**Abstract**

Homework is an integral component of most science courses but can have an impact on student learning only when students actually complete the assignment. Low completion rate of homework, then, is an impediment to student success in science courses, and a source of frustration for instructor and students alike. Here, we outline a set of design principles supported by research on how students learn, intended to streamline outside-of-class assignments to address course goals, improve student buy-in and motivation, and provide instructors better formative assessment data. We also share examples of outside-of-class assignments aligned to these principles to aid instructors in shortening and focusing the homework they choose to assign in their courses.

**Key Words:** Homework; instructional practices; formative assessment; motivation; engagement.

**Introduction**

Ask any high school or college instructor to list their gripes about students’ work, and “low homework completion” or “lack of preparedness for class” are bound to be near the top. There will certainly never be one magic-bullet solution to this problem, but a contributing factor may be the nature of homework. In this paper, we briefly examine the research in homework efficacy to make the argument that homework that is intentionally designed to be focused tightly on one or two instructional or assessment goals increases homework completion rates, student engagement, and course coherence.

In our classes, we have used homework for a variety of purposes, and we are not alone—research on homework effectiveness cites many common purposes for homework (Blazer, 2009). These include reinforcing course material, acquired skills practice, preparation for upcoming class work, application of knowledge, extension of class material, and “covering more” material / responding to semester- and year-long curricular constraints. In choosing the tasks we ask students to complete, and the goals we’re attempting to advance, “teachers not only assign homework, they design homework,” reflecting our understanding and priorities for “the skills, abilities, and needs of their students, and the characteristics and situations of their students’ families” (Epstein & Van Voorhis, 2001).

Even if every student completed 100% of their homework in a particular course, it seems unlikely that homework assignments would be able to successfully accomplish such a broad range of academic and social tasks—so how do we know if our students are being successful? How do we know that our homework assignments are contributing to student success? More troubling, how would students know that their work is contributing to their success in the course and is thus academically or personally meaningful? The first two questions speak to course design and implications on student learning, and the third speaks to student motivation and engagement. In our classes, redesigning homework assignments has not only helped students (as evidenced by homework completion rates and student evaluations) but also provided timely formative assessment data that has helped us as instructors to improve course coherence as we move through a unit of instruction (Minbiole, 2016).

**Design Principles**

With a concept as broad as homework, encompassing a wide variety of outside-of-class tasks assigned K–16, drawing conclusions from any single literature review may be problematic. In fact, this conflict in priorities and conclusions about efficacy of homework has itself been the subject of literature review. It is striking that, in the roughly 100 years that homework has been studied in the US, there is no conclusive body of evidence that it “works” broadly—meaning that it is associated with significant gains in student performance, absent other factors (Eren & Henderson, 2011). There does seem to be consensus around a few design principles. Homework is more effective when the task is high impact, when the assignment is completed, and when it leads to timely feedback.

**High impact** tasks are characterized by application of concepts (rather than lower-level thinking tasks), direct links to in-class work, and a student perception of achievement on completion.
Application: What This Looks Like in Our Classes

Shorter Problem Sets, with In-Class Discussion Procedures

In Julie’s genetics class, problem-set homework assignments have been shortened to one to two highly engaging problems, covering critical concepts or skills in the course. Students are expected to come to the next class meeting with the problem set complete to the best of their ability, but they are also given the first 10 minutes of class to discuss the work in pairs or small groups. This time serves several purposes: student talk provides valuable formative assessment data to the instructor, ties outside-of-class work to class activities, makes students responsible for evaluating each other’s understandings, and reinforces the habit of completing work. In our experience, 10 minutes is enough time for a student who made an honest attempt but needed clarification on a misconception to complete the assignment, but it is not useful for a student who has not attempted the homework to rush through a substantial response. High impact is achieved by distilling the task down to a two-problem set that requires understanding of multiple genetics concepts in order to fully execute the task. The manageable size of the assignment allows for completion of the task in a very reasonable amount of time outside of class, while the in-person discussion component allows students to receive real-time feedback and provides a sense of achievement as they refine and improve their answers as a group without relying solely on instructor feedback.

Building Formative Assessment into Flipped-Class Videos with TED-Ed

Using instructional videos as homework (the Flipped Classroom model) has become a popular method to move direct instruction out of face-to-face synchronous class time, making more room for lab and discussion, like in the collaborative homework debrief discussed previously (Heyborne & Perrett, 2016). In a traditional in-class lecture, students often complete clicker questions or exit tickets to check for understanding. The limitation of these strategies, though, is that the instructor cannot act on this assessment and make adjustments until the next class meeting. However, once students are consuming material between classes that might otherwise be a face-to-face lecture, it creates an opportunity for formative assessment to inform instruction before the start of class—essentially, students are completing entrance tickets rather than exit tickets. The TED-Ed platform provides tools to add multiple-choice and short-answer questions to any online video, and student submissions are viewable online or in an LMS such as Canvas. Additionally, the platform contains a library of highly engaging videos, or can be used with any video available on YouTube (including instructor-created videos). This creates a homework assignment that contains both the instructional video for students and questions on key concepts—letting the instructor check for student understanding before the next class meeting. In Julie’s class, TED-Ed videos are selected for key concepts, when textbook readings or static figures are inadequate. Delivering this material in video form gives students “the power of the pause button,” allowing them to process the material without the extemporaneous pressure of an in-class lecture. Additionally starting class discussing key ideas from the TED-Ed and addressing misconceptions has improved student understanding (measured by quiz scores) and engagement (these assignments are highlighted in course evaluations). The single-concept, engaging videos are high impact, and the short format increases the likelihood students will complete the task. The digital format allows instructors to grade the assessment quickly and provide timely feedback and/or course modifications to address student misconceptions before proceeding to additional course content.

Modifying Existing Homework Assignments to “Get More out of Less”

Not every assignment must be designed from scratch; the reality is we all have existing assignments aligned to our course goals. If low homework completion is an impediment to class functioning, it may make sense to look at existing assignments and pare down according to course and student learning priorities. The principles in Understanding by Design offer guidance by characterizing course learning goals into “essential,” “highly desirable,” and “desirable” elements (Wiggins & McTighe, 2005). To leverage out-of-class activities to improve student understanding, consider moving away from assigning/assessing multiple priorities in the same assignment and instead leverage interesting examples as hooks to assess essential course elements. To shorten assignments and improve student completion, the instructional challenge becomes, “What is the one thing I want students to take away from this topic?” Asking one or two questions that require application of concepts for a single understanding increases impact. This practice of focusing improves completion rates, gives the instructor clearer formative assessment, and gives time back to all stakeholders in the course—instructor and students alike.

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References


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