

Adjusting Courses to Address Varying Student Motivations

This column discusses how my enthusiasm and positive outcomes in course development need not translate to later offerings of a course—either taught by me at my own school or at other places. In particular, when a course seems nicely developed and well received by several classes of students at one school, a subsequent offering of apparently the same course may not resonate particularly well with students—even when the course utilizes the same schedule, pedagogy, class format, materials, assignments, etc., and when the students apparently have very similar backgrounds. Simply stated, *local context, particularly related to student motivation, can make a substantial difference to the success of a course and its pedagogy.*

This column begins by outlining my customary strategy for developing and refining courses and reviewing several examples that illustrate how students may react differently within separate sections of apparently the same course. The column then reviews some common motivations of students, the impact of those differences on pedagogy and class format, and some ways to adjust a course to accommodate student differences.

An Iterative Strategy for Course Development

When I expect to be teaching the same course multiple times over several semesters, I typically consider how elements of the course might be improved.

- After each class session, I may take notes of what elements might be im-

proved, and then edit specific assignments, labs, readings, etc. My plan is to refine materials while my experiences and my observations of student reactions are still fresh in my mind.

- At various points within a semester, and certainly at the end, I ask students for feedback on course detail. For example, I may ask which three labs students found least helpful and why. Although comments may identify areas requiring attention, students often mention symptoms of a difficulty, while pinpointing underlying issues may require additional analysis.
- Between semesters, I may reflect on course segments that might be re-worked beyond the change of an individual assignment, reading, or lab.

Altogether, this process represents an informal type of “iterative improvement,” through which I hope to improve and refine a course each time I teach it.¹ Over the years, I believe this process has helped me upgrade a course, and student end-of-course evaluations, while usually quite good, have moved up noticeably.

With such a practice of steadily adjusting a course, I sometimes feel that a course is sufficiently developed to be dependably

¹ My practice for on-going course development over multiple offerings depends on my own observations during a semester, on student feedback, and on my reflections after an offering is completed, so this approach can be considered a type of data-driven procedure. However, for an individual course, I do not follow a formal methodology or documented process as is sometimes described for “continuous improvement” for classrooms or educational organizations [4] or college-wide challenges [3].



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well received; I may even believe a current course can serve as an exemplar for other instructors at my own school and for courses offered elsewhere.

Local Context/Different Students Can Have a Substantial Impact on Course Success.

For many seasoned teachers, experience likely demonstrates each course offering is different and presents its own challenges. Not only are different students enrolled, but the course may be offered at a different time of day—not to mention new developments in the discipline, changes of textbooks, adjustments in pedagogy, etc. In a formal statement of “continuous improvement,” the Carnegie Study states,

... quality improvement is context-embedded: it “entails an engineering orientation where the varied demands and details of local contexts are a direct object of study and design” (Bryk & Gomez: 10). [4, p. 4, underlining added].

In my own teaching, I make long-term efforts to utilize well-researched practices, such as active/lab-based learning, collaborative activities, student engagement, clickers during large-group activities, etc. However, even within this framework, I sometimes am surprised at how dramatically different students may react to seemingly similar course designs and practices. Three examples highlight variations in courses I have taught, even when those courses have been well developed over several years.²

- **CS2 offered at two times in the same semester:** During one semester, I taught a CS2 course at 8:00 am and 11:00 am. Students in the 8:00 am section were much more lively, more engaged, and more willing to work in collaborative activities/pair programming. Altogether, the 8:00 section resonated well with student perspectives. In contrast, the 11:00 section was satisfactory, but lacked the same level of engagement

and willingness to work collaboratively with a corresponding reduction in enthusiasm, learning, and test scores.³

- **Software Development at the same time of day, in successive Fall semesters:** In one offering on software development that included a project tackled by several student teams, students responded extremely well to the class format, utilization of two textbooks/resources, balance between class discussion and teamwork, project selection and organization, etc. Since student response was extremely positive, I utilized the same approach the next year—keeping as many elements the same as possible. In the second offering, however, student response was largely opposite—students disliked the class format, textbooks/resources, allocation of time during class, project selection, etc. Just when I thought I had determined an approach for software development that resonated well with students, my second offering of the course had opposite student reactions.
- **CS2 at different schools:** After devoting several years to developing and refining a lab-based CS2 course with an application theme involving the control of robots, I taught largely identical courses in successive semesters at different schools. At the first school, the course was wildly successful, with considerable student enthusiasm, strong student participation in clicker questions and large-group discussion, student excitement in working through collaborative labs, high motivation to complete labs and assignments, and fine performance

on quizzes and tests. Although I experienced similar student reactions on one other campus, student reaction at two other schools was generally mixed—still using the same robots, class format, lab materials, assignments, etc.

These examples highlight the need to tailor details of a course to a local audience and context. It would seem that just because a course may be extremely successful in one environment, the same course may need substantial adjustment when taught in another environment or with different students. Perhaps this is one of the substantial challenges of teaching!

Student Motivations

Over the past five years, I am grateful to have been able to have a transitory status, in which I have taught one semester a year at Grinnell College (my home institution) and one semester elsewhere (serving as a visitor). Through this experience, it has been striking to observe variations in the motivations of students in a variety of environments. Of course, student culture is diverse at each school, but the factors that motivate a substantial fraction of students on one campus may be quite different (perhaps largely disjoint) from motivations found on another.

The following list, while far from complete, identifies several common themes among students I have taught.

- **Intellectual challenge/excitement of problem solving:** students in some environments are willing to work on problems/assignments of moderate difficulty, but end-of-course evaluations go up, when students are given challenging problems that require thought, insight and perseverance.
- **Career preparation:**
 - **skills:** in some environments, students indicate an interest/willingness to add requirements, courses, etc., if the students believe such credentials map directly to obtaining solid jobs at graduation
 - **portfolios:** some students seek to impress potential employers by collecting projects, programs, assignments, etc.
- **Potential to help people:** this group observes the pervasive nature of

³ Throughout my teaching career, class attendance and interaction have been quite good (perhaps due to the culture at schools where I have taught), and I have come to expect solid attendance regardless of when the courses meet. However, in this case, in addition to solid attendance and reasonable engagement, student involvement at 8:00 am was particularly noteworthy. Although I have no direct evidence to explain this experience, one possibility is that 11:00 am was a very popular time for courses. Strongly motivated students might choose an 8:00 am section of one course, so they could take another course at 11:00 am. Another possible explanation is students requesting courses that meet relatively early may be particularly well organized and want to take full advantage of each entire day of college life. For this CS2 course, students thrived with the 8:00 am meeting time, perhaps due to their personal circumstances, academic interests, or individual priorities. However, such analysis largely remains a matter of speculation.

² All of these examples were offered at institutions with similar admission standards, so the students generally would seem to have similar preparation and academic ability—at least on the surface.

computing to impact social, community, and individual wellbeing, and thus is motivated by assignments, examples, and projects that have clear potential to contribute to the common good.

- a student may choose to brag to a lab partner about not being prepared for a lab or discussion—the ability to work at the spur of the moment may be a way to show off.

With such a practice of steadily adjusting a course, I sometimes feel that a course is sufficiently developed to be dependably well received; I may even believe a current course can serve as an exemplar for other instructors at my own school and for courses offered elsewhere.

- **Excitement about a specific project:** some individuals seem captivated by a specific [type of] application or project (e.g., a game or a system to support local non-profit organizations), so connections to specific applications capture the imagination.
- **Grades and/or class standing:** for some, success seems connected directly to grades.
 - at one extreme, a student may seek the highest average in a course or to graduate with the highest average grade point. (In one case, a student viewed any grade below “A” as representing failure.)
 - at another extreme, achieving graduation seems the primary academic goal, so “C” grades [with a minimal amount of work] are fine.
- **Fear of failing:** a student (e.g., this columnist during his first undergraduate year) may believe that they likely will flunk out of school, but they want to delay the inevitable as long as possible. (Versions of this sometimes is discussed under the title, “the imposter syndrome”).
- **Enhancement of perceived status:** Some students may seek to gain stature within some group. Elements of this may have positive or negative attributes.
 - a student may come to class well prepared, so as not to be embarrassed when working with a lab partner.

- a student may choose to utilize jargon or flaunt apparent knowledge—often speaking within a group, perhaps to impress one or more peers or instructors. (Although sometimes such a display may demonstrate considerable knowledge or insight, a knowledgeable observer often may realize how little the speaker actually knows.)

Overall, students may vary substantially in their motivations and perspectives. Subsequent sections consider the impact of these differences in course planning and day-to-day teaching.

Some Challenges of Student Differences for Class Format and Pedagogy

Observations regarding differences in student motivations lead to challenges for class formats, pedagogy, and related elements of teaching and learning. In particular, some choices for a course may resonate particularly well for some students, but the same practices may actively turn off others. Three examples follow.

- Regular (weekly?) quizzes at the start of scheduled labs might be an appropriate response when students largely are motivated by grades or by just wanting to get through a course (e.g., with a C), so that students will arrive prepared. However, if students feel an obligation to a

partner or to build skills for their future careers, class preparation may be a natural response, and students may resent time devoted to weekly quizzes—such time detracts from other opportunities for teaching and learning within the classroom.

- Software development projects involving local non-profit organizations may resonate with students who want to make a difference in helping people and society, but these projects may seem irrelevant to students focused on developing computer games. Of course, projects emphasizing games likely will have exactly the opposite appeal for these groups.
- When several students wanted to learn material not in the regular curriculum, I offered to organize a course, including a day-by-day schedule with designated readings for each class session. Students then agreed that they would rotate days leading a class, with each student responsible for lecturing, discussion, etc. for a full class meeting about every other week. Although a student was expected to discuss whatever seemed important, part of the work was to lay a proper foundation for later class sessions. If a topic was not covered carefully or if material was omitted, students were expected to fill in details as needed in later classes. In practice, this group was remarkably motivated, prepared polished presentations, and distributed handouts most days; at the end of the semester, these undergraduates had covered about twice the material designated in a graduate course at another school. In contrast, when this approach was proposed to students on a different topic for another semester, students indicated little or no interest in proceeding this way.

In considering differences among students, a common teaching guideline suggests that teachers should use multiple formats and approaches, so that each student will encounter at least some elements

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within each course that resonate with their own motivations and preferences.^{4,5} Although this perspective has considerable merit—at least in my experience, I also have observed commonality among some groups of students (often on separate campuses). Three examples stand out among the several dozen campuses I have visited (either for an external review or for teaching a few courses). In each case, students attending the schools seemed to have similar academic backgrounds when they began their collegiate studies.

- The vast majority of students on one campus seemed motivated primarily by the intellectual challenge of problem solving or by the desire to work for the common good.

⁴ Many educators have noted differences among students that can affect learning. For example, Riener and Willingham “assert that a certain number of dimensions (ability, background knowledge, interest) vary from person to person and are known to affect learning.” [7]

Beyond this, for many years, one group of educators has highlighted a need for teachers and courses to accommodate diverse learning styles and perspectives. For example, Gentry, Sallie, and Sanders discuss “differentiated Instructional Strategies” for students “with different abilities, learning styles, and personalities.” Their presentation to the 2013 Urban Education Conference presents a nice overview of research, particularly for K-12 schools, and their References section identifies several foundational research studies on the subject [2]. Similarly, many research studies analyze visual, auditory, and kinesthetic learning style, and connections between teaching styles in class and students’ academic performance. A simple web search identifies numerous discussions of approaches for accommodating different learning styles, such as [5]. Also, [1] provides an analysis of the impact of learning styles on a college-level programming class.

On the other hand, in the last 13 or so years, other researchers, such as Pashler et al. state that “We conclude therefore, that at present, there is no adequate evidence base to justify incorporating learning-styles assessments into general educational practice.” [6]

⁵ A personal experience illustrates differences in the ways people approach topics. In Fall 1991, I was fortunate to co-teach a section of calculus with Grinnell’s new President, Pamela Ferguson. Both of us had PhDs in pure mathematics, Dr. Ferguson as an algebraist, and me as an algebraic topologist. Since both of us had taught calculus several dozen times, we alternated teaching the various topics, and we both thought we had figured out the right way to introduce various topics. In summary, we were shocked that the other person did not proceed as we expected. She began with algebraic properties and perspectives and eventually related the geometry of a concept. I started with the geometry and eventually progressed to formal algebraic definitions. Of course, we both understood that material could be introduced in various ways, but one approach seemed more natural to each of us than another. As the semester progressed, we finally realized that our approaches arose from our views of pure mathematics (algebra and topology), and we realized that students gained important insights by seeing alternative perspectives. However, coming to that realization took a couple months—after we understood our different views of mathematical objects and viewpoints.

- Most students on another campus seemed focused primarily on grades; if a course activity would not count toward a semester grade, students mostly ignored the work.
- The majority of students (and faculty) at a third campus seemed to relate most of their energy to work that would help them obtain jobs immediately after graduation; if adding a requirement to the CS major or taking an elective likely would help gain job offers, they accepted the requirement or work with little question.

Naturally, after teaching at a school for several years, one uncovers elements of the campus culture—what activities resonate with students fairly consistently and what do not. However, learning about a campus climate takes time, and even after several years, one can become surprised. Personally, I have often found that when I have used successful course elements from one school on a different campus, the results (while not terrible) have been mixed.

Thoughts on Tailoring Course Activities to Student Preferences and Local Context

In working with diverse students, the generic teaching guidelines mentioned earlier may provide a reasonable starting place: a course might incorporate a range of activities, such as written assignments, programming assignments, quizzes, longer tests, projects, oral presentations, labs (either done individually or in small groups), in-class problem solving (perhaps in groups), in-class worksheets (perhaps in small groups).

However, even when following such common advice, it seems important to consider the selection of examples and assigned problems. Games may resonate with some, but turn off others; problem solving/projects with community-outreach themes may motivate some, but bore others. Personally, I search for problems that at least hint at real-world applications, and I mostly avoid games, as real-world examples seem to resonate well with many students, especially those from under-represented groups—I want to find ways to help broaden participation. Of course,

knowing one’s audience can be quite helpful, but keeping in mind goals of outreach and inclusion also can be important.

Beyond such general advice, some additional thoughts may help in tailoring a course to a local audience.

- **Ask colleagues:** Particularly when new to a school, discussions with other faculty may provide insights about the student environment. Colleagues also may be able to suggest class formats and approaches for pedagogy that have worked for them.
- **Give students choice:** For some upper-level courses, I may present options for possible class formats during the first class. (See [8] for an example.) In after-class discussion, I ask students to email me their preferences (to minimize peer pressure), and I set the mix of class activities after receiving this student input—but before the second class.
- **Survey during a course:** After the first month of a semester or at mid-semester, I may distribute a survey asking for student feedback. As an example, recently I asked students their thoughts about continuing with weekly collaborative labs, completing a multi-question worksheet each week, having weekly quizzes, etc. I also asked about student perspectives on collaborative versus individual work on labs or worksheets. That class overwhelmingly preferred weekly worksheets done in pairs—in addition to some quizzes and tests.
- **Alternative problem sets:** Some years ago, for CS1, all students were responsible for the same computing concepts, but different problem sets were available for various levels of math (e.g., problems involving pre-calculus or calculus or linear algebra), chemistry, physics, or statistics. Each student could choose problems related to their interests—while practicing the same fundamental computing concepts (e.g., conditionals, loops, program organization, functions)
- **Student-selected projects:** During a course, students may need to develop a project of their liking, for which any context is allowed, as long as the project has specified elements. For example, a project within CS2 or an algorithms

course might require development and use of a function library to insert, delete, and modify nodes within a linked list.

- **Parallel Activities:** To allow variety, each student might choose which m of n activities to submit (e.g., labs, worksheets, programming assignments). In one recent upper-level course on computing and social/ethical issues, students had to write one paper and develop one poster. Students then could choose either a paper or a poster for a third product. When an instructor gives students choice, however, at least two considerations seem warranted.
 - If students are allowed extensive choice on what is turned in, some additional structure might be needed, so that they will still be responsible to learn the full range of topics.
 - If choice might involve some in-class work (e.g., quizzes) versus some out-of-class work (e.g., programming assignments), then allocation of class time can be complicated—who will be working on what type of activity in class?

Conclusions

Student motivation may be important for the success of various course activities, but students can vary substantially from school to school and even from one course offering to another at the same school. Thus, a well-received offering of a course during one semester may or may not be particularly successful during another offering.

Planning a course with a range of activities may provide some activities that resonate with many students, but school cultures also can have a substantial impact. As a result, an instructor may need to tailor class formats and pedagogy to each local audience. In this effort, flexibility and on-going student feedback seem essential, not only from one semester to the next but even within an individual offering of a course.

Altogether, experience can establish that specific approaches and pedagogies worked very well in some circumstances, but one must be careful not to over-generalize to other environments or even for other students in what seems to be a similar context. ♦

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