

Personalizing Quantitative Homework Assignments To Facilitate Student Learning

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Abstract

Electronic business tools, technology, and approaches have enabled organizations to reach new customers and markets more effectively and efficiently than ever before. A parallel process has occurred in the education industry. In many of these educational ventures, the desire to reach underserved populations is a primary motivation. In others, efficiencies and cost reductions are paramount. Still other e-learning and innovative teaching initiatives have been initiated by the sincere and direct desire to improve existing educational effectiveness.

The project described in this paper is focused on educational effectiveness of teaching operations management to college students. The idea is to have a student-friendly approach to developing customized homework problems where each student has the same problem type but unique values, answers, and decisions. In this way, we seek to encourage student interaction and discussion of the problems while minimizing the risk of cheating through rote copying.

1. Introduction

Electronic business tools, technology, and approaches have enabled organizations to reach new customers and markets more effectively and efficiently than ever before. Just a few short years ago, people interested in buying a book had to travel to their local bookstore to physically sift through inventory on the shelves. If the book they were looking for was not available, they were forced to settle for an alternative selection, place a special order and wait days or weeks for delivery, or leave empty handed. Booksellers, most notably Internet-based Amazon.com, have helped to revolutionize the customer purchase process by changing the very mechanisms with which the customers access and acquire books. Geographic limitations of customers have been eliminated while inventory searches are completed electronically in seconds where relevant results and independent evaluations readily available. Even the special order process has been reengineered. Customers of some Borders Books stores, for example, can have their hard to find texts custom printed, cut, and bound in minutes while they wait.

To most customers, the e-business phenomenon seems to have occurred at these very visible levels. In actuality, though, these front-end capabilities require sophisticated

back-office processes built around an electronic infrastructure predicated on integrated business systems. Reaching new customers, better serving existing customers to increase their purchase quantities and qualities, and lowering the costs of doing business are primary goals.

A parallel process has occurred in the education industry. Like business organizations, secondary and post-secondary educational institutions are finding new ways to attract and service students with greater efficiencies. The University of Phoenix is a leader in electronic learning, delivering dozens of degree programs to underserved populations primarily through Internet-based processes. More recently, on-line secondary schools have gained ground. In these high schools, virtually all curricula are delivered using electronic means where student and instructor may never actually meet face-to-face.

In many of these educational ventures, the desire to reach underserved populations is a primary motivation. In others, efficiencies and cost reductions are paramount. This is especially true in some government supported institutions where budget cuts have had a disproportionate impact. Still other e-learning and innovative teaching initiatives have been initiated by the sincere and direct desire to improve existing educational effectiveness.

The project described in this paper is focused on educational effectiveness of teaching operations management to college students. Most of these students are of traditional age and begin college directly out of high school with little professional business experience. Unlike graduate students and older individuals, who may have developed the discipline and motivation to thrive in a fully e-learning environment, these undergraduates often desire the structure and socialization that comes with a classroom setting. Distance and e-learning options are available to our students but remain a small fraction of course credit hours completed and are often utilized simply to access courses that are not offered at the time or location of the student's choosing. From a competitiveness position, though, these e-learning options will only improve and become more of a viable alternative for our student population. As instructors, our core competency must be to develop pedagogy to facilitate active learning and a community classroom.

The challenge for the instructor becomes not only how to pique student interest in this quantitatively-oriented operations management but to add genuine value to the

student's business education. At one point in time, a student grade in this course was based solely on multiple-choice exams. However, this did little to meet the needs of businesses who seek new graduates possessing computer skills that can be employed in solving problems and making decisions. As a result, spreadsheet-based homework assignments have become a more prominent component.

These assignments provide opportunity for integrated problem solving, model building, and decision making for this student population. Today, homework assignments account for up to 30 percent of our student's final grade. A student survey during the Spring 2003 semester indicates that more than 4 out of 5 operations management students viewed the homework assignments as being an important or very important component to their learning processes. Furthermore, voluntary student comments written on standardized university-level student evaluation of instruction (SEIs) are overwhelmingly positive with regards to homework. These clearly indicate that students perceive homework as a valuable addition to the course.

While these student perceptions are encouraging, as instructors we remain concerned about the loss of control that occurs with assignments completed outside of the classroom. Student interaction and dialogue on problem solving is indeed an important factor in the learning process but cheating via rote copying must not be dismissed out of hand. Indeed, published studies show that academic dishonesty is not a rare practice in undergraduate programs and student attitudes towards cheating is more accepting than it was years ago. Instructor concern with the impact rote copying of homework is especially relevant given that a gap exists between student performance on homework assignments and on corresponding in-class exam problems. Therefore, while student perception regarding the value of homework is encouraging, the efficacy of homework in student learning processes is less clear.

The goal of this project is to develop a means to develop and deliver quantitative homework problems that foster student interaction and collaborative learning while discouraging the rote copying of answers. Furthermore, the method must ensure student accessibility to the technology employed and to homework assignment delivery. In addition, instructor concerns must be addressed so that not only are effective assignments developed, but efficiency in grading facilitated. To achieve these goals, concepts of personalization and mass-customization from e-commerce and operations management were embraced.

2. Principles Used in Developing Homework Delivery System

2.1 Technology

Homework development and delivery is accomplished via a combination of Internet-based and microcomputer-based technologies. The homework generating programs are obtained by students by

downloading from the instructor's website ensuring easy access and distribution. This process is very well known to most students before they even enter the operations management course.

The homework problems are encoded using Microsoft Excel and Visual Basic for Applications (VBA), which comes standard with the Microsoft Office package. The VBA program is set to automatically launch upon opening of the Excel workbook, generates the homework files, and outputs the customized assignment in a Microsoft Word file. Students must then use Excel to solve the questions posed. Each assignment requires explanations of the decisions they made. This helps to meet the needs of future business employers who seek students with strong spreadsheet, analysis, and decision making skills.

2.2 Personalization

Personalization and mass-customization are two closely related concepts that require sophisticated back-office support mechanisms to make the user front-end appear seamlessly unique to each individual (Turban, 2002). Personalization in e-commerce is often achieved via cookie files which track and store pertinent user information so customized web pages can be rendered, tailored advertisements can be generated, and relevant related products and services or information can be displayed for consideration. Personalization can also encourage customer self-service as individuals who readily find pertinent information are willing to act upon it.

Personalization of homework problems is employed so that each student receives unique values in their assignment. Student self-service is utilized via dialogue boxes that automatically launch when the Excel file is opened. The dialogue boxes ask for the student name and the last four digits of their social security number. Error trapping routines ensure valid values are entered. The social security number entered becomes a seed to lookup one of (currently) 1000 problem variations in the database.

2.2 Mass Customization

Mass customization is an operations management process strategy that attempts to blend the efficiency of product-focused and repetitive-focused strategies with the flexibility of process-focused approaches. To achieve mass customization, organizations must excel at effective scheduling techniques, modular techniques, and rapid throughput techniques (Heizer and Render, 2003).

2.2.1 Scheduling Techniques

For organizations, effective scheduling techniques are a key because of the high variety of products made, the need to achieve high capacity utilization, and the desire to keep inventories low. In homework problems, variety is achieved by generating unique values for each student and is controlled using VBA and an instructor developed database. While current problem variety is arbitrarily set

to 1000 combinations in the database for testing purposes, utilizing random number generation routines will increase this to an essentially infinite number of combinations in the near future. A more difficult scheduling problem occurs in grading the assignments. Currently a manual grading approach is being implemented via VBA code. Scheduling in this sense occurs through logical layout of the grading key that is synchronized with the homework questions posed.

2.2.2 Modular Techniques

Modular techniques are often used in repetitive-focused processes such as assembly lines to achieve a specified balance of variety and volume. This concept often simplifies the scheduling concerns noted above. Modular techniques are also applicable in the mass customized homework assignments. Consider, for example, a forecasting problem where several forecasting techniques are applied. The homework combinations can be generated so that the decisions lead students to choose different forecasting methods as the best. As such, student interaction can be encouraged as individual analysis is required to make the correct decision in each setting.

2.2.3 Rapid Throughput Techniques

Rapid throughput techniques are a characteristic of most product focused process strategies such as making steel or paper. Very specialized equipment and facilities requiring significant capital outlays make large volumes of product with low differentiation. Customization is then achieved after manufacturing as finishing processes customize sizes and packaging. For homework problems, this issue speaks directly to the grading process. Automation of grading, where spreadsheet answers are evaluated via grading agents is foreseen. In this way, a single instructor could accommodate any number of students with little additional variable cost.

3. Conclusion

In this project, we have attempted to apply the e-business and operations management concepts of personalization and mass customization to student homework problems. The idea is to have a student-friendly approach to developing customized homework problems where each student has the same problem type but unique values, answers, and decisions. In this way, we seek to encourage student interaction and discussion of the problems while minimizing the risk of cheating through rote copying.

4. References

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5. Acknowledgement

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