

Restructuring Introductory Statistics Courses to
Free Class Time for Exploration and Deeper Understanding
BYU-Idaho
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Introduction BYU-Idaho is currently redesigning many courses to help reach more students at a lower cost to the student while still supporting a quality education. Our Introductory Statistics Development Team recently re-designed our multi-section beginning statistics course to help meet this university objective. The team also hoped the restructure would provide a quality course for new faculty and a more uniform experience for our students. The team unified outcomes, assessments, cadence and curriculum. Some teachers expressed concern about losing their individuality with so many uniformities; yet, many have now determined that the uniformity and structure actually allow them more freedom to teach, inspire and create a prosperous learning environment. Moving forward, the Introductory Statistics Improvement Team is now deciding how best to use data to make decisions about course improvement in the future.

Who are we? The core of the Introductory Statistics Development Team consisted of two professors and a curriculum designer. This core team met weekly over a year to research best teaching methods and to conduct preliminary studies on what was already working well in various introductory courses. They also meet regularly with an extended team comprised of introductory statistics teachers. As the core team made decisions, they sought constant feedback from the rest of the team. The principles of the BYU-Idaho Learning Model played a role in many design decisions.

The BYU-Idaho Learning Model invites students to actively take responsibility for their own learning and for teaching one another. BYU-Idaho's website describes the learning model as an approach based on three key steps: Prepare, Teach One Another, and Ponder and Prove. Students come to each class prepared to learn by studying assigned readings, completing required problems, and participating in online discussions and pre-class study groups. Through instructor-led discussions in class, students teach each other what they've learned--refining their own understanding in the process. Later, students internalize their learning through review, reflection, and application.

Why redesign the course?

The redesign hoped to provide patterns for continual learning and personal development long after graduation. To achieve this goal, the team studied and implemented many elements of the BYU-Idaho Learning Model. In an effort to promote consistency in grading, the team created uniform outcomes and assessments. In addition to closing the gap in grades between instructors, they also wanted the redesigned course to be easily accessible to both current and new faculty. Recognizing that many non-statisticians would teach the course, the team needed to create enough resources for them to gain confidence with the material and to enjoy autonomy in the class room. The course needed to allow time for in-depth class discussions and also give the students time to collaborate.

The university also directed the team to lessen the student expense and make the course scalable to meet the needs of future online students.

What did the redesign look like?

Traditionally, students met professors face to face three hours a week. The design team replaced one of these hours with two hours of small group sessions led by teaching assistants. In addition to the scheduling changes to incorporate the small groups, the team also created a free online textbook, scaffolded curriculum, instructional videos, end-of-lesson assessments and common exams. The content covered before class provided the foundational background necessary to engage in deeper discussions and analysis during face to face time with the professors.

The course was based on research strategies for maximizing learning gains. (Hattie, J. 2009)—namely, *spaced instruction* and *feedback*. The team implemented the spaced instruction by keeping the students actively involved in the course a little each day. A student studies two lessons a week, and all lessons follow the same pattern. First, students complete a reading and take guided notes. They then meet together in small groups, go over their notes and then together take a preparation group quiz. A highly-trained T.A. is present to provide feedback.

The next day, students attend class where the teacher can give feedback on the preparation and give guidance on group projects and other deeper learning activities. Here the faculty have the flexibility to choose how they want to spend class time. Following class, the students then take a homework quiz on their own. This pattern is repeated twice each week.

As for feedback, there are structured points of feedback in each lesson:

- Group feedback on the individually completed Guided Notes at the group meeting
- Teaching Assistant feedback on written problem sets
- Teacher feedback in lab on student preparation work and a weekly group quizzes
- Solution manual and recorded video feedback on the practice homework.
- Homework Quiz feedback available after the closing of each lesson

As the course began to unfold, the team found that, rather than feeling tied to the uniform structure, teachers experienced flexibility and room to grow. Since the new course requires students to meet in small groups to cover new material, teachers found that students were better prepared for classroom experiences. Because of this extensive preparation, faculty have greater flexibility in the classroom to try a variety of learning activities.

Using feedback and personal insight, faculty have a wide range of flexibility in their classroom activities, such as:

- 1) Summarizing the key points that were covered in the group meeting for a particular lesson to reinforce main ideas.
- 2) Reviewing problems or concepts that students struggled with during the group meeting.
- 3) Working in groups on a different set of problems based on the material in the lesson.
- 4) Using real-world applications during class.
- 5) Reviewing previously covered topics during the semester
- 6) Allowing students time to work on semester project and receiving instant feedback from their teacher

7) Guiding students in activities which foster deeper understanding of content

There is also flexibility that faculty can use outside of the classroom. For instance, with the group meeting structure, the amount of preparation students do before they come to class can be adjusted from section to section. For instance, they can instruct students to complete all of the preparation assignment before lab, or they may invite the groups to work on parts of the preparation together with their groups. Also, a teacher can decide if the students take the group quiz only once or take it a second time after they have received feedback.

Teachers also determine the amount of homework they want submitted. While all teachers require their students to take the homework quiz, some do not require their students to also turn in the practice homework assignment. Finally, teachers have the flexibility on how they use their teaching assistants. Teachers can direct their teaching assistants to conduct the group meetings in unique ways, grade student work, or individually tutor their students.

The cadence of the course and integration of group work were designed to emphasize spaced instruction and feedback. The team was curious to see if they accomplished their objectives from the students' perspective. We collected and analyzed data for three consecutive semesters through end-of-semester student surveys. The students consistently rated group preparation (4.26 out of 5) and TA feedback (4.07 out of 5) as the two aspects of the course that most contributed to their learning. Both of these aspects of the course emphasize frequent and immediate feedback as well as spaced learning.

Did the Redesign really provide a more quality experience for teachers and students by allowing more time for deeper discussions?

Another delightful and important outcome of this process has been the spirit of community—with both teachers and students. Because the student groups stay intact throughout the semester, strong group identity develops and friendships grow. When students participate in the highly structured group work, they synergistically create a learning environment where the gains are greater than those they would experience working alone. Restructuring group work has allowed students to act for themselves and accept responsibility for learning and teaching. The group structure also provides opportunities for students to strengthen and teach each other. In addition to the students, teachers have also learned to act for themselves and grow through collaboration and service. All of this has led to deeper discussion during class time.

Many professors doubted that collaboration among teachers could really help improve the course – especially when most professors were comfortable with the status quo. As the development team approached teachers to join in the collaboration process, some hesitated. One professor mentioned, “My students are doing fine, and I am comfortable with my curriculum for introductory statistics.” Comfort zones often serve as a major roadblock to collaboration.

Once the vision was established, many of the team members began to doubt that they actually had the resources to accomplish it. The vision states “Our team aims to develop a unified, high-quality, low-cost course which serves our students and is easily accessible to our face to face faculty as well as our online instructors.” Could the team really provide a high quality course for little or no cost? Did they have the resources for this? One teacher mentioned, “It might be nice to work with other teachers on this course, but I really don’t have time. Collaboration seems to take more time than just preparing material myself.”

One professor, post-design, mentioned, “I see that I have actually gained time to create and collaborate on more meaningful in-class lessons.” Once the course was developed, the team did not dissolve. Rather the core changed players and became the improvement team. Also, the larger group now breaks off into smaller polygons which meet regularly to share ideas, feedback and experiences. Online folders have been created within our learning management system to share our ideas. Thus, if teachers need some new ideas, there is a place to go and find inspiration.

The university collects course evaluation data from the students each semester. Our team analyzed the data which was collected before and after the course change. In particular, we looked at questions which covered the students’ perspective of the learning model in the course. Below you will see the statements which the students rated on a scale of 1-7 with seven being very strong agreement. The number behind the question represents the increase or decrease in the overall average of this rating.

- “I sought opportunities to share my learning with others outside of class” +0.28 points compared to traditional course.
- “I sought opportunities to reflect on what I had learned in the class” +0.12 points compared to traditional course.
- “I feel that I made important contribution of the learning and growth of fellow class mates” +.401 points compared to the traditional course.
- “I was an active participant in online or face-to-face class discussion” +.345 points compared to the traditional course.
- “The course provided the opportunities to learn from and teach other student” +.244 points compared to tradition course.

In addition to collecting students’ perspective about the course, we also sought feedback from teachers. This course design is very supportive of new and current teachers. One teacher on the development team is quoted below:

I loved teaching statistics, and I felt I was doing a good job in my introductory classes. I wrote my exams. My students took my exams, and I thought all was well. Then I was asked to serve on our development team to develop a quality course which could be used by many of our adjunct and first year teachers. I was flattered, thinking they must have recognized what a great course I had. However, now that I have taught our new course for a few semesters, I would never go back to my old course. I am inspired as I use class time to share deeper ideas with my students rather than computing a sample standard deviation from scratch. So much more fun!!”

Conclusion

The Learning Model Principles used in the course redesign have benefited the lives of our students as well as the faculty. By applying the principles, the team was able to overcome a number of course development and teaching challenges associated with balancing uniformity and complexity in a multi-section course. This course will always be a work in progress, but the current version comes close to realizing our original vision of “... develop a unified, high-quality, low-cost course which serves our students and is easily accessible to our face to face faculty as well as our online instructors.”

The course continues to improve. The improvement team is currently collecting data from exams, knowledge surveys and attitude surveys to better analyze learning and growth. They also are using focus

groups to understand the course from the students' perspectives. Rather than just making changes which "feel" right, this team is using data to drive decisions.

Some questions we are looking at in the near future are: What roles are the TA's playing in the success of this course? Do we need classroom space? Do some classes need different levels of resources than others? How do we challenge the bio-statistics students? How do we bring relevance to the classroom?

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. New York: Routledge.

Sousa, (2008). *How the Brain Learns Mathematics*. Thousand Oaks CA: Corwin Press

<http://www.byui.edu/about/our-mission>