Pearson

SPECIAL INTEREST ARTICLE

Planning Your Technology Implementation

Research demonstrates that technology-enhanced instruction can both increase student learning outcomes and lead to greater efficiencies in costs and other resources. As more instructors adopt educational technology, it is important that they understand how to implement the technology to achieve their desired goals.

It is important to note that knowing how to use technology is not the same as knowing how to teach with it.[1] Blended learning is about rethinking and redesigning the teaching and learning relationship. It is not enough to deliver old content in a new medium,[2] but rather, instructors must make technology implementation decisions that utilize the features of technology to address course needs and enhance learning and outcomes.

In a recent survey, many faculty report feeling that they could be more effective instructors if they were better skilled at integrating certain kinds of technologies into their courses.[3] To address that need, Pearson provides technology adopters with resources to guide technology use. This includes training and tools to help with implementation planning.

One resource developed by a group of long-term Mastering™ users is designed to help instructors make decisions about how to integrate technology into learning. Specifically, the process draws upon the theory of backward design, encouraging instructors to first look at their broader learning goals before adopting a technology or planning specific activities or assignments. The idea of backward design is that instructors cannot start planning how to teach until they know exactly what they want their students to learn. It is the same concept for technology—instructors cannot select or assign resources until they understand the role of technology in the course and how it can help accomplish teaching goals. Pearson has found that highly successful implementations share common elements, including instructors who:

- Identify issues and establish clear goals at the onset;
- Focus on creating active learning environments that integrate technology; and
- Commit to redesign as an ongoing process.

The three-phase (plan–implement–evaluate), ten-step planning process is described on page 4 and is designed to help instructors develop the most effective plan to implement technology and measure its impact on course outcomes, goals, and student achievement. Whether someone is new to technology or an experienced user, thoroughly understanding the importance of each phase and its related steps can help a user make informed usage decisions.

The planning phase may be the most time consuming. However, investing in understanding course issues, identifying goals, and putting a plan in place during the first phase of this process goes a long way toward better decision making in phase 2 when establishing how technology will be set up and used. In addition, it is important to evaluate technology use and course results on a regular basis and make adjustments as needed to keep up with changes in technology, students, and course objectives.

Each of the educator study summaries that follows demonstrate the implementation of a Pearson Mastering product as part of a course redesign. These are not exhaustive studies, and many other variables can affect student learning, such as motivation and study habits, which are difficult to measure. However, the summaries clearly demonstrate the importance of not only training on how to use technology, but also how having a well-thought-out plan to integrate technology can help enhance course results.

Modified Mastering Chemistry, Organic Chemistry, University of Cincinnati, OH

Allan Pinhas, Professor

Goals: Increase examination performance and address the issue of students who scored high on homework but low on examinations.

Implementation solution: Mastering best practices include assigning smaller, more frequent homework to engage students more often and to provide regular practice and interaction with course concepts. The instructor decided to split five Mastering assignments with ten questions into ten assignments with the same five problems spread across more frequent due dates. In addition, with Mastering, the instructor was able to assign the same type of open-ended problems students completed on examinations.

Research: Spaced practice leads to improved memory retention and such spacing effects are among the most robust in memory and cognition research. The research suggests that when knowledge is somewhat more difficult to retrieve from memory, as it is after a delay, the act of retrieval itself strengthens that memory, making it more likely to be successfully retrieved in the future. One implication of this is that giving students more opportunities to recall information, such as by spacing the same amount of content out over more homeworks, creates stronger memories.[4] Additionally, increasing the difficulty by making a problem require "recall" (i.e., fill-in-the-blank) rather than "recognition" (i.e., pick from multiple choices) improves long-term memory.[5]

Average exam scores

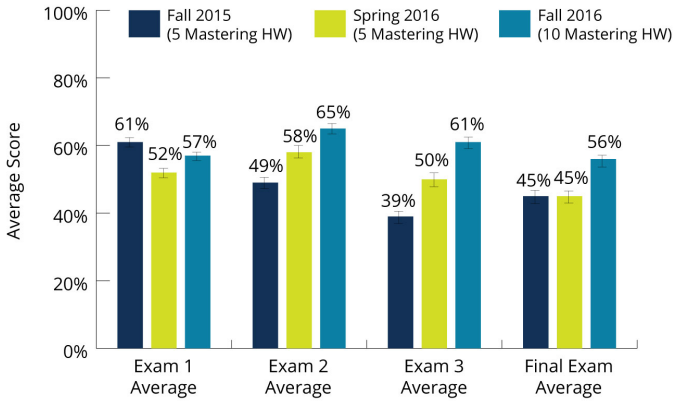

Figure 1. Average Examination Scores for Organic Chemistry, Fall 2016 (*n*=184); Spring 2016 (*n*=158); Fall 2015 (*n*= 142); Err Bars=Stand Err;<.05

Outcome: After changing Modified Mastering Chemistry homework to increase the number and frequency of assignments, final examination and semester examination averages were significantly higher than the prior reported semesters (figure 1). The percent of students earning above 90 percent on homework and below 50 percent on examinations decreased. However, this is an issue that the instructor plans to continue to address. Read the complete educator study online here.*

Mastering Engineering, Statics, Vanderbilt University, TN • Lori Troxel, Associate Professor

Comparison of exam scores

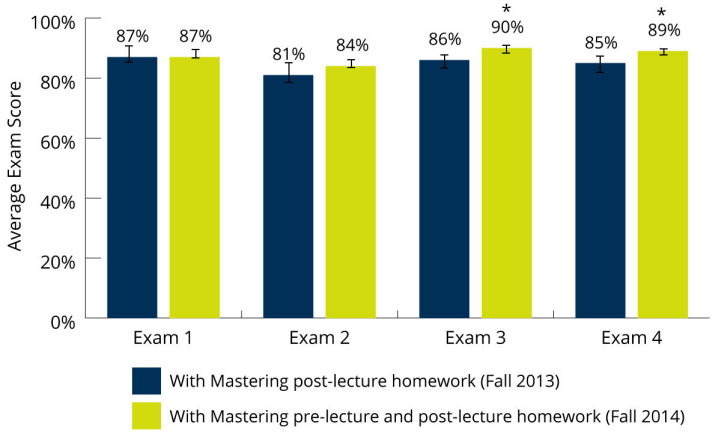

Figure 2. Average Exam Scores, Fall 2013 and Fall 2014 (*N*=138) Err Bars = Stand Err; *p<.05 (Note: In Fall 2014, pre-lecture assignments were added after exam 1.)

Goals: Minimize copying of homework answers; move toward a more active classroom with the goal of enhancing learning

Implementation solution: To enhance learning, the instructor decided to add Mastering tutorials as a pre-lecture learning activity, while continuing to assign post-lecture chapter problems. The goal of the pre-lecture assignments was to introduce concepts prior to class so class time could be used for problem-solving activities and helping students develop critical thinking skills, rather than lecturing on basic concepts. Post-lecture homework then allowed for additional practice and learning opportunities. Written solutions were required.

Research: A 2014 meta-analysis of 225 studies compared student performance in undergraduate STEM courses under traditional lecturing and under active learning. The authors concluded that the studies "document that active learning leads to increases in examination performance that would raise average grades by a half a letter and that failure rates under traditional lecturing increase by 55 percent over the rates observed under active learning."[6]

Outcome: Those students who took the redesigned course and were assigned Mastering Engineering pre-lecture tutorial homework tended to come to class more prepared for active learning and ended with significantly higher examination averages than students who were assigned only post-lecture homework. Students performed the same on examination 1 before pre-lecture homework, indicating that the two groups likely started at the same level early in the course (figure 2). Read the complete educator study online here.*

Mastering A&P, Anatomy and Physiology, University of Texas at Tyler, TX

Suzanne Pundt, Sr. Lecturer

Goals: Address unmotivated students and help those with poor study skills by adding required graded homework. Specifically, provide more opportunities for students to engage with the concepts, receive automatic feedback when working, and develop better study habits.

Implementation solution: The instructor adopted Mastering to try to reach unmotivated students, as well as help those who lacked good study skills. In particular, she expected that Mastering would help students with poor study skills by walking them through the material in an organized and engaging way, allow them to repeat the activities if needed, and provide access to additional interactive study material. For students who were not motivated, assigning required homework forced them to spend time engaging with the materials because they tended to do the assignments to earn the points. She implemented three different types of Mastering assignments to incorporate a variety of resources and personalized learning for students, which included chapter homework, personalized Adaptive Follow-Ups, and Dynamic Study Modules.

Success rates (ABC) with and without Mastering

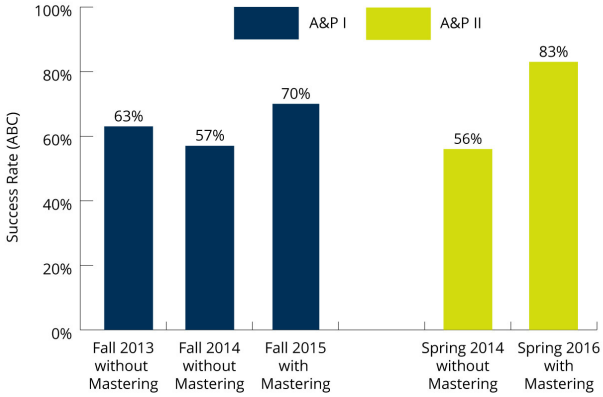

Figure 3. Success Rates with and without Mastering, A&P I: Fall 2013 (*n*=142); Fall 2014 (*n*=115); Fall 2015 (*n*=111); A&P II: Spring 2014 (*n*=166); Spring 2016 (*n*=118)

Research: A study published in the International Journal for the Scholarship of Teaching and Learning which looked at student attitudes toward online homework supports the importance of making homework required. The study found that, "...although most students felt that [online] homework was useful, most admit that they would not do it unless required."[7] In general, students struggle to understand which learning behaviors are likely to lead to better outcomes, particularly when they are novices in the domain.[8] In addition, the research identified for the following educator study from Broward College applies to this study as well.

Outcome: After implementing required Mastering A&P assignments, there was an increase in success rates (ABC) (figure 3) and examination averages in both A&P I and II. Read the complete educator study online here.*

Mastering Biology, General Biology, Broward College, FL • Thaddeus McRae, Assistant Professor

Final exam average based on number of Mastering Biology assignments skipped

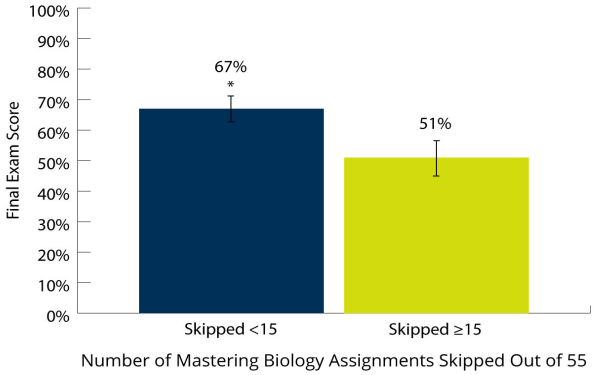

Figure 4. Fall 2015, Skipped <15 (*n*=17); Skipped 15 or more (*n*=12); Err Bars=Standard Err, * indicates $p<0.05$

Goals: Develop assignments that would provide students with diverse resources and activities, personalize students' learning experiences, provide more opportunities to engage with the content, and help students better track their progress.

Implementation solution: The instructor implemented three different types of Mastering Biology assignments for each chapter with staggered due dates. Dynamic Study Modules were due before lecture, while Mastering chapter homework and Adaptive Follow-Up assignments were due post-lecture.

Research: The use of different types of homework administered at different times in the learning process can help to engage students more frequently. For example, Moravec and colleagues (2010) found that, "including a wide variety of teaching strategies is helpful in keeping the diverse range of students that populate our introductory classes engaged throughout the quarter."[9] In this course, the pre-lecture assignments were intended to prepare students to participate in class; the chapter assignments were designed to help students develop a more in-depth understanding of the concepts through activities and tutorials; and the Adaptive Follow-Up assignments provided personalized learning opportunities for individual gaps in knowledge. Providing these numerous study and practice opportunities also helped enhance students' retention of material through spacing effects, as described in the Mastering Chemistry summary on page 2.

Outcome: Of the 55 total Mastering assignments, the mean number of assignments students skipped was 15 (27 percent). The results show that students who skipped fewer than the mean had significantly higher final exam scores than students who skipped more than the mean (figure 4). In an end-of-semester survey, students were asked what challenges they had using Mastering. One student responded, "Some challenges were that the work at times was hard, but if it was easy, I wouldn't learn. So it was a positive challenge." Read the complete educator study online here.*

The following ten steps to a successful technology implementation were developed by faculty who have successfully integrated Mastering into their courses. The phases and steps walk through the decision-making process to help each instructor determine the most effective way to implement technology in his or her own course. The 2016 Science and Engineering White Paper* includes helpful worksheets to facilitate the process and help plan a successful technology implementation.

Ten Steps to a Successful Technology Implementation

PLAN

1. Define the goals and outcomes you have for using Pearson technology in your classroom.
2. When choosing which features and assets to use, make sure they align with your goals, syllabus, and assessment plan.
3. Identify how you will measure your success.

IMPLEMENT

4. Take advantage of Pearson's professional development and training opportunities to improve learner outcomes.
5. Customize the course to best meet your goals and outcomes.
6. Use your "Getting Started" resources to set your students up for success.

EVALUATE

7. Monitor student performance throughout the term.
8. Improve student performance by using communication tools and other intervention methods.
9. Be open to making revisions during the term to improve the course's effectiveness.
10. Review data to measure success and plan course revisions.

Retrace your steps for another successful term if you're teaching this course again!

Citations

1. Mishra, Punya and Koehler, Matthew J., Technological pedagogical content knowledge: A framework for teacher knowledge.Teachers College Record, 108, June 2006, 1017–1054.

2. Garrison, D. Randy and Kanuka, H. Blended learning: Uncovering its transformative potential in higher education. Retrieved from www.anitacrawley.net/Resources/Articles/GarrisonKanuka2004.pdf

3. Dahlstrom, Eden. Educational Technology and Faculty Development in Higher Education. Research report. Louisville, CO: ECAR, June 2015. Retrieved from library.educause.edu/~/media/files/library/2015/6/ers1507-pdf.pdf

4. Pavlik, P. I., Jr., & Anderson, J. R. (2005). Practice and forgetting effects on vocabulary memory: An activation-based model of the spacing effect. Cognitive Science, 29: 559-586.

5. McDaniel, M.A., Wildmana, K., Anderson, J. (2012). Using quizzes to enhance summative-assessment performance in a web-based class: An experimental study. Journal of Applied Research in Memory and Cognition, 1: 18–26.

6. Freeman, Scott, et al. Active Learning Increases Student Performance in Science, Engineering, and Mathematics. Retrieved from www.pnas.org/content/111/23/8410

7. Doorn, David, Hanssen, S., O'Brien, M. Student Attitudes and Approaches to Online Homework. Retrieved from digitalcommons.georgiasouthern.edu/cgi/viewcontent.cgi?article=1205&context=ij-sotl

8. Zimmerman, Barry J. Becoming a Self-Regulated Learner: An Overview. Retrieved from mathedseminar.pbworks.com/w/file/fetch/94760840/Zimmerman%20-%202002%20-%20Becoming%20a%20Self-Regulated%20Learner%20An%20Overview.pdf

9. Moravec, Marin, Williams, A., Aguilar-Roca, N., O'Dowd, D., Wakimoto, B (monitoring editor.) Learn before Lecture: A Strategy That Improves Learning Outcomes in Large Introductory Biology Class. Retrieved from www.ncbi.nlm.nih.gov/pmc/articles/PMC2995765/

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For more information, contact Betsy Nixon, Customer Outcomes Analytics Manager at Betsy.Nixon@pearson.com
www.pearsonmylabandmastering.com