nudge education

Technology for people who transform education

What is Education Technology?

Young people today have access to more information in one day than their grandparents did in a lifetime. From the beginning of time until 1998, the world produced 2.5 exabytes of information. Ten years later in 2008, we created 2.5 exabytes in two days. Our world is changing quickly, and thus so are our classrooms.

Education technology is here to stay. It seems the speed of change is accelerating, and at times we can feel like we are on our heels, reacting. Technology in the classroom feels good when we own it, it doesn't own us. For us to have a healthy relationship with technology's role in our learning environments, it helps to understand what education technology is. Education technology is a lot of things, but let's focus on three important aspects:

Education Technology:
1) is a tool;
2) exists in a culture; and
3) its complicatedness is unrelated to its usefulness.

Education technology is a tool

Tools are neutral, static objects until agents engage them. A treadmill, for example, is a tool designed for exercise. It is a neutral, static object until a person decides to get on it, turn it on and start moving. It will only aid in exercise if the tool is understood by the user and used in the right way. Using it to hang laundry on will not result in weight loss. Neither will running on it once. If the treadmill is complicated and the user gets frustrated by the buttons and setting options, and gets off of it, the treadmill goes back to being a neutral, static object collecting dust (or laundry) in the corner.

Tools don't use themselves. That goes for treadmills and education technology. In order for these tools to bring about their intended effect, someone needs to use them. A tool requires an agent. This relationship between tools and the agents that use them is poorly understood when it comes to the role of technology in education. We need to name education technology as a tool so that we continue to identify ourselves, the teachers, as the agents. It is our job to understand the tool and to use it to the best of its ability for the sake of ourselves and our students.

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Some teachers never give technology a chance. Some teachers give technology exactly one chance and then swear it off

forever if any obstacles arise. Still other teachers give technology too many chances without fully understanding what the tool is best used for—imagine using a treadmill every day, but wearing roller skates on it. Like with the treadmill, all three of these moves may be a mistake that limits learning for students.

A 10th grade English teacher, Mr. Ottosson, is asked by his department to introduce NoodleBib as a tool for the students' fall research paper. On the first attempt with students, the tool can take longer to use than typing out the bibliography. Mr. Ottosson doesn't totally understand the long-term benefit for the students and cannot dissuade the students from finding the tool tedious. The technology becomes the focus of the frustrated classroom, and they go back to their old ways. If during that one use the technology is difficult to use, has anything less than the touted impact, or does not show a dramatic improvement over the teacher's existing practice, then Mr. Ottosson can label the technology unsatisfactory and discard it.

Now imagine a different trajectory for that situation. Suppose Mr. Ottosson had taken the task upon himself to become the agent that wields the tool instead of stepping back and letting the department be the tool's agent. In order for NoodleBib to have a shot at improving the students' experiences, he has to develop at least a basic understanding of the tool's operation and view the first several uses as learning experiences for everyone. This isn't to say that he has to love using NoodleBib right away, but he does have to decide to use it in order for it to get used.

Teachers and students will negotiate the meaning of technology within each classroom.

Education technology works best if given the right amount of power. The teacher who won't use technology may not be giving it enough power. The actual tool won't change the culture of a classroom, but a teacher can use the tool to its fullest potential to help change a classroom. You can't hop on the treadmill once and then go try to put on jeans from your college years and expect them to fit. And when your college jeans don't fit, you certainly can't decry the treadmill as ineffective. Some tools require time to develop sufficient skill before using them delivers results you desire.

Just like a treadmill won't make you any skinnier if you only use it to hang laundry, technology won't make education any better if you don't understand the role it can play in you transforming your own classroom.

Education technology exists within a culture

An axe consists of a sharp, flat piece of metal on a wooden handle. Yet that simple configuration can mean many things: Axes have different meanings to lumberjacks, medieval infantry soldiers, fire fighters, revolutionaries, and horror movie directors. The role that a tool plays in our lives depends on what meaning we give it, and it is surely the agent that gives meaning to the tool.

Just as tools do not use themselves, tools do not give themselves meaning. As sociologist Max Weber said, "[A human] is an animal suspended in webs of significance he himself has spun." Our tools are in those webs with us and we decide where to stick them.

Culture is what turns raising your first two fingers into a sign for peace. What culture have you created in your classroom? Teachers and students are constantly negotiating and assigning meaning to things. For example, homework may have a totally different meaning in one classroom compared to the next. For one teacher, it may be practice that is optional while for another it is a mandatory practice that largely contributes to the student's grade. A list of fraction multiplication problems doesn't come into the

world with its own meaning; its meaning has to be developed by the people who use it. Teachers and students have the power to make a tool sacred or meaningless.

How will technology be seen in the culture of your classroom? Is it replacing you as a teacher? Is it forbidden and not to be trusted? Is it introduced to increase efficiency? Or have you introduced pieces of technology in ways that shift power to students in exciting ways? Smartphones represent an interesting intersection between the classroom culture and a student's personal life. Students who enter the classroom with smartphones in their pockets also enter with a cultural understanding of what that smartphone means. It might be a status symbol, access to social groups, entertainment, or a burdensome expense. As a teacher, you likely expect students to use their smartphones differently during your class than they do after school. But what do you expect, and how do you communicate your expectations? Within the classroom culture that you establish, do you allow smartphone use as a helpful tool for note taking, fact checking, and capturing images of diagrams on the whiteboard? Or are smartphones taboo and forbidden because of their role in distracting and cheating during class? Teachers and students will negotiate the meaning of technology within each classroom.

The example about NoodleBib from above is worth examining from a cultural perspective. Teachers who don't intentionally address the cultural significance of their technological tools risk allowing their opinions and biases to create the cultural significance of those tools for them. Mr. Ottosson was instructed by his department to use this particular tool against his will to some extent. NoodleBib entered his classroom not as a guest and an assistant, but as an unwelcome foreigner intruding in the classroom against the teacher's objections. This led Mr. Ottosson to judge NoodleBib by unreasonably harsh standards, to focus more on its failings than its benefits, and ultimately to avoid learning to use NoodleBib out of protest.

Students, whatever their ability in the classroom, are excellent casual ethnographers. If a teacher lives and signals the importance of some element in the classroom, students will develop an understanding of the position of that element in the culture. This applies to all levels of education; schools signal the importance of cultural elements too, as do nations. (Think about what the emphasis on standardized testing in the early 2000s signaled to our students.) This phenomenon is not limited to technology, but certainly applies to it.

Anyone who has taught in a school with a uniform for students knows this phenomenon well. Administrators may have come up with a dress code for your students, but it is ultimately up to you how much power you will give that code in your classroom by the culture you have created. If teachers and administrators spend time and attention on how well students' dress follows the uniform code then students will spend time and focus on their uniform, too. If teachers indicate the unimportance of the uniform policy by obviously ignoring infractions and half-heartedly participating in inspections, then students will give little effort to dressing within the code.

If Mr. Ottosson spends little time on the tool, speaks of it in generally disparaging terms, treats errors as expected and successes as anomalous, and employs it inconsistently, these cultural signals will be obvious to the students. The students then likely adopt the cultural meaning exemplified by the teacher and develop low opinions of NoodleBib. With the technological tool occupying such a low position in the culture, it is unlikely to have a positive influence on the classroom.

Education technology's complicatedness is unrelated to its usefulness

In 2011, a team at UC Berkeley programmed a robot to fold a pile of towels. The robot they used was developed at the Willow Garage robotics studio, and has a retail value of about $400,000. The process of teaching a robot how to identify a towel in a pile of cloth, locate a single corner of that towel, locate the corner opposite the one previously found, orient the towel on the table, and ultimately fold it represented breakthroughs in many fields of robotics and computer science. For all this effort and expense, the robot originally took about 25 minutes to fold a towel; the time required to fold a towel has since decreased to about 6 minutes.

The robot uses an impressive array of tools to fold a towel that were not available decades ago. It has cameras that can communicate to the memory of a computer, computer libraries that can turn images of a towel into logical geometric representations, processors fast enough to make a plan for how to turn one logical geometric representation into a different geometric representation, and precise computer control over motors that can manipulate the robot's arms. Whole legions of smart people then applied their brains to these tools to assemble them into a process that can turn a disorganized towel into an organized towel.

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Obviously, the makers of this robotic system for folding towels were more inclined toward "Can we do this?" than "Can we make money doing this?" And we should focus much more on the fact that a robot can complete a task as complicated as adding order to a disordered system than on the 25 minutes it took to complete that task. The researchers that programmed this robot no doubt contributed important knowledge to the field of computer science, but our point remains: for how impressive and complicated this technology is, it is not very useful. But let's compare the towel-folding robot and its enormous complicatedness to another task: harvesting almonds.

The nuts that we call almonds come from trees that grow about 20 feet tall. The process of moving almonds still in their shells on trees in an orchard in the central valley of California to a bowl of mixed nuts in the Midwest is a complicated and impressive process, and might arguably give the towel-folding robot a run for its money. But the process of removing a treeful of almonds from their tree is a surprisingly and delightfully simple process. A piece of heavy machinery rolls up to an almond tree and extends a giant pincer that grasps the tree. What happens next cannot be described in hyperbolic terms: The machine shakes the dickens out of the tree. The vigorous shaking dislodges the almonds from their branches, and they fall to the ground. A person could undertake this shaking, but the heavy machinery accomplishes it with a thoroughness and a speed well beyond human capacity. If the reader retains any doubt about the vigor of shaking that occurs while mechanically harvesting almonds, simply search the keywords "almond harvest" on YouTube.

A comparison between the towel folding robot and the almond tree shaking heavy machinery can show us something important about the technical world: the degree of complicatedness of a piece of technology is not necessarily related to it utility. Any possible measurement of the benefit of buying an almond tree shaking device compared to the benefit of buying a towel folding device will come down heavily on the side of the flora

manipulator. The tree shaker is very simple and very effective.

Just as the towel-folding robot builders were probably very mentally stimulated by the complicatedness of their creation, teachers who love technology can get tied up in how cool a complicated tool for the classroom is. That complicatedness, however, does not necessarily correspond to its utility.

Take, for example, a 3D printer. 3D printers are so complicated, and oh so cool. Our school purchased several, and there are some teachers who are so enthralled by them that they look for ways to work, or perhaps shoehorn, them into the curriculum. Truth be told, the students think it's really cool, too, but using it rarely forwards the pedagogy of the classroom.

Consider one application that briefly caught on at our school using 3D printers: Several chemistry classes learned how to use the 3D printers in order to make simple molecules of various shapes. Understanding why molecules have their different shapes requires and reinforces understanding electron structure, so in that respect it represents a reasonable curricular goal. Students spent five class days learning how to operate the 3D printers and their auxiliary software, then the 3D printer slowly created the models of their molecules over the next couple of days. At the end of this process each student had a small plastic molecule. This activity has many low-tech counterparts; making the molecules out of clay comes to mind. The question that the technology-minded teacher should ask is, "What value is this technology adding to my students' experience?" If the answer is, "Nothing, but isn't it cool?" then we should take stock of costs and benefits associated with our approach to technology.

3D printer use in the chemistry classroom isn't necessarily wasteful. One of the important definitions of transformative technology in education that we have chosen not to focus on is finding new targets to aim at. 3D printers definitely allow classrooms to aim at new targets. For example, a chemistry classroom and a business classroom could team up to design, create, and market manipulable models of molecules. Aiming at a new target, in this case creating educational products for actual distribution, is totally different than what was available before and so represents transformative technology. Using a 3D printer to aim at the same target but take much longer to hit it does not represent amplifying or transforming technology. Because so much time is spent on it with no additional gain, it likely would not even count as technology that replaces.

Using 3D printers to create molecules in a chemistry class isn't necessarily wasteful if it fits into a larger plan of technology growth. The school might be trying to promote extracurricular use of a maker-space, develop interest in an advanced fabrication curriculum (like MIT's FabLab concept), or even just break out of an older cultural pattern that has little appetite for technology. There are good reasons to use complicated technology in the classroom, we just always need to keep the students' best interest in mind.

We can use education technology to transform our classrooms for the better.

In contrast to 3D printing, YouTube is a relatively simple tool, at least from a use standpoint. YouTube is simple in that it is easy to explain what it does (YouTube is a video sharing service) and it is easy to manipulate, especially if used only in a video consumption capacity. This next claim is a big one, but we contend that YouTube is the most important piece of education technology since the printing press. YouTube allows anyone with access to the Internet to receive instruction about anything, but its reach extends to both the more general and the more specific. More generally, broad Internet searches for educational queries often return an

explanatory YouTube video as one of the first suggestions. So much of the power of the Internet to instruct actually stems from YouTube. More specifically, very important instruction projects like the Khan Academy and MIT's OpenCourseWare exist largely on YouTube. We can think of these projects in some ways as applications of YouTube. YouTube's educational impact becomes even more obvious if we include non-academic education in the discussion: YouTube has innumerable videos about home improvement, automotive repair, arts and crafts, and many other how-to and do-it-yourself aids.

Without a doubt, 3D printers are flashy and YouTube has become commonplace. The 3D printer gets audible reactions of appreciation from teachers and students alike, where YouTube is often taken for granted. However, when it comes to the utility and ability to forward good pedagogy, I'd take the simple but meaningful YouTube any day. It is the almond tree shaker of the classroom. Now, of course, there are simple pieces of technology that don't work well in the classroom and complicated ones that do, but as we move forward, it is helpful to prioritize good pedagogy above complicated design and acknowledge the lack of a relationship between the two. In short, we have to be impressed with technology for the sake of the learners, not for our own sake.

Education technology is a tool that exists within the culture that we create, and its complicatedness is not necessarily connected to its utility. We as educators are agents who are in charge of assessing our tools, understanding them, introducing them into our culture in a healthy way that benefits our students and facilitates curiosity, creativity and learning. If chosen wisely, given the right amount of power and used effectively, we can use education technology to transform our classrooms for the better. At Nudge Education, we create transformative technology with one goal in mind: to help transfer power to the students so that they take on the responsibility for their own learning.

Nudge Education keeps teachers and students at the center of learning, supporting transformational classrooms with accessible, powerful technology. Our products help learners take pride in and responsibility for their own education, and our perspectives promote the professionalism and individuality of teachers.

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