not about the medium, *that’s* just a vessel for the content...

(standard errors: .1 and .060). Q 0.13

...and it’s all about the content.

**It’s ALL About Content!**

So, maybe the problem was my lousy program. Maybe if an expert did it, and made it more sophisticated maybe then it would make a bigger difference.
Apparently not. If we use the date of studies as a proxy for sophistication, then there’s little difference between older and newer studies.

How about Interactivity?

That has become a key selling feature of most educational programs.

Well, it seems to depend on what kind of interactivity we’re talking about. Take interactive questions? I had those, and they were hard to program. Should I have?

Well, maybe not – the results are pretty mixed. Four good quality studies exist, the only one supported the advantage of testing compared two different platforms – WebCT and something called IDLE, and apparently the students using WebCT performed significantly better.
Well, then why bother with all the hard stuff? I spend all this time trying to make it interactive, maybe it doesn’t matter? Maybe I should have copied my lecture and pasted it on a web page.

Well, apparently some types of interactivity does matter. For example, Simulations. I’ll talk more on that later.

But will mention that three studies in the metanalysis incorporated simulations; 2 had positive results. For example, Hibelink (2007) found good results when using three-dimensional simulations for teaching human anatomy.
Control is good.

- 7 studies
  - 4 positive
  - 3 negative
- But more indirect measures

For example, although the particular interactive scheme isn’t important, giving the students overall control of the program, so they can go at their own pace, that does seem to matter. A number of studies bear on this question, some directly, some not, and the more direct ones support the idea that user control is important.

For example, Zhang and colleagues (2005) reported on a comparison of two online courses incorporating video: the control group had to view the materials in a specific order, the other group got to watch the in any order they like. The group with control did better.

My only beef with that one is that the control group couldn’t even rewind the videos, which seems a bit like setting them up to fail. Still, if you’re comparing this to a lecture, those students don’t have a rewind either.

Variety is also good—presenting the same information in different formats. Now how can this be true - I already said snazzy stuff doesn’t help.

Well, the point is, the particular thing you do doesn’t matter, as long as you do something different once in a while.
Okay, then programs do work, and making reasonably fancy ones is worth the effort. So, maybe, I should lecturing and let the machine do it.

Well, not so fast. In the same metanalysis that compared online and computerized education, they also compared doing both, or *blended learning*, and that did the best – look, +0.35 (p<.001) a real effect size.
Which suggests students learn best when we and the machines work together.

Which sounds like a conclusion, right? But not just yet: I have to reveal that a lot of these studies didn’t control for one particularly important variable, and for the ones that at least reported the variable, that variable seemed to be the mediator that accounts for most of the effect. And what do you suppose that mediator was?

Time.

The more time you spent in an activity, the better you learned it. Which is why blended learning was so good – the students had two different activities, and doing them both took more time.
So, what does this all prove? Students are more likely to learn something if they

- Spend lots of time on learning
- Have some control so they can take it at their pace, and
- (3) get some variety so they don’t zone out

This sounds to me like good old fashioned, traditional teaching values.

Which is where I began...

Time is particularly interesting to me. That’s the one thing that I can’t control, and every year I seem to have less of it.

If machines can be there, teaching them, when I can’t – which is, let’s face it, *most of the time* -- again, that great.

So, as I said, rather than being all competitive with computers, we should thank them for being so helpful.
So, I want to give some examples of how I've used technology to help me be a better teacher.

EXAMPLES

Direct Teaching

I usually divide different kinds of teaching (or pedagogy) into three categories: lectures and similar presentation, skills-based teaching and inquiry-based teaching.

We all know what lectures are, and if you don’t, it’s what I’m doing now. It’s part of what we think of as traditional teaching.

Skill’s based teaching is another traditional approach. It is "learning by doing" and is based in the apprenticeship model of teaching.
I'm using Inquiry-based teaching to describe a bunch of approaches under the rubric of "active learning", including problem-based learning, team-based learning, case-based learning and similar approaches.

I would suggest no matter what method you use,
Lectures are easy. Almost all lectures these days are technology enhanced, courtesy of PowerPoint.

Some would substitute the work “enhanced” with “ruined” of course.

And when you think about it, some of the greatest presentations ever seemed to do just fine without PowerPoint.
And yet, talks enhanced by electronic graphics are – let’s face it - more or less expected. And PowerPoint seems to be the “Jello” of electronic presentation tools.

And we can, of course, get fancier, and use presentation programs that take a whole different approach. For example Prezi is designed to show the relationship between different concepts.

But computers can do more than make slides, it can enhance lectures in other ways.
We are always looking for ways to better engage our audience, especially large audiences, and make the experience more interactive, without it devolving into total chaos. One approach has been to use audience response systems, but the problem there was getting enough clickers, and at least for me they were expensive, and we were always losing them.

But really don’t need them now, almost everyone already owns a clicker, it’s called a Smartphone, and as we learned, it seems most if not all trainees have them. Please take yours out and go to this web site:

There are plenty of apps that can turn your phone into a clicker. Probably the most popular is one called Poll everywhere.

But here I am simply using Google Drive. If you use this link or the many are free or at least cheap.
When you go to the link you see this simple form. Here it is looking for feedback so I asked one question about content and one about process.

Using a simple web app I can view responses in real time.

And comments. And you can see the feedback too. If you put in your
My advice if you use this: Audience response is nice, it wakes people up, but don’t overuse it, it gets boring fast if you do it too much.

Technology can also be used to increase access to the lectures, and there are several workshops on video teaching so I’ll just give some quick advice. Watching recordings of live lectures are usually pretty boring. If you want to create online materials you should do it from scratch. There’s lots of advice about how to modify lectures for online use, one important one is to keep it pretty short. Attention spans wander more quickly with recorded video than in person interactions – 20 minutes is probably the maximum than any educational video should be. If you have more to say, break up your talk into parts.
But enough about presentation, that's all pretty clear. What may not be as clear is that it can help other forms of teaching as well.

For example, we think of skills-based teaching as hands-on learning.

This means that the trainee needs to actually experience something, not just read about it. That this would be effective seems obvious.

But there are limits to the experiences we can provide. Who here has seen someone with Neuroleptic Malignant Syndrome (MS) who wasn’t already diagnosed with it – you had to figure it out yourself? Who here has seen someone die from NMS?

Some things are thankfully rare, and just too dangerous to reproduce. But when you do see it, you never forget.
So how can we give students this experience?

Slide 79

With simulations.

Most schools have really cool simulation centers, but psychiatry has been slow to that table. Of course we've been doing simulations for years using standardized patients. But that can only go so far. It’s difficult to reproduce many critical psychiatric emergencies using actors. That’s where technology can come in.

Slide 80

For instance I’m working with a resident, Meredith Gasner and our sim center to develop modules to teach psychiatric emergencies. We aren’t the first to do it, but you can imagine a typical scenario:
For example, a student enters the room to find a young woman with a history of bipolar disorder who is nauseous and has been vomiting. On exam she is mildly tachycardic, has a tremor, myoclonus and downbeat nystagmus.
But, you know, I’m not convinced that we need things to be so high tech. Recently I’ve been exploring with lower tech items. Because after all, the most important thing in simulation is not technology, its fidelity – meaning that its not so much how cool your sim is, its how interactive and responsive it is.

And I can’t help thinking that a lot of what we do is cognitive, which means, to me at least that it can be reproduced in simple ways. You are all likely too young to remember text based adventure games, like this one, but the concept is simple.

They were pretty different from today’s games, as you can see, but the well designed ones were still very popular – long after graphic games started coming out, because they were interactive, and as humans we find that very compelling.
So I thought that maybe this is worth a try in psychiatry. (demo patient vignette)

Then there is inquiry based teaching. We think of this as low tech, small group learning.
And that is fine when you can bring everyone together, but what if you can’t. In our program, the residents can be at various places in Boston, and anyone who knows Boston knows that even if the places seem close on a map, it can be a chore to get from one place to another there.

So what else can we do? Well, who has ever made a Skype call? Who has done group meeting via the internet, using Skype, GotoMeeting, Google hangouts or something similar?

It’s easy to adapt these to the teaching setting. And at least some literature suggests it is just as effective as in person team-based learning.

And although we might worry about the loss of nuance when we are communicating through little video boxes, the fact is our trainees are used to it, and may prefer it. They certainly appreciate not getting dragged across town, so it usually gets good evaluations.
Slide 91

Which gets me to another problem we are always dealing with: evaluations. If I’ve learned anything from being on the regulatory side of Psychiatry training, it’s that we are all struggling with the problem of how to get good evaluations – both from our faculty and from our trainees.

Slide 92

Sure we already use technology for this, but those online forms can be challenging – often they are too long and people fill them out way too late. So we push them to fill them out on time and then what do people do? Maybe your place is different, but I see I lot of perfect scores down a row. My best hope is that maybe when I get to the end, there will be some comments better than “great job, pleasure to have on service.”

Slide 93

To deal with this, I worked with a resident, John Torous to figure out an alternative. We decided to give up on quality and frankly just go for quantity and speed. So instead of long evaluations we asked only a few questions so that you could fill out the form in about 2 minutes.
Then we send the link to everyone's phones and told them to do it as soon as possible. They’d click, tap a few boxes and usually write some comments. Younger people seem fine with writing on their phones. 2 minutes, done.

And the cool thing, since this is in a cloud, is that you can then program it to automatically send out the results to the user, in this case it goes to the resident who wrote it and directly to the faculty.

The residents are okay with it, and the faculty love it – most are giving multiple sessions so they can see how they are doing along the way and make corrections. It’s also good for faculty morale – most of the feedback is positive, when critical, its often helpful. My favorite is one course where the feedback was simply “we can’t hear you.” I asked a resident – how can that be, it’s a small room, they’re all sitting around a table. “He mumbles” was the answer. Well, this went out to presenter, who was a little embarrassed – “why didn’t they just tell me?” But he’s a bit of an intimidating guy, and they couldn’t confront him. After then, he spoke up.
This has been useful enough that we are thinking of ways to expanding it, like to the clinical setting. I wasn’t the first to figure this out, for example the surgical residents at Mass General, also in Boston are doing something similar to rate resident’s procedures – they let me demo it and I have to say its very impressive especially in being so simple to use.

But ultimately, in residency we are learning how to learn, which gets me to thinking of how we can use technology to improve our learning habit.

One technique that residents and students particularly like is the use of questions. There are a number of question banks out there, but they are proprietary, often expensive, aren’t really geared toward learning – they are more about passing board exams and teaching testing skills. And most of concern to me is that they often have poor quality control.
So we’ve developing a program on our own called Psy-Q to act as a question bank for students and residents. The problem here is that many have tried to do things like this, but it usually fails because the developers start strong, but it turns out to be too much work for too little reward, and the projects die out.

We decided to deal with this problem by crowd sourcing it. Crowdsourcing is the opposite of the usual editorial approach – here we turn much of the editorial process over to the masses.

For example, when a user signs in, they get a question
If you answer wrong, it gives you the right answer along with an explanation. But to me the interesting thing is what is happening below the explanation – the user is able to assign a level of difficulty to the item, and also to rate is whether they think it is a good question or not. Questions that rate poorly will be flagged and eventually eliminated, so over time the quality of the questions, hopefully, will improve.

So I hope I’ve made the point that

Whether technology-based education is preferable to face to face teaching is a meaningless question.

Because technology isn’t here to replace us, its here to help us

And it can even help us with our biggest challenges, like giving and getting good feedback.
And regardless of the type of teaching – whether its traditional lectures, skills based teaching, or inquiry based teaching, technology can be our friend.