The Paperless First Year Professor

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Abstract:

This paper presents the experience of creating and adopting a paperless curriculum framework for a first year visiting assistant professor. The professor utilized a learning management system (LMS) and internet-based applications exclusively inside a typical classroom environment. The self-imposed challenge of *going digital* across all assigned courses was in the hope that his classroom efficiency and effectiveness would be positive, and the transition from a business career and mindset to one of teaching and scholarship would be easier. Additional goals included increasing the opportunity and capability of easy and quick sharing of full course curriculum with fellow faculty, while reducing clutter (office and classroom) and grading times. Key to the framework was utilization of the LMS and its built in features, such as automated grading and tablet/stylus functionality. Also used were online tools for collaboration, industry supplied instructional materials, and lessons from massive open online courses (MOOC). Going paperless proved to be relatively easy due to the professor's technical proficiency and the type of courses taught. The focus of the majority of the professor's assigned courses were on the development of technical skills within a digital environment, such as computer-aided design (CAD), programming, and graphic design. Over one academic year, which included seven courses (six different), the professor was able to meet the original goals of the framework. Based on the end of course surveys, student feedback, and self-observations he also believes that the framework was positive for the students and the start of his academic career. This paper presents the framework used along with lessons learned and tips for those who are interested in embracing educational technology at the start of their academic career or those seasoned professors who just need a little guidance with new techniques.

Introduction

Disruptive technologies over the last decade have begun to unravel many of the long-standing traditions in higher education. Printed textbooks and the process of purchasing them in the campus bookstore has evolved into e-books and online rental agreements. Leading consumer electronics companies, such as Apple® and Amazon® were able to find a new market for their smart phones, tablets, and app stores. In person classroom lectures have been adapted and recorded for online delivery to the masses. Even the tried-and-true action of paying college tuition in return for classroom access is being challenged with the advent of free massive open online courses (MOOC). The *going digital* movement in higher education is true and has begun to pick up pace.

It would be very difficult to find a collegiate student that is not technology savvy, dependent, and/or welcoming of more gadgets, screens, and/or keyboards. On the other hand, it would not be hard to find a collegiate faculty member, junior or senior ranking, who resists and/or struggles with technology adoption in his/her classroom. There is a wide gap concerning technology acceptance between generations in higher education. The following statement by Ramasubbu (2015) illuminates the trend:

> The elusive generation gap is construed as being widest when one of the two generations is the adolescent. While the gap exists in almost all facets of social and personal domains, never is it more evident than in the field of technology, where one of the generations is a digital native and the other, an immigrant or even an alien, depending upon the stage of the continuum of adulthood (p. 1).

Most new faculty received their education in a traditional format consisting of lectures, printed textbooks, and pen and paper - lots of paper. Accordingly to professor Gabriel Egan who was named one of Britain's best teacher, universities are drowning in paper (De Montfort University, 2014). So it would be reasonable to expect that new faculty, especially those who transition directly from graduate school into teaching, would feel most comfortable implementing the same techniques and tools in their classrooms (Chachra, 2016). McManus (2001) specifically discusses how most new faculty members were taught by instructors who used the Teacher-Centered paradigm as opposed to the Learning-Centered paradigm and therefore they likewise use it once they enter academia. This professor, who transitioned from a working professional in the engineering and aerospace industry to teaching in higher education, self-imposed the challenge of *going digital* at the beginning of the transition. His game plan consisted of creating and adopting a paperless curriculum framework (see Figure 1).

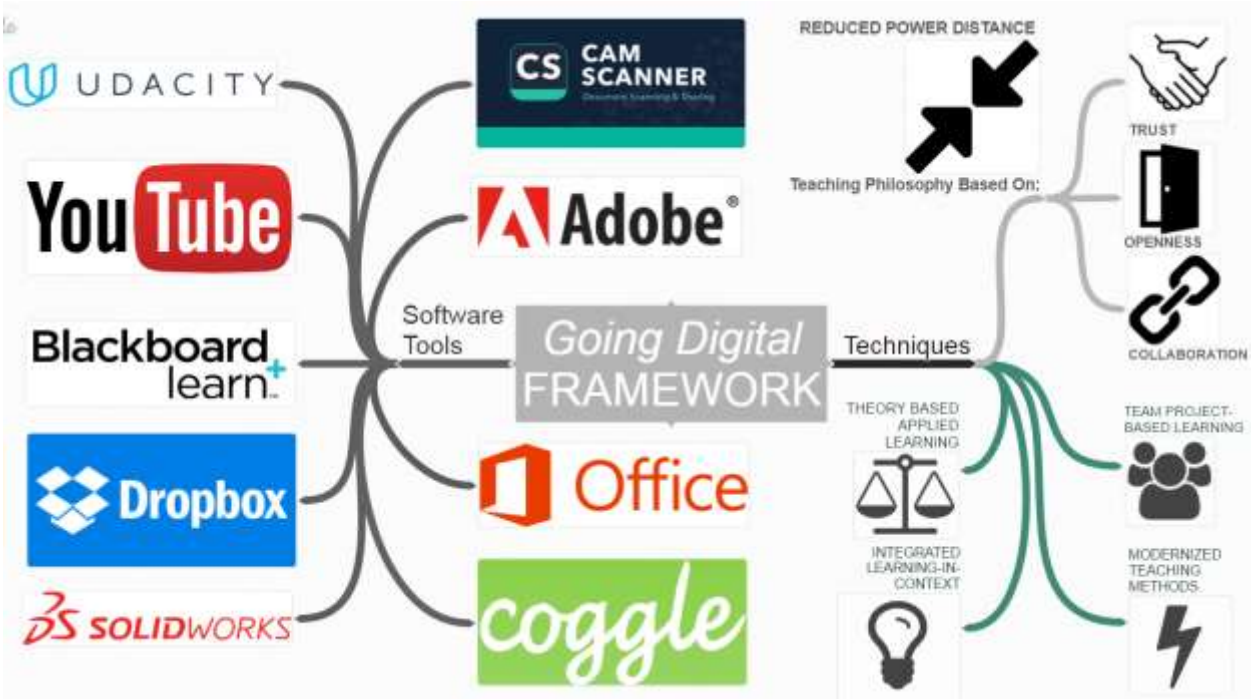

Figure 1. Going Digital Framework

As a first year visiting assistant professor at a research one land grant university he forecasted that he would be introduced to many of the same hurdles as proposed by Brent and Felder (1998):

> Writing proposals and trying to get them funded, attracting and learning how to deal with graduate students, and having to churn out a large number of refereed

> papers while you were still trying to figure out how to do research. You may remember the incredibly time consuming labor of planning and teaching new courses and the headaches of dealing with bored classes and poor student performance and possibly cheating and poor ratings and a host of other problems you never thought about when you were a student. And you may recall sitting through endless departmental faculty and committee meetings, wondering how you could manage to squeeze in some time for your family and yourself on top of everything else you had to do (p. 1).

The accomplishments needed to even be allowed to apply for a junior faculty position are not trivial. If you are lucky enough to receive a position, only roughly 5-9%, who are labeled as *quick starters*, will meet or exceed research and teaching expectations in their first two years (Boice, 2000, Brent, Felder, & Rajala, 2006). “Entry into the profession is if anything harder now than it used to be” (Brent & Felder, 1998, p. 1), and if you’re one of the lucky few “default preparation for a faculty career is none at all” (Brent et al., 2006, p. 1)

Between course planning and preparation, assignment and test creation, learning how to manage a classroom, and integrating into staff, faculty, and campus cultures the professor began to question if he would be a *quick starter* or a failure. This is when he began accepting the idea that a paperless classroom could be feasible and his rate of success would possibly increase if fully implemented at the beginning of what hopes to be a long career in higher education. The professor also felt strongly that to maintain a positive work-life balance he would need to use the strengths of educational technology to their fullest.

This paper presents the framework used, lessons learned, and tips for those who are interested in embracing educational technology (i.e. *going digital)* at the start of their academic career or established professors who just need a little guidance to help shrink the technological generational gap.

Scope and Goals

The framework presented in its entirety or portions of will not work for all new faculty, so generalizability should be limited. The professor was a tech-savvy millennial, who had just left a high-tech profession where for over seven years he worked as a mechanical engineer, researcher, and product developer. His comfort level with and willingness to try new technologies was high. He also had the opportunity to join a college that was in the middle of a large-scale transformation.

The Purdue Polytechnic Institute (formally The College of Technology), which is one of Purdue University’s 10 colleges, is “a transformational college unbounded by tradition … pioneers of learn-by-doing and use-inspired research” (Purdue Polytechnic Institute, 2016a). The transformation efforts, which started in 2013 and continue today offer extraordinary opportunities to students and faculty and touch all parts of the college, including curricula, teaching methods, and learning spaces. The breadth and depth of the transformation are enormous. Purdue Polytechnic Institute’s mission statement is the following:

> To inspire, educate, and mentor students through learn-by-doing and integrated study, preparing graduates for success as future technology innovators and industry leaders; and to advance trans-disciplinary learning, engagement, and use-inspired research addressing important state and global challenges.

The Purdue Polytechnic Institute is transforming the students' learning environments in an effort to respond to the changes in our students and society, in hopes that it better serve their needs (purdue Polytechnic Institute, 2016b). Faculty are being asked to evolve traditional pedagogy while they shape the minds of the 21st century engineering technology student. If the mission is known and supported by a faculty member and "every facet of life is becoming increasingly reliant on technology" (Edudemic, 2014, p. 1), it should ultimately pull faculty into a career and life which embraces and employs the idea of *going digital.* This was the professor's primary goal for constructing the framework. Secondary goals are as follows:

- Reduce the need for grading assistants
- Reduce grading time
- Reduce office and classroom clutter
- Reduce grading subjectivity/bias
- Allow for the easy transition of curriculum between adjuncts, limited term lecturers (LTL), assistants, and/or other faculty
- Learn and use the learning management system (LMS)
- Apply framework to all assigned courses
- Transition from a business career to one of teaching will be positive
- Classroom efficiency and effectiveness will be positive

Finally, the majority of the professor's assigned courses were either focused on or had elements of the development of technical skills within a digital environment, such as computer-aided design (CAD), computer programming, and graphic design. Over one academic year he taught seven courses, six of which were different. Course load consisted of upper and lower level classes. Additionally, he was hired a month early for training and course preparation, which was extensive due to the lack of instructional material shared by faculty and his desire to fully implement the LMS for all courses (new for all courses besides TECH12000). See Table 1 for a breakdown of course load.

Table 1. Course Breakdown

Semester (Year)	Course (Title)	Course Description	Student Count
Fall ('15)	CGT16300[1] (Introduction to graphics for manufacturing)	Introduction to the graphical language used to communicate design ideas using technical drawing and CAD. The course will emphasize the proper use of parametric solid modeling for design intent.	14
	CGT11000[1] (Technical graphics communication)	Introduction to the graphic language used to communicate design ideas using CAD. Topics include sketching, multiview drawings, auxiliary views, pictorial views, working drawings, dimensioning practices, and section views.	4

	TECH12000 (Design thinking in technology)	Critical analysis of real-world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.	29
	MET45100 (Manufacturing quality control)	Quality control practices used in manufacturing industries; management, statistical control charts, reliability, sampling plans, economics, computer methods, and test equipment are presented and applied.	11
	MET40100 (Capstone project I)	Methods to develop engineering requirements to meet project needs and formal design techniques are studied. Planning and design alternatives to meet cost, performance, and user-interface goals are emphasized. System tests and measurements are considered. Project planning, scheduling, and management techniques are studied. Different design approaches are compared.	5
Spring ('16)	TECH12000 (Design thinking in technology)	See Above	14
	MET30200 (CAD in the enterprise)	Theory and practice of management, use and integration of computer aided design systems, and related engineering tools and practices are studied as they are applied in the industrial enterprise. Emphasis is on course projects.	10
	MET40200 (Capstone project II)	Project management and system engineering methods are applied to solving an engineering problem.	4

Notes. [1]CGT16300/11000 contained the same curriculum and were co-located.

The Purdue Polytechnic Institute also has nine direct extensions of its main campus, which are called statewide locations. The professor was located and taught all courses at the New Albany location. Statewide locations have the same curriculum requirements but have the affordance of a much lower student-to-faculty ratio (Purdue Polytechnic Institute, 2016c).

Techniques and Tools

The techniques and tools used over the academic year were vast; however, the key was the LMS. At Purdue University, the LMS is Blackboard® (www.blackboard.com). Prior to joining Purdue, the professor had no formal training and very limited use with Blackboard. Initially, the idea was to use existing file servers and ignore the LMS completely. Due to a suggestion from a faculty mentor, the professor ultimately decided to fully embrace the LMS. Testing, assignments, resource sharing, grading, communication, etc. were all done through Blackboard. All sensitive data also remained in the LMS or institutional approved servers.

There was still a need for non-sensitive data/file management (i.e. organization, sharing, syncing, etc.) outside of the LMS and this is where Dropbox® Pro (www.dropbox.com/pro) was strategically purchased by the professor. He once again bypassed the use of a local server for the strengths of Dropbox, which consists of cloud-

based services for user identity and management, data storage, access, management, and programmatic interfaces (APIs); clients for data access and storage on desktop and mobile operating systems; and web applications for data and service management ([Is Dropbox safe to use?]. n.d., Wikipedia, 2016). The professor also had no experience with Dropbox and the same faculty mentor suggested its use. No sensitive data was stored in Dropbox and Purdue lists Dropbox as a possible data storage option to faculty and graduate students ([Data Storage at Purdue: Dropbox Basic]. 2016).

Additional tools and techniques included online streaming video providers (i.e. YouTube® Dailymotion®, Vimeo®, etc.), collaboration applications, and MOOCs. In MET30200, the online real-time collaborative mind mapping tool Coggle® (www.coggle.it) was used for a large half semester design project. Teams were forced by the professor to use the tool to visually organize information. Elements included were brainstorming outcomes, design breakdown, task breakdown, resource allocation, project scheduling, design goals, budgeting, and etc. Teams shared their mind map with the professor, which allowed for real-time change notifications, commenting, and progress tracking. The MOOC was used in MET40100 and was freely available from Udacity® (www.udacity.com). The MOOC had eight full lessons that provided the necessary instruction to cover eight of the sixteen weeks. This provided great relief to the professor in course preparation.

Specifically in the CAD courses (CGT16300/11000 and MET30200) there was great need for a medium that allowed students to submit CAD models (parts, assemblies, drawings) and the professor to digitally grade and return. The LMS has a built in .pdf utility that easily allows for grading/feedback directly in the browser window (i.e. no need to download file for grading). Feedback options include a commenting tool, highlighter, text selection tool, strikeout tool, and drawing tool. If you have a stylus (i.e. digital pen), you can annotate the document and your feedback will be preserved within the document. In the first few weeks of CGT16300/11000 the students were tasked with various hand sketches and technical drawings. This required the students to use either a scanner or a smart phone app (CamScanner®) to create a .pdf of their work for submission. When the courses moved into three-dimensional (3D) modeling and the assignment required screen shots of the students' work, the .pdf exporter within the 3D software (i.e. SOLIDWORKS®) was used. Both courses also used free industry supplied CAD guides (i.e. e-books) for numerous weeks instead of textbooks. The guides were produced by the software providers and delivered to the students digitally through the LMS.

Finally, the professor has a personal teaching philosophy of reducing the power distance between the teacher and the student. Paperless or not, the key to making this successful in any classroom is building a positive student-teacher relationship (Gallagher, 2014). The professor has an open-door policy, shares personal contact details (i.e. cell phone), and located his office in close proximity to the classrooms and labs. He also made it a habit of personally getting to know each student, his or her first

name as a bare minimum, and encouraged students to address him by his first name. The professor believes that this philosophy and fully communicating his expectations from the students the first day of class contributes to the positive outcome of *going digital*.

Results

After the spring semester, the professor determined his success by determining if his goals had been met by creating a single self-reflection goal attainment scale. The scale allowed the professor to subjectively measure qualitative goal impact and attainment (see Table 2).

Table 2. Goal Attainment

Goals	Much More than Expected (+2)	More than Expected (+1)	Expected Outcome (0)	Less than Expected (-1)	Much Less than Expected (-2)
Going digital[1]		+1			
Reduce the need for grading assistants		+1			
Reduce grading time		+1			
Reduce classroom/office clutter		+1			
Reduce grading subjectivity/bias			0		
Allow for easy course curriculum sharing		+1			
Learn and use the LMS		+1			
Apply framework to all assigned courses			0		
Positive transition from business to academia	+2				
Positive classroom efficiency/effectiveness		+1			

Notes. [1]Includes implementing transformational elements (purdue Polytechnic Institute, 2016b)

The professor's overall success in his first year ultimately depended on the students' reception and acceptance of his teaching philosophy, techniques, and tools. Each student was given the option to complete an end of course survey which asked them to rate the course and the instructor overall. See Table 3 for the mean results per course, which used a five-point Likert scale of 1 (very poor) to 5 (excellent).

Table 3. Course Evaluations

Semester (Year)	Course (Title)	*n*	Course Rating (SD)	Instructor Rating (SD)
Fall ('15)	CGT16300 (Intro to graphics for manufacturing)	6	5.0 (0.0)	5.0 (0.0)

	CGT11000 (Technical graphics communication)	4	5.0 (0.0)	5.0 (0.0)
	TECH1200 (Design thinking in technology)	24	4.6 (.75)	4.8 (.54)
	MET45100 (Manufacturing quality control)	11	4.8 (0.0)	4.8 (0.0)
	MET40100 (Capstone project I)	2	5.0	5.0
Spring ('16)	TECH1200 (Design thinking in technology)	14	4.4 (.61)	5.0 (.26)
	MET30200 (CAD in the enterprise)	10	5.0 (0.0)	5.0 (0.0)
	MET40200 (Capstone project II)	2	5.0	5.0

Discussion

Overall, the professor determined that *going digital* challenge was relatively easy and subjectively successful. The professor tried very hard to eliminate the action of handing students paper and vice versa. In the majority of the courses he was successful, while others still required on a very limited basis students to submit physical documents (e.g. technical drawings for instructor redlines). Measures are already under way to eliminate even these instances by acquiring a multi-touch computer. There were also instances where an assignment was posted online but it required the student to first print the handout to complete by hand and then submit digitally. While this does save the professor time by not dealing with the task of printing, delivery, and/or collection it does imply that his curriculum was not completely paperless.

If a course uses a printed textbook, it would also be justified to state that the course is not paperless. In the seven courses only MET40100 had an assigned text while CGT16300/11000 had a recommend text, both could be purchased electronically if the student wished. This meant that the professor had to create his own instructional material or locate open educational resources (OER). Lecture slides, guides, assignments, handouts, tests, quizzes, projects, demonstrations, etc. were all either created by the professor or located elsewhere. This required a significant amount of time and will have to continue as the courses and instructional topics evolve. It is now obvious to the professor why most faculty locate and utilize a quality textbook for their courses. The amount of publisher supplied supplemental resources that accompany a text can be a huge time saver and stress reliever. However, there is a fee associated and it is often passed down to the student by hefty price tags on textbooks. The majority of faculty view cost as an important influencing factor when selecting course materials. In a report by Green (2016a) quality (97 percent), cost (86 percent), and reputation (71 percent) are the three biggest factors when picking which textbook and course material they assign. The use of OERs and instructor created curriculum in the professor's framework resulted in a significant cost saving to the students.

The Green (2016a) report, which surveyed faculty perspectives on *going digital* and OER course materials, also raised questions about faculty awareness of free or

inexpensive alternatives to commercial textbooks. Seventy-five percent surveyed do not know about (39 percent) or have never used (36 percent) OERs. As Green (2016b) states, “the question about *going digital* is not one of if, or even when, but rather how” (p. 4). Arguably, the first step in the process would be to introduce OERs and educational technologies to faculty. Second and possibly the hardest task is to gain their acceptance and willingness to try them. Over the last year, the professor witnessed resistance to LMS adoption by many of the faculty at his location. Even after students openly expressed the desire for all courses and faculty to utilize the strengths of the LMS, such as real-time grading and 24/7 access to course materials. The reasons for resistance can be one of many. The 2,902 faculty respondents (81 percent full professors) from the *going digital* report cite the quality of digital course materials (80.9 percent), the instructors ease of use (59 percent), and the academic benefits to the students (72.3 percent) as factors (Green, 2016a). Based on the professor’s past experiences and observations, the known technological gap between generations, and the fact that over a third of tenured faculty are 55 years of age or older (Marcus, 2015), he would question if ease of use should not be a more determining factor for the slow acceptance pace of OER and *going digital*. Brain Jacobs, CEO and founder of OER platform panOpen, believes “that in order for digital educational materials to enter mainstream practice they cannot simply mimic physical textbooks and only modestly reduce costs. They must offer a compelling experience that is fundamentally different, available only in the new medium, and they must change the economics dramatically in favor of the user” (Straumsheim, 2016, p. 5).

Specifically concerning goal attainment (see Table 2), the professor met or exceeded his expectations on all. He was not able to include all transformational elements into his curricula but did include theory-based applied learning, integrates learning-in-context, modernized teaching methods, and team project-based learning. Grading time was decreased significantly with the automatic test, quiz, and assignment grading within the LMS, and there was no dire need for a grading assistant. However, initial preparation to automate grading was significant. There was also first time burdens with almost all the other educational technologies listed in the framework. None was as difficulty to master as the LMS but each do have a learning curve. Using the blind grading options within the LMS also reduced the risk of subjective/bias grading. Through observations of other classrooms, labs, and faculty offices, it was obvious that clutter was decreased. Once a course is *built,* sharing between adjuncts, limited term lecturers (LTL), assistants, and/or other faculty only required a few clicks within the LMS. File sharing and collaboration with Dropbox was just as simple.

Efficiency and effectiveness are factors that are difficult to measure and some may even argue that most new faculty cannot or will not possess both at the start. However through discussions with his mentor, director, and department head it was made clear that the professor had made significant progress in the right direction and authors such as Phillip Wankat have presented strong arguments that one can have both effectiveness and efficiency at the beginning of their faculty careers (Felder, 2002, Wankat, 2001). Since completing his first year as a visiting assistant professor, he has also been offered and accepted a position as a tenure-track assistant professor at the same university, college, and department.

There are many resources out there to help first-year faculty members be successful. Many offer wonderful and simple guidelines to follow. The following are some that were most impactful to the professor.

From Boice (1992), Brent and Felder (1998):

- Spend three or more hours per week on scholarly writing
- Utilize your classes (students and instruction) as a research opportunity
- Minimize course preparations, especially after teaching the course once
- Move from a passive learning environment to one of active learning
- Integrate yourself into the staff, faculty, and campus cultures
- Find mentors who are willing and capable to help you succeed, even if one is not who your department head originally assigns

From Felder (2002), Wankat (2001)

- Get help with instructional technology if you're not an expert or cannot self-train
- Motivate students by learning their names and communicating expectations clearly
- Make the course highly structured early and more open ended later
- Keep candy on hand and come out behind the desk

Conclusion

The presented *going digital* framework in this paper is not perfect or without needed adjustments. However, if you are entering academia and have the willingness to try something different then the result just might be positive. In the professor's case, the feedback and outcomes observed have encouraged him to continue his effort and to refine the framework to further enhance the students learning experience.

Beware the upfront time commitment will not be little. The framework requires much self-training and preparation. The tools and techniques used will require most to step outside of their comfort zones while introducing high frustration/stress levels. This is why support from other faculty and staff is so important. The professor recommends finding a mentor who has already *gone digital* to help. Finally, the students must also be willing and capable of working within the digital framework. Not all universities, colleges, departments, or even degree programs possess the student body that makes sense for the level of *going digital* as presented in this paper. The generalizability of the presented framework should be limited.

In conclusion, it is very tough being a first year professor. Sometimes it will feel as if all you can do is survive your morning lecture let alone plan a career research program. There are seven project management principles, which are applicable to becoming successful in industry as well as in academia. Collectively: planning, project management, problem solving, presentation, patience, persistence, and reflection are essential for success as an engineering educator (Banik, 2016).

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