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Course Integration: What Impact on Student Grades?

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I. INTRODUCTION

The College of Business Administration (CBA) implemented an experiment in the spring of 2001 to build an integrated view of how a firm functions. The experiment required that three core courses (i.e. finance, management information systems and production management) be offered in a block format using Enterprise Resource Planning (ERP) software as one of the integrating devices. This paper presents the curricular design used to integrate the content of the three courses and analyses how the block format may have affected student grades.

Three questions were considered in the analysis of the impact of the block format on student grades when compared to comparable courses taught in a non-block format. The questions addressed are:

Did students with high grade point averages self select into the block presentation of the courses?

Is grade inflation present in the block presentation compared to the same courses taken independently?

How correlated are student grades between the three courses when taken in the block format compared to student grades when the same courses are taken independently?

II. DESCRIPTION OF BLOCK DESIGN

The CBA is very aware of the movement in business curriculum design to change from a silo to an integrated format for presenting the core business content to students. The Porter and McKibbin report in 1988 (1) and the Stover, Morris, Reyes and Byers article in 1997 (2) highlight the need to serve the demand the business community has for graduates with an integrated understanding of business processes and the ability to work in teams to solve key business problems. Other universities including: the University of Idaho (3), Babson College (4), and many others, have made changes to their core intended to achieve a higher level of integration. The scope of integration proposed has varied from the entire curriculum (5) to units as small as a block of two courses (6). A “balanced-score card” approach has been suggested as a mechanism for comprehensive integration of a business school’s curriculum (7). Block level integration may be centered on a theme, such as experiential learning (8) or entrepreneurship (9). The use of ERP systems has also been proposed as a theme for integration and was used as an integration strategy by the CBA.

The block design was the approach the CBA chose because of its potential for success in our particular political environment. Frings, Prinzinger and Schneider (10) have suggested that there are distinct levels of block integration that may be used: The highest level involves jointly teaching formerly separate classes with a single overall grade and simultaneous team teaching at least part of the time. A second level requires students to take all block component courses the same semester and involves some common assignments and grading, but retains separate course grades. A third level requires the coordination of definitions and examples, and the use of integrating cases across a set of courses designed to be taken in different semesters. The CBA chose a variant of the second level for its integration experiments.

Two blocks of courses were designed as experiments intended to integrate the core material taught to our junior level students. Successive offerings of the blocks have resulted in some modifications resulting in blocks with the following content. The first block contains the information typically found in an introductory management, marketing and business communications course. The second block contains the content found in an introductory production management course (BA 301), a management information course (CIS 360) and a finance course (FIN 311). Additionally the second block contains a strong business communications component. This paper focuses on

the second of the two blocks. Students are required to register concurrently for the sections of all three courses offered in the block. They are informed that they may not drop one of the courses without dropping the entire block.

The block is offered on a Tuesday-Thursday schedule from 8 am to 12:25 pm with two twenty-minute breaks. Enrollment is capped at 70 students but the typical class size has been 55. A typical section of a traditionally offered finance course would have 35 students. Faculty teaching in the block are credited with teaching two sections when their teaching load is calculated. One large room is available for lectures to the entire group and a computer lab is reserved for breakout sessions for hands on work. In the current offering of the block approximately sixty percent of the time the finance portion of the class meets as one group, for the remaining forty percent of the time the class is split with half the students in lecture and half in the computer lab and then the groups switch and the presentation is repeated. The majority of the time only one faculty member is in the classroom.

More than one faculty member is present when integrating assignments are discussed or topics that bridge classes are presented. The faculty teaching in the block agreed that separate grades would be given for each of the three courses. It was further agreed that the communications component would constitute 20 percent of the grade in each of the three courses. A communications faculty member is assigned to the block part-time and presents lecture material and provides grading assistance for communications content in specific written and oral presentation assignments that cover content in each of the three courses contained in the block.

III. SAP AS AN INTEGRATING DEVICE

Why SAP?

Studies of the impact of ERP systems have generally found that cross-functional integration was a key to their successful implementation (11,12,13). This suggests that ERP software might successfully be used as an integrating mechanism in business college curricula. The use of ERP as an integrating theme has been proposed at both the MBA (14) and undergraduate (15) levels and encouraging preliminary results have been reported for an experiment in the use of ERP to broaden the knowledge base in a human resources course (16). The CBA decided to consider adopting an ERP package first for its integration potential and secondly because of the perceived direct marketability effects for students familiar with a prominent ERP system.

The CBA reviewed a number of ERP packages as part of the initiative to integrate ERP into the curriculum. These included Peoplesoft, Oracle, QAD, SAP and Great Plains. The decision was made to go with SAP because of the wide array of components SAP offers and the commitment SAP has to the University Alliance program.

IV. IMPACT ON FINANCE COURSE CONTENT

The following modifications were made to the content of the traditional introduction to finance course in order to integrate it into the second block of courses.

1. In a typical semester an introduction to finance course meeting on Tuesday and Thursday would meet 30 times during the semester plus a session for the final exam. In the block format five class sessions were devoted to the communications component. Two class sessions were presentations of projects detailed below that had finance content.
2. The reduction in the number of class sessions required that material be deleted from the course. Material dealing with the management of accounts receivables was deleted and the coverage of cash management topics and financial leverage was limited compared to a traditional class.
3. More emphasis was placed on group work and formal presentation of the results of a numeric analysis. The class was split into 16 groups of four students each. Students worked in groups on two major projects. The first was to prepare a financial analysis of a firm and the second was a solution to a production oriented case. All groups completed both projects. Eight of the groups formally presented the financial analysis and the remainder of the groups presented the case analysis. Presentation of the two groups of projects occurred at different points in time in the course. Student groups not presenting acted as evaluators for two group presentations in addition to an evaluation by the four professors involved in the block.

A major goal of the block is to increase the student's understanding of how concepts in different courses are integrated and how these concepts interact in developing solutions to key business problems. Examples of integrative assignments in the block follow.

Finance and Production

Student groups conducted a financial analysis of a firm of their choosing and presented it to the faculty teaching in the block. The following was a part of that assignment.

You will forecast the stock price for this firm as of the end of March using only data consisting of historical closing prices for this stock, historical values for the S&P 500 and forecasted values for the S&P 500. The historical information you need is available from Yahoo (<http://table.finance.yahoo.com/d>). Enter the time period and frequency of quotes and the ticker symbol for your company. Use the adjusted quotes. The S&P 500 is available by entering ^SPX as the ticker symbol. The forecast of the S&P 500 is available at <http://www.forecasts.org/stpoor.htm>. You will select and defend the forecasting technique used.

The assignment provides an opportunity for students to select, apply and defend a forecasting technique from a selection of techniques they have been exposed to in the Production portion of the block. From a finance perspective it starts students thinking about possible relationships between the S&P 500 and a company's stock price as a precursor to a discussion of the capital asset pricing model.

In the Production portion of the block the students analyze a capacity planning case. One component of the case presents students with the opportunity to purchase equipment. Students must apply concepts learned in production and finance to estimate and evaluate cash flows in a capital budgeting context to address the purchase decision.

Other integration points include the application of inventory models to the decision of how much cash versus marketable securities a firm should hold and how to forecast sales as a starting point for financial planning, cash budgeting or capital budgeting.

Management Information Systems

The financial analysis of a firm assignment referred to above also contains the following question.

How has this firm been impacted by e-business technology? (For example: is it using ERP software?) Does it have a web site and what purposes is it intended to accomplish? What e-business opportunities/threats are present for the firm and the industry in the near future?

This assignment gives students an opportunity to see how firms are reacting to e-business technology. In the finance portion of the block, the importance of a firm's ability to take advantage of new technology to create value is stressed when valuation of common stocks is discussed.

The SAP software presented in the block provides limited direct support for topics taught in an introductory finance course. The software captures and integrates the accounting, procurement and production information in the firm but it contains little direct support for analyzing financial questions. SAP does contain a Treasury Module discussed above that supports the cash management function of the firm. Management information systems (MIS) and finance professors make a joint presentation of this module. An MIS professor shows how SAP captures and presents the information necessary for a solution and a finance professor presents the conceptual context of the problem and its solution.

V. IMPACT ON STUDENT GRADES

Curricular content in CBA core courses is controlled by the entire faculty of the CBA. To assess the impact of the block experiment on course grades, grades in the class sections presented in the block and comparative data for a group of students graduating in Spring and Fall of 2001 were gathered. There were a total of 341 students who graduated with a Bachelor of Business Administration degree in the year 2001. Of those who graduated, the first 74 students in the spring and the first 76 students in the fall were selected from an alphabetical list to compare to the block students. There are differences between the control groups and the block students that must be considered when interpreting results. Few students in the control group will have taken the three courses in the block during the

same semester, control group students may have had a variety of instructors for these classes, and students may not graduate with an “F” in a core class.

An effort was made to recruit students into the blocks to ensure that enough students were in the blocks for a valid experiment and for efficient use of the resources of the college. Table 1 shows the distribution by major of students in the block and in the random sample of graduates. The structure of the accounting major at this institution made it difficult for accounting students to accommodate a 9 hour block of core classes along with their needed major courses. This is reflected in a substantially diminished presence of accounting students in the block experiment. Table 1 also suggests a slightly higher than expected representation of Finance majors.

Table 1: Distribution Of Students Across Majors
Recent Graduates versus Block Students

	Recent Business Graduates		Business Block Students	
	N	Pct. Of Students	N	Pct. Of Students
ACC	20	12.99%	5	4.42%
CIS	41	26.62%	26	23.01%
Finance	23	14.94%	30	26.55%
Management	37	24.03%	24	21.24%
Other	33	21.43%	28	24.78%

A. Did students with high grade point averages self select into the block presentation of the finance course?

There was no attempt to limit entry to the block based on grade point average or to make it an honors experience. Never-the-less, it may be possible that students struggling with grades may have avoided the uncertainty of a new presentation method or the requirement to take three core courses in the same semester. By the second semester of the experiment a number of students had the impression that the work level was higher in the block versus the presentation of the same three courses independently. For these or other reasons, poorer performing students may have opted out of the block experience.

The self-selection question is addressed by collecting the overall grade point averages for all students enrolled in the block in the Spring and Fall of 2001 and comparing them with the overall grade point averages for the sample of Spring and Fall 2001 graduates. There were a total of 112 students enrolled in the block for the year 2001. Table 2 presents the grade point averages calculated.

The cumulative grade point averages for students in the block sections were consistently below those for students graduating in the same time period. This supports the contention that students taking the block were not inherently better students than those not taking the block.

Table 2: Cumulative Grade Point Comparison

Semester	Number of Students	Grade Point Average
Spring 2001 Block	58	3.00
Spring 2001 Graduates	75	3.11
Fall 2001 Block	54	2.97
Fall 2001 Graduates	76	3.14

B. Is grade inflation present in student grades in the block as compared to other offerings of these courses?

Faculty in the college have expressed a concern that the grading in the block course may be easier in some way than the grading in a traditionally offered course. One argument is that the presentations students make in the course will allow them to raise their grade as compared to what it might be based on exams and quizzes alone.

It was mentioned above that separate grades were given for each of the three main content areas. This grading strategy was specifically selected to place faculty in the college at ease. Each of the content areas (finance, production and MIS) was evaluated independently and given a separate grade. This was done to ensure that students mastered each of the three content areas versus understanding one or two content areas well enough to produce a

passing grade on a nine-hour block with one overall grade. It was agreed that twenty percent of each of the three grades would have a common communications component evaluated by the communications professor.

A comparison of grades in the block with grades of recent graduates was made and the results are presented in Table 3. The data show no suggestion of grade inflation in any of the block courses. The average grade for the block classes was adjusted to remove the impact of “F”s to make it more comparable to graduates since students cannot graduate with an “F” in a core course. In fact, the average grade was from a tenth (CIS 360) to seven tenths (BA 301) of a grade point lower than the average grade of recent graduates. The record lends no support to the contention that grading in the block presentation of the courses was easier. In fact the data indicates the opposite.

Further, the grade point average for the finance portion of the Spring block was 2.3 and the Fall block 2.5 using a four point scale. The last five times the finance professor teaching the block taught the finance course in the traditional manner the high grade point average was 2.86 and the low was 2.5 with an average of all five offerings equal to 2.67.

Table 3: Average Grade Earned
Recent Graduates versus Block Students*

	Recent Business Graduates		Business Block Students	
	N	Average Grade	N	Average Grade
Finance 311	149	3.02	106	2.63
CIS 360	153	2.84	110	2.71
BA 301	141	3.26	110	2.52
Overall GPA	151	3.12	112	2.99

* “F” grades removed from block average to increase comparability to averages for graduates

C. Are Grades among the Block Classes More than Normally Correlated?

Success in integrating a block of courses can be measured in a variety of ways. One indicator of integration is to look for increases in the correlation of student performance across the courses. That is, if content is more integrated we would expect a student doing well in one of the courses to be more likely to do well in the others due to the integrated content of the courses. Under this hypothesized relationship, the correlation between grades provides an indicator of the impact of integration. However, there are confounding effects to be considered. Better students will tend to perform better than other students in each course they take (see Didia and Hasnat 1998 for a discussion of determinants of performance (17)). Thus, some positive correlation among the grades across courses is to be expected in the absence of any integration. In addition, 20 percent of the grade in each block course came from a common communications component. This causes an additional increment to correlation among the grades that does not truly represent integration of the content of the three courses.

Table 4 presents correlation coefficients among the grades of both block students and recent graduates. Also included are correlations of the course grades with overall GPAs for both groups and with the communications grade component earned by block students. The data in Table 4 suggest that grades across the three courses for both groups of students are positively correlated and (based on the Pearson’s Rho statistic (18)) the correlations are significant. Also it is clear that grades in the block classes are more highly correlated than those of the recent graduates. However, strong correlations of the grade in each class to the overall GPA (and to the common communications grade among block students) make it difficult to determine whether the observed correlations among the course grades are direct effects or merely indirect effects of these other factors.

Table 4: Correlation Coefficients Among Key Variables

Non Block Recent Graduates

	Fin 311 Grade		CIS 360 Grade		BA 301 Grade	
Fin 311 Grade			0.330		0.393	
	<i>Pr. Rho=0</i>		<.0001	*	<.0001	*
CIS 360 Grade	0.330				0.349	
	<i>Pr. Rho=0</i>	<.0001	*		<.0001	*
BA 301 Grade	0.393		0.349			
	<i>Pr. Rho=0</i>	<.0001	*	<.0001	*	
Overall GPA	0.561		0.532		0.633	
	<i>Pr. Rho=0</i>	<.0001	*	<.0001	*	<.0001

Block Students

	Fin 311 Grade		CIS 360 Grade		BA 301 Grade	
Fin 311 Grade			0.72521		0.66751	
	<i>Pr. Rho=0</i>		<.0001	*	<.0001	*
CIS 360 Grade	0.72521				0.62906	*
	<i>Pr. Rho=0</i>	<.0001	*		<.0001	
BA 301 Grade	0.66751		0.62906			
	<i>Pr. Rho=0</i>	<.0001	*	<.0001	*	
GPA	0.66363		0.63855		0.69804	
	<i>Pr. Rho=0</i>	<.0001	*	<.0001	*	<.0001
Comm. Grade	0.47989		0.58429		0.49465	
	<i>Pr. Rho=0</i>	<.0001	*	<.0001	*	<.0001

* Probability that correlation = 0 less than 5%.
Probability measured by Pearson's Rho Statistic.

Partial correlation analysis is used to identify the portion of the correlation that may be due to integration effects. Partial correlation coefficients are designed to isolate the effects of these confounding variables and allow one to assess whether there is a direct relationship between a set of target variables after the confounding effects of other variables are removed (17). In this case, correlations among the target course grades are assessed after removing the effects of the student's GPA (and removing the effect of the common communications component for the block students).

Table 5 shows these partial correlation results. Note that no significant correlations are found among the grades in the three courses earned by recent graduates who did not take them as a block. For block students there remains a statistically significant positive correlation between the grade in Fin 311 and the grades in both CIS 360 and BA 301. Interestingly, there is not a significant correlation between the BA 301 grade and the CIS 360 grade once the confounding effects are removed. The authors of this paper have hypothesized that an explanation for the remaining correlation is the presence of integration in the learning experience of the students in the block experiment. Other effects may still be present. Other events in a student's life may cause the block students to have a particularly good or bad semester and therefore affect the grade in all three of the courses. We have no evidence that this effect was or was not present.

Table 5: Partial Correlation Coefficients Among Grades
(GPA and Common Grade Effects Removed)

Non Block Recent Graduates

(GPA effects removed)

		Fin 311 Grade	CIS 360 Grade	BA 301 Grade
Fin 311 Grade			0.021	0.043
	<i>Pr. Rho=0</i>		<i>0.807</i>	<i>0.628</i>
CIS 360 Grade		0.021		0.087
	<i>Pr. Rho=0</i>	<i>0.807</i>		<i>0.324</i>
BA 301 Grade		0.043	0.087	
	<i>Pr. Rho=0</i>	<i>0.628</i>	<i>0.324</i>	

Block Students

(GPA & Com. Grade effects removed)

		Fin 311 Grade	CIS 360 Grade	BA 301 Grade
Fin 311 Grade			0.38751	0.23742
	<i>Pr. Rho=0</i>		<i><.0001*</i>	<i>0.0125*</i>
CIS 360 Grade		0.38751		0.10686
	<i>Pr. Rho=0</i>	<i><.0001*</i>		<i>0.2665</i>
BA 301 Grade		0.23742	0.10686	
	<i>Pr. Rho=0</i>	<i>0.0125*</i>	<i>0.2665</i>	

* Probability that correlation = 0 less than 5%.

Probability measured by Pearson's Partial Rho Statistic, correcting for indirect correlation through GPA (both groups) and the common Communication grade (block student group).

Table 5 presents the most rigorous comparison that can be performed between the grades of block students and non-block recent graduates. It is possible, however, to obtain a more accurate measure of student performance in the classes than the final grade received. Course points assigned for each portion of the course requirements are available for the block students. This allows us to directly subtract the communications points earned in each course. The percentage of possible points earned in the remaining content area portion of the grade is then compared across the courses. This provides a richer measure of performance and allows complete elimination of the confounding effects of the communications grade. Once again, better students will tend to perform better in all classes, so we continue to use partial correlation to remove the effects of the student's GPA. These results, Table 6, show a generally stronger positive correlation among the content area scores than was found among the grades given. Partial correlations among all three of the courses are statistically significant using this measure.

**Table 6: Partial Correlation Coefficients Among Subject Area Points Earned by Block Students
(GPA Effects Removed)**

Block Students	Fin 311 Points	CIS 360 Points	BA 301 Points
Fin 311 Points		0.54263	0.40782
	<i>Pr. Rho=0</i>	<.0001*	<.0001*
CIS 360 Points	0.54263		0.46477
	<i>Pr. Rho=0</i>	<.0001*	<.0001*
BA 301 Points	0.40782	0.54263	
	<i>Pr. Rho=0</i>	<.0001*	<.0001*

* Probability that correlation = 0 less than 5%.

Probability measured by Pearson's Partial Rho Statistic, correcting for indirect correlation through GPA .

IV. CONCLUSIONS

This paper has described one school's approach to integration in the undergraduate core curriculum with emphasis on the impact on the introductory finance course. The approach used involves defining blocks of courses whose traditional topics contain natural relationships, and organizing the integration of the blocks around a theme. ERP was the organizing theme for the block described in this paper. To accommodate integration, and the inclusion of a common communication element, some reduction in the number of finance topics covered was required. Examples and exercises based on simulated data present in the SAP software were used to reinforce basic concepts and enhance understanding of the application of finance concepts to data generated by organizational systems.

Results from the first two semesters of this experimental block suggest that students self-selecting the block classes tend to be of about the same quality as their peers. Grades earned in the block classes suggest that the block format as delivered does not contribute to grade inflation. Grades, in fact have been nearly half a letter lower than the grades earned in the same courses by recent graduates. Finally, one proposed indicator for course content integration is an increase in the correlation of student performance in the component courses of the block. After utilization of partial correlation analysis to adjust for confounding influences, we found that grades of block students in the component courses were generally significantly correlated, while performance in the same classes by recent graduates was not. We hypothesize that the higher level of correlation present in the block format is due to the student's grasp of concepts that bridge the content of the three courses. Additional work must be done to explore the use of partial correlation analysis in this application.

The lack of a fully comparable control group limits the conclusions that can be drawn from this study. Ideally, we would like to have a control group of students who took the same three courses as independent classes during the same semester from the same instructors. However, very few students would normally opt to take all three courses in the same semester when they are not a part of an integrated block and it is not academically defensible to require this of a set of students.

This study has focused on the structure of the block and student performance results. Assessment of potential crowding out of discipline-specific knowledge and improvements in the ability to apply concepts in an interdisciplinary context, would require the development of a skill assessment test and application of that test in block and non-block course sections on a systematic basis. Development of such a test is a formidable task, but one that could greatly enhance the assessment of block integration programs.

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