Assessment-Driven Collaborative Learning

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We Need To Change The Way We Teach

There is no way around it! We need to change the way we teach higher education courses, whether in the humanities or the sciences. The reasons are many and varied.

First, the time available to courses has drastically diminished, while the amount of material to be covered has, for the most part, increased. Courses that used to be spread over one or more semesters are now often crammed into a single quarter that, for summer sessions, extends over just five-to-six weeks. New materials and courses are continuously added to university curricula, while administrative pressures for "timely" graduation[1] limit the amount of time students can devote to truly engaging with the materials, experimenting with them in a variety of contexts, and reflecting on them.

Second, the way students learn is continuously evolving. Aspects of attention, engagement, motivation, and commitment are, to a large extent, influenced by the students' environment, which, in turn, shapes their expectations. While this is nothing new, the pace by which our students' environment and expectations have been changing over the last two decades calls for responses to change that are far more immediate and dynamic than the inertia of education, as a system, permits.

Third, the type of knowledge and skills valued by society, employers, and academia has changed dramatically over the last several years. Rather than students/scholars being repositories of large stores of information, what matters is knowing a) what type of information is needed and where to look for what information, b) how to evaluate information, and c) how to apply information to contexts other than those in which they are originally presented. As one scholar maintains, " . . . courses that are aimed at the acquisition and routine application of selected information will be largely irrelevant to the needs and interests of 21st century students."[2]

Compelling as the above arguments may be, they do not, on their own, convincingly argue for the need to change the way we teach. After all, the hard work, large amount of time, and low compensation involved in designing and teaching a university-level course can, understandably, make instructors resistant to change. Could it be that, in spite of the above changes, our courses and teaching continue to effectively accomplish their goal of supporting student learning? Recent studies, outlined below, indicate this is not the case.

One way to quantify learning success is in terms of the number of concepts learned in a course relative to the number of concepts already known to the students prior to the course. Studies assessing learning in physics courses found that, under traditional instruction, students end up mastering, on average, less than 30% of the newly presented concepts. The studies involved various implementations of the Force Concepts Inventory test and the results were largely independent of instructor, institution, or

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[1]Higher education is, for better or worse, often approached administratively as a business.
[2]Grayson, "Rethinking," 36.

class size.[3] Assessing learning success in terms of the students' ability to apply learned concepts to contexts broader/different than those addressed during instruction paints an equally grim picture. A series of paired-problems studies demonstrated the students' ability to successfully complete tasks that involved complex but familiar explorations of concepts taught in the classroom. However, it also showed an overwhelming failure of students to answer simple qualitative questions asking them to apply, in generalized contexts, the same concepts.[4]

Both retention and appropriate application of newly-learned information, addressed above, seem to be even more challenging when it comes to counter-intuitive concepts/facts. Retaining and applying such concepts requires resolution of the cognitive dissonance that results from the ensuing conflict between existing knowledge, however formal or informal, and new information.[5] It appears that the combination of the way we teach and the way students learn contributes to an inability of students to retain and apply knowledge that contradicts previous knowledge and/or common-sense understanding. This inability to resolve cognitive dissonance is so robust that it persists even when students are alerted to the fact that the concepts presented are counter-intuitive or that tests will be administered immediately after a given lecture.[6]

The Problem of the Student-As-Expert Assumption

Effective instruction has been defined as one that changes students, helping them think more like experts in a given field.[7] Experts see their field as a coherent structure of general concepts and ideas, established through research, and use systematic concept-based problem-solving approaches that are applicable to a wide variety of situations.[8] Novices, on the other hand, usually see their new field as a collection of largely isolated pieces of information, handed down by some authority, and are unclear as to the relevance and extent of applicability of this information to the world outside the classroom. A host of evidence from traditional teaching practices suggests that the instructional failures outlined in the previous section may have their source in a single implicit assumption instructors make about students, one that conflicts with the goal to transform student thinking from novice to expert-like. Instructors appear to assume that students already function at an "expert" level, following the same mental processes and approaches as faculty members, possessing similar levels of background factual knowledge that is supported by similar knowledge organization structures, and having already developed expert-like intuition for the subject at hand.

For example, most traditional courses neither explicitly organize and communicate overall and class-specific course objectives, nor offer clear and explicit links among (a) learning objectives, (b) assignments, (c) readings and other course materials, and

[3]Hake, "Interactive-engagement"; Weiman and Perkins, "Transforming."
[4]Mazur, *Peer Instruction*.
[5]Harmon-Jones and Mills, *Cognitive Dissonance*.
[6]Weiman and Perkins, "Transforming," 37.
[7]Ibid., 36.
[8]Ibid.

(d) application of the presented information to tasks relevant to the course objectives and the students. Consider the following student-posed questions: "What precisely am I learning today?" "Why is acquiring this new knowledge important to me in the context of the course or of my studies as a whole, and how does it relate to what I already know?" "How precisely will the specific assigned readings and other materials help me succeed in the course tasks?" "In what other contexts will this new knowledge be useful to me, and how?" Answers to such questions may, at least implicitly, be evident to the instructor teaching a course but are usually far from evident to the students. For most students, the learning path usually laid out within a course may appear rather vague, followed simply as part of a "college routine" with little motivation beyond "doing well at school." Failure to recognize this disconnect builds a gap between instructor expectations and student motivation, engagement, and performance that has the potential to sabotage learning.

This unintended vagueness often goes hand-in-hand with instructors cognitively overloading students by not taking into account the non-assigned information necessary for the assigned information to make sense.[9] Faculty members' years of experience and training turn a large portion of their subject-matter expertise into implicit knowledge that can be applied almost automatically, making it easy to forget how much knowledge they assume from themselves and how much of this knowledge cannot be assumed on the part of the students. In addition to cognitively overloading students, this manifestation of the student-as-expert assumption broadens the gap between instructor expectations and student motivation, as instructors are less likely to recognize the absence of something whose presence they implicitly accept as self-evident. For example, instructors appear to assume that students have expert-like information-literacy skills when it comes to finding and evaluating resources and aligning them to the objectives and needs of an assignment. However, the "learning through practice" approach, which has traditionally and implicitly been expected to compensate for the lack of formal information-literacy training, is no longer an option. The quarter system and the strict time-to-degree pressures leave no room for such "organic" forms of acquiring knowledge. These must now be replaced by a more formally structured instruction that clearly illustrates how materials are related to one another and to the course objectives and assignments.

The student-as-expert assumption is also reflected in the instructors' tendency to stick to a single (and familiar) mode of material presentation. Such practice misses opportunities for multi-sensory/multimodal stimulation that would assist students in absorbing the information presented and for presenting information in a multitude of relevant contexts (e.g., using analogies, illustrations, interactive demonstrations, etc.) that would promote cognitive flexibility and would help students develop intuition on the subject at hand.[10] Teaching requires from faculty much more than simply impressing students with subject matter knowledge and competence, and involves much more than simply presenting amassed information. For such information to turn from a series of isolated data pieces destined for memorization into true knowledge, it has to be dissected, reflected upon, and re-presented in a variety of ways that students can identify

[9]Chang and Ley, "A learning strategy," 105.
[10]Salomon et al., "Partners."

with and explore in order to develop expert-like subject-matter intuition. Unfortunately, given the assignments students are expected to complete and the level of performance they are expected to accomplish, even within less-than-ideally designed courses, the pre-existence of such intuition seems to be assumed.

The problem is fueled further by the lack of frequent and regular assessment of learning throughout the duration of a course. Appropriate assessment should include pretests, practice tests, and detailed feedback, in addition to the traditional graded assessments, such as a mid-term and a final exam along with an essay-style final project. Pretests not only show instructors where students are starting from but, more importantly, show students what they will be able to accomplish by the end of a class/course. Beyond giving students an idea of what to expect in a graded test and thus reducing their anxiety, practice tests provide students with opportunities to learn through trial and error, in a "safe" environment that promotes experimentation and open-ended engagement with the course materials. Finally, detailed feedback on graded tests personalizes the learning experience and, ideally, illustrates to the students how the learned material applies to their interests, assisting them in their ongoing motivational struggle.

This brings us to what may be the highest learning roadblock set up by traditional courses. The vast majority do not incorporate appropriately designed instructor-student and student-student interactions, failing to nurture two of the most powerful and motivational learning contexts: instructor feedback and peer instruction and feedback.[11] In most cases, instructor feedback is offered only after a test/assignment/project has been completed. It therefore comes at a time when students are neither motivated nor engaged enough[12] for the insightful, useful, and personalized information included in a good instructor's feedback to have any mind-changing impact. At the same time, student collaborations are often limited to informal and loosely structured in-class chats, open-ended and low-stakes online discussion forums with little direction/monitoring beyond minimum post requirements and discussion etiquette rubrics, or group projects dreaded by students. The latter usually become sources of frustration for those in the group that end up doing most of the work or provide disengagement excuses for those in the group that are not motivated to do well in the class. Ultimately, group work generates anti-climactic grade experiences that neither recognize nor fulfill anyone, while also failing to truly capture if and how much learning has occurred.

Towards Assessment-Driven Collaborative Learning

Building courses that incorporate frequent, well-designed and appropriately managed assessments may be the single most important step we can take to improve student learning. The following sections draw examples from several courses I have designed and taught at DePaul University and Columbia College Chicago, to outline the benefits

[11]Clark, "The Importance"; Crouch and Mazur, "Peer Instruction"; Falchikov, "Improving Learning"; Gilbert et al., "Peer Instruction"; Hess, "Enhancing Leadership."

[12]The assignment has already been graded, and attention has shifted to the next assessment due.

and components of assessment-driven course design that supports collaborative learning.

Assessment Frequency

Frequent assessment ensures that instructor and students are on the same page, paces student achievement of the course's learning goals, and gives students multiple opportunities to build on their grade and understanding of the material. Assuming that the course-level learning objectives have been broken down into manageable, self-contained, interrelated, and progressive sets of module-level learning goals, learning must be assessed after each course module. Therefore, designing a course around combinations of formative and summative assessments that frame and contextualize each course module is the best way to ensure appropriate assessment frequency. It also focuses the course on what is most important to undergraduate students (i.e. assignments/grades), by clearly communicating what is expected from them and what they will be able to accomplish by the end of each module and the course as a whole.

Assessment Design

All well-designed assessments share the following three characteristics: a) they are presented in contexts that encourage rather than prohibit collaborative student work, b) they are clearly and tightly aligned with the course- and module-level learning goals and resources, and c) they require rather than prohibit access to the course resources during assessment completion. Effective and efficient ways to nurture collaborative assignment-completion contexts and an outline of their major advantages will be presented in the next section. Tight resource alignment with a course's learning objectives may be accomplished through the following process, which introduces slight but important modifications to the backward design process described in the literature.[13]

After a clear list of interrelated general (course-level) and specific (module-level) learning goals has been determined, a systematic literature review process produces a short-list of relevant resources. The resources are examined in detail, leading to a slight modification and rearrangement of the learning goals list and a fine-tuning of the final resources to be used in the course. The precise portions of the resources addressing the final learning goals are identified, summarized into a set of statements that outline the concepts, ideas, and tools with which students should be familiar and comfortable by the end of each module, and converted into the module-level assignment questions.

Rather than being presented separately, lecture notes, readings, and other course-related materials are woven into the assessment activities as supporting materials,

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[13]See, for example, Wiggins and McTighe, "Understanding."

turning the course assignments into a one-stop-shop for everything course-related that the students should be addressing.[14]

The resulting tight alignment among learning goals, resources, and assessments, and the use of the minimum necessary resources to accomplish the desired goals avoid cognitively overloading students and help them focus on the desired resources to efficiently tackle the course's assignments. Assignment questions are open-ended, and responses require critical synthesis of information from multiple locations in the provided resources. Emphasis is consequently placed on how the answers are justified and supported through argumentation and reference to the course resources rather than on memorization and routine application of facts, creating contexts where students are encouraged to assume more responsibility for their learning.[15]

Designing assignments as sets of interrelated, focused questions that require access to all provided resources ensures that the students will familiarize themselves with the necessary materials and that the instructor will be able to clearly assess if the intended goals have been met.[16] In addition, all individual module assignments are designed to provide students with the knowledge and material necessary for the successful completion of a course's major final project. The module-level feedback incrementally sets the standard for the assessment of this project and is supplemented by detailed instructions and sample paper structures that clearly communicate the guidelines for project completion and grading. Each assignment is therefore designed and presented so that it

- consists of interrelated questions and sub-questions that distill everything the students are expected to get out of the module's resources;
- provides direct access to only those resources that are both necessary and sufficient for the assignments to be completed successfully;
- is an important building block for a large, end-of-course assignment that each student is expected to complete, helping students appreciate the relevance of each specific class module to the course-level goals; and
- supports development of student critical thinking skills.

Assignment example
(Aesthetics of the Motion Picture Soundtrack course, Module 6 of 8-Columbia College Chicago)

Module Focus
Films by the director/composer duo of A. Hitchcock and B. Herrmann (Previous modules have addressed the Classical Hollywood Cinema model, variations on this model, and Russian/Marxist contributions to the understanding of music's contribution to films.)

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[14]The course assignment resources may also be available in their entirety elsewhere, offering students a clear picture of the course's unfolding and the way each module fits into the course-wide learning goals. Such a bird's-eye-view of a course motivates students to muscle through their short term tasks, which may otherwise appear too tedious.

[15]Doyle, "Helping Students."

[16]The intended learning goals per module are statement versions of each module's assignment questions.

Assignment
1. Use examples from this module's films to illustrate how Herrmann's scores follow and challenge classical Hollywood film-music conventions. Do you find Herrmann's novel film scoring practices effective? Why or why not?
2. How do Herrmann's techniques relate to Eisenstein's and Eisler's ideas?
3. What do you think is Herrmann's most interesting scoring practice and why?

Resources
- Brown, R.S. (1982). "Herrmann, Hitchcock, and the music of the irrational." *Cinema Journal*, 21(2): 14-49.
- Kalinak, K. (1992). "The language of music: A brief analysis of Vertigo." In *Settling the Score: Music and the Classical Hollywood Film*. Wisconsin: The University of Wisconsin Press (pp.3-19).
- Brown, R.S. (1994). "Actions / Interactions: The source beyond the source." In *Overtones and Undertones*. Los Angeles: University of California Press [only pp. 82(top)-86(top)].
- Lecture Notes (critical discussion of the above readings & additional commentary by the instructor)
- Selected clips from *Vertigo* (1958), *North by Northwest* (1959), and *Psycho* (1960), relevant to the assignment questions.

Assessment Management

Assessing and providing detailed feedback to the number and type of assignments described so far presents faculty with serious challenges regarding effective and efficient use of their expertise and time. Furthermore, taking advantage of the benefits of peer review and instruction requires the creation of team-based learning[17] contexts and activities that support relevant and productive student interactions. For the most part, such contexts and activities are introduced in addition to a course's standard assessment tools. This creates more (busy)work for instructors and students and fails to accomplish the intended goal: supporting a serious discussion on the materials/assignments that would enhance learning. Usually, students complete such interaction activities by posting a minimum amount of required messages and message responses to an online discussion forum, contributing to discussions that are often tedious and take up a large amount of the instructor's and students' time with minimum return.

The solution proposed in this study argues for discussion-based and instructor-moderated group assignments, supported by a clear and simple set of discussion/collaboration instructions. Groups of a maximum of four students (along with the instructor) draft, edit, and submit each assignment online, via an appropriate discussion forum. The forum provides direct access to all necessary resources, with each assignment question constituting a separate discussion thread-set that includes one thread for drafting and

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[17]Michaelsen et al., "Team-Based Learning."

one for submission of the assignment responses. Students are permitted to modify and build on their posts, a feature that helps alleviate some of their fear of error and positively influences their learning and performance. The instructor follows and grades the entire process of assignment drafting, rather than simply the final submission, converting his/her traditional "judge-like" role to that of a coach. This motivates students to enter into useful lively debates about their assignments, working, in the process, on their argumentation, critical thinking, collaboration, reading/writing/editing, and timeliness skills. Such a setting both requires and facilitates monitored student-to-student and student-to-instructor interactions. It presents students with instructor-guided opportunities to clarify, deepen, and communicate their grasp of the materials and instructors with the information needed to grade each group member individually. The resulting assessment-driven collaborative context supports a useful mix of personalized, collaborative, and actively enhanced learning and helps assess learning outcomes in a more comprehensive, dynamic, individual, and fair manner. Both open-book completion of assignments and student collaboration are encouraged, putting more emphasis on understanding and application rather than simple memorization of the assigned materials, while avoiding easy cheating, a common assessment problem especially in online courses.

To summarize, in the described context, group members are able to:

- make their own, individual contributions to the assignment questions, while gauging their understanding of the material relative to that of the rest of the group members;
- comment on and edit the contributions of their fellow group members, and enter into meaningful, assignment-related discussion with their peers and the instructor;
- take advantage of instructor feedback during the assignment drafting process;
- improve their skills and confidence as writers, editors, debaters, and peer-reviewers, as they argue their points to come to a group consensus; and
- earn an individual grade that fairly reflects their contributions to the group assignments.

The proposed design has all the communication and critical-thinking-skills practice advantages of group work without the disadvantages of: (a) potentially unfair distribution of workload among group members, (b) potential internal allocation to only portions of the full assignment to each group member, resulting in an incomplete image of the course material to all members, and (c) an impersonal group grade that fails to address each student's individual participation, contribution, skills, and accomplishments, consequently failing to truly motivate any of the students. By being part of the drafting process, the instructor has the opportunity to provide feedback that students will pay attention to and which will make a difference in their understanding of the materials, argumentation skills, and overall performance. Such feedback can be personalized (answering a student's assignment-related posts) while avoiding duplication (the feedback is available to all students in the group). In addition to providing opportunities for in-

depth discussion on issues raised within the course materials, the recorded discussions end up constituting the students' personalized lecture notes.

In other words, discussion-based and instructor-monitored and assisted group assignments provide a single place where both faculty- and peer-led instruction transpires, personalized lecture notes are created, meaningful discussions and collaborations take place, assignments are completed, and learning occurs. On average, courses following the suggested format have resulted in two grade levels improvement, 10% reduction in instructor workload (quantified in terms of the time devoted to grading and entering feedback to assignments), and 30% improvement in student satisfaction, when compared to other versions of the same courses.

Conclusion

Assuming frequent and well-designed assessments, assessment completion contexts that are collaborative, monitored, interactive, and directly linked to each student's grade significantly improve student confidence levels, sense of responsibility, communication skills, initiative, engagement, and learning. Conducting the same courses multiple times in this and more traditional formats revealed that the proposed group setting motivates students to work harder on their assignments (wanting to impress their fellow students in addition to the instructor) and helps them to focus their arguments in order to respond to other students' challenges. Students are able to identify content, writing style, and argumentation errors in others that they may not always see in their own writing (it is arguably easier to edit than it is to write) and improve their group work by taking advantage of instructor feedback that, in more traditional contexts, would have been entered in the form of largely inconsequential corrections/comments to already graded assignments. Students producing high-quality initial contributions to their group are proud to guide others, while students producing lesser-quality initial contributions are ultimately proud to have contributed to an eventually high-quality group project. The quality of student work and the end-of-course student evaluations testify to the success of the interaction strategies employed.

The proposed "assessment-driven collaborative learning" design single-handedly accomplishes a) student motivation and engagement, b) meaningful instructor-to-student and student-to-student interactions, c) instructor- and peer-led learning, and d) formative and summative assessment, by wrapping a course around a single set of manageable, self-contained, resource-supported, and interrelated group assignments. Group assignment responses are drafted and submitted online, in instructor-moderated discussion forums. This setting maximizes a course's learning impact, results in individual rather than group grades, and utilizes most effectively and efficiently the instructor's expertise and time.

Bibliography

Chang, Shujen L. and Kathryn Ley. "A Learning Strategy to Compensate for Cognitive Overload in Online Learning: Learner Use of Printed Online Materials." *Journal of Interactive Online Learning* 5, no. 1 (2006): 104-17.

Clark, Ruth A. "The Importance of Instructor-Guided Revision in a Public Speaking Course." Paper presented at the 88th Annual Meeting of the National Communication Association, November 2002. http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1a/a9/65.pdf.

Crouch, Catherine H. and Eric Mazur. "Peer Instruction: Ten Years of Experience and Results." *American Journal of Physics* 69, no. 9 (2001): 970-77.

Doyle, Terrence. *Helping Students Learn in a Learner-Centered Environment: A Guide to Facilitating Learning in Higher Education*. Sterling, VA: Stylus Publishing, 2008.

Falchikov, Nancy. "Improving Learning through Critical Peer Feedback and Reflection." *Higher Education Research and Development* 19 (1996): 214-18.

Gilbert, Clark G., Steve Hunsaker, and Brian Schmidt. "Peer Instruction: Faculty as Architects of Peer Learning Environments." *Perspective* Autumn 2007: 98-115.

Grayson, Diane J. "Rethinking the Content of Physics Courses." *Physics Today* 59, no. 2 (2006): 31-36.

Hake, Richard R. "Interactive-Engagement Versus Traditional Methods: A Six-Thousand-Student Survey of Mechanics Test Data for Introductory Physics Courses." *American Journal of Physics* 66, no. 1 (1998): 64-74.

Harmon-Jones, Eddie and Judson Mills. *Cognitive Dissonance: Progress on a Pivotal Theory in Social Psychology*. Washington, DC: American Psychological Association, 1999.

Hess, Peter W. "Enhancing Leadership Skill Development by Creating Practice/Feedback Opportunities in the Classroom." *Journal of Management Education* 31, no. 2 (2007): 195-213.

Mazur, Eric. *Peer Instruction: A User's Manual*. Upper Saddle River, NJ: Prentice Hall, 1997.

Michaelsen, Larry, K., Arletta Bauman Knight, and L. Dee Fink (eds.). *Team-Based Learning: A Transformative Use of Small Groups in College Teaching*. Arlington, VA: Stylus Publishing, 2004.

Salomon, Gavriel, David N. Perkins, and Tamar Globerson. "Partners in Cognition: Extending Human Intelligence with Intelligent Technologies." *Educational Researcher* 20, no. 3 (1991): 2-9.

Wieman, Carl and Katherine Perkins. "Transforming Physics Education." *Physics Today* 58, no. 11 (2005): 36-41.

Wiggins, Grant and Jay McTighe. *Understanding by Design*. Alexandria, VA: ASCD, 1998.