**Flipping the Logic Classroom: Arguments for and Challenges Addressed**

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**Abstract:** Despite increasing evidence that the traditional lecture is inefficient for student learning, such methods remain the central paradigm for teaching logic. In this paper, I identify the deficits of the lecture model and outline the many benefits of flipping the logic classroom—namely that students can absorb information at their own pace, freeing classroom time for active learning activities, and allowing the students to come prepared to actively engage in deeper levels of learning. I provide advice for curricular change from the traditional model, and guidance for flipped classroom implementation. I also offer suggestions for the best use of newly available class time, and advice for keeping students accountable for learning the information prior to class. Last, I consider common challenges with the flipped classroom model. I acknowledge possible obstacles to flipping the undergraduate logic course and address these challenges with potential solutions.

Introduction

 For years educational researchers have questioned the efficacy of the traditional lecture as the primary tool for undergraduate education.[[1]](#endnote-1) Despite research that demonstrates the lecture to be less effective for student learning than student-centered pedagogical techniques, it remains the central paradigm for teaching logic, specifically, and philosophy more generally. In the following paper, I make the case for adopting a flipped classroom model in undergraduate logic courses.

Below, I argue that the current teaching and learning literature and research in cognitive science provide good reason for instructors to shift away from the traditional teacher-centered logic lecture in favor of more student-centered learning environments. To begin, I identify the deficits of the lecture model and outline the many benefits of flipping the logic classroom—namely that students can absorb information at their own pace, freeing classroom time for active learning activities, and allowing the students to come prepared to actively engage in deeper levels of learning. Next, I will provide advice for curricular change from the traditional model, and guidance for flipped classroom implementation. I offer suggestions for the best use of newly available class time, and advice for keeping students accountable for learning the information prior to class. Last, I will consider common challenges with the flipped classroom model. I acknowledge possible obstacles to flipping the undergraduate logic course and address these challenges with potential solutions.

Ditching the Logic Lecture

 The logic lecture is a less effective model for student learning compared to alternative models. In short, the logic lecture causes students to disengage and fails to take students’ attention spans into account. The lecture model is also poorly suited to for a skill-centered subject that requires mastery of cumulative content. And, by treating lessons as one-size-fits all, the logic lecture poses difficulties for students with disabilities.

 Research in teaching and learning tells us that the sage on a stage archetype of instructor-to-student knowledge transmission creates a passive audience of students, where student interaction and accountability are unexpected.[[2]](#endnote-2) While the data shows that participation increases learning outcomes, few lecturers actually encourage active participation.[[3]](#endnote-3) A logic lecture without a serious effort to encourage student participation is an environment that breeds inattention.

This is not to say the well-taught lecture is never appropriate for philosophy in general. Many intro, history, and special topics courses flourish when skillfully taught, particularly when there is a focus on student engagement. Integrating technology, such as Poll Everywhere, YouTube videos, and instant quizzes can invigorate a traditional lecture course.[[4]](#endnote-4) That being said, I aim to show that the lecture is a far-from-perfect pedagogical style, and a particularly poor choice for an undergraduate logic course. Instead, the subject matter of logic lends itself particularly well to the flipped classroom model.

Let us begin with a number of concerns regarding the traditional lecture model for the logic course. First, the typical lecture lasts for approximately an hour, but students’ attention and ability to retain information drops off severely after 10-20 minutes.[[5]](#endnote-5) Relatedly, instructors have increasingly grappled with the proliferating problem of smart phones and devices in the classroom. It’s time that we connect these symptoms with the broader phenomenon. When students succumb to attention fall-off, they disengage and find entertainment elsewhere. Millennials in particular show a decreased tolerance for lecture courses, preferring instead greater engagement and social learning of course information.[[6]](#endnote-6) As a greater number of students yield from Generation Z, it becomes maximally important for us to consider the increased need for communication and flexibility, which digital natives have grown to expect.[[7]](#footnote-1)

The inevitability of attention drop-off has particular force for students attending logic lectures. Let us draw a parallel to learning a foreign language: Learning logic requires one to build a sufficient foundation of conceptual building blocks. If, at any point, the student fails to understand a fundamental concept or skill, they will be ill-equipped for the next step in the cumulative course. Once the lecture is over (unless it has been recorded) the relevant guidance is no longer accessible. A student’s failure to adequately grasp earlier concepts will reappear later in their assessment results.

Second, the logic lecture is delivered from one instructor to all students at the same time and the same pace, regardless of individual student needs and preferences. Logic lectures are both content dense and skill focused. This means the lecturer has the challenge of not only explaining what all of the concepts are, but also how they ought to be used. The instructor must not only present the information, but also lead the student in the meta-cognitive process of correctly translating, evaluating arguments for validity and consistency, and constructing proofs, truth tables, and deductions. While history and intro-level courses have greater focus on content and argument analysis, and are therefore better-suited for a lecture style curriculum, logic contains a dual challenge for instructors: They must guide students through all of the skill-development of a math class while teaching all of the content of a foreign language. A fast-paced lecture requires the logic lecturer to address both prongs of the subject, leaving little time for questions or for addressing specific student needs.

While it is true that a good lecturer will attempt to adapt their course content and pace, the structure of the lecture (both in terms of time constraints and the dynamic of one instructor to many students) limits the quality and quantity of communication between the instructor and student. Regarding the time constraint, lectures require all students to keep pace with the material if they are to succeed in absorbing the target information and skills. Again, while the successful lecturer will encourage questions and ask for feedback on the pace of material, there are structural challenges which make a certain speed of pacing unavoidable. Pacing is determined by the allotted class time and the school calendar, rather than the schedule that would best suite learning that particular skill set.[[8]](#endnote-7) Regarding the quality of communication, consider a lecturer’s attempt to “check in” with her students by asking the question—“How are we doing? Is everyone following?” In this scenario, it is generally the most confident students who will vocally reply, often obscuring students who are not grasping the content as quickly. In addition, lectures also rely heavily on the student’s ability to take notes, despite the fact that notetaking is rarely if ever formally taught. The lecture’s effectiveness, then, is limited by the student’s skill to record the information in class for later review.[[9]](#endnote-8)

 Third, precisely because logic lectures are necessarily one-size-fits all, students with disabilities face the challenge of learning as the material is presented in a way that is intentionally developed for students without disabilities. Though of course some students with disabilities may be accommodated within the lecture, I will demonstrate in a later section why a flipped classroom can provide personalized attention, allowing students with disabilities to navigate the material in a way that best meets their individual needs.

Thus, we have noted that the logic lecture is limited by the time of the course period and the sheer amount of content and skill development to be covered. While there may be time for questions, there are simply limitations on how many one can accept, and how slowly one can demonstrate that day’s skill. If the student misses the explanation or is unable to follow, the burden is on them to resolve their confusion (by coming to office hours or finding the relevant portion in the text). If they fail to take on this task, as so many students do, their capability to succeed in logic is correspondingly affected by the failure to master these elementary skills. And, because each class is dense in both content and meta-cognitive skill demonstration, students are likely to miss out on key information and guidance.

I will show that the flipped classroom model can successfully address these traditional concerns.

What is a flipped classroom?

 Flipping the classroom refers to inverting the traditional course structure—it calls for the reversal of content introduction (which usually takes place *during* class time), and homework assigned for practice and application (which is usually assigned for students to complete *outside* of class time).[[10]](#endnote-9) A flipped classroom assigns students to access and absorb the content of the lesson on their own time, prior to class. Students are then expected to arrive prepared to apply, discuss, and analyze the information they accessed before the course, and ready to practice the target skill with their peers, guided by the instructor.[[11]](#endnote-10)

The flipped classroom frees up class time that would otherwise be spent learning surface-level factual material and method, and instead focuses on implementation. In this way, the flipped classroom model is naturally aligned with active learning, as it requires student participation. Education researchers have recognized that we must teach for understanding, rather than mere knowledge retention.[[12]](#endnote-11) To develop deeper understanding, the flipped classroom method avoids “surface learning”—rote memorization of knowledge and facts—and focuses on “deep learning”—where knowledge is developed through an active process of knowledge construction through guided practice.[[13]](#endnote-12)

The Benefits of Flipping the Logic Classroom

 The benefits of the flipped logic classroom are the mirror image of the disadvantages found in the traditional lecture model. As a student-centered paradigm, it requires student engagement, avoids cognitive overload, allows for individualized pacing for information absorption and assignment completion, and is the natural choice for accessibility regarding students with disabilities.

Further, flipping the logic classroom also addresses two logic-specific challenges. First, the method provides the resources for students to master the foundational building blocks when learning cumulative content. And second, the curricular redesign assists the instructor in organizing and allocating the time to provide content-centered and skill-centered instruction.

Before we continue, it might be noted that we have yet to discuss how content is provided for students to absorb at home. Flipping the classroom does typically involve video lectures—but they are markedly short, usually less than ten to fifteen minutes—and they avoid the consequences described with the traditional lecture method, as I will explain. These lectures are usually a result of the instructor filming themselves or providing a voiceover to PowerPoint slides. Without student interruptions, instructors are able to convey the important material briefly and directly.

Educational software platforms like Blackboard, Latte, and Canvas provide the opportunity for instructors to upload these videos directly to their classes. Or, for a more public demonstration, instructors can choose to publish their videos on YouTube for all to see. Students can also be assigned resources beyond their courses’ instructor, such as another instructor’s tutorials. The technology allows instructors to be creative and provide varied content, thereby increasing student engagement.

The greatest benefit of this structure reversal is the availability of class time where previously there was only time for lecture. Flipping the logic classroom maximizes the time for active learning and makes the best use of the face-to-face time between students and instructors.[[14]](#endnote-13) The instructor facilitates in-class activities that allow students to take the next steps with the information they have learned outside of class. For instance, the instructor can provide exercises so that students can attempt truth tables, truth trees, or proofs in an environment where they can ask for assistance from each other and from the instructor when they get stuck. Students can be assigned to teams or paired off to encourage peer learning. During class time, the instructor guides the student in their tasks, using group time as an opportunity to observe, provide assistance where needed, or work with students one-on-one.

Flipping also boosts metacognition—students become more self-aware of their own learning process, when compared to traditional classrooms.[[15]](#endnote-14) We can imagine, for example, an activity where students are put in pairs, with one student verbalizing their thought process as they attempt a natural deduction. Let’s say that during this process, this first student applies a rule incorrectly, or select the wrong rule altogether. Perhaps they inadvertently affirm the consequent. In this case, the peer will (ideally) note the mistake, allowing the speaker to become aware of their misapplication of the rule. By affording more time to learning the method for how one tackles particular kinds of logic problems and proofs, students are primed for success when they re-visit the problems independently. Greater awareness of their own thought process also allows students to monitor their own progress with the desired skill set. With their education in their own hands, students are more likely to be self-motivated to achieve mastery of logic. Meanwhile, the instructor is free to observe the class, focus on students who appear to be struggling, or assess the development of individual student’s learning.

For students with disabilities, the view-at-home content is ideal, allowing for the use of computer features like volume adjustment and screen zoom. We can very well imagine a scenario where, in our haste to complete the lesson during our designated lecture period, our proof becomes sloppy and difficult to read. Or, perhaps we turn towards the board and, in what we take to be an audible voice level, explain how a translation is best done. These common occurrences exacerbate the difficulties that students with disabilities already face. Flipping the logic classroom has the benefit of giving all students control and agency over their own personal learning, enabling them to watch course videos on their own time at their own pace, wherever, whenever, and however they like. Gone are the days where students scramble to take notes before the board is erased and the class period is over. With flipping, students control the speed at which they watch, and are able to rewind and review whenever necessary.[[16]](#endnote-15) Importantly, if students find their attention lagging, they can pause, grab a snack, take a nap, and return to it later when they are ready to be active listeners once more.[[17]](#endnote-16) Attention drop-off is no longer an impediment to sustained learning.

The recordings have the added benefit of addressing the challenge of learning logic that, I have noted in a previous section, is quite similar to an analogous challenge in language-learning—that, if students fail to grasp the foundational skills and concepts, they will fail to succeed when the content is compounded. Recorded lectures provide students with the opportunity to master the building blocks straight from the horses’ mouth. Instead of attempting to make sense of their own notes, which contain only what they were able to record and may have been misunderstood, students now have the ability to revisit the unadulterated material. All too often, students drop important signs (negations, quantifiers), or misread their own variables, Ts and Fs. By minimizing the gap for misinformation, recorded lectures are an untapped resource for the logic classroom. Recorded lectures may also supplement the traditional lecture, if one is unable or unwilling to make the full leap.

Similarly, by restructuring the curriculum, the instructor is able to address the unique challenge of teaching logic—a content-dense and skill-oriented course. To demonstrate how flipping the logic course offsets this challenge for logic instructors, consider Bloom’s taxonomy—a model used to classify educational learning objectives based on their hierarchy of cognitive complexity and depth. Bloom’s taxonomy is a helpful visual to demonstrate how flipping the classroom treats different learning goals relative to the traditional lecture model.



Graphics Credit: McGee, Caryn McKindra[[18]](#endnote-17)

Traditional lectures spend most of the time training students to remember and understand material. To be fair, logic lectures often demonstrate application, where the instructor completes a proof on the board, for example, and argument evaluation. But there are few opportunities in the lecture-model for students to engage at the top levels of Bloom’s taxonomy. Flipping allows instructors to be more strategic and design course activities where students achieve all levels of Bloom’s taxonomy.[[19]](#endnote-18) Instructors off-load the information aspect of the course for students to learn at home, knowing full-well that students will have the easiest time with the lower-level learning (memorizing and understanding) and the ability to master this on their own.[[20]](#endnote-19) The design enables instructors to be present during students’ engagement with the higher levels of Bloom’s taxonomy, and lend a hand if students require assistance with the more difficult tasks of application, analysis, or synthesis.[[21]](#endnote-20) Whereas the lower-level learning objectives are easily done at the students’ own time and pace, instructor guidance on the higher-level tasks allow students to ask questions, receive assistance if they need it, and depend on peers for direction and collaboration.[[22]](#endnote-21)

Flipping also avoids the problem of cognitive overload by taking advantage of the techniques of “priming” and “chunking” information, a learning procedure backed by cognitive science research.[[23]](#endnote-22) A learner is primed to retrieve a particular memory or set of facts by being introduced to a stimulus prior to their need to recall it. Their previous experience with the stimuli then assists their recollection when it is time to recall.[[24]](#endnote-23) In short, by introducing students to content prior to their attendance in class, they come prepared to learn the material more effectively when they engage in in-class activities.[[25]](#endnote-24) Chunking, on the other hand, refers to organizing small units of information into chunks, which allows for individuals to more easily memorize the information and build long-term memory. Chunking results in a person’s ability to remember more information than they would without having used the method.[[26]](#endnote-25) For these reasons, short lecture videos prior to class and active learning activities within class result in a winning combination for recalling and retaining information.

Further, flipping benefits the logic instructor’s ability to monitor learning development and has the added benefit of increasing students’ exposure to feedback. With the traditional lecture model, instructors may not be aware of student progress until after a formal assessment, such as the logic exam or graded problem set.[[27]](#endnote-26) A flipped classroom gives the instructor the opportunity to informally assess student learning in the classroom, increasing the quality and duration of student/teacher interaction without the formality of affecting the student’s grade.[[28]](#endnote-27) Not only does flipping allows for more feedback from the teacher during the process of skill application, but it also encourages peer-to-peer feedback, as students work together to complete tasks. The increase in feedback helps logic students to recognize their own challenges—their initial failure to understand that validity is a technical term distinct from the naïve concept, for example—and how best to address them. When students can monitor their own progress, they are more invested in defining learning goals and working to achieve them.[[29]](#endnote-28)

The Nitty-Gritty: Advice for Implementation

 For any logic instructor looking to implement a flipped classroom, there will be two major areas of logistical focus—producing content for students to view at home and developing active learning activities for use in class.

 Instructors have three primary choices when it comes to lecture content creation: (1) Filming their own condensed lectures with their laptop webcam or smart phone, (2) recording a PowerPoint slide show with voiceover to guide students through the presented material[[30]](#footnote-2), and (3) utilizing other instructor’s public YouTube videos, with proper citation of course. Method (1) allows for the repurposing of lecturers from previous iterations of the class, and the normal use of blackboards/whiteboards. This method is best used for the demonstration of proofs and other material that is more easily drawn than computer produced. Method (2) is useful for the presentation of information—for instance, of validity and soundness, or sets of arguments in natural language. Method (3) can be used sparingly to supplement one’s own content; this is particularly useful to visually diversify content styles, since other instructors may be skilled with animation or video affects that may be beyond the average instructor’s skillset.

 When planning active learning activities for class, instructors can choose from four broad categories (a) individual activities, (b) paired activities, (c) informal small groups, and (d) cooperative student projects.[[31]](#endnote-29) A natural choice is to develop a short problem set and assign students to work together to complete the questions. However, instructors should pay special attention to the higher-order thinking skills at the top of Bloom’s taxonomy, including analysis, synthesis, and evaluation.[[32]](#endnote-30) Likewise, instructors must provide a mechanism to assess student understanding.[[33]](#endnote-31) The most effective activities will combine these efforts. For example, students can be assigned to create one invalid argument, and one valid argument in natural language. Then, they can be told to exchange this paper with a partner, who must determine which is which. An activity such as this challenges the student to be creative and produce their own independent work in the first stage and tests their skills of evaluation in the second. Students can then turn in their work for participation credit, or to count as their attendance. To minimize grading on the part of the instructor, the assignment can be graded as pass/fail. In turn, the instructor can adjust the class based on what the assessments show about the students’ level of understanding and skill development.

 Additional pillars of this curricular framework will be a pre-assessment, which will serve as a baseline for student understanding, and a post-assessment, to gauge student progress after the lesson is complete.[[34]](#endnote-32) Pre-assessments can take the form of a short quiz on the video material prior to class,[[35]](#footnote-3) questions imbedded in your video before moving onto additional content or requiring students to bring in questions on the take-home material ready to turn in at the beginning of class. Pre-assessments serve a two-fold purpose: First, they provide an incentive for students to watch the video lectures and be adequately prepared on arrival, and a second, they allow the instructor to check in on how well students are understanding and have actively engaged with the material prior to its application in class. It is important for remember, however, that pre-assessments serve only as a quick check—they are not a stand-in for traditional homework assignments. Likewise, post-assessments are also brief, usually a short assignment done at the end of class. Many instructors use “exit slips,” where students must answer a question and turn it in prior to leaving. You might ask students any number of questions, but this is an excellent opportunity to focus on metacognition, giving students time to reflect on their own learning. You might ask something like, “What is one thing about informal proofs that you found confusing before our lesson? Did you resolve this confusion during class, or do you need additional explanation?” When done properly, the post-assessment can open the lines of communication, providing important feedback to the instructor and allow students to track their own progress.

 To better understand the differences in how time is spent during the class period, below, Figure 1.0 compares the schedule of a traditional class compared to the flipped class:

**Figure 1.0**

|  |  |
| --- | --- |
| Traditional | Flipped |
| **Activity** | **Time** | **Activity** |  **Time** |
| Lecture on New Content Q&A on New Content | 50 minutes10 minutes | Team Check-In andQ&A on the VideoGuided and Independent PracticeReflection (exit slip) | 5 minutes30-40 minutes5 minutes |

Adapted from Bergmann and Sams[[36]](#endnote-33)

As you can see, the emphasis on guided and independent practice makes logic ideal course content for the flipped classroom. Any course from the standard introduction to sentential and predicate logic to the more advanced mathematical logic or modal logic will be an excellent fit for a flipped classroom. Because the knowledge transmission aspect of logic is to provide students with the tools to create proofs and evaluate arguments, shifting away from a teacher-centered class paradigm to a student-centered class paradigm ensures that students have access to resources for help when they need it, during these most difficult applications of the subject.

Challenges Addressed

 I have argued that flipping the logic classroom would be an ideal methodological shift; however, like all curricular redesigns, implementing an inverted course structure will face certain practical challenges. I believe that such challenges can be adequately addressed. And, at the very least, these challenges are dwarfed in quality and quantity when compared to those that correspond with the traditional model.

 The largest hurdle for flipping the logic classroom will be the amount of time it will take the instructor to develop new course material—namely, recording and editing lecture videos, organizing in-class activities, and creating pre-assessments and post-assessments. Instructors who have undertaken a flipped classroom have reported that making teaching videos (as well as finding and reviewing other instructor’s videos) is a substantial time commitment.[[37]](#endnote-34) There will be something of a learning curve for instructors in terms of how best to utilize video technology and PowerPoint recordings, with which they may have little or no experience.

 I argue that this burden is an initial investment that is well worth it in returns. The technology-related learning curve is front-loaded—once instructors understand how best to use their educational software platform and decide which form of content delivery works best for them, the burden tapers off to manageable levels. It is true that this will require the set-up of equipment and video upload, however the average laptop camera is now suitable to the task. And, while one may have to resist the temptation of re-filming portions of the video, a quick online tutorial of iMovie or other editing software will provide the tools required to make necessary alterations. It should also be noted that most colleges and universities have teaching and learning centers that are on-call to assist you both with the technological aspect of your course and course platform, and also the necessary curricular re-design.

Admittedly, this curricular shift—like any new course design—will require time, effort, and dedication. As a result, the workload required for designing and implementing a flipped classroom may lend itself to a particular type of instructor. Namely, one who has a greater likelihood of using the recorded materials again. Further, adjuncts, graduate students, and post-docs are advised to use their discretion as to whether or not their pay is commensurate for the level of work required. Other factors may include department (or chair) support, job security, and the regularity of the course offering. Staying the conventional course may be required for instructors in certain circumstances, but interested instructors might investigate the plausibility in consultation with their chair or teaching advisor.

Regarding the in-class activities, logic texts typically come with a whole host of practice problems pre-packaged for just the occasion. As such, the instructor need only to decide the method by which students tackle these problems (individually, in pairs, in teams, etc.). While creativity on the part of the instructor is desirable—particularly as it enables the student to participate in all of the learning objectives in Bloom’s taxonomy—it is certainly not necessary that the instructor develop a creative activity for *every* lesson. Pairing students up into teams to tackle a translation, prove consistency, or determine whether or not a sentence is a tautology, is a perfectly suitable use of class time. The delivery of practice questions can be tweaked easily to differentiate the learning experience. For instance, students can be asked to finish problems on the chalkboard or work together at a table with their teams. Variety does not require difficulty and does much to improve student engagement and output.

Returning to the challenge of workload—it may seem like a pre-assessment for every video and a post-assessment for each class is simply too much to put in place. Yet all logic courses require student assessment anyway, and most, if not all, require participation. Per-assessments and post-assessments, then, are merely a formalized re-design and re-purpose of assignments instructors are already requiring of their students. As noted in the previous section, preassessments can be as simple as preparing a question to be discussed at the beginning of class, and post-assessments as easy as students reflecting on what they learned that day. Instructors can make these assignments in a matter of minutes, count them as pass/fail so as not to add to the grading load, and use them to determine attendance.

It might be noted that, in at least one way, instructors actually save time because they do not need to re-teach content to students that miss the class. Instead of rehashing the entire lesson in office hours, responsible students will continue to keep up with the video material during their absence from school.

One challenge of flipping the classroom for the first time is that both the students and instructors must be open to change their expectations of classroom life and student responsibilities they have developed over decades of participating in the traditional model. Amy Roehl, Shweta Linga Reddy and Gayla Jett Shannon say it nicely in their paper, “The Flipped Classroom: An Opportunity to Engage Millennial Students Through Active Learning Strategies:”[[38]](#endnote-35)

The introduction of any new strategy requires a shift in the minds of both educators and students. Teachers must be willing to experiment with alternative strategies in the classroom. For those instructors who are willing to apply these new methods, it is important they periodically reflect on their teaching and effectiveness. At the same time, students may require more than a semester to adapt to the new method of instruction and to recognize its value.

Thus, succeeding in planning and implementing the curricular necessities of a flipped logic course will not guarantee success. Students must be taught how to approach this method, what it is, and why it is of value to their educational outcomes. This can be done, but it requires transparency, communication, and—if it is your first time attempting a flipped classroom—a willingness on the part of both parties to make adjustments to the plan as needed.

 Some instructors may be concerned that the video lecture prevents students from asking questions in real time, as the lecture unfolds. This much is true, but I have two things to say in response to this: First, instructors know very well that many times a student’s question is merely anticipating something that will become clear if they have patience and continue to listen to the instructor’s exposition. Second, if the student’s question is not answered by the remaining video content, they can bring this question to class, where there is ample time to discuss such things now that course time is freed up by the lack of a lecture on new material. Instructors can also anticipate this need by allowing a student’s question to count for the pre-assessment. Either way, I do not necessarily think that this scenario is any more problematic than having a student at home, doing their homework and having questions about how to proceed. If anything, that scenario is worse, seeing that they are graded on the assignment that they produce.

By this point, I hope to have convinced the reader of the value of in-class guided practice. And yet, if the benefit of a flipped classroom is an emphasis on skill development, one might be asking—should students watch lecture videos at all? After all, it would save instructors a great amount of time and effort if the students could learn the equivalent information from their textbooks. Alas, this loophole is not a viable alternative. Certainly, a textbook will provide the information. But, as every good instructor is aware, it is our job as teachers to take the course content and relate it in a way to help the student understand and process that content. Further, cutting the video would also cut out the crucial demonstration of meta-cognitive modeling. We as the experts are tasked with guiding the students through the thought process of our tasks, the steps and methodology of our subject. Without this guidance, student learning is sure to suffer.

In a similar vein as this last question, defenders of a traditional classroom may ask—What if students simply choose not to watch the videos at all? In every class there are some students who almost all of the work and some students who do almost none. The majority of students lie in a third category—call these half-effort students. The concern regarding half-effort students is that, in the traditional lecture course, they would get two bites at the apple: during the lecture and at home on their own time. The flipped classroom, it is argued, cuts their exposure to the material in half. Even worse, if these students fail to watch the video, they will choose not to come to class, lest they be compelled to partake in guided practice of a skill they have yet to learn. And, if these students do come to class, they might simply pull out their phones to do what should have been done outside of class or rely on the instructor or other students to get them up to speed.

To respond to this criticism, it is important to highlight the control that instructors have over certain positive and negative curricular incentives. Instructors can require students to engage with the lectures by including embedded quiz questions, which will not allow students to proceed without a correct answer. Instructors are free to weight this grade heavily enough to compel students to take these pre-assignments seriously.

In addition to this, the education software now also provides professors with useful information such as how long students looked at certain pages of the course website, and how they interacted with the material. Therefore, if a student has failed to adequately interact with lecture links from the course website, you may be safe to penalize a participation grade (though of course this deficiency will sure to be showing in this student’s graded work, and the students should be warned of this possibility on the syllabus for the sake of transparency).

Another option is to institute a peer accountability mechanism. Since most days students will be assigned to teams, instructors can begin the class with a team check-in, where students answer questions such as “Do you feel prepared today?” or “On a scale of one to ten, how well did you understand the lecture video?” This will help students orient themselves with their group members, determining where each member is at prior to skill application. There is reason to believe that students may feel more compelled to come prepared to class if the alternative is to admit to their group-mates they are unprepared for team work. If the instructor notes the same students continue to be underprepared, they can schedule a meeting for intervention.

Ultimately, I believe that the instructor has sufficient tools to motivate half-effort student by setting clear expectations, rewarding sufficient engagement, and penalizing the lack of participation, as one would with any other class assignment. When students become aware of how seriously this aspect of the course will be taken, how failing to interact with the videos will doubly affect their grade (both via a participation grade and a pre-assessment grade), and how abstaining from this aspect of the course will hamper their reputation among team members and their ability to succeed during guided practice, the instructor can guide student behavior as well—if not better—than one might in a traditional course.

Beyond this, at a certain point it’s simply the student’s responsibility to keep up with the videos, just as it’s their responsibility to keep up with the reading or pay attention to lectures in other courses. It is true that the flipped classroom requires students to take on a greater participatory role, which comes with greater responsibility. It is on instructors, however, to provide clear and explicit expectations for student’s self-direction throughout the course[[39]](#endnote-36). When students know what is expected of them and how can control their own success, they are more likely to accept rather than shirk this responsibility.

Let us consider, next, the pedagogically-minded instructor who expresses concern regarding what they perceive to be a limited amount of Understanding- or Remembering-level content for students to learn outside of class. This instructor might cite the fact that the logic courses are skill-centered to question whether there is enough *information* to keep students busy on their own, prior to in-class practice.

Perhaps there is an argument to be made here that this method is best used with introductory logic courses, rather than advanced courses. Well-versed instructors should be challenged to recall the experience of opening their first-ever logic textbook, filled with mysterious symbols and technical jargon. With this experience in mind, I disagree with the suggestion that a logic course does not have enough foundational Understanding- and Remembering-level content to provide sustained content delivery for students to digest prior to class. Truth values, inference rules, and definitions are the scaffold on which the skills of deduction, evaluation, and translation are built. Particularly in an intro-level course, it takes a full semester to arm students with the foundational concepts necessary for increasingly complex skill application. Additionally, the Understanding- and Remembering-level course content will not be taught in isolation. The video lecture will often contain the instructor modeling the application of such concepts, demonstrating their methodology of how to solve particular problems or how to go about constructing a proper translation.

Implicit in this earlier challenge is skepticism about the ability to teach *logic*by video. After all, so much of logic cannot be conveyed in Understanding- and Remembering-level course material. To address this concern, let us remember that the instructor can and should integrate the traditional methods of lecturing into their video materials. New content should be interwoven with demonstration on how to apply the concepts to questions of the type that appear on problem sets and exams. The video lecture is not the end-all-be-all. It should be thought of as a primer. A means by which we prepare our students to arrive ready for guided practice.

In previous sections I have touted the benefit of guided practice as an opportunity for instructors to provide needed support to struggling students. And yet, this vary feature may result in particular needy students dominating one’s time and attention. The instructor may inadvertently mismanage their time by spending more time with one group over others. To address this issue, consider the following practical suggestions. First, when circulating between groups, one can set their cell phone timer to go off at regular intervals. This will prevent instructors overstaying their allotted time. At the end of that period, if students still require help, remind them of your office hours and location, availability by email, or the ability to post questions on an online forum, if available. Second, instructors might routinely shift team members in each group, such that no one group will contain the needier students. Recall that peer learning can be equally fruitful to instructor intervention. And, students grouped by learning level often catch on, which may negatively affect their confidence in the subject. Thus, while time management is a challenge for the flipped logic classroom, the instructor can manage it with appropriate anticipation.

 A final objection reflects a concern that “open” classrooms create a risk for instructors, either due to piracy concerns—that content might somehow be shared without permission—or because the instructor’s teaching is captured on record even if they don’t “show well.”[[40]](#endnote-37) To the first point, it is true that instructors always face potential misuse of materials they put online. For those especially concerned with this, selecting a private method of delivery (through the course website) will make sharing with outsiders quite difficult. If a public method such as YouTube is chosen, you can provide fine print in the video description for other students and instructors to credit your work. More concerning to some is the thought of a video capturing a poor-quality lecture that could be seen, subsequently, by a department chair or dean. To guard against this scenario, simply do not publish a video that provides a disorganized or unclear lecture. After all, such lectures will not be helpful to either the instructor’s reputation or the students learning. If, upon creating video lectures, the instructor realizes that he or she uses too many filler words, that they pace information delivery too quickly, or that the lecture is too difficult to follow for whatever reason, this is an opportunity for the instructor to come face-to-face with the reality of their own teaching and work hard to fix these flaws. In this way, a flipped classroom will provide motivation to improve one’s teaching in ways the instructor may never have realized were necessary.

Conclusion

 In conclusion, I have done my best to demonstrate that a flipped classroom model for undergraduate logic, though not without its challenges, would be a worthwhile investment for any logic instructor. The traditional logic lecture is limited by time, location, and method. In contrast, the flipped classroom has a range of possibilities, allowing for diversified content outside of class and personalized attention inside of class. With the flipped classroom, logic instructors may address issues specific to the cumulative content of logic learning, as well as the complex task of teaching both content and skill. By taking up the challenge of establishing a flipped logic classroom, instructors have the opportunity refocus and revive their stale curriculum, transitioning class time from a lecture hall of inattentive students to a bustling room of learning activity.

In sum, if the goal of a logic course is for students to understand and apply the rules and tools of truth trees, tables, and proofs, to translate accurately, and to evaluate for soundness, validity, and consistency, guided practice during class time will ensure that students quickly recognize and rectify their mistakes swiftly and productively. Thus, replacing the lecture’s passive participants with the flipped classroom’s active learners will be fruitful for logic students and instructor alike.

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