

Educational Autonomation: Creating Case Study Challenges for Large Enrollment Classes

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The reality of a very large class often precludes the explicit assignment and assessment of case studies, due to factors such as the unusual number of assignments requiring guidance and grading, or barriers to facilitating in-class discussion with such a group. Compounding these constraints is the likelihood that the larger the cohort of students, the wider the range in academic strength and the greater the diversity of learning styles among the members. As a result, talented students often go unchallenged by a diet consisting solely of deterministic exam problems, while other students' knowledge may be understated by the assessment procedures. Further, students may experience a lessening sense of community within the very large class, potentially eroding their interest level and commitment to ethical behavior.

The word *autonomation* originates in manufacturing, describing a partially automated process or, "automation with a human touch." The phrase *educational autonomation* has been coined here to describe the deliberate partial automation of an educational process traditionally associated with an intractable instructor workload in the context of a very large class. Specifically, that process is case analysis: *Native Sun* and *Fine Wine Rack* are two examples of semi-automated case study activities, or "auto-cases," developed specifically to enhance the instruction of undergraduate operations management in a large enrollment environment. Both the example cases have been used by over 2,500 students to date.

When I joined the faculty of the University at Buffalo in 1994, I began teaching operations management to

large sections of undergraduates. During the next three years, I taught in this context five times to groups exceeding 100 students. Traditionally, course delivery had consisted largely of lecture, while assessment consisted of exams and small "homework" assignments on problems similar in style to those available in the textbook. Student opinion of the course was favorable and exceeded that of the average UB School of Management class on almost all dimensions but one: student opinion of the assignments. Essentially, students liked the course, but hated the homework assignments. This deficit might be argued "normal" in that the size of these particular classes constrained the nature of the assignments that could be reasonably implemented, yet the school-wide benchmark averaged in feedback from numerous smaller classes with much broader opportunity sets. Nonetheless, I was determined to find a remedy to the apparent weakest feature of my class, and *Native Sun* and *Fine Wine Rack* emerged from a multi-year project to address this deficit. More important than the particulars of these two undergraduate case assignments is the general concept and potential of the auto-case itself, which I'll describe in the next section.

The Auto-Case Model: Necessity as the Mother of Invention

To develop an auto-case, one needs to first identify an authentic problem that demonstrates concepts covered in lecture, yet this problem's resolution requires creativity beyond the analytic techniques established in class. For example, *Native Sun* requires the scheduling of 73 work segments associated

with filming a motion picture. The case problem is introduced during in-class discussion of quintessential project management, as it provides examples of tasks, precedence relationships, timing-related costs, and conflicting objectives. *Native Sun* defies subsequent PERT/CPM analysis, however, due to the high degree of shared resources represented by actors and settings. *Fine Wine Rack* requires the determination of four employees' activities during an upcoming work week at an existing business. Strongly related to inventory management and material requirements planning (MRP), the case provides authentic bills of material and assemble-to-order product structures, and relies heavily on comprehension of inventory logic and inventory positions. However, despite the apparent applicability of the textbook chapter on MRP, students soon find that a week's work plan cannot be calculated through construction of typical MRP records, due to MRP's notorious blind spot concerning capacity constraints.

In summary, the "story" upon which an auto-case can be founded could also be described as a good "end-of-chapter" case. However, auto-case studies must also meet a second, more confining requirement: any answer to the creative challenge can be summarized in a standard numerical format. For example, all decisions involved in the preparation and moving of personnel and equipment across two continents to successfully film *Native Sun* can be summarized as 73 pairs of numbers: the first number is a work segment number, and the second number is the day on which the student chose to start that work segment. Here begins the automation, or partial automation, of the case study process. This standard numerical format is prepared as a text file which then serves as an input file read by a computer simulation coded in C++, which rapidly assesses both the merits and the errors associated with the proposed solution. The simulation program then writes a report providing this information on the individual's submission, as well as updates class-

wide batch files used for "community data" reports and anti-cheating provisions, discussed in the next section.

In the spirit of automation, the auto-case model both begins and ends with manual processes. Just as *Native Sun* and *Fine Wine Rack* enrich my lecture material and challenge students in a conventional fashion, their de-briefing and final grading is largely conventional and manual as well. But the automated element, the mechanized core that allows the repeated processing of hundreds of attempts over the course of several days, results in a series of services such that a single instructor would not otherwise be able to provide a class in this context.

The Evolving Services of the Auto-Case

In 1997, I did not picture the utility of *Native Sun* and *Fine Wine Rack* as more than the reintroduction of case studies into my undergraduate operations management class. Undergraduates, in particular, are often unfamiliar with the ambiguity of realistic problems, and these assignments represent an important break from "cook book" methodology. Both *Native Sun* and *Fine Wine Rack* are highly related to certain chapters in the students' text, yet neither can be explicitly "solved" by the techniques described within those chapters. Both case assignments were first put into service in 1998, replacing the maligned homework assignments, and student opinion of class assignments strengthened significantly by the end of the inaugural semester. However, the innovation central to *Native Sun* and *Fine Wine Rack*, the partial automation of assessment, gave rise to several opportunities that I did not fully anticipate in 1998. Principal among these derivative services are previewing, competency-based grading, anti-cheating provisions, "community data" reports, and class-wide competitions.

Previewing had theoretically always been a side-benefit of *Native Sun* and *Fine Wine Rack*. Beginning in 1998, I announced to each class that anyone

who brought their solution to me on diskette during office hours could have a "free" report generated before the submission deadline, providing an important check for any mistakes the student may have made. A distinct minority of students took advantage of the service. In 2000, I offered to run and return preview reports if the input file were e-mailed to me as an attachment. Previewing fairly exploded in volume that year. Today, students e-mail their input files to a preview e-mail address during the two weeks prior to the project's due date. Either I or a teaching assistant runs the simulator and replies to each preview e-mail with an attached output report. A recent cohort of 378 students (many working in groups of two) submitted 597 previews in the two weeks before the *Native Sun* deadline, with an average of 2.66 previews per final submission.

Once e-mail technology transformed previewing, I realized that both assignments would serve the class better as competency-based challenges. Competency-based grading allows a student to repeat an assessment as often as required to meet a pre-determined standard, at which point the assessment is treated as completed for full credit. Competency-based grading provides important feedback on the abilities of students whose assessment may go understated by timed exam scores alone, due to issues such as test anxiety. Unfortunately, competency-based grading implies the repeated evaluation of assignments, and thus is not usually an attractive option to an instructor when student head-count is extremely high. The previewing of auto-case solutions, however, supports this type of assessment, and thus students are now issued a benchmark before they begin work on either *Native Sun* or *Fine Wine Rack*, and are informed that if they can craft a resolution that meets the benchmark, they are assured full credit. If they submit a preview that successfully meets that benchmark, their output report begins with a message of congratulations, instructing them to send the same file for final submission. Typically,

	Pre-Auto-Case Period 1994-1997	Entire Auto-Case Period 1998-2004	Most Recent Semester Spring 2004	School-Wide Mean Scores
Number of Class Sections	5	7	1	
Total Enrollment	589	1,585	378	
Number of Respondents	208	874	151	
“Rate the usefulness of the outside assignments in helping you to learn.”	3.32	3.81	4.28	3.62
“Assignments were...” 5=useful ... 1=useless	3.85	4.16	4.16	3.99
“Your overall rating of this instructor’s teaching effectiveness...”	4.13	4.21	4.53	3.64
“What is your overall rating of this course?”	3.77	3.98	3.98	3.54

Table 1: UB School of Management course and teacher survey (CATS) data.

60-70 percent of submissions will achieve full credit by final submission, allowing me to concentrate on grading the balance of the class for varying degrees of partial credit.

One drawback to a large enrollment class is the reality that students may feel anonymous, doubting that their personal behavior is monitored very closely in such a crowd, and thus are more tempted to simply copy someone else’s work. By 2001, I developed anti-cheating provisions to use with *Native Sun* and *Fine Wine Rack*, designing against within-semester and between-semester copies. Within-semester copies are created by non-participants obtaining another’s work and submitting that file as their own. These students are gambling that the exact match will be missed in the review of hundreds of submissions. However, the simulation program that accompanies each case now records a unique numerical “fingerprint” of each submission by compiling certain key values into a separate batch file. These fingerprints are then sorted, making matches and near matches readily apparent. A between-semester copy is obtained by a non-participating student from another student who had completed the same case assignment in a previous semester. However, both case studies require a key set of input data, such as the lengths of the individual filming tasks needed to schedule production of the movie *Na-*

tive Sun. Each semester this data set is changed, touching off a string of tell-tale error messages if a previous semester’s input file is run with the current semester data set. Publicizing these capabilities in advance of the assignment minimizes such temptations.

When running previews and final submissions, descriptive data from each solution are also compiled into common “community data” files, which can then be analyzed and posted for discussion in the class. Students can access such files through the class Web site, and see where their particular answer “fits in” among the community of solutions created by the class. This collection of community data also makes possible the class-wide competitions associated with both projects. In a large group, a few students with outstanding academic abilities can grow bored with a pace designed to challenge average class ability. Creation of class-wide competitions with highly public updates encourages outstanding students to apply themselves beyond what is required to simply gain full credit on an assignment. These competitions apparently appeal to some students in particular. During the previewing period, it is not uncommon to witness certain students investing many times more effort than required to simply obtain full-credit, due to their desire to place in the final rankings displayed on the course homepage.

Evidence of Success

Table 1 summarizes the course survey data that illustrates both the motivation for and the success of these two auto-cases. Structurally, the course in question remained fairly constant throughout the 10-year time period of 1994-2004. Lecture content was naturally updated each year, but the subject, instructor, issue of section size, exam formats, campus and even textbook (excepting editions) remained consistent in the four-year pre-auto-case period and the six-year subsequent period. Student perception of the course assignments in this large enrollment setting now rests comfortably above the mean, particularly in recent semesters. (I credit that trend to improvements in the previewing process.) Interestingly, student’s perception of the instructor’s effectiveness remains largely unchanged, but introduction and refinement of *Native Sun* and *Fine Wine Rack* are also associated with a distinct overall strengthening of student perception of the course.

One important difference within the summarized period of 1998-2004 is a distinct growth in section size starting in 2003, due to the introduction of video-streaming as an alternate distribution channel for the course. Prior to 2003, section sizes ran from 105 to 163 students. Section sizes for the last three academic semesters included in Table 1

were 375, 267, and 378 students, respectively. At this level of enrollment, ironically, processing even the traditional homework assignments of 1994-1997 would represent a daunting amount of work even with assistance. Likewise, community building efforts such as class-wide competitions and comparative data grows even more relevant, as many students are now not in actual attendance of the class at its stated time, and may never witness any fellow students outside of exams.

Most important, the auto-case model is readily transferable to any instance in which a relevant learning problem can be identified such that subsequent decisions on the student's part can be summarized as a standard file for processing and compilation by a central automated element. The paradigm of automation, combined with the recent, rapid advance of Internet-based technologies, challenges us to rethink the meaningful learning experiences and the forms of assess-

ment that we might practically provide any single cohort of several hundred students. Just as I have plans to develop additional auto-cases to support the exploration of operations management, I think it likely that there exists opportunities for the development of similar assignments to enrich many other courses often taught in the context of very large classes. ■

BOARD OF DIRECTORS REPORT

President Thomas E. Callarman (Arizona State University) chaired the Board of Directors meeting that was held on Saturday, April 23, 2005, in Atlanta, Georgia. The following is a report of the actions taken by the Board and matters brought to its attention. The Executive Committee also met on Friday, April 22, 2005. Its recommendations to the Board are included in the items reported below.

1. The minutes of the January 15, 2005, Board of Directors meeting were approved, with one change.
2. The financial statement for the period ended March 31, 2005, was reviewed and accepted.
3. The proposed standstill budget for FY 2005-06 was approved in addition to the following alternative items, which become part of the approved standstill budget:
 - An expense item for a salary increase for the Home Office staff.
 - An expense for the extension of the current full-time salary for the second-half of FY 2005-06 for the Information Technology Systems Manager and WebMaster.
 - An expense item for an additional cash bar to be held Sunday night during the 2005 Annual Meeting in San Francisco.
 - An expense item for a Wine and Cheese Reception for the Doctoral Students on Friday night in the President's Suite.
 - Elimination of the expenses associated with providing lemonade and cookies to the Doctoral Students at the Friday get together.
 - Elimination of expenses associated with providing 50 drink tickets to Doctoral Student Consortium student participants.

- Elimination of printing, postage, and tabulation charges for election ballots.
 - Elimination of printing and postage charges for publicity flyers.
 - Elimination of printing and postage charges for the Placement System instructions.
4. The policy statement that provides one drink ticket to all student Annual Meeting attendees for the Welcome Reception immediately following the Beta Gamma Sigma sponsored Social Event for the Doctoral Student Consortium was eliminated.
 5. The Institute's 2005-06 Marketing Plan and Marketing Director's Report were reviewed and accepted.
 6. The Institute's Strategic Plan with Goals and Subgoals for 2005-06 was approved.
 7. Objectives for the Board of Directors, and proposed committee (and other) charges for 2005-06 were approved.
 8. Committee membership appointments for 2005-06 were approved.
 9. The appointment of a new Job Placement Coordinator was made.
 10. The recommendation for the appointment of the Program Chair for the 2007 Annual Meeting was accepted.
 11. The proposed 2005 Fellow nominations were reviewed and approved.
 12. The recommendation for the reappointment of the Professional Development Programs Director was accepted.
 13. Changes to the Northeast Region's Bylaws were reviewed and approved.
 14. Changes to the Institute's Bylaw 5, Section 1(b) were reviewed and approved.
 15. A change to the policy regarding promoting the Institute in the programs of the

Doctoral Student Consortium and the New Faculty Development Consortium was reviewed and approved.

16. A \$40 discounted membership fee offered in conjunction with regional conference registrations was reviewed and accepted.
17. The following reports were presented, reviewed, and accepted:
 - Report on the 2005 SAP Innovation Congress
 - Statement of the accomplishments of the 2004-05 Board of Directors
 - Results of the 2005 election of officers
 - Schedules of the 2006 Executive Committee and Board of Directors meetings
 - Results of the election of a Vice President to serve on the Executive and Strategic Planning Committees
 - Reports on the 2005 Southwest and Western regional meetings
 - Annual report from Blackwell Publishing on the *Decision Sciences* Journal and the *Decision Sciences Journal of Innovative Education*
 - Slate of nominees for the 2006 election of officers
 - Report on submission statistics for the 2005 Annual Meeting in San Francisco
 - Report on the 2006 Annual Meeting
 - State of the Southwest Region's report
 - Report on the number of DSC students who retained membership in DSI
 - State of the Northeast Region's report ■