Handbook of Research on Innovative Pedagogies and Technologies for Online Learning in Higher Education

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Chapter 19
Improve the Flipped Classroom with Universal Design for Learning

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ABSTRACT

The flipped-classroom approach has been adopted widely across higher education. Some faculty members have moved away from it because of the perceived workload required in order to implement a full course "flip." Faculty members can adopt the three principles of Universal Design for Learning (UDL) in order to reduce their own workload and make their flipped-classroom content and interactions more engaging, meaningful, and accessible for students. Adopting both the classroom flip and UDL provides benefits to learners and instructors that go beyond adopting either separately.

INTRODUCTION

The flipped-classroom model holds the promise of allowing faculty members to be able to focus on higher-order thinking and application of course concepts with students during in-class meetings. While the term "flipped classroom" is relatively new, the concept is not. Faculty members at colleges and universities have been experimenting with the idea of "the inverted classroom" since 2000 (see Lage, Platt, & Tregalia), but there are still different interpretations and definitions, especially since 2007 when the term "flipped classroom" was coined (Noonoo, 2012). In this chapter, the authors will suggest a three-part solution that helps faculty members to create robust and engaging flipped classrooms across the higher-education curriculum to improve learning, encourage engagement, and enhance access to learning interactions for all learners.

As scholars continue to analyze the different models and definitions for the flipped classroom model, educators are eager to learn more and to assess the value of the approach for student learning. Research

has shown that the flipped classroom model improves student achievement of learning outcomes and increases student engagement (see Roach, 2014; Deslauriers, Schelew, & Weiman, 2011; Moravec, Williams, Aguilar-Roca & O'Dowd, 2010; and Shaver, 2010). However, faculty experiences with the model vary, based on how the flipped classroom is defined and implemented. For example, the following case shows how one definition can result in negative experiences for both faculty members and students.

In 2012, Dr. Barbi Honeycutt visited a campus to facilitate a faculty-development workshop focused on the flipped classroom. As she was arranging her materials, distributing handouts, and organizing her work space, a faculty member came into the room, introduced himself, and said, "I flipped all of my lectures last semester for my 300-level course. I recorded all three lectures a week for the entire semester."

Dr. Honeycutt smiled politely and asked, "Oh, you did? So how did that work out for you?" She suspected what was coming next, but let the faculty member share his story. He said, "I'm exhausted. My teaching assistant is exhausted. After each recording, we spent about six hours per lecture finishing the editing and uploading files. It took so much time. And I'm not sure it was worth it."

Of course they were exhausted. A three-credit course meets for approximately an hour three times a week over the course of a typical semester. That's a minimum of 45 hours of video-recorded lectures. Add another six hours to each of those one-hour video segments and the whole idea of the flipped classroom seems impossible, especially on top of all of the other responsibilities that faculty members and students have.

Dr. Honeycutt was curious: "Wow, that's a lot of time spent in the recording studio. What kind of feedback did you get from your students?" The faculty member said, "That's the thing. I'm not so sure my students ever watched all of the videos. Very few came to class prepared. I eventually found myself just going back to my routine and delivering the same lectures during class that I had recorded in the videos. I figured that the videos were there if students wanted to re-watch a lecture or if they missed class. I guess I don't see the point of the flipped classroom. It took too much time, and it didn't seem to matter to the students anyway. At least I can say I tried it, but it's probably not something I would do again."

Dr. Tom Tobin and Dr. Honeycutt have heard versions of this record-every-minute story from faculty members in colleges and universities across the world. It is a common misconception about the flipped-classroom model. In a recent article on "The Condensed Classroom" for The Atlantic, Ian Bogost even perpetuates this misunderstanding: "condensed classes actually seem to require more work rather than less … [T]hey require the creation of elaborate video lectures" (2013).

Faculty adopters nearly always begin with excitement and enthusiasm about the possibilities of the flipped model, especially after hearing from other faculty members about positive changes in their students and even reports of having collaborative fun in the classroom. Some faculty members, however, respond with resistance and hesitance when the words "flipped classroom" are mentioned, for reasons much like those expressed by the faculty member in the case above. It is tempting to want to "dive in head first" and move all of one's content-sharing, lectures, readings, and student self-guided study away from in-classroom time. The most common method for doing this is by recording videos for students to watch—not surprising, since the original "flipped classroom" concept was primarily video-focused (see Noonoo, 2012). In cases like the one described above, three challenges can be addressed to help faculty members to be successful with the flipped approach.

First is the lack of a common definition of what is meant by the term "flipped classroom," and consequently, confusion over how best to apply it. Think of the exhausted instructor who recorded all of his

in-class lectures and then spent hours editing, arranging, and sharing 45 hour-long videos—which most of his students didn't watch, and who could blame them? Or, at least, think of his exhausted teaching assistant who spent weeks editing and uploading files rather than actually learning more about how to teach and engage students. We need a better definition of "flipping" that helps us to avoid the "record it all and post it" temptation.

A second challenge is lack of clarity, purpose, and structure when it comes to designing assignments, assessments, and activities in the flipped classroom. This has a lot to do with how people feel about the reasons for which they do the work of putting interactions and content into fixed formats to begin with—something this chapter will explore in depth. The faculty member in the narrative above achieved the goal of making information available to students. In fact, he probably did too thorough a job, focusing on access to information at the expense of interaction and learner engagement. His students likely gave up on watching those hour-long lectures three times a week because there was too much to sort through, a lack of focus, and too much of a similarity to the in-class lectures. We need a better way to design the out-of-classroom learning experiences for our students so that they feel a connection between the in-class and out-of-class tasks. The two experiences need to be distinct yet connected, so that students feel supported, encouraged, and motivated to continue with the course. Students need to see the value of both the in-class and out-of-class learning experiences.

Finally, there is the challenge of how to adjust to the shifting roles of both the faculty member and the students in the flipped learning environment (Mazur, 2013). The educator in our case study understood what he thought he and his students were supposed to do for the flipped activities outside of their in-class meetings: create and watch videos. This mental model wasn't sufficient to keep the students engaged, however. It also taught the faculty member that the flipped-classroom approach was too much work for very little reward.

By not formulating and clarifying roles for himself and his students that went beyond just watching videos of lectures, he set himself and his students up for frustration and burnout. It's no wonder that he and his students reverted to what was more familiar (and less time consuming) to them—traditional lectures. We need a better way to set expectations for what faculty members and students do in the flipped-classroom model. We need a better way to encourage students to adopt the model and see the value of this type of learning experience, not only for the content knowledge in their discipline, but for all of the other "transferable" skills they learn when participating in these dynamic learning experiences.

Fortunately, researchers in the area of Universal Design for Learning (UDL) have been addressing these three challenges for many years, but in a different context: supporting learners across the ability spectrum. Especially with the advent of multimedia technology and the widespread use of mobile devices among learners in higher education, Dr. Tobin (2014) argues that it is time to broaden the scope of UDL in order to apply it for reasons beyond disability support (pp. 13-14).

UDL is an ideal way to address the three challenges of definition, design, and expectation setting that can help faculty members to create a positive and engaging flipped-classroom experience. As objectives for this chapter, readers will be able to define the flipped-classroom and universal-design-for-learning approaches, implement specific ways that the two can be used simultaneously to create a seamless means of support for learners, and create interactions that allow learners to obtain information, demonstrate skills, and stay engaged with their learning.

CHALLENGE 1: DEFINING THE FLIPPED CLASSROOM

It may help to craft a better definition of flipping the classroom by looking at the limitations of the current understanding and application of the concept, both among practitioner faculty members and in the scholarly literature. Lage, Platt, and Treglia published in 2000 on the "inverted classroom," which has the same premise as the flipped model. They explain, "Inverting the classroom means that events that have traditionally taken place inside the classroom now take place outside the classroom and vice versa" (p. 32). Since then, a robust scholarly literature has developed around how best to implement the flipped-classroom model in order to engage and support learning.

As technological innovations have emerged, they have allowed faculty members and course designers to create more opportunities and resources for what the flipped classroom can be. As a result, the definition of the inverted, or flipped, classroom model has evolved. Strayer (2012) expands on Lage, Platt, and Treglia's definition, explaining that "an inverted (or flipped) classroom is a specific type of blended learning design that uses technology to move lectures outside the classroom and uses learning activities to move practice with concepts inside the classroom" (p. 171). The conversation around the flipped classroom model has broadened exponentially since teachers in K-12 settings started implementing the model (see Bergmann & Sams, 2012). In addition to the literature, when Dr. Honeycutt and Dr. Tobin speak with instructors across the world, they hear many definitions and interpretations of what it actually means to flip a classroom.

As cited above, the most common—and most debated—definition centers on the creation and integration of videos as tools for delivering instruction. Videos can indeed be an effective way to deliver and review information, and some educators are embracing the advantages of video-based education. Salman Khan is one of the pioneers in creating videos for educational purposes. His creation, Khan Academy, provides instructional videos to audiences through free Internet platforms such as YouTube (Bishop & Verleger, 2013). Khan's work opened the door for other educators to re-think the role videos can play in education.

Likewise, the definition of the flipped classroom from EDUCAUSE, a nonprofit association which conducts research on instructional-technology integration in higher education, specifically mentions video: "The flipped classroom is a pedagogical model in which the typical lecture and homework elements of a course are reversed … Short video lectures are viewed by students at home before the class session, while in-class time is devoted to exercises, projects, or discussions" (EDUCAUSE, 2012).

Somewhere along the way, the flipped-classroom model became synonymous with recording entire video lectures for students to watch on their own outside of class time. There are so many design flaws and assumptions made when this is the only way the flipped classroom is defined. For example: How to assess whether or not students watched the video? What if students do not have access to video-watching technology outside of campus? What would happen if all professors recorded all of their lectures and students were suddenly tasked with watching more than 15 hours of lectures every week just to prepare for their classes? Who has time to record and edit all of these videos? Why exactly does an entire lecture have to be recorded for every class?

Most importantly, what is the goal? Watching a recorded lecture is not teaching, and not automatically learning. A video of a lecture is still just a lecture. Where's the innovation?

Many educators challenge the idea that the flipped-classroom model must include videos of lectures to enhance learning. High-school science teachers Jonathan Bergmann and Aaron Sams are the authors of *Flip Your Classroom: Reach Every Student in Every Class Every Day*. They define the classroom

flip as a mindset, rather than as a set of strategies or techniques: "It's about flipping the attention away from the teacher and toward the learner … and leveraging educational tools to enhance the learning experience" (Sams & Bennett, 2012).

In order to help to avoid the frustration felt by the faculty member who had recorded 45 hours of lecture videos, the authors advocate re-framing the definition of the flipped classroom back to one of its earliest forms. Instead of focusing the definition on a specific technology or practice—in this case, recorded videos of lectures—the key to the classroom flip is intentionally leveraging various types of technology as pedagogical tools. This approach hearkens back to the original concept of inverting, or flipping, the design of the learning environment as first identified by Lage, Platt, and Treglia (2000, p. 34). They made it clear that inverted, or flipped, instructional design could indeed include videos as instructional tools, but the main idea is to reverse the types of interactions that happen in and out of the classroom.

Additionally, if a video is used, it should be designed with a specific purpose and connected to a learning outcome. It is not a replacement or substitute for the instructor. It is not used solely for the purpose of accommodating students who miss class. The purpose of the video should be to prepare students for the in-class activities where the content will be applied and analyzed. Such an approach when using video has been show to increase student learning outcomes as measured in test grades and assignment grades (Calimeris & Sauer, 2015, p. 14).

In addition to reversing when and where activities occur, educators can make class activities serve more structured purposes. The adoption of a definition of the classroom flip that is not limited to a specific technology or technique allows faculty members intentionally to design learning interactions in specific sequences based on the progressive categories of Bloom's Taxonomy of learning domains (see Anderson & Krathwohl, 2001). For each course topic, students engage with learning concepts within the lowest levels of Bloom's Taxonomy—knowledge and comprehension—before class. In-class time is spent focusing on the higher levels of Bloom's Taxonomy: analysis, evaluation, and creation (Honeycutt & Garrett, 2013, p. 2).

Derek Bruff (2012) provides a useful distinction between the traditional classroom and flipped classroom in terms of when learners first encounter new ideas. In the traditional classroom, new concepts are typically first encountered via the classroom lecture. The instructor introduces learners to new material, with deeper understanding and content reinforcement taking place via homework. Although this is an oversimplification—inquiry-based learning (IBL), problem-based learning (PBL), and active learning approaches also provide learning gains—many courses are still taught using the traditional lecture format, and research demonstrates that adopting the flipped-classroom model for individual or group activities leads to improved student learning outcomes (see Foldnes, 2016, pp. 47-38).

In the flipped classroom, learners first encounter new ideas via videos, readings, interviews with practitioners in the field, or other self-directed study. Deeper learning, application, and critical thinking are then emphasized in the classroom via individual and group activities. The promise of the flipped classroom is the potential to connect students effectively, encourage engagement, and enhance learning.

As scholars continue to expand what it means to flip a classroom, educators are seeing promising results and are looking for ways to make the flipped model more successful (see Mason, Shuman, & Cook, 2013; Riendeau, 2012; Talbert, 2014; Wilson, 2013). One connection that has started to emerge is the intersection between the flipped classroom model and Universal Design for Learning. Both approaches emphasize the importance of intentionally designing course interactions around learners' needs, with the goals of enhancing learning, increasing student engagement, connecting students with the course material, and allowing learners to demonstrate their skills in supported and varied ways.

In Dr. Honeycutt's conversation with the early-adopter faculty member, these challenges can be examined more carefully, with an eye toward how to can address them using UDL. The faculty member's overly-rigid interpretation of the flipped-classroom model all but guaranteed his students' and his own burnout. He was creating and sharing too much information, all without a purposeful focus on the design and structure for the students' learning experiences, both during and outside of class meetings. There was confusion around the roles and expectations for the students and the instructor, which eventually led everyone to revert to their comfort zones in more traditional lecture-based class roles. To address these common challenges, concepts from UDL can be introduced into the flipped model to help faculty members and students succeed better in this type of learning environment.

CHALLENGE 2: OVERCOMING BARRIERS (NOT THE ONES YOU THINK)

In adopting the flipped classroom, we need a better way to design the out-of-classroom experiences for our students so they feel supported, motivated to stick with the course, and engaged with the learning. The theory and practice of UDL allows us to create out-of-classroom interactions and support that meet exactly these needs.

Faculty members often associate UDL with the use of technology to help extend learning opportunities to students with disabilities, since most faculty members have had the experience of students with disabilities requesting specific accommodations, such as extra time on tests or alternative formats being created for course materials.

Unlike accommodations, UDL is not a means of making specific changes for individual students upon request; in fact, it allows us to do much more than merely accommodate student disabilities. In order to blend UDL and the flipped classroom model, we must first address an obstacle: people may be hard-wired not to want to use UDL or the flipped classroom model at all.

Most faculty members and institutional staff members have had the experience of working on requests for accommodations from students with disabilities. Also, most faculty members have not yet received formal training or conducted, research about Universal Design for Learning (Lombardi & Murray, 2011), and are unlikely to know specific details about what UDL encompasses. This sets people up to color their emotional response to UDL with the valence that they associate with accommodations.

For neuropsychologists, the term "valence" has to do with how people add emotional coloring to "events, objects, and situations" that "may possess positive or negative valence; that is, they may possess intrinsic attractiveness or aversiveness" (Frijda, 1986, p. 207). In plain English, this means that people's emotions affect how they perceive the world around them and the events that they experience.

Researchers have been asking college and university faculty members for decades about how they respond to having students with learning challenges in their courses (see Fonosch & Schwab, 1981; Fichten, 1986; Nelson et al., 1990; Houck et al.,1992; Bento, 1996; Benham, 1997; Bigaj et al., 1999; Cook et al., 2009; Murray et al., 2009; Zhang et al., 2010; Lombardi & Murray, 2011; Murray et al., 2011). Faculty members should always respond supportively when students come to them with forms for accommodating challenges. Say you are a faculty member teaching a business-writing course, and a student comes to you at the end of the second week with a piece of paper to request an accommodation. The student says, "I need time and a half on tests and quizzes, and I need either software that can read the test questions out loud for me, or a live human being to do the same." What should your answer be? Of course, it should be "Sure, I'll set that up. Thank you for letting me know."

But how do faculty members actually feel when presented with accommodation requests? Based on the twelve large research studies mentioned above, the emotional valence associated with accommodations is almost uniformly negative. In many faculty members' minds, the fact that one must accommodate learners with disabilities brings up feelings of uncertainty, confusion, annoyance, and even anger, as the following excerpts from the research indicate.

Although faculty were willing to accommodate students with learning disabilities, they were concerned about maintaining academic integrity. For instance, several faculty members indicated that they would be willing to make accommodations for students with LD only if they could be assured that it would not lower academic standards … Some faculty commented that each student's case would have to be treated on an individual basis. Finally, faculty indicated that the student's attitude would influence whether or not they would provide him or her accommodations. (Nelson et al., 1990, p. 198)

Among the statistical group comparisons presented … four are somewhat troubling. Specifically, if faculty [members] perceive that having a learning disability could limit the selection of a major … and influences whether students with a learning disability can complete a degree program, such views may be inadvertently communicated to students with learning disabilities … This could be especially damaging at the university level, where student-teacher interaction is often limited, thus making alterations in one's perceptions more difficult. Whether conscious or unconscious, misconceptions or prejudicial attitudes may create barriers to the pursuit of certain careers or result in unequal opportunities. (Houck et al., 1992, p. 693)

Faculty attitudes towards disabled students were typically characterized by … the perception that disabled students were somehow "less able" and that their "disability" could jeopardize not only their own individual performance, but also limit the other students and the instructor. In several cases, these unfavorable feelings were compounded by the phenomenon of reactance: the professors grieved the perceived loss of their academic freedom, curtailed by the legal requirements of special accommodations. (Bento, 1996, p.494)

Faculty members rated the majority of items under one theme, Accommodations-Willingness, as low importance and low-agreement … It is possible that faculty members felt negatively about … accommodations because they are relatively difficult to implement, perceived as altering the nature of the course, or both. (Cook et al., 2009, p.93)

[M]any faculty members are not fully supporting students with disabilities according to legal requirements or recommendations for best practices. This is an area of concern that institutions of higher education need to address to make certain that faculty members provide the necessary and reasonable accommodations and supports to students with disabilities. (Zhang et al., 2010, p 283)

For many faculty members, interactions with students with disabilities, especially specific requests for accommodations, carry an aversive and negative emotional valence. Regardless of what they think ought to be the case—and regardless of whether people act consciously on such negative emotions—they ground our reaction and approach to learners with disabilities. In interviews with faculty members

throughout North America about adopting UDL, the authors have heard feedback similar to the research findings above:

- "I don't have time to do all of that work if it benefits just a few students with disabilities."
- "My institution doesn't have a service for captioning videos, so I would have to do it all myself, and I have a lot of video clips for each of my courses."
- "I've had a number of students come to me with 'learning disabilities,' but they don't seem to have disabilities when I interact with them in my courses."
- "I think at least a few of my students are trying to game the system by claiming to have disabilities."
- "I know that I should be following the law, but I'm not always clear about what it requires, and no one at my institution is enforcing it."
- "I haven't had a student with a disability in my courses for years. I will wait until I have a request for an accommodation before I start doing all of that work."

Based on this kind of feedback, any conversations, training programs, or advocacy for adopting Universal Design for Learning principles would stand poor chances of success even before they happened, due to the negative emotional valence associated with making accommodations for students with disabilities, even though UDL is not a means of granting specific accommodations.

In fact, the contrary actually applies. As Sam Johnston, a research scientist at the Center for Applied Special Technology (CAST) puts it, "we want a situation that is good for everybody … Part of it is thinking about what has to happen at the level of design that makes accommodation less necessary" (personal communication, November 15, 2013). Dr. Johnston means that adopting UDL principles in the design of course interactions, the need for specific accommodations requests is greatly reduced, because it increases access for all learners—including people with learning challenges.

So why hasn't everyone adopted UDL yet? Because people apply their negative emotions related to their experience of granting accommodations when they are presented with the option to apply UDL principles in their course design and teaching. Conversations about UDL are often smothered by aversive emotional valence before they can be considered on their merits.

Like Chocolate and Peanut Butter

Before addressing how and why to adopt UDL principles when designing interactions for flipped classrooms, here are a few core definitions. The research scientists at CAST came up with the concept of UDL, based on the various ways in which our brains process learning tasks:

Universal design for learning (UDL) is one part of the overall movement toward universal design … While providing access to information or to materials is often essential to learning, it is not sufficient. UDL requires that we not only design accessible information, but also an accessible pedagogy … The framework for UDL is based in findings from cognitive neuroscience that tell us about the needs of individual learners. It embeds accessible pedagogy into three specific and central considerations in teaching: the means of representing information, the means for students' expression of knowledge, and the means of engagement in learning. (Rose et al., 2006, p. 17)

UDL is often associated with the use of technology to help extend learning opportunities for students. UDL is an approach to the creation of learning experiences that incorporates multiple means of

- Engaging with content and people
- Representing information
- Expressing skills and knowledge

The CAST web site for higher education, UDL on Campus, notes the importance of learner engagement among UDL principles (CAST, 2014); in light of this, CAST re-arranged the presentation of the components of UDL in 2014 to list engagement first. For the category of engagement, this means creating multiple ways to help students to self-regulate, such as helping them to keep pace with readings for the course, suggesting ways to portion out writing and research to avoid last-minute "crunching," and encouraging learners to make connections beyond the immediate work they are doing in our courses.

Making multiple representations of information is the part of UDL with which most of us are familiar. Faculty members largely know that they should be captioning or transcribing video clips, providing audio versions of text-based lecture notes, and segmenting longer items into more manageable (and more reviewable) chunks (see Zhang et al., 2010; Lombardi & Murray, 2011; Murray et al., 2011).

Allowing learners to express their skills in multiple ways is often a new exercise for faculty members and course designers: if learners can write a 3-page essay, they can also be allowed to choose to create an audio podcast or video report, so long as all of the alternatives provide students with the means to meet the required assignment objectives. Choice is a powerful motivational strategy. Not only is choice part of UDL, but it can be helpful in addressing some of the challenges of the flipped-classroom model as well. Student motivation is often one of the top concerns for faculty members who flip their courses. If choice as an option for completing assignments is "built in," then this challenge is addressed through the application of the principles of UDL.

Before diving in to practical applications about how best to apply UDL principles to course interactions, however, we must first determine how to uncouple UDL from the negative emotional valence of people's experiences with requests for specific accommodations.

UDL began in the disability-advocacy community as a way of creating a more inclusive society, generally, which began with an architectural movement called universal design. "Recognition of disability as a civil right entails making sure that a person with a disability has access to the buildings, classrooms, and courts where those rights are learned and adjudicated" (Davidson, 2006, p. 126). UDL is an outgrowth of universal-design ideas in the built environment—such as allocating parking spaces for drivers with disabilities.

UDL can often get mired in people's perceptions of a "medical model" that perceives disability as primarily a health issue, where disabilities are deficits in function that reside within the individuals themselves. This medical model of disability helps to explain why many people unconsciously associate negative emotions with their interactions with people who have disabilities (Stodden et al., 2011, p. 83): the "otherness" is associated with the people with whom they interact. Contrast this with a social model of disability, in which the disabling factor is seen to be in the environment. If a student in a wheelchair encounters a library building with stairs but no ramp or flat-ground entryway, the disability is not inherent in the student—it is the poor design of the building that presents the challenge.

Because higher education is largely in transition between these two mental models of disability, our first radical reflection about UDL is to re-frame it away from the concept of disability all together, and

situate UDL in a narrative with which all faculty members and staffers are familiar—and one which ties in with the flipped-classroom approach through a much more neutral emotional valence: mobile learning.

In comparison with learners from only fifteen years ago, the students who come to college today are significantly

- More likely to require remedial instruction (Adams, 2015)
- More likely to have poor study habits and time-management challenges (College Board, 2015)
- Less likely to have significant time for study outside of the classroom (College Board, 2015)

In North America, more college students than ever before are adult learners with family and job responsibilities—and precious little time for studying: "Adult learners are juggling family, work, and educational responsibilities. They don't do optional" (Mason, 2014).

A recent EDUCAUSE study shows that 86% of college students own smartphones, and a significant percentage also own other mobile devices such as tablets (Chen et al., 2015). The authors of an article reporting on the study extol the potential benefits of any-time, anywhere learning and collaboration:

As an integral part of students' daily lives, mobile technology has changed how they communicate, gather information, allocate time and attention, and potentially how they learn. The mobile platform's unique capabilities—including connectivity, cameras, sensors, and GPS—have great potential to enrich the academic experience. Learners are no longer limited to the classroom's geographical boundaries; for example, they can now record raw observations and analyze data on location. Furthermore, mobile technology platforms let individuals discuss issues with their colleagues or classmates in the field. The ever-growing mobile landscape thus represents new opportunities for learners both inside and outside the classroom. (Chen et al., 2015)

The argument for adopting Universal Design for Learning has always been based on the broad benefits that UDL methods provide to all learners, but for years there wasn't a compelling and simple case that demonstrates in a concrete way how those benefits play out. Now there is one: UDL is a way to reach out to adult learners on their mobile devices to help them to find more time for studying and engaging in learning. Mobile devices can also be valuable learning tools in the flipped-classroom model. They can be used before, during, and after class for reviewing content, conducting research, engaging in problem solving, and assessing learning. They can connect students to the course material, to other students, and to the instructor.

The Fight for a Level Playing Field

An important aside about re-focusing on mobile devices: if the fight for access to the built environment has largely been won, thanks to the protests and voices of disability-rights advocates, the fight for the rights of people with disabilities in higher education continues in earnest. In recent years, several high-profile court cases took nationally-prominent institutions to task for failing to meet even the minimum legal requirements, such as the decision against Harvard and MIT for not captioning their edX course materials (Lewin, 2015). In advocating for a switch in tactics to broaden the argument for adopting UDL practices, the authors are cognizant of the way that such a switch can take the spotlight off the needs of people with disabilities. Hao (2016) performed research that shows strong student preferences for

flipped-classroom approaches; the results incidentally demonstrate a corresponding strong preference for mobile-device-positive UDL, as well:

The students showed the highest preference levels for BYOD [bring your own device] and IRS [instant response system]. Not only did the IRS feature impress the students, but also, the students repeatedly mentioned how much they loved both IRS and BYOD. One junior wrote in response to the open-ended questions, "The IRS got me less anxious about pop quizzes and made me look forward to taking a quiz." Comparatively, the freshmen who reportedly had low motivation and self-discipline skills especially loved BYOD. One student noted, "I was never allowed to use my cell phone in class. I'm amazed that cell phones can be used for educational use in class. It's so cool!" Another favorite feature was the absence of formal lectures and inclusion of a group discussion format. "I like to exchange opinions with my peers. The discussions stimulated me to think from different aspects," one emphasized. "Lectures are boring. I prefer doing activities in class!" (p. 86)

Our hope is that making the argument that adopting UDL benefits students using mobile devices will reduce the need for making specific accommodations and move us closer to the larger goal of disability advocacy, which is to allow everyone to have the same opportunities to learn—to erase difference and the need for separate accommodations as far as possible.

UDL applications create opportunities for learners to encounter new information on their own, outside of interactions with instructors—leaving more time and space for collaborative review and exploration when instructors and learners are together. This is also the goal of the flipped-classroom approach. This is why the flipped-classroom approach and UDL work so well together, like "peanut butter and chocolate: two great tastes that taste great together," to borrow a phrase from the candy-sales world.

Flipped + UDL Narratives

Imagine a single mother—call her Melissa—who is taking business-management courses at her local community college. She has a job in order to be able to support her family, and she takes courses in the evenings and on weekends. She does her homework, engages with the course readings, and completes her course projects after 10:00 p.m., when the kids are finally in bed. Her statistics-course professor has posted video clips in the learning-management system as study aids toward the midterm and final exams, but Melissa cannot take advantage of the videos because she doesn't want to wake her children and she doesn't want to tune her kids out all together by using headphones. Melissa does not have a disability, but she does have a challenge: time.

Now, imagine if Melissa's professor provided transcripts of the audio in the video clips, or, better yet, captions. Melissa can turn down the sound, turn on the captions, and study for her course examinations, while remaining available in case her children need her. Adopting good UDL practices lets Melissa's professor reach out to her—and to all of her classmates—with options that allows her to choose how she experiences the materials that the professor has posted. This is a double win: the professor's work in creating the videos, plus one alternative version, is rewarded with more students actually using the resources, and the professor's students are rewarded with more flexibility in how they study for the course and learn its materials, concepts, and processes.

Imagine, too, a student on the football team at a large university in the Southeastern United States: call him Jamaal. Jamaal is often on a bus or train, traveling to away games with his teammates. He al-

ready has a special arrangement that allows him to miss a certain number of in-person course meetings in his chemistry course, and he realizes that he's missing out on an opportunity for learning. He wants to keep up with his professor's narrated lecture slides, but his Internet connection is spotty when he is traveling. Jamaal has to wait until he is back on campus to be able to download and open his professor's PowerPoint slides from the course web-resources page, since his mobile phone doesn't have Microsoft Office on it. Jamaal does not have a disability, but he does have a challenge: resource availability.

Now, imagine if Jamaal's chemistry professor took the same narrated PowerPoint slides and created a screen-capture video version that the professor then uploaded to YouTube. Jamaal—and all of his classmates—could then stream the video, even under challenging bandwidth conditions, and he would not need any specific software title in order to experience the lecture slides.

Finally, imagine a student—call her Amanda—whose National Guard unit is called up for an active-duty military tour of duty, right in the middle of her studies toward her nursing degree. Amanda's professor in her anatomy and physiology course requires all students to pass a two-part final examination, in which the professor and student meet one on one and the professor quizzes the student on the name and location of various parts of the human body, with the professor providing one piece of information (the name of the part or its location on an anatomical model), and the student providing the other, by naming the part or pointing to the location on the model associated with the name. Amanda suspects that she will need to drop the course, since she will not be present to be able to complete the final examination, and there are no options for demonstrating her knowledge in a different way. Amanda thought she could buy her own anatomical model, but a quick look online showed her that the model used by her professor costs more than $6,000.00. Amanda does not have a disability, but she does have a challenge: distance.

Now, imagine that Amanda's professor offered students two different ways to take the final examination: in person (as above) or by Skype or other video-call software, using un-labeled diagrams provided by the professor ahead of time. The professor asks students to pan their cameras around themselves to show that there are no open books or study sheets being used; students can schedule the one-on-one time when and where it is most convenient to conduct the exam. Amanda uses the "private calls to home" area where she is deployed in order to do her live session for the final exam, and is able to continue her studies.

These examples highlight professors adopting UDL techniques in order to reach out to their students who are using mobile devices in order to overcome distance, time, and resource limitations: challenges to which everyone can relate, and which are not freighted with aversive emotional valence. If anything, these stories about designing course interactions for mobile learners are uplifting, and they provide faculty members with motivation to put in the effort up front to intentionally design experiences to enhance student engagement, increase learning, and decrease potential barriers. Educator Allison Posey is interviewed in CAST's recent book, *Universal Design for Learning: Theory and Practice*, about why she adopts UDL practices: "I work the hardest the first time I design a lesson; then it gets much easier and I even find that I do not have to re-teach the content as often: most students get it the first time" (Meyer et al., 2014, p. 161).

CHALLENGE 3: ADJUSTING STUDENTS AND FACULTY ROLES

Remember that UDL is an approach to the creation of learning experiences that incorporates multiple means of

- Representing information,
- Engaging with content and people, and
- Expressing skills and knowledge.

As the definition of the flipped classroom evolves, one characteristic remains constant. Students must complete foundational knowledge work prior to class in order to be prepared to engage in the higher-level discussions and participate in the activities that will take place during class time. If that individual engagement doesn't happen, and students aren't well prepared to discuss and analyze, then it's very challenging to have a productive group session during class. Lack of student out-of-class preparation is one of the most frequently cited reasons for perceived flipped-classroom failures (see Perchik, 2014; Brame, 2013; and Bishop & Verlager, 2013).

If instructors are not introducing new concepts and materials during the in-person classroom setting, they need some way to ensure that learners' first encounters with new ideas will be productive—and they need to find ways to make sure learners actually do encounter the new ideas and don't skip that first exposure or bail out if things get challenging. Here is where UDL plays a significant role.

UDL gives all individuals equal opportunities to learn and provides a blueprint for creating instructional goals, methods, materials, and assessments that work for everyone—not a single, one-size-fits-all solution, but rather flexible approaches that can be customized and adjusted for individual needs (CAST, 2013). UDL helps with two aspects of the flipped-classroom approach, specifically:

1. Deep student engagement with first-exposure concepts, processes, and ideas; and
2. Meaningful student expression during in-person group interactions.

Student Motivation and Engagement

UDL offers a framework for shifting the roles of faculty members and students in the flipped-learning environment. In fact, the first tenet of UDL, engaging with content and each other, is where adopting UDL practices does the most service to the flipped-classroom model. In addition to merely presenting new information to learners outside of class time, that presentation can be designed so that it triggers interaction and engagement, providing roles and specifying responsibilities for learners and faculty members to inhabit and explore.

UDL works best when learners receive feedback and encouragement about their progress in as close to real time as possible (CAST, 2014). Especially since learners encounter new topics on their own, it's up to faculty members and course designers to structure the materials they are using in order to help keep learners engaged and interacting with the course concepts and with each other. This is one of the benefits of the flipped classroom model, as well. When students are engaging in activities and experiences during class, the instructor can immediately see their progress, identify areas of confusion, and provide resources and support to clarify misunderstanding and confusion. This type of "assessment in action" is done in real time, and it's what makes the flipped-classroom model so effective for learning and maintaining momentum throughout a course. Students and instructors don't have to wait until a midterm or a final exam to make adjustments. This characteristic highlights the power of combining both the flipped model and UDL principles.

Some educators misunderstand the flipped-classroom model to require only that learners read the textbook or watch the lecture or review course materials on their own, and thus are expected to master

key concepts without any guidance from the instructor (Plotnikoff, 2013). Such a scenario is no different from the traditional-classroom model where students study their notes on their own or prepare individually for class. The flipped-classroom model asks learners to collaborate most closely and immediately when they are in the classroom together. Not only does this approach not preclude the possibility of interaction and collaboration during out-of-class activities, the level of engagement in out-of-class activities correlates to how well learners are prepared to be active participants as part of in-class activities. Thinking about out-of-class interactions through the lens of UDL helps us to design activities that keep learners engaged, focused, and on task.

In the case of the faculty member who abandoned the flipped classroom, it is clear that neither he nor his students were clear about their roles and expectations. The students were required to watch a video of a lecture. But what were they supposed to do with that information? How do they know what information is important? How do they know what information will be applied during the in-person class?

Often when instructors create assignments or tasks for students, they do so through the lens of being an expert. They are used to the expert role because they are scholars in their disciplines and they have been studying this information for a long time. As a result, they suffer from "the curse of knowledge" which means they know so much about the topic that they can't remember what it's like not to know it (see Heath & Heath, 2007). Faculty members often have a difficult time putting themselves into the role of being the novice, which is exactly what most of their students are. Their students are not experts yet. They are encountering the course material for the first time.

If the instructor has not clearly designed a path towards success from the perspective of the novice, then students will disengage and resist. This ambiguity causes frustration and can lead to apathy, which is then often interpreted by the instructor as "it didn't seem to matter to the students." In our narrative, the students and the faculty member reverted back to the more traditional roles of lecturing and taking notes during class time rather than engaging in the higher domains of critical thinking and analysis.

One way to design interactions so that the applications for learned content are evident to learners is to adopt the "ten and two" mental model. In driver's education, learners are often told to place their hands at the ten o'clock and two o'clock positions on the steering wheel in order to have the strongest and most flexible control over the car. A similar model for course-interaction design offers maximum flexibility and control for learners. It has to do not with the clock face, but with minutes of time. Ask learners to spend no more than ten minutes encountering new things and ideas, and then ask them to spend at least two minutes taking an action related to it. For example, students might watch a five-minute video, read the first part of a textbook chapter for five minutes, and then take two minutes to reflect on the commonalities between the two resources. These reflection notes then feed forward into the next "take two" break, and create a foundation for richer in-class "flipped" conversation, as well.

Good UDL supports interactions and new collaborative roles in the face-to-face elements of the flipped classroom model, as well. Faculty members and course designers can move beyond the learning management system (LMS) and use social-media and Web 2.0 tools like Google Apps in order to foster collaborative exploration and application of course concepts during face-to-face time together. Students can choose their roles as writers or speakers (or both) in the face-to-face environment if options are available for collaborative work in spaces that extend beyond the face-to-face classroom:

To flip the classroom discussions, I instituted a 200-word maximum (or a 1-minute time limit for audio and video posts), forcing students to be pithy, but concise. Whatever they did not get to talk about in the

main post could be discussed in the comments field with other students. Students were much more likely to engage multiple times with the same post. (Cummings, 2016, p. 92)

Representing Information

In the flipped-classroom model, learners encounter new ideas outside of class time. Students stand the best chance of understanding those ideas if they are presented in the ways in which the learners take in information best. But how do professors and course designers know how each student learns best? Well, they don't. That's why UDL counsels people to present each piece of new information in at least two ways.

Some might perceive UDL as requiring all possible alternative formats for any content that are created for learners. For videos of professors explaining course concepts, for example, one would have to create captions, a separate text transcript, an audio-only version, and so on. Think, in such a mindset, of how many separate files would have to be created in order to support the class flip in the first place. Having to make five times that number of files seems like an insurmountable obstacle.

Only, UDL doesn't work like that. And neither does the flipped-classroom model. With UDL, two questions help to maximize the utility of out-of-class content without multiplying the workload. First, think about the course content as it's taught in a traditional fashion. Which concepts do learners traditionally find challenging? Where do they always get things wrong on tests and assignments? Where do they benefit from different approaches to the content? Those are the "first pass" places to create multiple alternative versions of content files.

Second, select one primary and one secondary format for all course materials. This means that existing text-based course materials, such as lecture notes, study guides, and practice quizzes, are the primary format. Then, by selecting a secondary format, such as audio-only, a whole-course application of UDL can be done within a narrowly-defined scope.

With the flipped-classroom model, it is best not to try to flip everything in a whole course. It's best to start by identifying "flippable moments" or places where active learning will add value to content mastery (Honeycutt, 2013). Start by looking for places within the course where students are confused, bored, or where there's information they absolutely must know before moving on to the next part of the course. These moments are the places to invest the most time and energy in when flipping, and they can provide a good starting point for figuring out where to integrate UDL principles.

UDL doesn't ask us to create materials to anticipate every possible use (e.g., students with visual disabilities, learners with poor Internet connections when they are going home on the bus), just to "design for the extremes," and add more ways of representing information later on, if and when new learner needs get expressed. CAST has created an "Educator Worksheet" to help professors and designers to work through this decision making process (2011). Adopting a "plus one" mentality regarding the formats in which course content is offered also automatically takes advantage of differentiated instruction (DI), which aims to assess the level from which students are beginning, and offers varied ways for them to learn.

One of the primary objectives of differentiated instruction is that it acknowledges that not all students learn the same way. By offering instructional choices, students can use the learning style(s) that works best for them. The differentiated instructional process begins with an assessment of the students' prior knowledge and experiences. (Livingston, 2006)

Just having more than one pathway through learning content and interactions opens up the benefits of differentiation; it is not necessary to plan for and execute every media approach in order to have a positive effect on student learning and persistence.

Likewise, UDL doesn't advocate a narrow adherence to rule-bound structures. For example, Quality Matters (QM) Standard 8 deals with "Accessibility and Usability," and is founded on the principles of UDL. QM pointedly does not prescribe the forms that such design must take:

- 8.1 Course navigation facilitates ease of use.
- 8.2 Information is provided on accessibility of technologies required in the course.
- 8.3 The course provides alternative means of access to course materials in formats that meet the needs of diverse learners.
- 8.4 The course design facilitates readability.
- 8.5 Course multimedia facilitate ease of use. (Quality Matters, 2016)

In the case of the faculty member who had problems flipping his classroom, he had narrowly defined the flipped classroom as "recorded videos of lectures" and he expected his students to watch each full hour of his lectures prior to coming to class. He burned himself out and became exhausted recording all of these videos, and he did not successfully integrate them into the overall learning experience within the course. The students were burned out and frustrated because they were unable to see the purpose and value of spending time watching the videos. Had the professor considered alternative formats, integrated existing resources, segmented them into smaller chunks, and intentionally designed the videos to enhance or support specific learning outcomes, then the approach would have been more effective and engaging. The use of videos allows students to "pause and rewind the professor" (Ehlers, 2014), but relying on videos alone to deliver the message does not address the needs of all learners, nor does it allow faculty members to identify more effective and engaging means for delivering information and engaging students in the learning process.

Expressing Concept Mastery

This final part of UDL and the flipped-classroom model can be the hardest to implement, but is also the most fun (yes, that says "fun") for professors and students alike. Where possible, provide students with multiple ways to demonstrate their skills and learning. This does not necessarily mean having to create separate alternative assignments. Rather, look at the objectives for assignments and think of whether students must use a particular format in order to demonstrate those objectives, or if they can accomplish the same tasks in different ways. The research shows that allowing students choices about their work leads to increased satisfaction and learning gains. For example, Wanner's idea of the "flexible student" is supported by "designing in" choices to course interactions:

Choosing assessment tasks was also well received by the students. They were content with the number of choices available and felt that additional choices could have been confusing. They did not always choose areas of strength for their assignments (such as an accomplished essay writer choosing to write an essay rather than another form of assessment), but this was the most common response. (Wanner & Palmer, 2015, p.361).

For some assignments, such as learning how to write a business memo, the format is an integral part of the assignment; learners who created videos in response to such an assignment would not demonstrate good memo format. However, there are many kinds of assignments where the format is not integral to the skill set being demonstrated. In those situations, offer students the chance to create their responses to the assignment in any format that meets the objectives, or provide a list of possible formats, such as a written response, a short video report, an audio podcast, or a hand-drawn diagram that students then photograph and submit. Not only does allowing multiple means of expression free up learners to select their best skill sets, but it also makes grading less of a repetitive chore. Many faculty members would rather see varied and creative responses to an assignment than have to grade dozens of five-page essays. However, if varied assignments are used, then the instructor needs to be prepared with several assessment strategies to accommodate the variety of assignments. This is not meant as a deterrent to inviting students to submit assignments in other formats. Actually, it can open up the potential for more feedback and less grading if designed carefully.

For example, one way to address this challenge is to integrate both formative and summative assessment processes. Formative assessments—such as classroom assessment techniques—are designed for practice and allow students to test their skills and knowledge and receive feedback without the high stakes involved in grading (see Angelo & Cross, 1993). Formative assessment tasks may be graded, but the percentage towards the overall course grade should be low. These "practice" assessments allow students to test their knowledge and correct their mistakes while giving the instructor valuable feedback about how to proceed, based on learner performance and feedback. Formative assessment activities provide ideal opportunities to try alternative assignment formats. In the business-memo example, a flipped strategy would be for students to write a summary or record a one-minute video explaining in their own words how a memo is formatted and why it matters. Or, in another flipped strategy, students could be given a poorly formatted memo and asked to correct it by circling the errors and explaining how to make corrections. These activities would be completed during class time to allow students to practice analyzing, evaluating, and creating skills before they are given a summative evaluation such as a test, project, or final exam where the students would demonstrate mastery.

The instructor who spoke with Dr. Honeycutt had uploaded at least 45 hours of video lectures without carefully considering whether or not video was the best medium. He was also unable to make stronger connections between the videos and the activities designed for the in-person class time. He delivered the message only one way—using a video. He did not specify what to look for in the videos or how students could test their own knowledge of the information presented. Had he introduced multiple ways for students to demonstrate mastery and test their knowledge, then his students would have become more engaged and prepared for their in-person class time. And by modeling different approaches and formats to the students, the faculty member could have motivated his students to do the same when they completed their assignments.

CONCLUSION

As faculty members continue to implement the flipped-classroom model and other active learning strategies, they will face many challenges and opportunities. It is important to identify which flipped-classroom techniques work best for both instructors and their students. Clearly defining the flip and its expectations for faculty and student roles is essential in creating a successful learning environment. It is

also important to consider carefully the design and structure of both pre-class and in-class activities, in order to ensure that students are set up for success and not burnout. Designing with this intent creates a clear path for assessment by allowing students to practice before demonstrating mastery. By integrating the elements of UDL into the flipped-classroom model, expectations are clarified, and they focus on a variety of ways to connect students to the professor, the course material, and to each other as partners in the learning process.

In early 2015, Dr. Tobin visited a campus to facilitate a faculty-development workshop on UDL. As he was arranging his materials, distributing handouts, and organizing his work space, a faculty member came into the room, introduced herself, and said, "You know, I expanded all of my course content according to UDL last year for my freshman-level writing course. I had no idea how much work accessibility was! I had to make three, four, and sometimes five different versions of everything in my course."

Tom smiled politely and asked, "Oh, you did? So how did that work out for you?"

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KEY TERMS AND DEFINITIONS

Accommodation: A specific change that allows an individual with a learning challenge to enjoy equal access to educational opportunities. Accommodations are usually provided reactively, in response to requests from students via campus units, such as disability-services offices, who act as advocates.

Bloom's Taxonomy of Learning Domains: A pyramid-shaped representation of the various ways in which learners acquire and demonstrate their learning, ranging in cognitive complexity along domains of remembering, understanding, applying, analyzing, evaluating, and creating. Anderson and Kratwohl's 2001 update to the original 1956 pyramid structure redefines the cognitive domain as the intersection of cognitive processes and knowledge dimensions, creating a three-dimensional hierarchy along their intersections. See Heer (2015) for a visual representation of the model.

Emotional Valence: A term from psychology that refers to the intrinsic attractiveness or aversiveness (or "emotional coloring") of the events, objects, and situations that people experience.

Flipped Classroom: A model for teaching and learning in which what is traditionally thought of as "homework" is performed together during in-class sessions and "lecture" is experienced by students during individual study away from the classroom. Learners encounter new concepts first on their own, and work collaboratively with the instructor and classmates to examine, test, and demonstrate new applications and skills.

Plus-One Approach: A mental model for prioritizing interactions to be expanded in terms of adding media alternatives, learners choices, and modes of learner engagement. Think of the places in the course where learners always: 1) Have questions, 2) Get things wrong on tests and assignments, and 3) Request explanations in different terms. Apply "plus one" design to these elements: add one choice, alternative, or means of self-regulation in each place identified. Plus-one thinking helps to focus one's design efforts to the places where they are likely to have the greatest impact for learners.

Ten and Two: The practice of providing not more than ten minutes of information or content before asking learners to spend at least two minutes taking an action of some kind. The ten-and-two rule of thumb is a handy way to ensure that content and interactions are appropriately "chunked" throughout one's course.

Universal Design for Learning (UDL): A set of principles for designing interactions with learners to create multiple means for learner engagement, multiple means of representing information, and multiple means for learners to demonstrate their knowledge and skills. UDL increases access for all learners, not just individuals with learning challenges.