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"Now, What Happens During Class?" Using Team-Based Learning to Optimize the Role of Expertise Within the Flipped Classroom

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If instructors desire students to gain a deeper understanding of the content and begin thinking like experts, then they need class time for active, collaborative learning. In the flipped classroom, primary knowledge acquisition occurs before class, which creates space for students to practice applying the information of the discipline with their peers. Team-based learning is an effective in-class, instructional-strategy that (1) assesses and enhances student content acquisition from pre-class study, and (2) uses the majority of class time for activities that enable them to discuss, take-risks, and make mistakes while developing their expertise.

Introduction

The traditional college classroom is designed around the instructional paradigm centered on efficiently covering content, where students typically "learn about" the discipline by passively listening to lectures given by experts in the field (Bass, 2012). Afterwards, students are expected to replicate the thinking and behaviors of the expert by completing homework outside of class. Many students encounter the "illusion of understanding" when what is required for completing homework seems straightforward while watching an expert do the task, but then face difficulties when they try to put what they observed into practice on their own (Druckman & Bjork, 1994). This is just one example of how the instructional paradigm is "contrary to almost every principle of optimal settings for student learning" (Barr & Tagg, 1995, p. 13; Pierce & Fox, 2012; Talbert, 2012).

Despite mounting evidence from the learning sciences regarding high-impact practices that produce meaningful learning gains, the vast majority of college courses continue to be taught with the *instructional paradigm*. High-impact practices include students taking responsibility for their own learning, investing time and energy in practice, collaborating with classmates around challenging learning activities, receiving and responding to frequent and timely feedback from instructors, and seeking to connect their learning to real-life applications (Kuh, Kinzie, Shuh, & Whitt, 2010). Taken together, this approach represents a *learning paradigm* (see Table 1).

Many instructors experience a tipping point toward the learning paradigm when they delve into data on learning gains from concept tests or retention rates (for example, the percentage of students who finish the class with a passing grade). This was the experience of Erik Mazur, a Harvard physicist who taught for many years within the instructional paradigm before being confronted with learning data. When Mazur examined this learning data, he came to the realization that "simply transmitting information should not be the focus of teaching; helping students to assimilate that information should" (Berrett, 2012).

A critical mass of dedicated instructors is needed throughout higher education to generate a paradigm shift to the learning paradigm. A potential catalyst for increasing the rate of adoption of the learning paradigm may be the "flipped classroom" model. This framework flips where and when students acquire basic content ("lecture") and practice applying concepts ("homework"). Flipping the classroom addresses one challenge facing many instructors interested in creating dynamic learning environments: how to free up time during class. The "lecture" happens before class and is commonly in the form of brief online content like screencasts, simulations, or video podcasts (vodcasts).

Technology-enhanced learning elements tend to pique instructors' interest when they first hear about the flipped classroom. When instructors begin to redesign their course around this framework, they eventually come to the realization that the impact of this model goes far beyond offloading lectures to before class. If

Table 1
Comparison of the Instructional Paradigm and the Learning Paradigm

	Instructional Paradigm	*Learning Paradigm*
Role of Instructor	**Sage on the Stage –** teaching by telling in order to efficiently cover the vast amount of content in the field	**Cognitive Coach –** designing appropriate learning experiences that place students in situations where they practice thinking like experts while honing their knowledge and skills
Role of Students	**Passive Participants –** listening to experts explain content, demonstrate problem solving, and/or showcase expert thinking during class and replicating these outside of class by doing homework – *expert products*	**Cognitive Apprenticeship –** actively engaging in practice in the presence of an expert (cognitive coach); working individually and collaboratively on activities requiring higher-order thinking – *expert practice*
Premise of Instruction	**Learning about** - memorizing facts and formulas to "pack brain" with knowledge for future use	**Learning to be –** constructing knowledge by tackling challenging problems where one practices how to think like an expert
Purpose of Instruction	Identify the best suited students for the field – "sink or swim"	Develop students' knowledge and skills to move them along the journey from novice to expert

students watch online lectures to acquire the basic content, then the question becomes "Now, what happens during class?" What happens inside the classroom is the crux of the learning paradigm and the flipped classroom. Leaving the lecture behind as the primary instructional approach during class means designing learning experiences that challenge students to apply the concepts acquired before class.

Anyone familiar with team-based learning (TBL) will recognize that for over 30 years, TBL users have reaped the benefits of the flipped-classroom philosophy. TBL excels at producing a learning-centered classroom where students elevate their level of thinking while working within teams to solve concept-oriented problems (for example, see Michaelsen, Knight, and Fink, 2004; Michaelsen, Davidson, and Major, 2014). In this article, we will review the flipped classroom framework, explore the changing roles of instructor and students within the flipped classroom, and explicate how TBL maximizes affordances of a flipped framework to foster expertise.

Framework of the Flipped Classroom

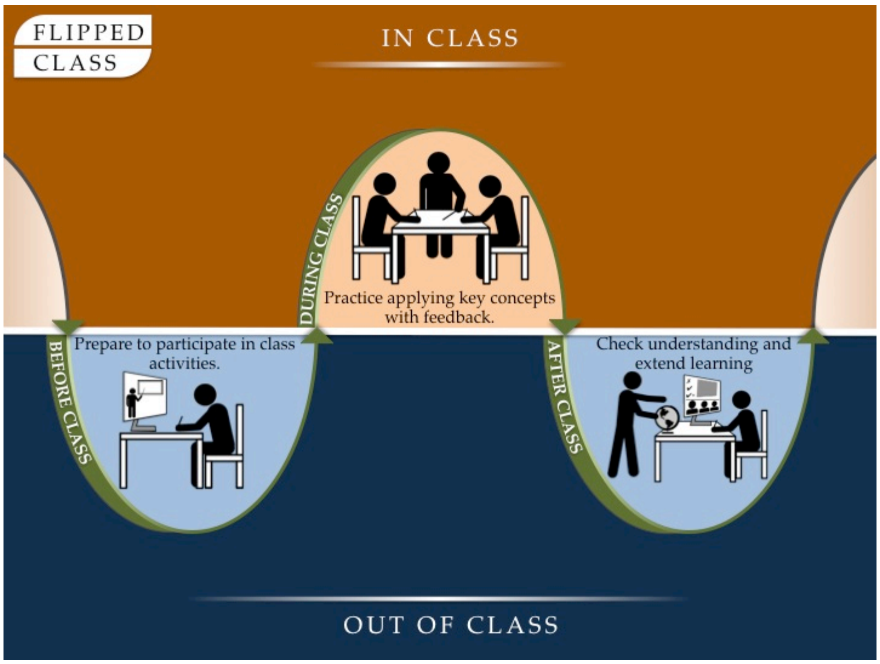
The traditional instructional paradigm, where lecture happens during class and homework occurs outside of the classroom, is inverted in the flipped classroom model (see Figure 1). Requiring students to acquire foundational knowledge before class creates space during class for learning opportunities where students apply that knowledge. Bergmann and Sams (2012) pioneered this approach in 2007-2008 when they pre-recorded all of their lectures for students to watch as homework and then used class time to work problems and address areas where students were struggling. Inexpensive technology for producing and posting online content (for example, screencasting software, YouTube) and high-speed Internet via laptops and mobile devices have served as a catalyst for the proliferation of this model within K-12 classrooms. A wide variety of instructional techniques can be applied in creating a flipped classroom; thus, "there is no such thing as THE flipped classroom" (Sams, 2011).

Underlying the variety of ways to flip a class is the fundamental issue of trading what has traditionally taken place in the classroom for what has typically been done as homework. The fulcrum for this pivot is the distinction between *content acquisition* and *content application*. Content acquisition is the goal of instructional practices like giving lectures or doing demonstrations that are designed to deliver course material to students. Content application involves instructional practices, where the goal is for students to make decisions about an existing product (evaluate) or to generate a novel product (create). These practices are designed to let students practice thinking like an expert.

Bloom's Taxonomy

These two broadly categorized learning goals involve different levels of thinking. A familiar way to delineate the various cognitive processes involved in this range of learning activities is by using Bloom's

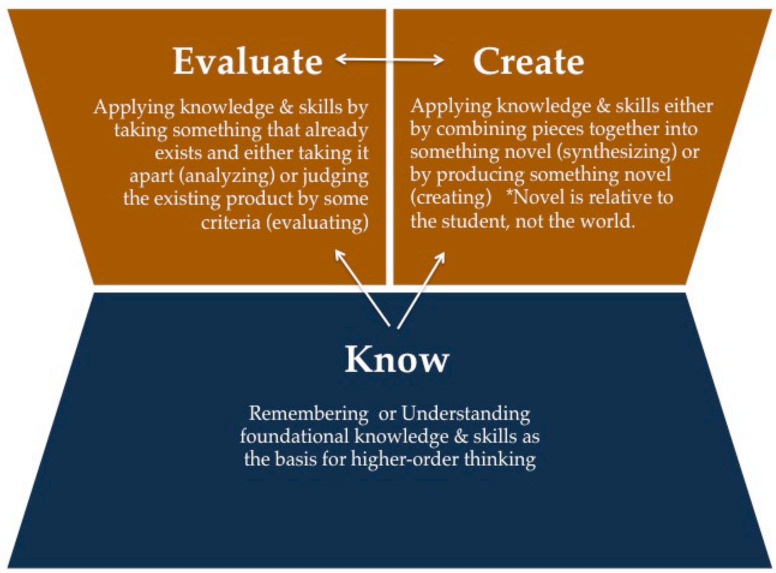
Figure 1
Flipped Classroom Flow Model



taxonomy for the cognitive domain (Anderson et al., 2001; Bloom, Englehard, Furst, Hill, & Krathwohl, 1956). Thinking progresses from low-order to higher-order along a continuum with six distinct levels: remember, comprehend, apply, analyze, evaluate, and create. For instructional design purposes, the taxonomy can be simplified into its essential components based on what the task is requiring students to accomplish, either by working with an existing product or producing something novel (see Figure 2).

In Figure 2, Bloom's Taxonomy is simplified to clarify the types of thinking and products generated within the flipped model. Know is the focus of before class activities. Evaluate and Create become the basis of what happens during and after class. When this simplified taxonomy is mapped onto the traditional sequence of classwork and homework in a lecture-based class, those activities aimed at content acquisition occur mainly in-class, relegating content application activities mostly outside of class. In a flipped class, the initial content acquisition is designed to occur

Figure 2
Bloom's Taxonomy Simplified



before class, thus freeing up class time to focus on those higher levels of cognitive processing involved in content application (Honeycutt, 2013).

This compartmentalization of Bloom's taxonomy into lower- and higher-order, and then allocating each to either inside or outside of class, is clearly an oversimplification. Plenty of lectures, when engaged skillfully, can incorporate higher levels of thinking in how students stay involved. Conversely, simply telling students to work on something in class is no guarantee that they will be successfully applying course concepts. These in- and out-of-class "zones" of learning are best suited for particular types of activities that are aimed at particular levels of thinking.

If the learning activity involves receiving information by listening and watching and reading, which is inherently individualistic, then students can accomplish this task on their own time and in a setting where they have the ability to move at their own pace (that is, slow down or speed up as needed). On the other hand, if the learning activity can be enhanced by guided practice with the opportunity for collaboration with peers and immediate feedback from experts, then using class time for active learning makes the most sense.

If the majority of didactic teaching is exported to free up face-to-face time, now it is possible to capitalize on developing deeper understanding and practicing higher-level thinking in the presence of an expert. To completely redesign a course around the flipped classroom model requires considerable thought and planning. While a plethora of approaches have been labeled the flipped classroom, the most effective approaches possess some common elements and approaches to learning. What happens before class—content acquisition—is linked to what happens during class—content application, collaboration, and immediate feedback—which is, in turn, connected to what happens after class, practice and reflection.

Changing Roles of Instructor and Students Within the Flipped Classroom

With the affordability and capability of an array of technology, today's college students have access to an exponentially increasing amount of information. This information that was once confined to the minds of experts or books within libraries can be readily accessed by anyone with a laptop, tablet, or smartphone at any time, and practically anywhere in the world. Wireless access, high connectivity speeds, and a wealth of online information were inconceivable when many current faculty were undergraduate students. For them, the experts within the field were still the lynchpin for essential knowledge.

If the knowledge that has made today's university instructors the "experts" in their fields is so readily available, what role should the expert be playing within the classroom? Nobel Laureate Carl Weiman proposes that the new role for instructors is one of cognitive coach: "A good coach figures out what makes a great athlete and what practice helps you achieve that. They motivate the learner to put out intense effort, and they provide expert feedback that's very timely" (Berrett, 2012).

The change in the structure of a flipped classroom impacts the traditional role of students, many of whom have grown accustomed to sitting in class listening to an expert cover the content while attempting to transcribe what is being said verbatim. After class, students are expected to replicate the kinds of thinking and problem solving demonstrated during class, often without timely feedback or guidance. This passive approach perpetuates surface-level learning that leads students to cramming as much information into their brains in hope of doing a successful "data dump" on the exam. The flipped classroom transforms students from passive participants to cognitive apprentices who are expected to take ownership of their learning, become active members of the community of learners within the course, and practice thinking like an expert.

As the active agent in designing the new learning environment, the instructor needs to think about how to assist students in adapting to their new role and expectations. A driving question for instructors developing learning activities for flipped classrooms is this: "What does it mean to think like an expert within my field?" Thinking like an expert emphasizes expertise as a process, a capacity for learning, not simply experience and knowledge (Bereiter & Scardamalia, 1993; Cushman 2010; Luntley, 2009). Expertise has to be embedded in building new concepts and creating new knowledge, not just absorbing what has gone before (Bereiter & Scardamalia, 1993). What differentiates experts from experienced non-experts is not how much they know but the way they use that knowledge.

With expertise seen as a process, the apprenticeship now becomes more than modeling and copying techniques. Students explore, ask authentic questions, problem solve, and construct their own knowledge to become "prescription makers, not prescription takers" through experiences and activities (Luntley, 2009, p. 367). The instructors intentionally create space during class for students to learn the process of how experts think through problems within their field (Tal, 1994). The focal point becomes a classroom "as a knowledge building community similar to the knowledge building communities that make up the learned disciplines" (Bereiter & Scardamalia, 1993, p. 201).

When instructors adopt the role of cognitive coach, their approach to teaching becomes less content-driven and more focused on designing and facilitating activities that engage students in the process of thinking like an expert. These activities are rich problem-solving contexts where their cognitive apprentices are prompted to articulate internal thought processes so they become visible (Collins, 2006; Collins, Brown, & Holum, 1991; Collins, Brown, & Newman, 1989; Collins, Hawkins, & Carver, 1991). Making these thought processes visible is not always easy and requires the cognitive coach to consider what it takes to develop expertise rather than how he or she can simply cover the content most efficiently and effectively (Svinicki, 2004). Collins (2006) has determined four dimensions for developing expertise within the cognitive apprenticeship framework:

- *content and procedural knowledge*, including strategies for how to learn new concepts and procedures.
- *methods*, including exploring, modeling, coaching, articulating, justifying their thinking, scaffolding where

experiences gradually become more complex with less support provided, and reflecting upon their learning.

- *a sequence of learning activities*, so that over time they increase in complexity, provide variety that emphasizes broad application, and initiate problem solving by conceptualizing the whole task before executing the parts.
- *the learning environment*, which provides realistic tasks, encourages collaboration within community of learners to accomplish goals, and promotes becoming responsible for their own learning.

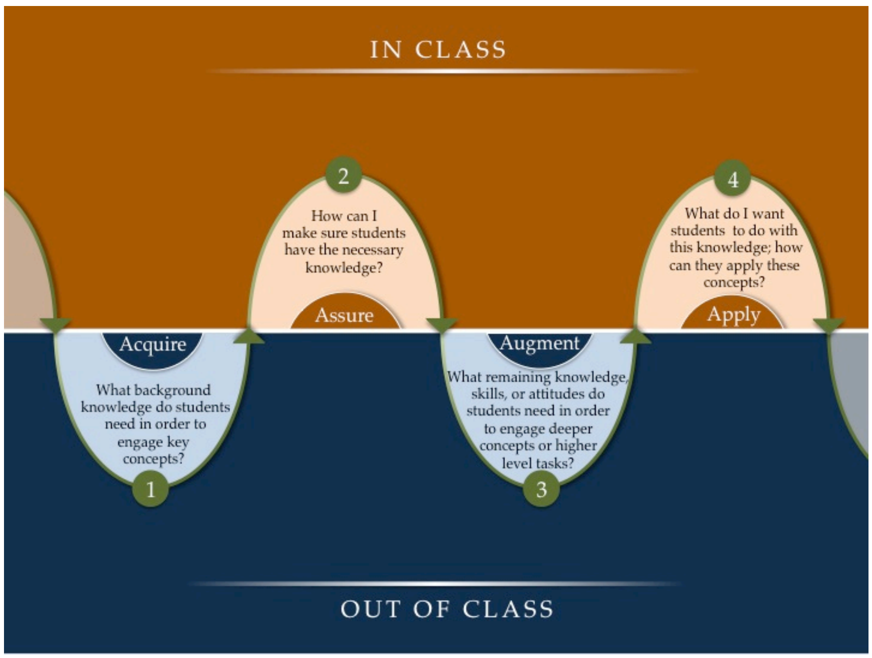
There are a variety of instructional approaches that can be deployed that will provide students with the opportunity to practice thinking like an expert, including team-based learning, process-oriented guided-inquiry (Hanson, 2006), peer instruction (Crouch & Mazur, 2001; Schell, 2012), case-based learning (Herreid, 2011; Herreid & Schiller, 2013), and problem-based learning (Allen, Donham, & Bernhardt, 2011). Of all of these options, TBL provides the most compelling framework for cognitive apprenticeships (Sweet & Michaelsen, 2012). The TBL learning environment places students into the context of authentic tasks, where they are challenged to consider various perspectives as they work together to accomplish a goal. In the next section, we will provide insights into how TBL and the flipped classroom model can work together to create a dynamic learning environment where cognitive apprentices develop expertise guided by their cognitive coach.

Team-Based Learning and the Flipped Classroom

Team-based learning, as a flipped class pedagogical approach, maintains the basic framework where content acquisition occurs outside of class so that content application can occur in class. TBL naturally maps onto the flipped framework, as instructors assign out-of-class work to help students acquire and augment the knowledge and skills they need to prepare for the application activities that take place in class. Fundamental questions guide the instructional decisions that maximize learning both inside and outside of class (see Figure 3).

Team-based learning naturally maps onto the flipped class framework as instructors assign out-of-class work to help students acquire (1) and augment (3) the knowledge and skills. This allows instructors to use class time for the Readiness Assurance Process (2) and application activities (4). Within the TBL framework, instructors serve as cognitive coaches and

Figure 3
Team-Based Learning as a Flipped Class Pedagogical Approach



use their expertise to figure out what content their cognitive apprentices should be familiar with prior to class (Sweet & Michaelsen, 2012). They strive to design 4-S applications (that is, **s**ignificant problem, **s**ame problem for all students, **s**pecific choice, and **s**imultaneous reporting) that champion higher-order thinking, draw upon the collective intelligence of the team, and leverage effective collaboration to produce a cogent choice (Michaelsen & Sweet, 2008). During class, instructors facilitate the active learning environment by managing the Readiness-Assurance Process and the application activities.

TBL and the flipped classroom are not synonymous. Digitally capturing and sharing lectures online is commonly associated with flipping a class, whereas TBL does not offer specific guidance on how pre-class content is delivered. Both require students to acquire content in advance of class, but the frequency of how often this occurs typically differs. The cycle of flipped classroom often has students acquiring content before each class, whereas TBL starts a unit with students acquiring the foundational content. Both promote active learning in the classroom, but TBL goes further by prescribing a specific structure for what happens during class. More important, TBL and the flipped classroom share a commitment to strategically designed learning opportunities to optimize the role of instructor in guiding students toward deeper learning. This section discusses how TBL maps onto the modified flipped classroom framework in Figure 3 and elucidates how its scope and sequence is well suited for developing expertise due to how it designs units.

Assurance: Solidifying the Foundation

Like students in all well-implemented flipped classes, TBL students are first expected to invest their time acquiring the requisite content on their own prior to class. Whereas a flipped classroom might place accountability inside of class by having students complete a quiz at the start of class followed by active learning, TBL devotes an entire class period to the much more robust experience of the Readiness-Assurance Process (RAP). This process ensures each individual student is held accountable for coming to class prepared. The team Readiness-Assurance Test (tRAT) encourages peer learning, which brings students up to speed while building relationships within the team. Peer learning within the tRAT is part of the knowledge-building process and provides immediate feedback to students regarding their understanding of foundational material. By the end of the RAP, students will receive clarifying instruction around any questions that remain about the pre-class work, as needed. After class, students may need to augment their burgeoning understanding to prepare for the application activities they will encounter in the next class.

For many instructors who are flipping their class, the emergence of academic social media tools (for example, Hoot.me, Piazza.com) has enabled students to clarify areas of confusion or curiosity with the instructor and classmates prior to class. This use of technology is an additional way for instructors to increase their awareness of student mastery of out-of-class material. The value and potential impact of incorporating this layer of student-generated questions and answers within the basic TBL framework is being explored in different ways by many who are flipping their classes.

Application: Framing Up Key Concepts and Finishing With Complex Activities

The lesson following the RAP is when students immerse themselves in solving challenging problems that require them to think critically and work collaboratively with their teams on 4-S application activities (see Michaelson et al., in this issue). These activities should capture their interest, promote higher-order thinking (evaluate and create), deepen their understanding, and approximate real-world problems and decision-making. By the end of class, teams simultaneously report their decisions, which produces fruitful discussions about the rationale for their choices and prevents "answer drift," which can occur when teams report out sequentially (Sweet, Michaelsen, & Wright, 2008).

Once the content has been acquired, accounted for, and clarified through the RAP and then applied through a 4-S application activity, a more pertinent question for TBL arises: What happens next? The answer typically assumed by instructors is "more application activities." This TBL- flipped framework presents an opportunity to deepen understanding and to practice thinking like an expert within the field by extending learning in subsequent classes. Fink (2004), for example, suggests ways of leveraging the inherent complexity of problem-based learning in later stages of a TBL sequence. Also, McInerney and Fink (2003) developed culminating projects for a senior-level course in microbiology. Teams were given two such projects, one based on the material from the first half of the semester and the other based on the material from the second- half. These projects were designed around data that was not yet published, and the task required students to approach the problem like an expert. The results were compelling, because a vast majority of teams generated plausible solutions.

Another option designs a scaffolded series of advanced application activities. This technique works well for lower-division courses, where students lack experience, content knowledge, and skill sets. Scaffolding activities are more highly structured and explicitly guide students along the lines of thinking required to tackle a more complex problem or decision-making scenario. As the semester progresses, the support structures are gradually diminished and eventually removed. Students gain greater control over the parameters of their learning experience as they master the requisite skills and abilities associated with thinking like an expert within the field.

This scaffolding approach fits into the TBL 4-S framework for application problems by having all teams share the same significant problem. A range of options found within the TBL literature allows students simultaneously to share their specific choice or decision. When scaffolding is done well, it results in deep understanding of the concepts beyond rote memorization, a sense of responsibility for one's own learning, and progress toward thinking like an expert within the field.

The following series of scaffolded activities models how an instructor might make use of these principles in a sociology course for the purpose of training students to think like a sociologist. The basis of this authentic problem came from a local news story about a plan to widen an existing thoroughfare to include a toll lane on MOPAC, a road in Austin, Texas. The MOPAC problem is used throughout the scaffolded problems to focus attention on how this technique enables students to tackle problems with increasing complexity, ask their own questions, and craft compelling arguments addressing multiple perspectives.

Activity 1

To help students begin asking effective sociological questions and learn how to use appropriate information, the instructor could start with relatively simple application activity, where teams needed to make a specific choice from four options:

> The most useful aspect of the MOPAC Boulevard Express Lane Project is that it will:
>
> A. Help UT students get to class quicker
>
> B. Get money from toll roads to help fund other roads around Austin
>
> C. Encourage people to use buses rather than cars
>
> D. Allow people who can afford the tolls to get to work quicker

The teams would be asked simultaneously to reveal their specific choices and justify them. All of these answers are feasible; thus, all perspectives are valid. The original article suggests the most useful aspect of having a toll road built is getting people to work quicker. However, from a sociological perspective, the debate centers on the lynchpins of sociological thinking: economics and inequality. The discussion following the students' specific choices serves as an opportunity for the instructor to build awareness of a sociological perspective when reading these types of articles. Most importantly, students should expand their initial thinking and become aware of the need for further information to fully answer the question. Realizing the "muddiness" of real-world problems and the kinds of information needed to address them is an important step in sociological problem solving.

Activity 2

When students are initially asked to do research, they are often overwhelmed with the amount of information available. Working together as a team with specific activities ensures that the concepts being taught do not get lost in students' pursuit of information. The next stage in scaffolding would direct students to appropriate resources in order to collect the evidence needed to analyze the social context of the situation:

> The City of Austin had a $200 million dollar budget for road improvements. It was voted that all of the money should be spent on an express lane for MOPAC. Your team has to decide whether this was the best decision for the city, rather than repairing or improving other roads and highways, particularly I-35, around Austin. Collect the following data to support your decision:
>
> 1. On a map of Austin, locate Downtown, MOPAC, and the proposed toll road.
> 2. Look at the GIS map of Austin population from the census bureau.
> 3. Shade in the areas where lower socio-economic populations cluster.
> 4. Shade in the areas where professional populations cluster.
> 5. Mark on the map the major businesses that employ over 100 people, excluding retail stores that would be served by having this toll road in Austin.
> 6. Determine what person or group of people made the decision to improve MOPAC.
> 7. Find out the area where people who are most likely to use the toll road live.

The seven pieces of information introduce students to geographic and socioeconomic ideas about money, power, and influence, as well as who is most likely to possess that power and the resulting consequences. This guided search is important because students are still developing skills and forming the concepts through the information they are collecting. The teams would work through the evidence and determine whether or not they agree with the city's decision. Once each team reached a consensus, they would compose a single paragraph justifying their decision. The teams would submit their paragraph to the instructor, who would post all of the teams' decisions simultaneously through the learning management system. Each team would then peer review other teams' explanations, laying the foundation for the third activity.

Activity 3

In this activity, students would take on more responsibility about what information is needed to make a decision. The new challenge ensures that students would begin to consider issues from multiple points of view. As practicing cognitive apprentices, they would have to figure out which additional pieces of information are important in order to articulate an argument from different perspectives.

As a team, students would develop two competing arguments: one that would justify building the MOPAC toll road and the other that would challenge the merits of such a decision. Students would build upon the existing information and would determine what new information would be needed to gain a broader perspective regarding this issue. As a starting point, teams would answer the following questions:

- What new information do you need to find?
- How will this new information help you with your argument?
- Where are you going to find this information?

Each team would generate a poster for a gallery walk. During the walk, teams would be required to add a post-it-note with a star next to high-quality sources and a post-it-note with a question mark next to areas requiring clarification. Sharing of resources adds to the collective intelligence of the entire class and promotes evaluating the quality of the resources teams are using to answer the question.

Teams would be responsible for finding relevant sources of information from multiple perspectives to make the strongest argument for each possible decision. Then the members would outline each of the arguments using an instructor-generated template. The outlines would be used to develop clear and compelling arguments for each position. This activity requires students to think about the information they will need, rather than the instructor merely giving them information. However, the writing part remains highly structured.

Activity 4

At this point in students' development of thinking like a sociologist, they could be challenged with finding, evaluating, and synthesizing their own resources that provide appropriate information. Their next task would be to collect resources useful for designing a proposed study on the potential effects of the MOPAC toll road. They would not actually be required to conduct the study, but the design would need to be feasible and showcase how they might approach collecting and analyzing pertinent data to determine whether or not the MOPAC toll road should be built.

Teams would collect a full list of resources needed for designing a study on the effects of the MOPAC toll road, including the economics of Austin (particularly businesses), the effects of demographics about where people live, and the physical effects on the people in the neighborhood as well as on the people who dwell east of the I-35 corridor near downtown Austin. The teams would be required to develop a wiki page for their proposal, including each team member's contribution.

Each team would evaluate three other proposals based on specific criteria. Afterwards, the four teams would engage in a discussion to address questions and clarifications. Each team would work to address issues that might arise within the discussion and would revise their proposal. A practicing sociologist from the city would be invited to the classroom to allow students to ask their own questions and witness how an expert thinks through such a proposed study.

Activity 5

At this point, having advanced through a carefully guided sequence of experiences, students should have the capacity to address a problem like a sociologist with little to no scaffolding. In the final activity, the instructor would provide a related real-world problem and task teams with conducting the actual study, collecting data, analyzing results, and making recommendations.

During the previous activities, the instructor used the 4-S team application activity structure to develop and practice the skills needed to cultivate thinking like a sociologist. The final activity would be conducted as a summative assessment for individual learners. Each student should be able to think through a sociological problem and be able to

- ask reflective questions about the scheme,
- research appropriate sources to collect data,
- critically evaluate the evidence,

- synthesize alternative choices,
- identify salient aspects of the situation,
- analyze the social context of the situation, and
- reflect on his or her argument and be aware of some of the consequences.

The preceding example is one way to use TBL application activities to extend learning and develop expertise. The flipped class framework creates ample space to explore how the TBL strategy can be used to guide students through increasingly complex applications of content.

Concluding Thoughts

An instructor who has learned the basics of the flipped classroom and gets wrapped up in the technology of producing lectures for online consumption without considering the true intent of the model is inevitably left wondering: "Now, what happens during class?" What matters most is creating space during class for active learning, whether implementing the flipped classroom, TBL, or a fusion of the two frameworks as described in this article. The strategies each have the same core mission of replacing the instructional paradigm, where teaching by telling is the central focus of class time, with the learning paradigm, where students actively engage in the process of learning. The learning paradigm emphasizes "learning to be" (practicing applying the content to develop expertise gained by experience) rather than "learning about" (covering content to "pack the brain" with facts and formulas for future use). Instructional approaches based on the learning paradigm assist students in the hard work of constructing knowledge. The flipped classroom and TBL create space for learning, where students adopt the role of cognitive apprentice to practice thinking like an expert within the field by actively applying their knowledge and skills to increasingly challenging problems. During class, the expert's presence is crucial to intervene at the appropriate times, to resolve misconceptions, or to lead the apprentices through the confusion when they get stuck. Outside of class, the cognitive coach spends time and effort designing and developing effective learning experiences for acquiring content knowledge before class, applying that knowledge during class, and extending practice either after class or during the following class.

What matters most is developing students' capacity to think like an expert within the field, where they learn how to conceptualize the solution path as an expert might rather than fixating on superficial features of the problem. Challenging problems exist in every discipline, from the humanities to the sciences and from education to engineering, that require deep learning to solve. The flipped classroom model and TBL offer a compelling and complete framework that can result in learning that lasts when all the essential elements of the models are implemented.

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