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EDTECH 592
July 26, 2018
Reflection Paper

The Education Revolution

Introduction

On December 13, 2014, my life abruptly changed. During the prior decade, I enjoyed a stable and rewarding career in food science education, leading training teams that were charged with rescuing flailing food companies on the verge of bankruptcy after a devastating food safety incident and subsequent recall. My professional life was comprised of desperate midnight calls, last-minute travel to random areas of North America, and debate of scientific theory as it related to foodborne microorganisms with governing authorities such as the Food and Drug Administration (FDA) and the United States Department of Agriculture (USDA). I was afforded the opportunity to “save the day”, not through administrative action, but rather through appropriate and effective food safety education programs that would surely prevent recurrence of these disastrous events. That was, until that fateful day where I was ironically diagnosed with multiple life-threatening food allergies. You see, food manufacturing plants synthesize convenient forms of food for public consumption, and I had unfortunately developed severe respiratory symptoms when exposed to these allergens within the processing environment. This, of course, impacted my ability to audit, consult, and train food companies since I couldn’t even enter their facility. So after more than ten years in a beloved field, I found myself undertaking a career transition.

Fast forward approximately six months to May 9, 2015, which is the date in which I began my journey as a professional educator. I began employment as an instructional designer within a postsecondary institution and became a newly enrolled graduate student at Boise State University. It is at this point that I must admit my prior lack of formalized expertise with evidence-based learning theories, field-tested instructional strategies, and educational technology. One thing was certain - even as a novice, I realized that the "traditional" education system was broken, as I witnessed hundreds of students pouring into the university unable to form complete sentences, craft a persuasive essay, and apply critical thinking skills to solve authentic problems. It was at this point in time that I realized that an **Education Revolution** was desperately needed, and I found a new purpose to "save the day". This paper explores five lessons learned during my two-year journey as an educational technology graduate student, and the instructional strategies, theories, and best practices that will craft and cultivate my professional teaching practice in the years to come.

Lesson One: Reflections on Learning

As a new educator, I have witnessed that modern advances in technology and mounting pressure from federal and state requirements for teacher accountability have unlocked new directions for education research. The flipped classroom, a relatively new pedagogical approach, is defined by Lage, Platt, and Treglia (2000) as "events that have traditionally taken place inside the classroom now take place outside the classroom and vice versa", is at the center of this discussion and catalyzes change in the physical classroom (p. 32). The flipped classroom, often referred to as an "inverted" classroom in areas outside the United States, is a pedagogical method which "employs asynchronous video lectures and practice problems as homework, and active, group-based problem solving activities in the classroom. It represents a unique combination of learning theories once thought to be incompatible—active, problem-based learning activities founded upon a constructivist ideology and instructional lectures derived from direct instruction methods founded upon behaviorist principles" (Bishop & Verleger, 2013, p.5).

Within the *K-12 Online and Blended Teaching* course as part of the MET program, I was provided the opportunity to create a flipped classroom lesson within a high school chemistry class. Using the 5E instructional model, a framework enacted to sequentially represent the constructivist learning cycle which builds individualized learning from new experiences and ideas, I created asynchronous digital learning for the Engage, Explore, and Explain stages as out-of-class activities. Reserved for in-class time are the Extend/Elaborate and Evaluate stages where students could interact with peers and school resources through an inquiry-based scenario or case study. This approach agrees with Bishop & Verleger (2013) where, "a flipped classroom is an educational technique that consists of two parts: interactive group learning activities inside the classroom, and direct computer-based instruction outside the classroom" (p. 5).

Lessons learned from teaching with the flipped classroom model include how to best manage students that do not perform the out-of-class activities needed in preparation for the in-class experience, and how to create a comprehensive activity for a 90-minute block period. For the first lesson, the best recommendations I found were written by Faculty Focus, a media publisher blog focused upon creating career-and-college-ready learners through individual accountability. Honeycutt (2014) suggests two procedures for motivating unprepared students: (1) re-think participation grades, whereby "homework" now becomes participation preparedness and is assessed for each flipped lesson, and (2) setup a corner for students who come to class unprepared. The burden falls on the student to not only complete the out-of-class assignment, but the in-class assignments as well on their own time. For future lessons, I have arranged the classroom environment to provide space for students who are unprepared as I learned that they will rely on their classmates to supplement their learning without doing the work. According to Hackathorn, Solomon, Blankmeyer, Tennial, and Garczynski (2011), active learning is required to construct deep learning through engagement with the material. The flipped classroom model forces students to engage with the content and take accountability for their individual learning.

In practice, Szparagowski (2014) piloted a four (4) day high school mathematics flipped classroom and makes the following recommendations for educators new to this instructional approach: "one important aspect needed to make a successful flipped classroom is to choose videos and create handouts that are the right level of difficulty to build confidence, but also build groundwork of knowledge for the work they will be doing in class" (p. 30). He adds that the importance of lesson planning in creating a robust learning experience for in-class activity cannot be understated. In fact, Szparagowski noted that "[lesson planning] could take as much as 2 to 3 times the time to [traditionally] plan in order to find the write (sic) video, video questions, supplementary handout, and then plan the lesson to build upon the video effectively" (p. 30).

Lesson Two: The Art & Science of Teaching

From my limited teaching experience but lifetime academic experience, I have found educators can be considered fundamentally divergent as they are often comprised of a predefined set of abilities, unique skills, varied professional experiences, and diverse personalities. Even if a compendium of best practices was created to include a repertoire of field-tested instructional techniques to inform a preferred teaching practice, creating the perfect learning environment would remain elusive. As a new educator, I attribute this uncertainty to the concept of variance, where a particular strategy for one instructor may not be effective for another as elements such as school culture, student demographics, learner ability, technological access, and personal preference can restrict the use of these vetted teaching techniques. I learned that instead of standardization, teachers must be equipped with numerous evidence-based options to facilitate the learning experience. This is known as the “art” and “science” of teaching, or the skillful implementation of strategies that facilitate learning and retention.

Research conducted by Welch, Adams, Brown, Welch, & Marzano (2008) suggests that teachers should concentrate their instructional techniques on building active processing of new content which is critical for concept mastery. These are known as “critical-input experiences” and can include such strategies as: teacher-guided notes that emphasize key concepts, nonlinguistic representation such as graphic organizers and mnemonics, elaborative interrogations by the teacher to question why the student’s thoughts about the subject are believed to be true, small-group cooperative learning where students are provided with an opportunity to witness their peer’s active processing, and metacognitive activities where students address and rectify their previous misconceptions about the topic (Welch, et al., 2008). Published just one decade ago, this research seems to override the efficacy of the former didactic approach of the direct instruction lecture. In my experience as a new K-12 teacher, I find myself reverting back to lecture as it is familiar and easy. However, summative assessments reveal that despite extended class time being devoted to the content, lower-order thinking skills such as recall and recognition are sometimes not mastered, showing that lecture as a sole strategy is no longer effective for deep learning. In fact, research by Hackathorn, Solomon, Blankmeyer, Tennial, and Garczynski (2011) indicate the same. Evidence collected during their study found that lecture methods lead to the lowest overall scores, thus suggesting that passive learning is not effective.

Modern educators rely upon assessments to drive their instructional techniques to promote improved learning outcomes for their students. One way to measure active processing of learning and student engagement is through formative assessment. Though formative assessment "as" or "for" learning is essential, recent research reveals the perceived effectiveness of interactive teaching strategies in experiential learning, where the student is both involved in the learning process and is responsible for their own learning. In a study conducted by Hackathorn, Solomon, Blankmeyer, Tennial, and Garczynski (2011), these interactive strategies can range from "[an] appropriate use of media and electronic resources to homework assignments and quizzes to demonstrations and group projects" (p. 41). Further, the authors note that interactive teaching strategies increase student motivation, involvement, and enthusiasm, and by integrating experiential learning, "students may engage in higher-order thinking such as analysis, synthesis, and evaluation" (Hackathorn, et al., 2011, p. 41). Drawing upon these insights, I aided my mathematics department to implement technology-based projects focused upon real-world challenges to promote critical thinking and problem-solving skills. I learned that by encouraging the student to determine how mathematics principles can be used to solve complex issues, they are able to apply, evaluate, and create concrete mathematical solutions based upon abstract concepts. For example, students were provided with a relatable problem (designing floors in a house with perpendicular angles using rectangular tiles) and instructed to use technology to model the finished design using Geometric principles of parallel and perpendicular lines. As part of the assignment, students were required to sketch a prototype, which served as a formative assessment to correct misconceptions and ensure successful acquisition of mathematic concepts and procedures. From this experiential learning approach, the student is better positioned to retain the key concepts through active learning (Hackathorn, et al., 2011).

The "art" of teaching can be summarized by the teacher having a repertoire of the various "science" strategies available, or those in which peer-reviewed research has determined its learning effectiveness. Armed with this knowledge, the teacher is able to select instructional strategies based upon the cognitive ability of the students, define critical needs experiences, create formative and summative assessment activities, appropriately pace the material, identify the technological capability of the school, and determine the technological proficiency of the teacher and student base.

Lesson Three: The Design and Evaluation of Instruction

As a new K-12 educator, one of the most daunting tasks is creating standards-aligned lesson plans with measurable learning objectives, while accounting for differentiated instruction, learner preferences, enrichment and remediation strategies, learner motivation, activity sequencing, and resource organization. What I found to be particularly elusive is how to maintain student engagement for those students that learn material quickly, or for those that lose interest with "boring" content. After completing my student teaching assignment, my class survey revealed that some students' lack of engagement stemmed from limited opportunities for new learning. As a potential solution, my mentor teacher recommended that I consider a modified competency-based education (CBE) model to design and evaluate instruction for future classes.

CompetencyWorks, the leading authority on CBE, defines this approach as a learning-based system rather than a time-based system (2012). In fact, it is noted by this same source that CBE is founded upon the principle of personalization, making education relevant for each student and allowing educators to respond rapidly to learning needs. This instructional approach can alleviate boredom as it presents new learning opportunities based upon individualized needs. Another benefit to this system is the stepwise evaluation provided through authentic assessment of competencies that are effectively aligned to each learning objective and cross-referenced to the relevant learning content. These competencies must be mastered with high accuracy prior to the student moving ahead to new material (CompetencyWorks, 2012).

Though fairly new to the K-12 sector, CBE best practices for curriculum design can be reviewed, considered, and extrapolated in whole, or in part, from research institutions such as the Bill & Melinda Gates Foundation and the Lumina Foundation. Partnering with the Competency-Based Education Network, the Public Agenda report published in 2015 provides us with ten (10) best practices to design effective instruction for CBE models. At the top of this list include: learner-centered programming where students become active participants in the learning experience, provision of flexible learning arrangements allowing students to progress through the same content within a different path and pace than that of their peers, and inclusion of intentional scaffolding to help the student practice and master the pre-selected competencies and learning objectives (2015).

In practice, it appears that CBE shares the same design approach as classroom instructional planning, though the difference between these two modalities is evident in timeliness and convenience of lesson deployment. CBE models are highly time-intensive to develop and rely heavily on technological delivery. Though it is implausible to expect a teacher to create an entire annual curriculum for a CBE framework within one short summer, the teacher can evaluate how this approach may fit into a challenging instructional unit. According to Roth (2007), when designing the lesson, it is necessary to consider the "backwards" design framework, which focuses upon the projected performance outcomes as the starting point in curriculum development. With the end-in-mind, I could design performance-based learning objectives which may include knowledge, skills, and behaviors, develop authentic assessments which evaluation mastery of the required concepts, and select relevant learning objects for varied student abilities (CompetencyWorks, 2012). When considering diverse learner paths and pacing within the CBE framework, I could consider how differentiated instructional strategies could be introduced for learners of varying cognitive ability and how those modifications and adaptations translate to a multitude of product deliverables. By providing my students with choice in their learning pathway, intrinsic motivation and higher-order thinking skills can develop. (Marzano, 2003). On a very simplistic level, I provide my current students with a choice in submitting written, multimedia, or visual work to demonstrate mastery of the learning objectives. Moving forward, I would like to introduce lesson quests to further individualize the learning path through choice and sequence.

Lesson Four: Networking and Collaboration

According to Marzano (2003), the most important factor in assuring that students obtain high levels of learning is the quality of instruction that they receive from their teachers. One way to promote this standard of excellence is by providing tools and resources for instructors to improve both their "art" and "science" of teaching. In simplest of terms, teachers must be afforded the opportunity to share, converse, debate, and model effective learning practices and instructional organization among their peers, keeping in mind the value that multiculturalism and diversity would offer to develop robust global teachers. Aside from the necessity for expert content knowledge, effective classroom management skills, in-depth prowess for developing learning activities in accordance with evidence-based instructional theory, and understanding of imposed educational standards, there is a seemingly insurmountable learning curve in discovering how to best organize the abundant workload, apply practical, ease-of-use technology, and successfully assimilate into the school's existing infrastructure. The remedy to these challenges can be applied through the simple creation of a professional learning community (PLC). Crowley (2014) describes this system in Education Weekly as, "a vibrant, ever-changing group of connections to which teachers go to both share and learn. These groups reflect our values, passions, and areas of expertise" (p. 1). What a PLC means to me is defined more simply - the act of creating relationships with other like-minded professionals with a common goal to affect positive learning experiences for our students.

The use of technology creates ease in connecting and collaborating with other educational professionals, irrespective of global location. Tools such as RSS provide professionals with timely updates to web-based content based on their interests. I was exposed to how simple this operation can be in developing a PLC during the *EDTECH 501 - Introduction to Educational Technology* course. Diigo groups is another popular collaborative tool that permits its users to select groups of interest, and community members of that group share research to proliferate professional development. For example, my ability to effectively flip my classroom stemmed from the ideas postulated in the "Flipped Resources" Diigo group.

Crowley (2014) recommends that educational professionals build their network based upon three groupings: professional organizations, niche groups, and peer mentors. A few of the professional organizations that I currently hold membership with include the National Educational Association (NEA) which focuses on advancing the political agenda and best practices of public education, the Association for Educational Communications and Technology (AECT) which explores how the theories of educational technology can improve and sustain learning, and the National Association of Biology Teachers (NABT) which connects and inspires secondary and postsecondary science teachers to share expertise, trends, and curriculum design within the life sciences field. My niche support portfolio includes social media business pages and like-minded groups within Twitter, Pinterest, Facebook, and LinkedIn, along with multimedia platforms such as YouTube channels and the Teaching Channel, a popular resource launched in 2011 that provides professional development topics through teacher interviews and classroom demonstrations. As a new educator, I am still seeking to fill my third grouping for mentors, though my recent employers have provided me with an onsite instructional coach to support my development. In practice, these supports form faculty cohorts to discuss and plan interdisciplinary instruction and problem-based learning projects for cross-cutting concepts.

Lesson Five: The Research-Practice Connection

Januszewski and Molenda (2008) define educational technology as, "the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources" (p. 1). This definition provides credibility for the field of educational technology, reminding us that as a "study", research methodologies and subsequent peer reviews validate, recommend, and promote certain technological strategies based upon findings. In fact, research demonstrates that technology plays a critical role in student learning (Russell, Lucas, & McRobbie, 2003). Ironically, despite technological proliferation, many teachers still find the integration of technology within their classrooms and curriculum challenging. This may be due to restricted time, lack of proficiency with technology, or poor administrative support (Guzey & Roehrig, 2012).

Luckily for me as a new science teacher, research colleagues have performed studies that will guide my practice. For example, according to Guzey & Roehrig (2012), three teachers were examined over the course of three years to partake in new instructional approaches utilizing educational technology and report their outcomes. The first teacher reported that in order to become an avid technological champion, the key is to embrace the need for technology in teaching and learning, not only for administrative tasks. Teacher candidates must also be willing to spend personal time learning about new technology methods and tools, as many schools will not anticipate the ultimate benefit in learning depth and retention. One of the key ways that I have applied educational technology to support higher-order thinking is through virtual field trips, media literacy, and webquests, all mastered within the MET program and showcased as artifacts. According to Russell, Lucas, & McRobbie (2003), interactive activities such as the ones described above provide discovery learning opportunities for the student, thus promoting meaningful learning through student collaboration and inquiry.

The second teacher indicated a deeply rooted teaching philosophy in constructivism, where the students need to create their own knowledge and conceptual understanding of science. His major takeaway from integrating classroom technology was the reduction in classroom disruption (Guzey & Roehrig, 2012). Many new teachers struggle with effective and appropriate mechanisms for classroom management. In fact, I have personally found that keeping students active and engaged in learning prevents outbursts, reduces out-of-class breaks, and increases curiosity, thus leading to improved intrinsic motivation. As such, using educational technology to facilitate learning and improve performance will become a staple within my lesson planning.

Finally, the third teacher included simulations in his curriculum to provide students with an opportunity to fail in a system that would not have consequences. As a former food scientist, I plan on including a foodborne illness “event” from the perspective of the microorganism. Students would control the time to product removal and collect data on the victims. Students would learn routes to infection, incubation time, and preventive measures through active learning processes and uncover additional details and treatment for infectious disease through exploratory learning.

Despite these value-added ideas, the common theme I noticed is that all three teachers demonstrated the critical importance of self-reflection in creating, using, and managing technology in their classrooms. This inspired me to create a new tag within my Boise State Learning Log where I can periodically reflect upon current tools and instructional strategies, and document opportunities and victories from the associated technology-rich lessons. As I uncover novel ways to engage my students in science education, this collection of thoughts will become my new K-12 portfolio.

Closing Thoughts

As I reflect upon my first-year teaching experience and my educational journey with Boise State University these past two years, it is clear that I have the potential to become a world-class educator. This is not a result of my grade average, the number of books read, or the complexity and diversity of my MET artifacts, but rather my ability to consider how evidence-based learning theories and modern advances in technology converge to create unprecedented possibilities for today's learners, and how I can apply my learnings to benefit my students and my new profession. For example, flipped learning was introduced a decade ago, but is still evolving in 2018 as a tool to maximize classroom engagement. I plan to use this strategy as a promise of more time for active learning within the classroom while students forge lower-level thinking skills at home. I used to believe that teachers were only proficient if they knew all the tricks to managing a classroom. Now, I accept that having a "one-size-fits-all" approach to teaching is neither sustainable nor advantageous, and instead, teachers must build their repertoire of skills to use as part of their individualized "art and science" of teaching. I learned that competency-based education promotes learning personalization, but it's design is adapted from traditional classroom planning. Because of this reason, it no longer seems daunting to explore and implement. I am overjoyed at the prospect of being in a profession that celebrates professional development! The social learning construct is not just for students, but for teachers alike, and as such, is essential to build global professional learning networks and stay abreast of advancements in the education and technology fields. Lastly, I learned that educational technology is the linchpin for all of these modern teaching and learning strategies. Surprisingly, my former belief about EdTech being the catalyst for the **Education Revolution** I now consider false. Instead, what remains true is that educators themselves can create lasting change through dedication to their profession, commitment to their students, and willingness to improve their own learning … one day at a time.

Now that is the real revolution!

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