The Match Between Undergraduate Academic Instruction and Actual Field Practices in Production/Operations Management

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ABSTRACT. To compete in today's business world, a college graduate must be equipped with the skills to be applied in the business environment. This study explored undergraduate production/operations management (P/OM) students' preparation for management careers and the expectations of firms in the field. The results show that though only 65% of students are exposed to computer-based decision-making, 90% of the field operates in this environment. The study also surveys P/OM textbook and computer software use in the classroom.

In today's technology-based, highly competitive world, education is a prime factor in the success of new employees entering the workforce. A university degree has replaced the high school diploma as the training prerequisite or credential needed to apply for a high-paying job, and the cost of acquiring an undergraduate degree is escalating yearly. But are these classroom hours being used effectively? Are our students being prepared to function in the high-tech industries of today and tomorrow? How are undergraduates prepared to assume positions in production/operations management (P/OM)? In this article, we report the results of a study exploring the degree to which P/OM instruction in undergraduate classes matches P/OM skills needed in industry.

Classical or Applied Training?

Business schools in general have historically been seen as somewhat suspicious entities by the more traditional disciplines and have constantly attempted to demonstrate that they are, in fact, providing something more than a mere how-to-do-it program of study (Rhodes, 1992). Moreover, it is interesting that recent changes in the accreditation guidelines call for *more* time to be devoted to traditional (nonbusiness oriented) disciplines. Therefore, rather than focusing on the content of the P/OM courses, we investigated the medium within which the content is presented.

Specifically, the AACSB is responding to an emphasis upon "quality" that has its origins in the widespread adoption of total quality management (TQM) programs (Seymour, 1991; Cunningham & Sarayrah, 1994). In recent years, there have been calls to bring TQM to academia and make academics more accountable for the quality of their "product" (Higgins & Johnson, 1992). This shift, in turn, has led to an examination of students as both the customers and the end products of the educational system. The business community, the government, and society as a whole all have a vested interest in the products of our universities because tax support and private contributions pay the majority of the costs of a college education (Johnson, 1992). For the most part, the business community seems to be calling for graduates who have been trained broadly *to think and to communicate* (Subcommittee on Technology & Competitiveness, 1992). The result of this input has been a renewed emphasis on more classical training, which has led the AACSB to increase the classical (nonbusiness) component of the business degree.

In contrast, however, the business community has called for several skills reminiscent of the trade school. One of these is computer literacy and some hands-on familiarity with the commonly used computer applications (Luebbe & Finch, 1989). Students, in their role as customers of the education system, are reiterating this concern and pointing out that, in a tight job market, versatility with the computer typically represents the competitive advantage that can mean the difference between a top-paying job and a mediocre one. The competitive edge for students is not so much in what they have learned as in the ability to apply their knowledge within the current computer-oriented business environment.

The debate in academia often does not take the form of "classical training versus applied training," but rather one of "human memory skills versus machine technology." In the early 1970s, when the hand-held calculator revolutionized the process of performing mathematics in business, many academics fought the introduction of this "evil" tool into the college classroom because it would remove the requirement for students to "use their brains." In fact, the calculator facilitated students' use of higher order cerebral skills by performing the simple arithmetic for them. While a student equipped with pencil and paper could calculate the square root of a combination of inventory holding and ordering costs, in the same amount of time another student with a calculator could analyze an entire inventory policy. Students today may use the calculator to determine sales data trends or, in the same period of time, use a microcomputer to fit the data into many different forecasting models to choose the best method for forecasting demand.

Many professors still require students to memorize their course materials and then complete closed-book examinations. We could find no record of a business meeting in which the CEO said, "Please put all your books and notes under the table and take out a clean sheet of paper; we are going to make a business decision." The medium within which decisionmaking is applied is also important.

What Is the Current Situation?

A production/operations management (P/O) course and microcomputer literacy are basic curriculum requirements for a business degree at most universities in the United States. Though two courses are often required, little has been documented about the need for *computer-based P/OM training*. The problem-solving techniques taught in P/OM courses may be based in the traditional medium of hand-held calculators, paper, and pencils; or the solutions may be computer based. The traditional medium uses computationally simple problems and emphasizes the mathematical processes required. The computer-based medium provides a minimum of process knowledge and emphasizes the use of the computer model as a tool to solve more realistic problems. For the research reported in this article, undergraduate college professors and manufacturing companies located in the same region were surveyed to determine how well the instruction offered matched the skills required by employers.

Survey Results

The Production Field

One hundred manufacturing companies were selected at random from a commercial listing of businesses in the Gulf States area (Texas, Louisiana, Mississippi, Alabama, and Florida); operations officers in 59 of the companies responded to a telephone survey. The questions (listed in the appendix) asked if, and where, computers were used in the planning and control of operations. Of the responding companies, 89.8% said that they used computers in their daily operations. Their computer applications (programs) included both specially developed (in-house) and commercially available (off-the-shelf) software.

In examining the sample that reported using computers, we found the most popular uses were for cost accounting (96.2%), inventory control (94.2%), and production control (92.3%). The other uses reported were production planning (84.6%) and purchasing (80.8%) (Table 1).

The most often listed P/OM programs were inventory management (82.6%), electronic data interchange (EDI)/purchasing (78.3%), and materials requirements planning (MRP) (69.6%). Also, many operations officers said that they were soon coming "online" with their quality assurance programs (69.6%).

The P/OM Faculty

To determine how students are prepared for careers in operations management, 100 professors who teach production/operations management (P/OM) courses at the undergraduate level were randomly selected for telephone interviews. The 63 responding professors all teach at universities located in the Gulf States region (Texas to Florida), the same area as the business field sample. Each professor was asked if a P/OM (or management science) computer application was used as a part of his or her course instruction and, if so, which application was used. Information about their current

TABLE 1. Production/Operations Management Applications Used in the Professional Field

Application name	Computer users who use application (%)
Inventory Management	82.6
Electronic Data Interchange/Purchasing	78.3
Materials Requirements Planning	69.6
Quality Control/Assurance	69.6
Operations Scheduling	67.4
Forecasting	65.2
Production Lot Sizing	50.0
Work Measurement	50.0
Work Assignment/Scheduling	47.8
Decision Analysis	43.5
PERT/CPM	30.4
Assembly Line Balancing	26.1
Linear Programming	23.9
Simulation/Modeling	19.6
Facility Layout	19.6
Learning Curve Calculations	15.2
Aggregate Planning	13.0
Queuing Problems/Waiting Line	10.9
Other	10.9

textbooks was also collected, such as whether or not a P/OM software application was available with the text and why, if it was available, it was not used.

Our survey found that computer-based P/OM applications were not as popular among professors as among practitioners: Only 65% of the professors used software packages in their courses. The most popular application among the professors using computers was an automated spreadsheet (Lotus 123, EXCELL, or others), which was used by 22% of the group. The next-most-popular application was STORM (Emmons, Flowers, Khot, & Mathur, 1989), a stand-alone modeling package for decision support, used by 20% of the computer-based courses. The most popular educational application is actually two versions of the same software by Howard J. Weiss: PC-POM (Weiss, 1990) and AB-POM (Weiss, 1993), used by 17% of the courses. Computer Models for Operations Management (Hall, 1989), LINDO (Schrage, 1989), and Quant Systems for Business (Chang & Sullivan, 1989) each captured a 10% share of the applications market (Table 2).

By far the most popular textbook in our sample was *Production/Operations Management* by William J. Stevenson (1993), which presents decisionmaking techniques applicable to both the manufacturing and service industries. The book was adopted by 30% of the responding professors (Table 3).

Although no computer application is included in the Stevenson book, a software package has been developed to accompany it: Decision Support Systems for Production/Operations Management (Lotfi & Pegels, 1986). Only 32% of the professors who adopted the text used either of the suggested applications, and 53% of the adopters did not use P/OM software.

Three textbooks tied as the next most used by our survey respondents (each named by 8%): *Production and Operations Management* (Chase & Aquilano, 1992), *Operation Management* (Dilworth, 1992), and *Production and Operations Management* (Gaither, 1992). Although the publishers of the Chase and Aquilano text do not include a software application with the book, 100% of the professors using it said that they used a software package in their course (60% of these use STORM). Publishers of the Dilworth text will provide one of four different software packages inside the cover of their book, but only 40% of the professors who adopted that book used any software in the course. The Gaither textbook provides software that is specifically sequenced to the course; the software uses the text's notation, and sample problems in the text are designed to be solved with the use of a computer. Yet though 80% of the respondents who used the Gaither book also used a P/OM software package, none said that they were using the supplied application. We found that, in the majority of the cases where software was used in the course, it was with the text (56%). When we asked why software was not used when it was supplied with the textbook, the most frequent response was no response. The next-most-frequent response was that the software supplied was not "user friendly" (3%).

TABLE 2. Production/Operations Management Software Used by Respondents

Application name	Author	Users (%)
Spreadsheets (LOTUS, EXCELL, & others)		22
STORM	Emmons, Flowers, Khot, & Mathur	20
POM (AB-POM & PC-POM)	Weiss	17
Computer Models for Operations Management	Hall	10
LINDO	Schrage	10
Quant Systems for Business	Chang & Sullivan	10
O.M.I.S.	Attaran	7
Decision Support Systems of P/OM	Lotfi & Pegels	5
Microcomputer Software for Management Science	Render & Stair	5
Spreadsheet Operations Manager	Gardener	5
Adventures in Operations Management	Hawkes	2
Computer Models for Management Science	Erickson & Hall	2
The Management Scientist	Anderson, Sweeney, Williams & Joseph	2
P.O.M.S.	Gupta, Zanakis, & Mandakovic	2
Self-developed programs by the professors		2

Note. Percentages total to more than 100% because some professors used more than one software package.

TABLE 3. Textbooks Used by Respondents in P/OM Courses

Title	Author	Adopters (%)
Production/Operations Management	Stevenson	30
Production and Operations Management	Chase & Aquilano	8
Operations Management	Dilworth	8
Production and Operations Management	Gaither	8
Applied Production and Operations Management	Evans, Anderson, Sweeney, & Williams	6
No text. Just class notes		6
Production and Operations Management	Heizer & Render	5
The Management of Operations	Meredith	5
Title unknown	Coon & Russell	3
Applied Production and Operations Management	Evans	2
Title unknown	Vonderembse & White	2
Title unknown	Wilson & Keeting	2
Other text		10

Analysis and Conclusions

This research was designed as an exploratory survey, aimed at discovering whether P/OM students are being adequately prepared for careers in manufacturing. Our basic assumption, stemming from the debate over how business students should be educated, is that we in business colleges should link our teaching with the needs of the business community (Borenstein, 1992). Our central question was whether a manual- or computer-based medium was being used in the academic world and the professional field for decisionmaking during the forecasting, planning, monitoring, and control of operations.

Our results suggest reason for concern. Specifically, we see relatively little academic emphasis on using computers to solve business problems in the classroom, juxtaposed with a heavy reliance on computer-based analysis and decision support in the business environment. Therefore, we conclude that a substantial portion of the undergraduate students in the Gulf States region are not receiving instruction in the decisionmaking medium they will need for a career in manufacturing.

In gathering P/OM software packages for this analysis, we found a number of applications that contain many, if not all, of the decisionmaking techniques used by the professional field. (Refer to Table 3 for the specifics.) Why is the classroom usage so low? A considerable number of software application criticisms indicated that the packages were not "user friendly."

Though the term "user friendly" is often directed to users with computer experience, many of the packages we examined appeared friendly even to a novice computer user and easily understandable to a graduate of a computer literacy course. We concluded from this examination that professors are not using P/OM compute software because they do not realize the extent to which these applications are used in the field, or because they themselves do not have the minimal computer skills required to teach the computer-based programs we examined, or because they lack the motivation to upgrade their classrooms to the computer environment. Whatever the reasons, perhaps this study will spur discussion of, and further research on, the need to have students train in the same medium that they will be expected to work in.

A number of anecdotal comments received during this study led us to believe that many faculty members are concerned that students trained in a heavily computer-based environment will attempt to use the computer only as they have been "programmed" to use it, and will lack understanding of the underlying principles needed to apply their knowledge to new situations. These were the same concerns expressed by undergraduate accounting teachers in the 1970s who said, "If you use a calculator now, you won't be able to solve complicated problems by hand when you need to." Have you used a table of logarithms lately? Students should be prepared to think critically and to communicate. In today's environment, that means they should be able to use the computer as a tool to facilitate, not replace, human decisionmaking.

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