A Review of Flipped Classroom Research, Practice, and Technologies

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HETL note: We are proud to present the July 2014 issue of the International HETL Review (IHR) which contains the feature article "A Review of Flipped Classroom Research, Practice, and Technologies" contributed by a team of authors from James Madison University (U.S.A.), led by **Dr Michele D. Estes**. The authors present a compelling case for the use of the "filliped classroom" approach based on an extensive review of the research literature and other relevant sources on learning design and practice related to flipped learning, and on applying the approach to foster collaboration and achieving meaningful learning outcomes. The authors propose and explore a staged flipped classroom model and suggest that the flipped learning experience may be particularly well suited to set up the scene for learning activities that generate awareness and transfer of course content.

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A Review of Flipped Classroom Research, Practice, and Technologies

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Abstract

Flipping the classroom is emerging as a unique approach to improving learner retention and transfer, and making efficient use of class time. This article reviews the literature and research that offer evidence-based implications for its practice in higher education. The purpose of the article is to help higher education instructors maximize the learning experience, make data-driven decisions, and effectively shift accountability for learning in ways that improve learner outcomes. Emphasis is placed on aspects of
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flipping that situate it in the field of instructional design. The authors describe specific strategies and tools for flipping using a three-stage framework for instructional design that involves learning in both asynchronous and synchronous environments. Readers will take away an understanding of effective practices and basic procedures and tools used to analyze, design, develop, implement, and evaluate a *flipped learning* experience.

Keywords: flipping the classroom, instructional design, student-centered learning, research, implementation

Introduction

The nature of flipping a classroom is similar to that of classroom-oriented instructional design models proposed by Gustafson and Branch (2002) and Morrison, Ross, Kalman, and Kemp (2011) where the instructor of a course serves in many roles that may include subject matter expert, instructional designer, and media developer. For example, he or she collects practical data before, during, and after live instruction that inform the instructional design; moves didactic instruction to an asynchronous environment, often using technologies and incorporating media; and plans for active learning during live instruction to help scaffold deep learning during class time. The role of students in the flipped classroom is to use self-directed learning methods to review and critically consider materials outside of class, and then actively apply what was learned in a collaborative class environment.

While flipping holds promise for helping students achieve meaningful learning outcomes, and for helping instructors make more efficient use of class time, it is but one of many instructional strategies. Instructors who evaluate and select this instructional design approach must make important decisions regarding content sequencing and flexible formatting for access and delivery both in and outside of scheduled class time. This article reviews the literature and research that offer evidence-based implications for the practice of flipping in higher education. A review of the tools and techniques that enable this approach is also included in this paper.

The Emergence of Flipping

An evolution of existing pedagogical practices, flipping the classroom emerged from strategies like Just in Time Teaching, described by Novak and Patterson (1998) as a way of combining collaborative coursework with

online materials and activities to help instructors understand student needs, offer timely feedback, and plan lessons responsive to those needs. The practice of flipping was also influenced and popularized by more recent approaches including the inverted classroom reported by Lage, Platt, and Treglia (2000) and Talbert (2014a), to maximize active learning in class by using a variety of media and delivery formats to help develop student self-regulated learning (Talbert, 2014c) outside of class time; and by peer instruction that Mazur (2009) employed to engage his physics students after questioning the role and limited success of the traditional lecture in his discipline.

The flipped classroom has emerged as both a disruption and an opportunity for the higher education community. The concept reverses traditional thinking about the instructional process and calls for the use of innovative strategies to deliver materials and resources. Flipping the classroom can help nurture active learning, and can also demand more of both teachers and students (Berrett, 2012; Zhang, Wang, & Zhang, 2012).

Technological advancements such as the increasingly accessible and reliable nature of the Internet afford the delivery of content in ways not previously possible. Technologies that use online video and audio, for example, have made it simpler to deliver asynchronous instruction to students in the growing number of flipped classrooms today (EDUCAUSE, 2012). Although technologies do not define a flipped classroom, Bergmann and Sams (2012) list a number of benefits of the flipped classroom when materials are made available in a blended, online and in class, format. Benefits include helping busy and struggling students, increasing teacher-student and student-student interaction, being friendly to students with diverse abilities, and enabling customizable and flexible instruction.

The Flipped Learning Network (2014) describes flipped learning as moving direct instruction “from the group learning space to the individual learning space” (p. 1) where the “resulting group space is transformed” (p. 1). An opportunity then, is for students to develop critical foundational knowledge and understanding prior to class time while “…work[ing] together to solve local or global challenges — or other real-world applications — to gain a deeper understanding of the subject” (New Media Consortium, 2014, p. 36) during class time. In class the educator “guides students as they apply concepts and engage creatively in the subject matter” (Flipped Learning Network, 2014, p.1). By helping students engage at strategic times in

meaningful ways using modern technologies, there is potential to increase the quality of the learning experience.

As the term flipping becomes more commonplace, it is useful to further distinguish and define terminologies. For example, the Flipped Learning Network (2014) and Talbert (2014b) point out that the terms *flipped classroom* and *flipped learning* are not interchangeable and one may not always lead to the other. According to Flipped Learning Network, for flipped learning to effectively occur, “four pillars” (p. 1) must be applied in practice. These four pillars of good practice include: (1) *flexible environments* where the learning environment is physically rearranged to accommodate different types of learning and where there is flexibility in timelines for learning and assessment; (2) *learning culture* where a learner-centered approach that features student construction of personally-relevant knowledge is used; (3) *intentional content* where content is intentionally designed to promote critical and higher-order thinking (e.g., as when one designs according to the levels of Bloom’s taxonomy of the cognitive domain) in student-centered activities in and outside the classroom; and (4) *professional educator* where the instructor is an active observer who offers timely and relevant feedback and assessment, connectedness, reflection, revision; and demonstrates a tolerance for “controlled chaos” (p. 2) during live instruction.

It is also useful to understand that while reported as examples of flipped learning research, studies conducted and published prior to the Flipped Learning Network (2014) publication may actually document a wide range of learner-centered approaches and may well suffer from ambiguity regarding the constructs of interest. In addition, from previous research into best practices in teaching and learning, we know that “any learner-centered educator would provide activities in the classroom that are action based, authentic, connected, and collaborative, innovative, high-level, engaging, experience-based, project-based, inquiry-based, and self-actualizing” (Hamdan, McKnight, McKnight, & Arfstrom, 2013a, p. 17). Hamdan, McKnight, McKnight, and Arfstrom (2013b), for example, include peer instruction, active learning, priming, and pre- and post-class modelling that are designed to reduce cognitive load, as important aspects of flipped learning.

By defining and distinguishing the terms *flipped classroom* and *flipped learning*, and explaining the four pillars of good practice, the Flipped

Learning Network (http://flippedlearning.org/site/default.aspx?PageID=1) has assisted authors and researchers by better differentiating the flipped approach from associated but disparate logistics and practices; and by reporting with greater clarity, the conduct and analysis of research studies that address flipped learning.

Literature Review

Flipping the classroom reverses a traditional model of in-class lecture followed by homework. The roles and responsibilities of instructor and student are proactive and often require a new or enhanced skill set. The instructor designs intentional learning experiences to engage students. The learner is accountable for exploring online materials in a self-directed manner, attempting to gain foundational knowledge before class, and then actively applying it in the collaborative classroom (EDUCAUSE Learning Initiative, 2012).

The purpose of this proactive strategy is to improve quality and efficiency of the teaching and learning process (Demski, 2013; EDUCAUSE Learning Initiative, 2012; New Media Consortium, 2014; Kronholz, 2012; Sparks, 2011). Although the tenets of flipping the classroom and flipped learning have existed for many years (Novak & Patterson 1998; Lage, Platt, & Treglia, 2000; Mazur, 2009), the number of systematic studies into its effectiveness as a pedagogical approach in postsecondary education is relatively small since the flipping model has only recently migrated to higher education from K-12 (New Media Consortium, 2014).

Doyle et al. (2013) as cited in Meeting Abstracts (2013) concluded that faculty and students favored several different innovative approaches (including flipping the classroom) because they increased student engagement and reinforced essential clinical skills for real-world application. By moving away from a learner-centered approach, Elliott, Suda, Hamilton, Curry, and Byrd (2013) as cited in Meeting Abstracts (2013) found that course satisfaction and student perceptions of meeting course objectives decreased. Students in another study seemed to prefer active learning although “exercises that demanded higher in-class performance were less preferred” (Fisher & Assa-Eley, 2013 as cited in Meeting Abstracts, 2013, p. 9). Likewise, Doyle, Krupicka, and Vo (2013) as cited in Meting Abstracts (2013) found that student acceptance and favorable perceptions of flipping were inversely related to the amount of preparation required for in-class discussion. Training students to transition

from passive learners to active learners may promote success in the flipped classroom (Kugler, Gogineni, Tai, Law, & Chung, 2013 as cited in Meeting Abstracts, 2013); Anderson et al. (2013) as cited in Meeting Abstracts (2013) report that students are differentially predisposed to be more or less well suited for it.

Aronson and Arfstrom (2013) reported on a series of studies focusing on the flipped classroom in higher education. In one such study conducted at the University of British Columbia, Deslauriers, Schelew, and Wieman (2011) implemented a flipped intervention with a large lecture physics course. Results indicated that:

…students in the flipped section increased attendance by 20% and that engagement, as measured by four trained observers, increased by 40%. Even more impressive, they found that students in the flipped course scored more than twice as well as students in the control group on a multiple-choice test measuring comprehension of the content in the final week. Students also enjoyed the flipped experiment: 90% agreed that they enjoyed the interactive learning methods tried in the last week. The instructors concluded that using these active learning methods in a flipped course can improve both learning and engagement (Aronson & Arfstrom, 2013, p. 2).

In another study in higher education, at the University of Michigan at Ann Arbor, Berrett (2012) describes a flipping approach for an introductory calculus course wherein instructors guided students through exercises and then asked students to work with their peers to present and discuss solutions. Compared to the results obtained in the traditional course, students in the flipped course “were able to make gains at twice the rate” (as cited in Aronson & Arfstrom, 2013, p. 2). In a third study, Freeman (as cited in Aronson & Arfstrom, 2013), a biology instructor at the University of Washington, implemented a peer instruction component with his class, which resulted in an appreciably reported improvement in learning. Likewise, Lizer and Wesner (2013) as cited in Meeting Abstracts (2013) reported post assessment data indicating that the flipped model improved student performance in a pharmacy course.

By flipping the classroom, an instructor intentionally designs a flexible experience to engage students in asynchronous online learning followed by synchronous active learning during a scheduled class time. When Elliott, Suda, Hamilton, Curry, and Byrd (2013) as cited in Meeting Abstracts

(2013) reduced the number of self-directed assignments outside of class time to study the impact on learners, there was a significant reduction in student scores and grades. This finding lends support to incorporating out-of-class assignments in better preparation for in-class activities.

Assessment in the flipped classroom may take place online, in the classroom and/or in an authentic setting. Fisher and Assa-Eley (2013) as cited in Meeting Abstracts (2013) found that student examination performance on questions presented explicitly during in-class exercises was better than for questions that were not directly presented in class.

Flipping in Practice

The tenets of flipping the classroom are not new, and instructors already use a variety of methods to address learner needs. With flipping, the *strategy* used to reach learners is important. The instructor carefully selects and utilizes flexible features of learning environments to design instruction that meets diverse learner needs. He or she distinguishes lower-level and higher-level cognitive skills and makes decisions about what to deliver, and how to deliver it in a way that maximizes class time and leads to deep, meaningful learning.

Bloom's Taxonomy of the Cognitive Domain (Anderson, Krathwohl, & Bloom, 2001) is a useful framework for determining which thinking skills to teach online and which to teach in-person in a flipped environment. One might reasonably expect students to be able to learn, recall, and comprehend the subject matter at a basic level online; then, use higher order thinking skills to apply, analyze, evaluate, and create new material in the synchronous classroom. Fagen, Crouch, and Mazur (2002) recommend that more able students become peer tutors or 'learning buddies' for their classmates, helping with basic operations that may still require attention during class time.

Students seem to prefer the flipped format except when online preparation and the level of in-class performance are perceived to be demanding (Fisher & Assa-Eley, 2013 as cited in Meeting Abstracts, 2013; Doyle, Krupicka, & Vo, 2013 as cited in Meeting Abstracts, 2013). Instructors balance needs and perceptions to help students reach their full potential. This learner-centered approach where the instructor is subject matter expert, instructional designer, and facilitator, places the "burden" of active learning squarely on the shoulders of the student. Students in the flipped

classroom are expected to show initiative, be proactive, inquire, collaborate, and contribute new knowledge in observable ways.

Because not all students have been predisposed to learner-centered environments (Anderson et al., 2013 as cited in Meeting Abstracts, 2013) and may feel that “flipped learning is just self-teaching” (Talbert, 2014c, p. 1), instructors should orient students with learner-centered approaches (Kugler et al., 2013 as cited in Meeting Abstracts, 2013), make instruction personally relevant (Flipped Learning Network, 2014), and make teaching transparent by clear explanation of pedagogical purpose and being responsive to learner strengths and weaknesses as they are revealed (Talbert, 2014c). Together, instructor and students in a flipped classroom commit to being active participants who make the most efficient use of time together in class. This synergistic and proactive relationship creates a dynamic and rich learning context that bridges the online and offline experience.

Optimal instructional designs support teaching and learning in a flipped environment. The use of widely available Internet-based resources can help one redesign not only the delivery method but also the sequence of instructional content; the interactions between learner and content, student and instructor, and among students; and the means by which learning and transfer in-class and in online environments are assessed. Each should be considered with careful planning (Driscoll, 2005; Gustafson & Branch, 2002; Morrison, Ross, Kalman, & Kemp, 2011).

Since flipped classrooms are intended for more in-depth and collaborative learner-content interaction, knowledge construction can be an important learning outcome. Both out- and in-classroom environments allow students to demonstrate knowledge construction as evidence of learning (Reiser, 2001). For this purpose, a variety of tools and techniques can be used in instructional design considerations for connecting learning environments, creating and managing learning tasks, and developing frames of references (Driscoll, 2005) before, during, and after live instruction.

Not all instructors have been predisposed to learner-centered environments, and the thought of moving to a flipped instructional design can be daunting. We propose a low-cost, simple model for flipping the classroom, shown in Figure 1 [The model was first presented by the authors at two workshops for faculty members at James Madison University, Virginia, USA, in April 2013]. The pre-class, in-class, and post-

class portions of the figure reflect three general stages informed by the tenets of learning theory rather than specific technologies. Driscoll (2005) describes the nature of effective instructional design as that which is grounded in the psychology of learning.

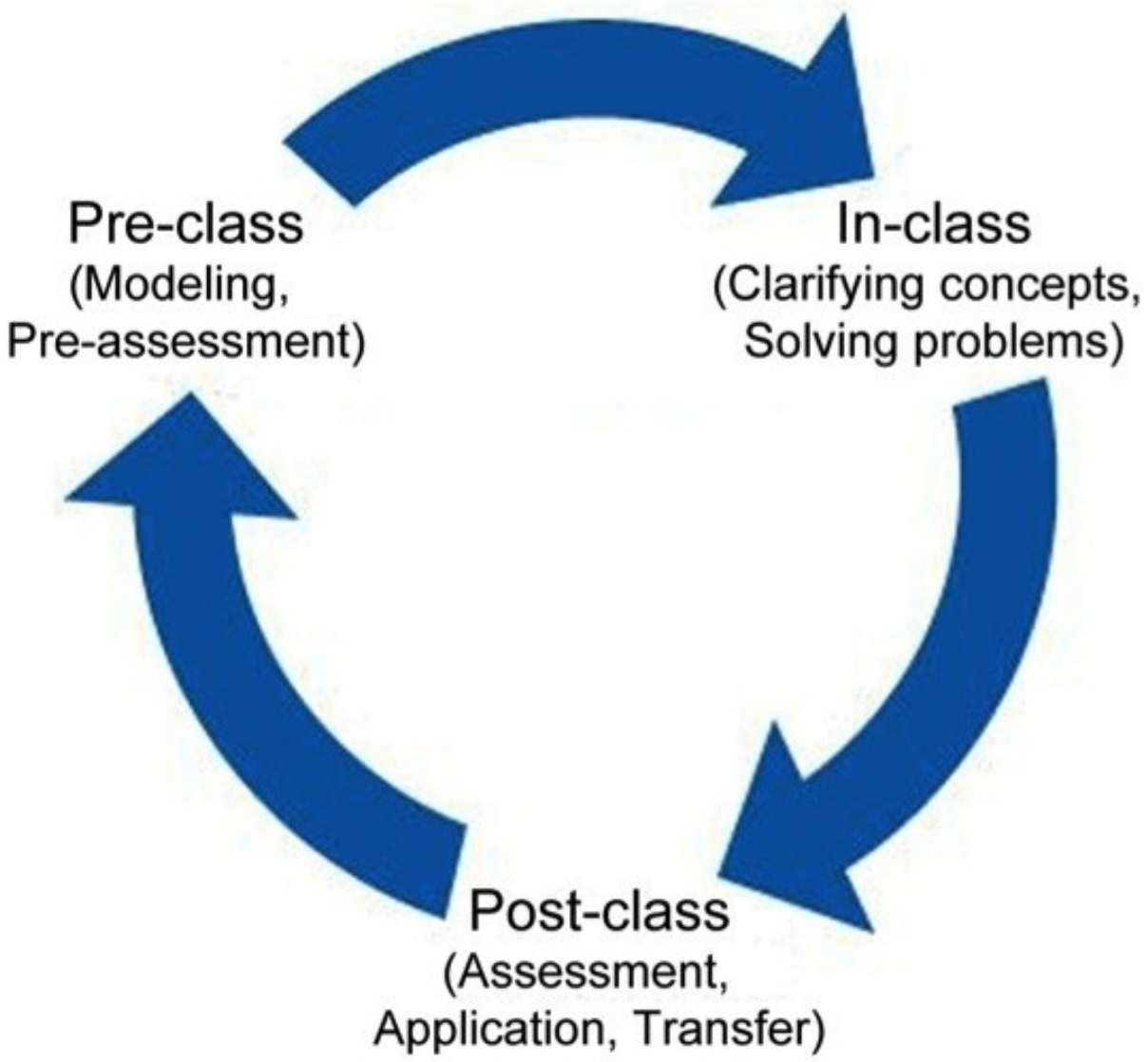

Figure 1. The stages of flipping a class

Pre-Class

Instead of using face-to-face classroom time mainly to inform, communicate and generate awareness, the flipped instructor will generally move this type of activity to an asynchronous environment. For instance, if the information is available online, students may read and refer to it as often as needed in order to recognize and recall it later. Procedural instruction that changes very little with time is also appropriate for the asynchronous environment. This type of instruction leads to near transfer (Clark & Mayer, 2011; Horton, 2012). The information or experience can be documented, simulated, and explained in a way that stays relatively consistent over time. A variety of technologies may be helpful in this move. For example an instructor may link to a *YouTube* video demonstration that shows how to use a particular software program or how to use a particular piece of equipment. Students can follow along with the video and practice on their own.

Creating instructional materials and assessments prior to class time can become complex, depending upon the course, the learners, and goals set forth. Rather than flipping an entire course at once, it may be more feasible to begin with only one aspect shown in Figure 1, like pre-assessment. In this step the instructor assesses student knowledge in advance of class time, to identify areas that require clarification or emphasis during class time (Novak & Patterson, 1998). Instructors may conduct regular pre-assessments of student knowledge, skills, and attitudes toward a particular topic prior to class time in an attempt to make student learning transparent, and also to make the most of scheduled class time together, later. Understanding student needs prior to class time is how the instructor will know what in-class adjustments to make. A technique like Just-in-Time-Teaching (JiTT) offers a low-tech solution for gathering data before class and responding to results in class. Using JiTT, the instructor may have students read relevant material and complete an assessment and/or post-reading reflection.

Universities often use a learning management system (LMS) for storing online materials for instruction, and for engaging students online. In the LMS an instructor can readily address low-level tasks by explaining in detail basic terminology, operations, or calculations. Features of systems like Blackboard, Canvas, Moodle, and Sakai help instructors create, organize, and manage online experiences such as the asynchronous component of flipped instruction. The Khan Academy (https://www.khanacademy.org/) is

an example of a site that provides ready-made instructional media that supplements or enhances an instructor's original work in the LMS.

Instructors may design original, pre-recorded materials in a variety of media formats (Mazur, 2009; Demski, 2013). For example, Olivo (2011) produced video guides to explain different sections of the undergraduate neurobiology textbook for Smith College students. He recorded video of the book's pages along with his audio narration, highlighting areas of interest and focus, and interpreting difficult jargon. Students indicated that they enjoyed and gained value from the specification and explanation that made a difficult textbook more understandable, and appreciated the personal touch of the professor's voice in the recording.

Recorded lectures and media are not uncommon in education and their use is often associated with flipping techniques. The Khan Academy, mentioned earlier, is an example of a well-known online community where learners participate via asynchronous delivery by watching video and other media that animates, annotates, verbalizes, and visualizes the subject matter. E*xplain Everything* and *Docen*i are two examples of tools that allow one to create similar materials where the instructor annotates on-screen with audio narration and models problem solving and similar techniques. An instructor may record embedded narration in a .pdf document that guides students through materials using a tool like *Adobe Acrobat Pro* (Ice, Curtis, Phillips, & Wells, 2007) or use an online application such as *VoiceThread* with play-by-play narration.

In the asynchronous environment instructors should assess student learning and comprehension and use resulting data to effectively design the next in-class session. There are a wide range of free, electronic applications that offer survey and questionnaire features for this purpose. *Google Form*, for example, offers multiple question types. An extension of this application, *Flubaroo*, assists with online grading and scoring. The instructor may download results to Microsoft Excel for further analysis. Assessment solutions like *Zoho Survey* offer a mobile solution for creating surveys on the go and viewing real-time results. *KwikSurvey* is one example of an assessment application that allows for unlimited questions and responses; it also supports the integration of text, images, and videos directly into the survey. The survey itself and the results can be embedded on a blog or website for students, and results may be downloaded. Assessment strategies may or may not require the use of technologies

although online technologies, and applications that make information accessible and meaningful in the asynchronous learning environment, are often a part of the online instructional delivery mode of flipped instruction.

If materials are online, students will need Internet access and the appropriate tools and technologies for access. Many resources are freely available through sites like Open Educational Resources (OER) (https://www.oercommons.org/) and the Creative Commons. Students must have a basic familiarity with how to launch and navigate the learning materials without assistance (Dahlstrom, Walker, & Dziuban, 2013) that may require instructor guidance. Students who are unsure about how to be a successful self-directed learner, and who feel a need for immediate questioning and feedback, may find the asynchronous online component challenging and may need training on learner-centered strategies.

In-Class

When the goal is for students to perform in a way that models particular principles (ex. effective interpersonal communications), the learning experience will inherently be ill-structured. The outcomes will vary based on the scenario. Using many examples and helping students develop strategic skills through trial-and-error is important. Far transfer occurs when students are able to effectively apply these strategic skills in a variety of circumstances (Clark & Mayer, 2011; Horton, 2012). Learning in this way requires an approach that is highly constructivist and typically team-based or social. This is the nature of the in-class instructional design for flipped learning.

In the flipped classroom, the instructor will use questions and prompts to increase student-teacher contact through in-class discussion, observation, and potentially the use of technologies such as learner response systems. For example, an instructor may review pre-assessment data to identify areas of weaknesses in student comprehension; then generate a set of prompts and questions to explore those areas further during class. If the class is large or distributed it may be helpful to use an Internet-based application like *Socrative* to collect and display feedback intermittently. In this way the instructor may make data-driven decisions about the instructional design that day.

Student-student engagement in the flipped classroom is also important, and it is common to use peer feedback and peer instruction for discovery

and practice (Crouch, Watkins, Fagen, & Mazur, 2007; Powell, 2003). When Eric Mazur, a Harvard physics professor and well-known figure in flipped literature, found that his students' conceptual and real-world understandings were weak following traditional podium lectures (Crouch & Mazur, 2001; Lambert, 2012), he increased student-student interactions using peer instruction. The method is described on the Mazur Group website as a strategy in which the instructor poses conceptual questions during lecture, to which students reflect, respond, discuss, and attempt to reach consensus on the answers in groups of three to four. This strategy, which promotes deep thinking, has led to significant gains (http://mazur.harvard.edu/research/detailspage.php?rowid=8).

Increasing instructor-student and student-student contact is regarded as a best practice in higher education (Chickering & Gamson, 1987). The features of technology can be used as a lever to make it happen effectively (Chickering & Ehrmann, 1996).

Post-Class

Before and after the asynchronous and synchronous components of flipping have occurred, instructors in the flipped classroom have an opportunity to increase and sustain student motivation for engagement outside of class time, and to assess learner progress. For example, the instructor may incorporate extrinsic motivators that encourage advance preparation, such as associating out-of-classroom learning tasks with grades and setting clear expectations for in-class engagement. He or she should use this time to design clear and consistent explanations of the flipped process, instructional goals, and intended outcomes to accompany asynchronous pre-class materials (Talbert, 2014c). Finally, adoption of techniques that shift the role of instructor to that of a learning coach will support the development of student self-regulation skills necessary for success in the flipped environment (Talbert, 2014c).

Ideally in any course, students will begin to transfer knowledge and skills from one learning context to the other, and apply what is learned to authentic situations. A variety of methods and tools are available to assess student learning after instruction. Rubrics are widely used to both articulate expectations and to measure student progress. Developing effective rubrics takes time, and it may be more efficient to identify and adapt existing rubrics available at sites such as *iRubric* (see https://www.rcampus.com/indexrubric.cfm) where users create, collaboratively assess, modify, and

share rubrics using a free online account. Alternatively, students may present and demonstrate outcomes (Mabrey & Liu, 2013) in person or online using a tool like *YouTube*. With proper instruction and clear expectations from the instructor, students can record individual or group presentations using a web camera, photos, or synchronous meetings. Other free tools like *Screen-O-Matic* and *Jing* may be used to record on-screen activities with narration. These can be uploaded and hosted by the vendor or YouTube. Project portfolios provide an excellent way to document progress over time in the flipped classroom, and to archive and display completed works. Electronic portfolio features are available in many learning management systems, and through online applications including but not limited to *Wix* and *Weebly*.

Challenges and Solutions

While the use of flipped learning in higher education is growing rapidly, and nine of ten teachers who responded to the Sophia & Flipped Learning Network survey Sophia & Flipped Learning Network, 2014) reported improvements in student engagement, there are challenges to its implementation. For instance, to acquire foundational knowledge in the asynchronous environment, students must recognize and demonstrate self-directed learning skills to be successful. In the flipped classroom teachers must be able to respond to spontaneous questions from students after pre-class activities (Berrett, 2012; Zhang, Wang, & Zhang, 2012). In addition, there may be technology or media creation and access issues (Talbert, 2014d). These matters raise legitimate concerns that the instructor needs to address as a learning coach, facilitator of active learning, and one who is transparent about the process and expectations for flipped learning.

Public labs and computing resources are generally made available to students in postsecondary education. However, these do not always allow for playing audio, or for the download of applets that run particular applications. Space may be limited or unavailable. If online access to flipped instruction is an issue, the instructor may reserve a functional computing space for students to use outside of class time; or alternatively provide asynchronous materials on paper or digital file handed to students on a storage device like a USB drive, CD, or DVD media.

Access also relates to prohibitive factors like cost and bandwidth. Free online applications and learning management systems are widely available and should be a first stop for instructors who expect students to create

artifacts, recordings, demonstrations, and portfolios of their work. Also, it is important to consider the use of rich media versus lower-tech solutions that demand less bandwidth. The instructor should ask key questions at the design stage of a flipped class in order to determine the best way to accommodate student technology access (Talbert, 2014d).

The practice of flipping involves activities pre-class, in-class, and post-class. Technologies may be used to enhance the instructional design and delivery of flipped instruction but it is not without challenges. Fortunately, low-cost, low-tech, and alternative strategies and solutions are available.

Conclusions

The aim for effective instructional design is to establish conditions for learning with particular attention to activities that generate awareness, near transfer, and far transfer of course content (Clark & Mayer, 2011; Gagné, 1985; Horton, 2012). This paper has examined the concept of the flipped classroom from this perspective. The authors have provided a review of the literature and related research, and have presented practical strategies for effective implementation. The literature review reinforces the sense that the flipping technique is useful when seeking to optimize class time, support the development of higher-order thinking skills, and enhance teacher-student and student peer-to-peer interactions. The success of a flipped approach hinges on the synergy between instructor and students and requires sustained motivation and contribution before, during, and after live instruction. When used appropriately, flipping the classroom is a valuable addition to higher education practice as evidenced in the research.

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