THE FOURTH TEACHER: TECHNOLOGY
(OR WHAT LYNDA.COM HAS TAUGHT ME ABOUT TEACHING)

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1. INTRODUCTION (THE FOURTH TEACHER):

Writing about the future of the classroom for Forbes Magazine in 2010, d-school director George Kembel wrote: "In 2020 we will see an end to the classroom as we know it. The lone professor will be replaced by a team of coaches from vastly different fields. Tidy lectures will be supplanted by messy real-world challenges. Instead of parking themselves in a lecture hall for hours, students will work in collaborative spaces, where future doctors, lawyers, business leaders, engineers, journalists and artists learn to integrate their different approaches to problem solving and innovate together". We are now half way to 2020 and this scenario, at least for institutions like Stanford, seems feasible if not right on schedule. The classroom experience necessary to provide students with this mixture of open-ended experimentation, interaction with different domain specialists, and unconstrained movement around the campus, city, or world requires a very different physical and temporal space. Education theorist Sir Ken Robinson describes it this way: "So I think we have to change metaphors. We have to go from what is essentially an industrial model of education, a manufacturing model, which is based on linearity and conformity and batching people. We have to move to a model that is based more on principles of agriculture. We have to recognize that human flourishing is not a mechanical process; it's an organic process. And you cannot predict the outcome of human development. All you can do, like a farmer, is create the conditions under which they will begin to flourish." Classrooms are becoming less defined by the physicality of their space and more defined by the temporal activities that take place inside them. The physicality of the book is changing in similar ways.

Kembel's prediction in many ways maps on to the Reggio Emilia methods developed by Loris Malaguzzi in Italy in the 1940's. Malaguzzi theorized that children learn from three teachers including adults, other children, and the environment itself- the 'third teacher.' The physical space of the school as well as that of the home, the natural environment, and, of course, the built environment (village, town, or city) all aid in the development of any child. Today this can be expanded to include a fourth teacher- technology- more specifically, technology in the form of online and interactive materials. If the classroom is outgrowing its physical boundaries then certainly the book is following a similar trajectory and breaking free of its reliance on what can be printed on physical pages. Students are blending resources together like never before given the flattening effects of digital technology. Where once a student might watch an instructional video on a video deck connected to a television she is now viewing it on a laptop, phone, or tablet device. On the very same screen she's reading written text from an online magazine, blog entry, or text message from another student or teacher. Students are increasingly searching online for answers before even bothering to ask others including faculty and staff thus taking charge of the education in new and novel ways. We as faculty are of course, no different. The enormous wealth of information off-loaded to the web makes it a constant presence in the classroom precisely because it is always within reach. Students are coming to rely more on the web than on the library if for no other reason than its convenience and immediacy.

To truly compliment the progressive model of teaching and learning predicted by Kembel, rich resources need to be at the students' fingertips throughout this messy somewhat self-guided education. Relying, however, entirely on the power of the web may not be the best solution. I think we've all experienced just how insidious the internet can be. It is as much a distractor as a clarifier. Nicholas Carr, author of the book The Shallows: What the Internet Is Doing to Our Brains describes it this way: I'm not thinking the way I used to think. I can feel it most strongly when I'm reading. Immersing myself in a book or a lengthy article used to be easy. My mind would get caught up in the narrative or the turns of the argument, and I'd spend hours strolling through long stretches of prose. That's rarely the case anymore. Now my concentration often starts to drift after two or three pages. I get fidgety, lose the thread, begin looking for something else to do. I feel as if I'm always dragging my wayward brain back to the text. The deep reading that used to come naturally has become a struggle." Suffice

it to say, students are not going to take a break to run over to the library to access a book if they've got their phone, a laptop, or a tablet sitting at the desk. One of this century's challenges will be to develop resources that are dynamic enough to fit the changing classroom. And while Kembel's scenario was most likely not a prescription for how institutions might save money by downsizing their physical plants and minimizing the interactions (and size) of their faculty, it maybe part of the solution to a true 21st-century educational conundrum.

2. CLASSROOM DISRUPTION:

Education has been undergoing what can only be described as a period of prolonged disruption. With the rise of web 2.0 and the empowerment of the average individual to 'author' shareable content, students now have access to information far removed from the university library, bookstore, or resource room. Accessible content now comes in the form of downloadable PDFs (books, journal and magazine articles, essays, case studies etc.), audio and video podcasts, video tutorials, inspirational talks/lectures (TEDTALKs), and static step-by-step instructions designed for viewing on web sites. Meanwhile the Massive Open Online Courses (MOOCs) are actively shaping the next phase of asynchronous online learning innovation. And while much of the focus of MOOCs has centered around learning computer programming or liberal arts content which is often reserved for large lecture halls (history, social science, economics, etc.) that is now changing. The relatively recent launch by Udacity of Don Norman's classic book The Design of Everyday Things (introductory chapters) is an example of creating a new online learning experience that includes the author in a variety of situations conversing with an anonymous web audience and assigning tasks with specific outcomes that can be posted to the site/platform to engage the power of crowd-sourced knowledge.

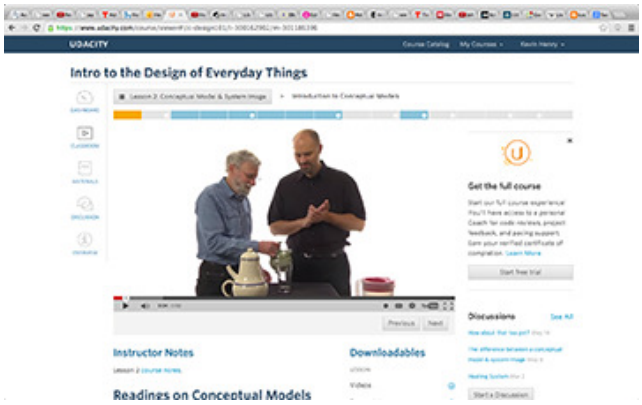

Figure 1. Udacity screen shot from the online course: The Design of Everyday Things (Don Norman).

And regardless of whether you find the production values or the content compelling, the mere existence of a classic print book repurposed for mass consumption through interactive media represents a watershed moment. There is no turning back because students have become so accustomed (entrenched might be a better word) to their new methods of information retrieval that the teaching environment must evolve as well. All of us now 'offload' to the cloud or a handheld device so much of the information we once committed to memory that it seems only fitting that much of the information our students need is not in their heads at all. Online content will only continue to grow and so as educators we will be thrust into the role of 'curating' knowledge as much as conveying it. And, perhaps more importantly, educators need to be involved in the development of new and innovative ways of engaging students and disseminating critical information that can be transformed into knowledge because all of this disruption is taking place against the larger backdrop of increasing student indebtedness and escalating costs associated with operating bricks and mortar institutions. In other words, the disruption of the educational space offers a unique opportunity for design educators to innovate around the process of learning itself- to actually design the full experience.

So if education is indeed a service then every touch point has the potential to be improved upon by design. These are opportunities that publishers like Wiley (Wiley Online Video Training) and McGraw Hill (Smartbook), who continue to experiment with different formats and platforms, have seized upon. Meanwhile instructional designers exploit the possibilities afforded by tablet devices and smart phones and, in the process, provide excellent examples of good pedagogical design practice. Meanwhile some of the most exciting developments in the educational space are happening out on the fringes such as the youtube channels Veritasium by Derek Muller (physics education) or Proko by Stan Prokopenko (figure drawing). The British firm Cognitive Media founded by illustrator Andrew Park has pioneered new ways of visualizing complex materials by the leading intellectuals of our time such as Steven Pinker in his TEDTALK on language or the RSA lecture on time by Stanford psychologist Philip Zimbardo. These are just a few of the many channels I regularly frequent and incorporate into my own teaching to get students excited about big ideas as well as to assist them with their learning.

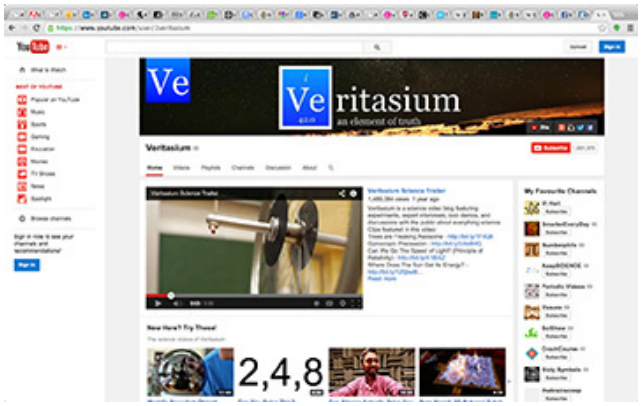

Figure 2. Veritasium screen shot (Derek Muller explores science).

As a result of the disruption I find myself personally covering less material than I once did. Instead I feel the need to creatively select or curate the learning experience of my students by directing them to new and exciting places to discover information for themselves or to discover it alongside them (or even be informed by them). And while this challenges my own sense of authority as well as the 'value' I bring in to the classroom, it simply requires some adjustment. At the same time it has opened up a 'space' that I've never taken full advantage of until now. That space is one inspired by the often crystal-like presentations viewed on TED or similar sites where speakers are generally provided a short period of time to present a complex topic. It is of course a lot of work to put together an inspirational talk that is neither lecture nor demonstration but instead a concise and coherent presentation backed by compelling visualizations. 21st century students have grown accustomed to dynamic presentations that combine compelling stories with equally compelling visualizations. It's increasingly difficult to present any content without some of the elements of good traditional 'campfire' storytelling. In this case the magic of fire and darkness has been swapped with visually engaging slidedecks synchronized to engaging narratives.

3. LIGHTING SMALL FIRES (COACHING VERSUS TEACHING):

In 2012 my book Drawing For Product Designers published by Laurence King was finally available through amazon.com. It had taken me nearly five years to research and then write the text as well as do all of the illustrations (information graphics, CAD models, step-by-step tutorials, etc.). By the time I uploaded the InDesign package (database) to my publisher's ftp site, I was beginning to sense the irrelevance of print. Youtube was, by this time, in full swing and the iPad had just been released. I was beginning to experiment with video tutorials but was generally dissatisfied with the production values I was able to achieve with the primitive tools I had at the time. Nevertheless the experience of crafting a rich narrative around design sketching/visualization (including a compelling backstory about perception and object recognition) provided me with new material to try out in the classroom. This narrative material was now accompanied by many of the custom visuals I'd created specifically for the book. Over time I found myself animating portions of the visuals to help communicate the ideas more clearly. I now had two versions of the book: the traditional print version and the 'live' version which included an ever-changing set of dynamic slidedecks that allowed me to deliver content in more engaging ways. Over the next two years I

continued to refine the live version bringing more of the research that had been excluded from the print version into classroom presentations. The book's content continued to grow despite the fact that the print version remained statically frozen on the printed page- a fact that made me appreciate the idea of the 'open book.'

Figure 3. design visualization workshop image.

While writing and illustrating the book I had also started experimenting with short workshops to test out some of the specific approaches I was developing for the step-by-step tutorials. The workshops have evolved into highly organized events consisting of lectures, activities, and feedback all tightly structured to fit into either a full 2-day or 3-day schedule. This structure provides participants with the same materials I would normally cover in about 8 weeks during a regular semester however the results from the workshops are uniformly better and the student engagement deeper. I find that students walk away from a two-day workshop with the confidence required to continue diligent and focused practice. The concentration that comes with working non-stop for 7 hours accounts for much of the learning. I've found this nearly impossible to replicate in my current institution where classroom instruction is slotted into much smaller units of time and spread out more thinly- confirming Ken Robinson's 'factory-model'.

The coaching approach developed in the workshops has taught me that teaching and learning are not just about content and delivery but also about the all-important temporal element. How much time, for example, should be devoted to a specific task? Or if a student feels unrushed in her learning will the experience be deeper? I became fascinated with the idea of designing learning materials that could replicate some of the workshop experience: the coach-like mentoring that comes with deep explanations that are clear, concise, and well illustrated. I was convinced that developing materials for online learning or with a mobile device like the iPad was a viable direction. It was a matter of figuring out the best way to do this. So when Apple released their ibooks author software in 2012 I thought I had the perfect combination of materials to develop an accompanying workbook that would be truly interactive. What I had not fully considered at the time was the complex nature of media and the different ways in which each type (video, audio, text/image, animation) engage or distract the reader/viewer.

4. BOTTLING THE MAGIC OF COACHING

I began in earnest experimenting with the various interactive design typologies iBooks Author supported. Apple in it's ongoing desire to provide intuitive and well-designed productivity tools to its users had created a suite of 'widgets' that could be easily customized by the author. The challenge had less to do with determining the correct choice (there were only 6 at the time of the release) but more with the media itself. If I was going to make a video demonstrating a specific skill or technique I knew it had to be short and to-the-point. It also needed to have sufficiently high production values to engage the audience. After a series of experiments shooting tests with the help of a film and product design student I realized I would need a professional videographer, possibly a sound designer or composer, a sound editor, an animator, and a dedicated studio with a teleprompter to shoot all the videos. I would need to script every spoken word of explanation and finally edit it all into concise well-produced chunks no longer than 5 minutes each. My focus at this point switched quickly

to animation. I realized that 'talking heads' are the least compelling aspects of instructional media anyway. I needed to work out the right balance in the animations between an aesthetically pleasing explanatory graphic and the voice over. I began teaching myself After Effects with the aid of lynda.com and other online resources. I also explored 3-D animation software like Maya, Blender, and sketchup. I quickly realized that the project was once again getting out of hand in terms of the time and associated freelance costs of producing what I saw in my mind's eye.

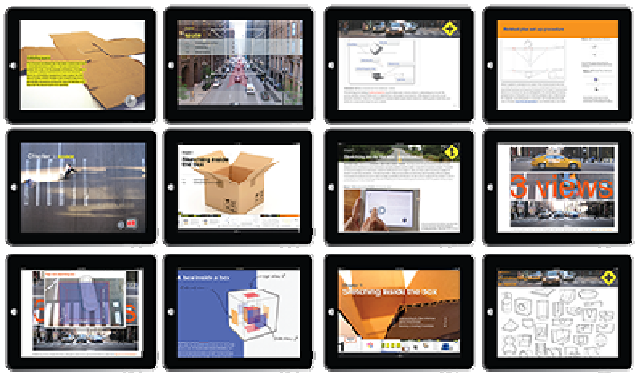

Figure 4. screen shots from iBooks author workbook for the iPad.

5. LEARNING FROM LYNDA

My desire to produce engaging media that creatively augmented the content of the print book so that students could use both (and buy both) was running into time and cost issues. I had an epiphany at this point. Why was I trying to reinvent the wheel when others had invented perfectly good and successful wheels? It's at this point that I began in earnest developing a proposal for an online course devoted to design sketching for lynda.com. I won't go into any depth here on the proposal process other than to say apart from the short demo video of me lecturing, the process was nearly identical to a traditional print book proposal.

What I'm learning- this project is in post-production as I write- is that producing engaging on-line content is like producing a short documentary film. And while there are definite overlaps with traditional publishing in terms of working with editors and designers, the process is far larger with more moving parts. Lynda.com has taught to consider the audience in ways I never have while writing a traditional print book. The team I've had the pleasure to work with combine an enormous range of skills including writing and editing, graphics, motion graphics, film, set design, and instructional design. They've taught me to consider the audience and their attention in new and different ways. They've taught me to articulate the narrative content both temporally and visually. They have taught me to consider every second that goes into the content and how to consider it through the multiple filters of media. I've seen firsthand how the team communicates through the cloud to maintain the continuity amongst all stakeholders thus ensuring that we are literally all on the same page. I have also come to realize that innovative productions like these are intensely time consuming and thus requiring pre-planning- the likes of which I've never experienced. And if there's one hard lesson I've learned it's that every second of the course has to be accounted for; I'm no longer writing for the temporal experience of book reading but rather for the temporal and haptic experience of real interaction. This lesson is by far the hardest and yet the very reason I'd chosen to go down this path in the first place. The future of the book is truly interactive and yet creating such an artifact requires design considerations that move far beyond many traditional products because after all the 'design of learning' does not solve a problem as much as provides a pedagogical service for the future of learning.

The single biggest challenge in developing on-line learning materials for a skill like rapid visualization is capturing the essence of the sketching process itself. And because the approach I teach focuses on speed over accuracy emphasizing exceptionally light line construction that is differentiated with heavier lines afterwards, it's very difficult to capture the true provisional nature of the process. Additionally, the time required to film over-the-should shots of every sketched line results in a long and drawn-out process. Taking into consideration the need for repeats or mistakes made while sketching only lengthens this process. To alleviate that problem, we decided to animate everything that would normally be sketched live. The idea was to think of it more like an 'instant replay' than the original action itself. I felt it was best to remove the

hand from the process and to focus instead on call-outs and other visuals that could direct the viewer's eye to the most salient aspects of the process. The challenge, something I did not take into full consideration until I returned from shooting in California, is that every animated graphic would need to be created in Adobe Illustrator so that the lynda.com animators could set them in motion and synchronize them to the recorded voice and intercut between the live-action clips. This process alone has already required nearly three hundred hours of work with more to come but the early prototypes are very promising as they help to break a process down into small discrete steps before the viewers' eyes.

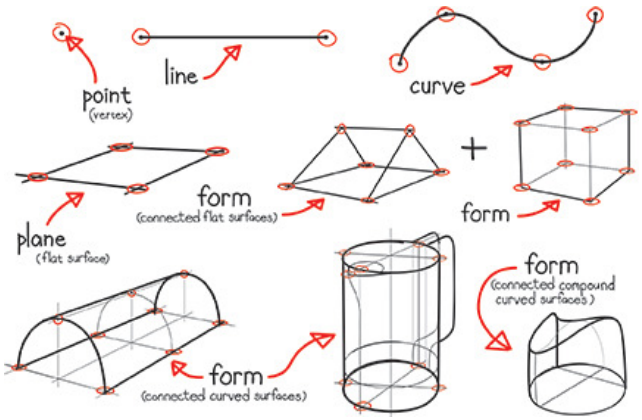

Figure 5. Adobe Illustrator file prepped for animation.

6. SUMMARY

The disruption within education shows no signs of abating. Higher education in America will look dramatically different in the next ten years for a variety of reasons- the associated costs of operation being certainly one of them. But even institutions with secure and reliable enrollments and deep endowments lacking financial incentives to lower costs through more online learning will be admitting students with learning styles shaped more by the web than by the library. The rapid proliferation of iPads and other tablets in K-12 education is raising the expectations of what constitutes engaging learning material for the average student. This represents a great opportunity for designers as well as educators. The profession of industrial design with its emphasis on user-centered design approaches, prototyping and testing, refining and simplifying is an ideal contributor to the future of educational resources. And while the physicality of the product may be less of an issue, the ergonomic constraints remain- they simply shift from physical to cognitive. Designing the experiences for engaged learning will of course need to be a collaborative effort involving teachers, interaction designers, instructional designers, programmers, and storytellers. Pedagogical design could become a course (or series of courses) that embraces the cross-collaborative efforts of product/interaction design, graphic design, computer science, film/video/animation, instructional design, and of course, specialists in pedagogy.

The development of smart learning tools that effectively build skills and confidence regardless of the subject will need to leverage highly produced materials that engage the learner along with well-designed testing opportunities to confirm that the materials are actually having an impact. The power of digital technology to assess learning is one of the great lessons emerging from MOOCs as Coursera co-founder Daphne Koller points out in a recent article from The Journal of Learning Sciences. Testing, as learning specialists like to point out, regardless of its perceived negative connotations, remains an essential part of the learning process. Interspersing (interleaving) related materials between studying can also improve learning outcomes according to psychologists who explore learning such as Henry Rodiger author of Make It Stick or Robert Bjork. A world of opportunity awaits the design profession now that interactive tablets have become commonplace in the classroom. It's time to start considering not only the conceptual information and technical skills that we teach but also the delivery mechanism itself. The new 'designer-of-learning' will be a hybrid who will help map the contours of cognition much as Henry Dreyfuss and Niels Diffrient mapped the human body. The future of education will be designed.

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