RIDING THE PERFECT STORM: DESIGNING AND DELIVERING CONTENT FOR TODAY'S LEARNERS

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Abstract

In a time that could be described as a *perfect storm* in higher education, faculty and administration have been exploring all possible tools to attract students and help them stay on a curriculum path so they can graduate within a reasonable time. This paper explores three strategies for riding the storm in the College of Applied Science and Technology of The University of Akron: increased choices in scheduling, redesigning the curriculum, and offering multiple options for mode of delivery. In addition, the pilot of these strategies in a Technical Data Analysis class will be described and evaluated.

Introduction

Declining numbers of traditional-age high school graduates, changing student demographics, and struggle with student retention and success are dominating problems that create what can be termed a *perfect storm* in higher education. Having a diverse ever-changing college population is challenging; it is crucial to understand what current and prospective students want and need to be able to do upon graduation in order to increase retention and encourage degree completion.

As Figure 1 shows, the first-year retention rate for bachelor degree-seeking full-time first-time (FTFT) students enrolled in Ohio varies from 62% to 93% (2010 cohort), while the six-year graduation rates for such students varies from 30% to 81% (2005 cohort). Columns representing The University of Akron, abbreviated "UA," are indicated in orange, with a first-year retention rate of 72% and a six-year graduation rate of 38% (data from U.S. Department of Education).

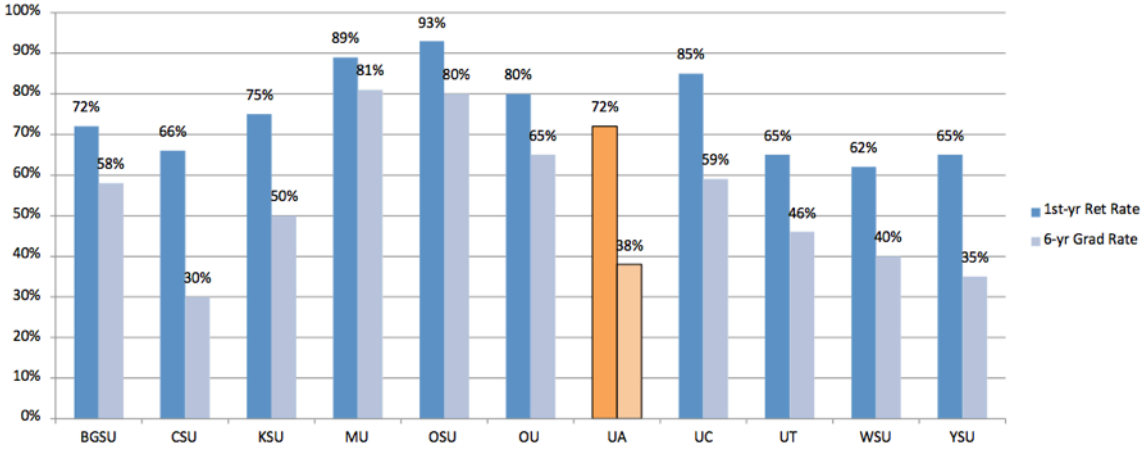

Figure 1. FTFT bachelor degree-seeking 1st -year retention rates and sixth-year graduation rates for Ohio universities.

According to Inside Higher Ed's survey of Chief Financial Officers (CFOs), "Retention is displacing recruitment of new students as institutions' top priority" (Lederman, 2013, para.10). Ninety two percent of the CFOs identified retention as the top revenue producing strategy, beating out increasing the endowment (62%), developing and expanding online programming (58%), and investing more in fundraising (53%) (para. 23). In Ohio, retention is particularly critical as state subsidies depend on successful completion of a course and rise with each year that a student remains enrolled; as a result, a senior generates more financial support than a freshman.

The *2015 Horizon Report* of the New Media Consortium notes, "All over the world, universities and colleges have been gradually rethinking how their organizations and infrastructures can be more agile" (Johnson et al., p. 7). While improving enrollment is a complex task that involves the entire university structure from top to bottom, student retention and course completion have their beginning at the bottom level, including individual programs, departments, and advising.

Many sources show that students are looking for time flexibility in course scheduling and structure and clarity in course content and its delivery. It is also important for students to see logical connectivity among courses while following program curricula and for curriculum designers to think far beyond traditional methods of teaching and learning. Therefore, faculty and administration have been exploring all possible tools to attract students and help them stay on a curriculum path so they can graduate within a reasonable time.

Three strategies have emerged as the most effective ways to make a difference:

1. Creating numerous scheduling choices for students to stay on a curriculum path
2. Redesigning the curriculum with logical connectivity among sequential courses (e.g., a Course contextualization/Linked Courses/Integrated model)
3. Developing a wide spectrum of delivery modes to accommodate learners' preferences and schedules

Such strategies can be easier to implement at a local rather than global level in terms of university administration. This presentation results from the collaboration of two individuals from the same university: a department chair who is also faculty and an instructional designer who is also an adjunct faculty. In the context of the overarching goal of creating a flexible schedule utilizing a variety of course delivery methods (including but not limited to online, hybrid, and accelerated sequels), we will document how we redesigned a traditional face-to-face class in a 300 level Technical Data Analysis for online or hybrid delivery while ensuring accessibility and the achievement of learning objectives.

The College of Applied Science and Technology at The University of Akron

The University of Akron is a public, state university in the state of Ohio with several branches, including the College of Applied Science and Technology (CAST), which is adjacent to the main campus. Originally designated a community and technical college offering associate's degrees, it has evolved to include bachelor's degree programs as well as certificates in departments of Engineering and Science Technology, Business and Information Technology, Public Service Technology, and Applied General and Technical Studies. It also houses two training centers: Fire/Hazardous Materials and Law Enforcement and Criminal Justice. CAST has long focused on preparing learners for technical vocations in fields with a high hiring demand.

CAST was an early leader in developing courses taught in alternative delivery formats. Such delivery methods include distance learning classrooms, which utilize point-to-point and multipoint videoconferencing originally, and online courses, which pre-dated a learning management system (LMS) and were originally offered via e-mail. Alternative delivery methods provide options for learners who may be balancing the demands of full-time work, family, and school.

Strategy 1: Scheduling Choices

UA faculty and administration have been trying all possible tools to attract students and keep them on curriculum paths with the hope that they will graduate within a reasonable time. It has become imperative to recognize and understand what current and future students want and develop innovative opportunities to increase student access to degree and certificate programs that are flexible in time and location. One approach is to create numerous scheduling options varied in time, sequential course arrangements, and delivery options. Understanding that students represent different levels of preparation and learning styles, the administrators of CAST's Department of Associate Studies diversified the course schedule in many directions to create accelerated sequences of different general education courses offering flexible pathways to graduation (Figure 2). This was the most efficient way to utilize students' time. For example, all degrees require at least two writing and two social science courses. As a result, during the traditional 16-week semester course sequences were offered in an alternative eight-week "fast and furious" format with both courses offered back-to-back in the same time slot and at the same place so that students would not experience changes in their schedule and habits in the middle of the semester.

Strategy 2: Redesigning the Curriculum

Today, a major goal of education is the ability to find suitable work at suitable pay upon graduation. Therefore, preparing students for the workforce is a major consideration in curriculum design, but it is not enough to ensure degree completion. Students need to be engaged and persistent in order to remain motivated and therefore succeed. According to Davis, "Most students respond

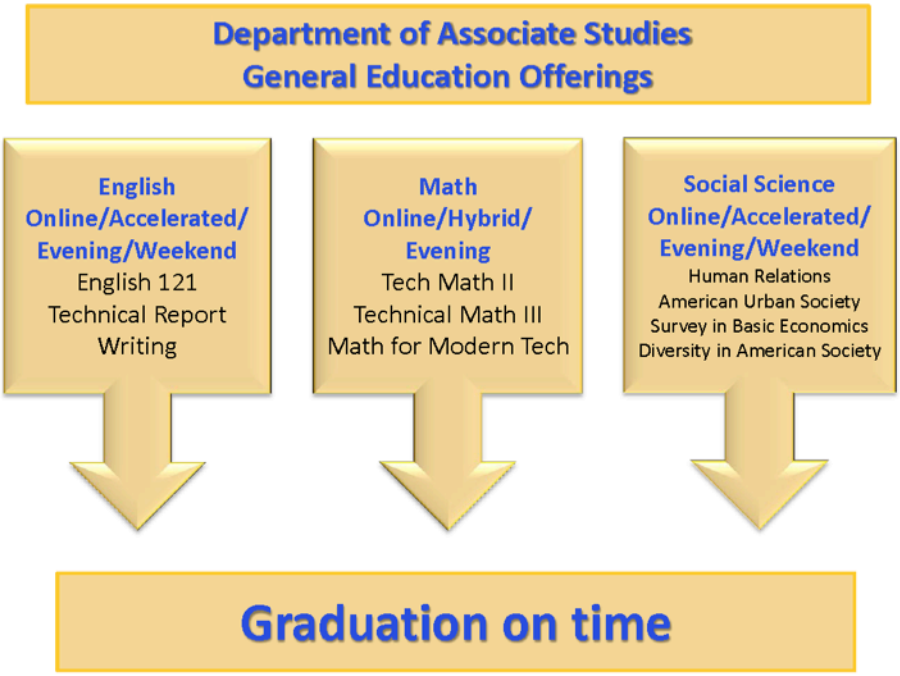

Figure 2. Flexible pathways to graduation.

positively to a well-organized course taught by an enthusiastic instructor who has a genuine interest in students and their learning" (2009, p. 31). However, enthusiasm and expertise are not enough; faculty must also be prepared to help students meet their needs. There are two factors that must be considered when designing curriculum: *what to teach* and *how to teach it*. We have applied these factors in redesigning the curriculum for the sequence Technical Mathematics I-IV as an example of motivating students through "what to teach," as depicted in Figure 3. The figure conveys the fact that the courses are discrete and sequenced as well as the fact that there is scaffolding in the content, as depicted visually in the overlap between the sets of courses from left to right.

We started with asking the following three questions, originally posed by Walvoord (2004, p. 94):

1. Are the learning objectives of the course being met? Are students being inspired and motivated to think analytically and creatively and develop habits of mind appropriate to the discipline?
2. Are the course material, concepts, and activities rigorous, current, relevant for students' needs, and consonant with the announced course description?
3. Do students perceive themselves to be well taught?

Changes have therefore been made at the department level with two directions in mind: (a) smooth connection between all courses in the sequence and (b) including repeated review blocks with material of increasing complexity in each course in order to maintain students' algebraic skills, which usually disappear very fast if not practiced. Thus, teaching goes in two directions: forward with new material and backward with spiral repetition. When courses are logically structured and have overlapping parts, students gain

knowledge and confidence that they have mastered skills and this develops their own self-motivation.

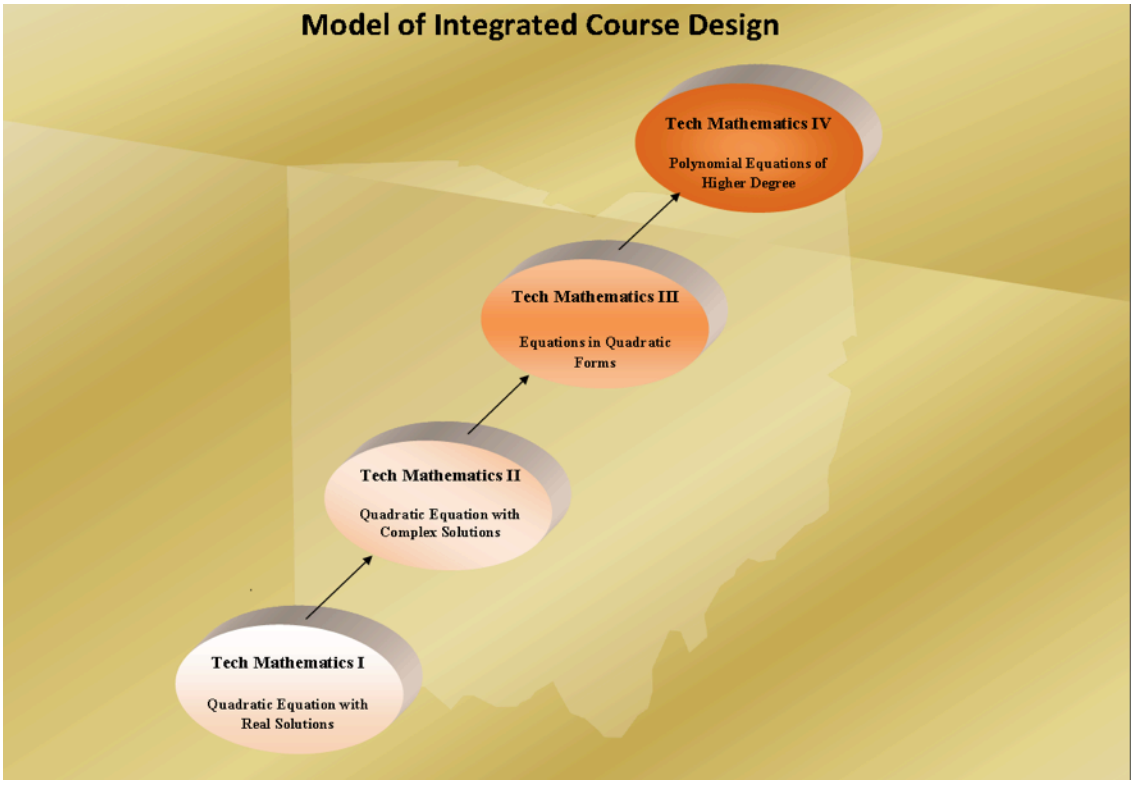

Figure 3. Redesigning the curriculum for the technical mathematics sequence.

Strategy 3: Developing a Wide Spectrum of Delivery Modes

A U.S. census report on enrollment and work status reveals that 19.7 million students were enrolled as undergraduates in 2011, and 72% worked, with 20% working full-time (Davis, 2012, p. 1). Students who are balancing studies with work as well as other aspects of their personal lives can benefit from having options in the selection of courses, especially when one of those options includes online delivery. The Open Education Database summarizes ten advantages to taking online classes (2012), including "Convenience and flexibility" (para. 6) and the opportunity to "Avoid commuting" (para. 10). Many universities have responded to the demand for convenience and flexibility by adding not only online courses but entire online programs; in fact, 69.1% of chief academic officers report that "online learning is critical to their long-term strategy" (Allen & Seaman, 2013, p. 4). While some institutions may envision new programs with entirely online delivery, it is probably more common to have existing face-to-face courses approved by the institution for online delivery, one course at a time.

Transitioning One Course to Online: Technical Data Analysis

In Summer 2014, Irina Chernikova was a member of the first cohort at The University of Akron to complete the two-week full-day workshop "Designing and Developing Your Online Course" offered by Design and Development Services (DDS) through the Institute for Teaching and Learning. This

workshop provided demonstrations of LMS tools by the staff of DDS, including Litsa Varonis, and opportunities for faculty to immediately apply new skills by practicing inside a development shell for one of their own courses. Relationships formed between faculty members and DDS staff during the workshop have typically generated continuing partnerships even when the workshop is over, and such was their relationship.

One challenge faced by Chernikova in converting a face-to-face course in Technical Data Analysis to online delivery was the design of the assessments. They are scaffolded to require increasingly complex responses from the learners, and in a paper-and-pencil version students are expected to work complex, multi-part problems and show their work in the space provided. This method allows awarding partial credit for answers that are only partially correct, but also involves time-consuming manual review of each submission.

There were a number of factors to consider in translating the original questions for online delivery:

1. The questions had to measure equivalent performance; in other words, it should be possible to determine if students had met the learning objectives for each unit no matter if they were tested traditionally or online.
2. It should be possible to provide both questions that could be automatically scored, and questions that could be manually scored.
3. The fact that students would not be able to share their work leading to an answer should not affect the outcome of the assessment.
4. Questions had to be accessible to all students, including those with disabilities that might affect the way in which they received information from an image or table.

As an example, consider this question from Quiz #3:

> 2) (8 pts) The heights (in inches) of 30 adult males are listed below.
>
> 70 72 71 70 69 73 69 68 70 71 67 71 70 74 69
>
> 68 71 71 71 72 69 71 68 67 73 74 70 71 69 68
>
> (a) Construct a frequency distribution table. **Show how you find the class width W**.
> Show all columns (Classes, Frequency, Midpoints, Relative Frequency, Cumulative Frequency). **Use 5 classes.**
> **Important suggestion**: round W up to **2** and start your first class from **66**
>
> (b) Construct a frequency histogram.

This question actually contains multiple sub-parts totaling 8 points, but how points will be awarded is not specified. In addition, it calls for students to explain how they will arrive at one of the responses.

Translating the problem into an online format involved breaking down the task into simpler units that would still allow students to demonstrate their

ability to solve the problem. Our mission was to create assignments and assessments that would allow us to verify the process students used to solve complex problems. Answering the questions would allow the students to prove, for example, that they had correctly constructed a frequency distribution table even if they were not required to share it.

In order to make the data available for each of the questions students would have to answer, a *section* was created in the LMS Question Library that would allow the heading and data set to be displayed until students were completely finished with the problem. The data table was recreated instead of being inserted as an image in order to assure that the data could be read by a screen reader. In addition, the problem was broken down to contain 8 separate questions with boxes for students to enter their responses for automatic grading. Students were advised that their answers would be graded automatically and that therefore providing the exact form requested was critical. It is also possible to manually override the automatic score if a misspelled word or extra space renders an answer incorrect.

> Frequency Distribution for Heights of Adult Males [section name]
>
> The heights (in inches) of 30 adult males are listed below.
>
> 0 2 1 0 9 3 9 8 0 1 7 1 0 4 9
>
> 8 1 1 1 2 9 1 8 7 3 4 0 1 9 8
>
> Construct a frequency table on paper and answer the following 8 (eight) questions. [Note: boxes are provided for students to write in their responses]
>
> Question 4 (1 point). What is the class width W rounded up?
> Question 5 (1 point). What is the low limit of the second class?
> Question 6 (1 point). What is the frequency of the third class?
> Question 7 (1 point). What is the midpoint of the fourth class? Do not round your result (example of the answer: 4.6)
> Question 8 (1 point). What is the upper limit of the fifth class?
> Question 9 (1 point). What is the relative frequency of the second class in percentage? (example of the answer: 22%).
> Question 10 (1 point). What is the cumulative frequency of the fifth class?
> Question 11 (1 point). What is the sum of all frequencies?

In designing the online version, we decided that it was not necessary to ask every question that had been presented on the pencil-and-paper exam. Instead, students could demonstrate their grasp of concepts and ability to solve problems by correctly answering some of the questions that could be asked about each data set.

Online quizzes with converted questions were first piloted in Spring 2015 with a face-to-face class in preparation for use with a fully online class in the future. Additional online features that were introduced to this class include homework sets and solutions as well as a *Coffee Talk* discussion forum for conversations about course concepts and general communication. In addition, a *Week 0* module was created with a structure identical to that of the other modules containing information and exercises students could practice with before the course began.

In the course of converting the quizzes, we engaged in many discussions about learning objectives, what students needed to demonstrate in order to meet those objectives, how to make images accessible to all students, and how such performance could be equitably assessed online in a manner that allowed for automatic scoring. Some questions became multiple choice; others, like the example above, allowed correct answers to specific questions to represent success in solving a complex problem as a whole. We experimented with "matching," "multiple answer," and "multiple choice" question formats. We also made sure that all images were alt tagged so crucial visual information was provided (e.g., describing a histogram as "positively skewed").

Evaluation of Pilot

Redesigning paper assessment documents such as homework and quizzes into an electronic format is a seriously challenging process at least in two ways: 1) it is necessary to adequately rewrite and organize questions for online delivery; and 2) it is important to carefully design how students can enter their answers. Confirmation of the quality of such transformation requires testing. That is why we offered students in a traditional face-to-face class to be our judges, to help prepare the assessments for the future totally online students. Feeling empowered, they agreed.

The process was the following: students first submitted a paper version of an assignment or quiz, which was graded. Then, they submitted the assignment or quiz online. At first glance, the results of the online quizzes appeared strikingly low. However, there were two reasons for this: first, some questions that ask for written answers require manual grading, and second, there were instances of students misunderstanding of a question or human error in the answer identified as correct for automatic scoring. After responding to the problems that required manual grading and correcting the errors, the results of the paper and online assessments were comparable.

We observed the adequacy of both paper and online quizzes and homework. Students at the same time were checking correctness and understandability of online assignments and offering helpful feedback. For example, they pointed out that some of the "matching" questions were difficult to answer in the original format, and therefore the format was modified so it would be more usable.

Conclusion

Our collaboration on this project began with the very concrete task of converting assessments for online delivery and grew to include theoretical discussions related to curriculum design as a whole. In the safe environment

of a face-to-face class, we introduced online course elements, including assessment tools, in order to test them and determine if they could help students achieve course learning objectives in an alternative way. The pilot proved the adequacy of online assessment tools even though the questions asked had to be modified, both to work within the LMS quiz tool and to allow for automatic grading of questions with clear "correct" answers. Additional resources were developed and utilized to enhance students' interaction with content, with the instructor, and with each other, considered a best practice for online course design by Quality Matters (2014). The students were engaged with the process and happy to offer their feedback.

Continued discussion led to the realization that our strategy aligned with two others already introduced in various departmental courses. All three strategies could be implemented together to help address the challenge of guiding students through a curriculum path to degree completion despite the barriers that are common among students enrolled at a public state university. Providing choices in scheduling courses (strategy 1), redesigning the curriculum to offer flexible pathways to graduation (strategy 2), and offering students options in delivery modes (strategy 3) increase the likelihood of student success, allowing us to find a way out of and therefore escape the "perfect storm" that higher education finds itself in today. Continued testing and implementation will give us the information we need to improve and perfect these strategies in order to increase retention and degree completion.

Acknowledgements

We are very grateful to the Spring 2015 students of Technical Data Analysis for engaging with, responding to, and providing feedback on the changes implemented in their course and to Orestes Varonis for his feedback on an earlier draft of this paper.

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