

A COMPARISON OF STUDENT OUTCOMES FROM AN INTERNET-BASED INVENTORY SIMULATION

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ABSTRACT

The increasing globalization and global integration of national economies suggests the necessity of developing pedagogy that infuses global content throughout the business school curriculum. Business school graduates need experience and familiarity with other cultures to function effectively in today's global economy. Aside from actually travelling to other countries, other economical alternatives are needed to introduce students to other cultures. The Internet provides a reasonably priced medium for connecting students from around the world. This paper reports the preliminary results of an internet-based trial in which undergraduate business students from a state university in the USA competed in a retail inventory simulation against undergraduate industrial engineering students from Ireland. These results suggest that the technical issues associated with internet-based simulation are real, but can be worked out. Successful multi-cultural enrichment however, requires clearly defined objectives, and specific instructor training.

PROJECT HISTORY

During the 1998 Spring semester efforts were made to match students from Montana State University-Bozeman and from National University Ireland-Galway in a simulation competition. These efforts built upon an established student/faculty exchange relationship that had existed for approximately two years. Small numbers of student exchanges had taken place between the two universities on an on-going basis. These exchanges led to the possibility of an inter-campus inventory management simulation competition.

RETAIL INVENTORY MANAGEMENT SIMULATION USING JAVASCRIPT

This student project is designed to encourage comprehension of the tradeoffs associated with inventory management. Success in the simulation requires detailed understanding of these tradeoffs, thus encouraging deeper analysis, lateral thinking and discovery learning. Brightman [1] and Evans [2], as well as Raymond and Gross [3] suggest the importance of pedagogy that supports the development of these types of higher level thinking skills. At the time of the

cross-campus competition the internet-based inventory simulation had been piloted at MSU-Bozeman for two semesters.

Access to the simulation is obtained through any standard web browser, thus providing world-wide access dependent only upon internet access. The simulation is found at:

<http://www.montana.edu/cob/BUS331/MJFrame.htm>

(a Javascript compatible browser is required, Netscape 4.xx or MS Internet Explorer 4.xx are recommended). Simulation instructions are provided within the simulation itself with a brief introduction which states:

Instructions: As the retail manager at MJ Clothiers your ultimate goal is to maximize profits which you accomplish through ordering the appropriate stock in anticipation of demand, and setting prices at a level sufficient to earn an acceptable profit. In addition to general administrative overhead, other costs are incurred when you purchase stock (including incremental ordering costs), hold inventory, stock out and pay interest on flooring loans.

In every circumstance the student is placed in the role of the decision-maker. The scenario is simple enough that students quickly assimilate all needed information, but, the situation reflects the complexity and tradeoffs facing actual decision-makers. Experience with this simulation has shown that most students are not competent in dealing with these types of tradeoffs.

STUDENT LEARNING OUTCOMES

To gather preliminary information regarding the effectiveness of this approach, students in the Spring 1998 semester were asked to provide feedback regarding the strategies they had used, changes they would make next time, their success or failure, what they had learned, general comments and any suggestions. A summary of the student responses to the question, what did you learn by participating in this simulation, is provided below categorized by university:

National University of Ireland Galway Students

- That the virtual market to which we were selling was very price sensitive and the market would respond quickly to even small price changes.
- The relation with price and demand.
- Business is business.
- It's not that easy to manage demand and stock level. Well, we are gonna change our future job. Carlos's gonna be a cleaner. And me, a pastor!!
- The number of the demand should be in balance with the number of the items in the warehouse.
- The ability to manage stock and prices while continually monitoring what the customer truly wanted.
- How to calculate the breakeven amount, and that stock-outs cost a lot of money!!!
- Importance of customer satisfaction
- We must have good stock management, satisfy customers and cover costs.
- We learned of how to have sufficient inventory on hand while at the same time not overcrowding our warehouse.
- That you keep your order costs to minimum by ordering just enough to meet demand i.e. JIT philosophy.
- Time is very precious.
- That JIT is a good form of management
- It gave us an insight into how a business works and the various things that can happen if you do not look after your inventory properly.
- We learned the way such systems as JIT can operate successfully in a business. We also learned through our experience of the simulation the practical applications of JIT.
- We learned that we must use all information available to us to create an effective pricing strategy and to enable us to order sufficient amounts to satisfy the JIT process. It also increased our understanding of logistics.
- Just in Time was understood.
- The influences of retail and cost price fluctuations
- The value of J.I.T
- That for products of this nature the market is extremely sensitive to price. I also observed the effect that an effective ordering strategy can have on a firm's profitability.

Montana State University-Bozeman Students

- Ordering and pricing strategies
- having inventory on hand is costly
- It is hard to stay ahead.
- That ordering and pricing is more complex than we ever assumed. It is also very sensitive to even small changes.
- We learned that all costs need to be taken into consideration, not simply ordering costs
- Demand is most important

- Even though demand and operating costs may vary, it is important to keep a consistent method of pricing and ordering. This strategy makes it easier to see what I was accomplishing and if I needed to make any changes.
- How to work the program, and how to price for certain demands. We also learned to look at every little item to cut costs
- Even if we sell a lot, we still didn't make that much money.
- To pay closer attention to all costs.
- To earn a profit you need to carefully balance ordering and prices.
- That although we knew the unit prices changed for our weekly orders, we didn't need to adjust prices as frequently since the shoppers had no idea of the price increases or decreases.
- We learned that it is difficult to determine the optimum order quantity and sales price that will bring in the maximum profit. We also learned that we need to buy larger quantities when product costs are low so as to qualify for quantity discounts and prepare for demand increases. Along with this we need to price slightly higher during periods of high demand so as to take advantage of the customers' willingness to pay slightly higher prices.
- We learned more about the structuring of pricing in a retail environment, and how important it is to keep the customer happy.
- How holding and ordering costs affect the amount you should order, and eventually your overall profits.
- Inventory and stockouts are costly. Buying in volume helps.
- That trying to manage all these costs against one another is not easy.

These responses indicate that a number of key learning outcomes were achieved through student participation in the simulation. These outcomes suggest a deeper understanding when compared to rote memorization. Particular student learning outcomes included knowledge of:

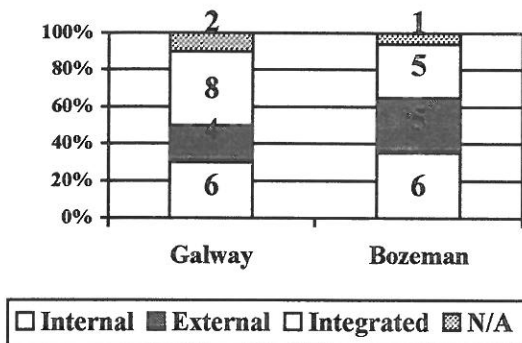
1. The integrated nature of pricing and stocking policies
2. Methods for taking advantage of quantity discounts.
3. The sensitivity of profits to minor policy changes
4. The difference between revenue maximization and profit maximization
5. The importance of matching orders to forecast demand
6. The sensitivity of demand to inventory stock outs
7. The practical application of EOQ

The responses given above can be categorized based on the internal vs. external focus of the insights gained. Some comments suggest an external focus on customers, markets, demand and pricing, while other comments suggest greater

insight regarding costs, inventory and JIT. Other student comments indicate an integrated comprehension of both the internal and external aspects of the simulation. The student comments are categorized in this regard and compared for the two universities below.

Analysis of National Differences and Similarities

A number of observations can be made regarding the results of the analysis shown in the figure below. First, it appears that a larger portion of the student groups from Galway were able to gain insights regarding the integrative nature of ordering and pricing decisions. A second observation is that a slightly larger portion of the Bozeman students was more focused on external factors. Since no efforts were made regarding experimental design, and no prior hypotheses were stated it would be inappropriate to come to any hasty conclusions based on such preliminary data. The authors plan further data collection and analyses in the future.



ADVANTAGES OF APPROACH

This project has demonstrated a number of advantages and disadvantages of the internet-based simulation approach summarized in the following sections.

Higher Level Cognition: The student is required to use some of the higher level cognitive styles from the Bloom taxonomy (see Brightman [1]). Rote memorization and/or parroting of learned skills aren't sufficient to accomplish the required task, so the student must attempt to structure, synthesize and integrate unstructured information.

Group Communication Skills: Students are also encouraged to practice group problem solving skills including communication and leadership.

Discovery Learning: A third advantage of the interactive web page is that learning becomes self-directed and self-

motivated. When students structure the problem in their own minds, develop solution strategies and then discover the solution to their problem they take ownership of the problem and the solution.

Worldwide Accessibility: Interactive web pages once created can be accessed and used by a wide educational audience. Faculty is free to utilize such resources, as they become available.

Upgradeability: The web page, as an electronic resource, is upgradeable on short notice. Unlike texts, which once printed must be distributed in the printed form, a web page can be updated as needed.

DISADVANTAGES OF APPROACH

Programming Requirements: Interactive web pages using Java and Javascript require technical sophistication to write the programs supporting the pages. Many faculty in colleges of business may not possess this programming ability.

Internet Access: Student access to the interactive web resource may be limited by their limited access to the worldwide-web. This is particularly true in parts of the world where communications infrastructure is lacking.

DISCUSSION AND CONCLUSIONS

Though the inventory simulation appears to be an effective teaching tool for reinforcing and encouraging deeper understanding of the concepts of inventory management, more work needs to be done to make the experience a "global" learning experience. Aside from the fact that the students realized they were in competition with students from across the Atlantic there were no real "global" learning outcomes achieved.

REFERENCES

- [1] Brightman, H.J. Toward Teaching Excellence in the Decision Sciences, *Decision Science*, 18(4), 1987, 646-662.
- [2] Evans, J.R. Creative Thinking and Innovative Education in the Decision Sciences, *Decision Science*, 17(2), 1986, 250-262.
- [3] Raymond, B.C. and Gross, J.R. Microcomputer Support of Educational Objectives in POM Education, *The Journal of Education for Business*, 68(1), September/October 1992, 49-54.