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In this issue:

Incorporating ERP into MIS Curriculum: Some Insights

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Incorporating ERP into MIS Curriculum: Some Insights

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Abstract

Successful Enterprise Resource Planning (ERP) integration in curricula is achieved by creating and maintaining the system infrastructure, motivating and mobilizing faculty resources, identifying course material to suit curricular requirements, developing matching case studies, and facilitating student learning through discussions and hands-on activities. The three authors collectively have direct experience, albeit gathered at different times and under varied circumstances, in addressing these issues with regards to the ERP system SAP R/3. By organizing these issues under three major categories, the authors present a cohesive theme for successful SAP R/3 integration into undergraduate MIS and business curricula.

Keywords: ERP in Curriculum, SAP R/3, courseware

1. INTRODUCTION

Integration of commercial products – be they hardware or software – as tools into the computer related curricula – Computer Science, Applied Computer Science, and Management Information System programs – gained considerable momentum during the last decade. Talbott (1999) cites two significant developments concerning industry's influence in education: (i) during 1998, *40% of large organizations had plans to negotiate training deals with colleges and universities* (April 13, 1998, Computerworld) and (ii) *companies were developing curricula for schools and giving them the equipment*

to aid the learning process (May 12, 1998, Investor's Business Daily). In the Enterprise Resource Planning (ERP) sector, companies like SAP AG established several university alliances during the last decade. This was primarily for meeting the skills shortage organizations faced when choosing ERP systems as solutions to their then impending Y2K problems. The following quote from Gould (1999) sums up the ERP growth in that period leading up to Y2K: *The good thing about the Y2K crisis is that it was a wonderful excuse for companies around the world to update and upgrade their enterprise resource planning (ERP) systems...and make 1996, 1997, and especially 1998 banner*

years in ERP sales and implementation projects. In order to facilitate a rapid development of skilled personnel required in the implementation and effective use of SAP R/3 projects, SAP AG came up with a program for *global higher learning* with different types of packages ranging from the establishment of *University Competence Centers (UCC), Centers of Excellence, SAP College* to the creation of *academic chairs and scholarships* (Gronwald, 1998).

SAP R/3, like many of the present day integrated software systems, is a very complex product (Rosemann and Watson, 2002). This robust capability is driving the demand for skilled implementers and users in all the functional areas to not only implement and manage but also to apply it effectively. The relatively large market share SAP AG enjoys and the intrinsic characteristics of SAP R/3 in integrating the business processes stand in favor of using SAP R/3 as a tool in many business curricula. Sensing the market demand for graduates with ERP exposure and recognizing the challenges and rewards associated with it, many business schools

(a.k.a. business faculties, in some parts of the world) gave serious consideration to SAP AG's alliance initiative (Becerra-Fernandez, 2000).

An excellent summary of the issues in incorporating ERP in curricula is given by Rosemann and Watson (2002). They attempt to provide a structure to ERP education and discuss different approaches for the integration of ERP in curricula. However, the current paper provides some insights for introducing ERP in MIS programs based on the authors' experiences. The authors consider the following three major components essential for successfully using ERP in curricula - infrastructure, courseware, and facilitation (see Fig. 1). **Infrastructure** includes setting up the computing platform, installing the SAP R/3, training the systems support personnel, and training the faculty members. **Courseware** refers to the course material, the case study, and its related exercises using SAP R/3. **Facilitation** is the actual teaching process involving lectures, the lab sessions and the evaluation process.

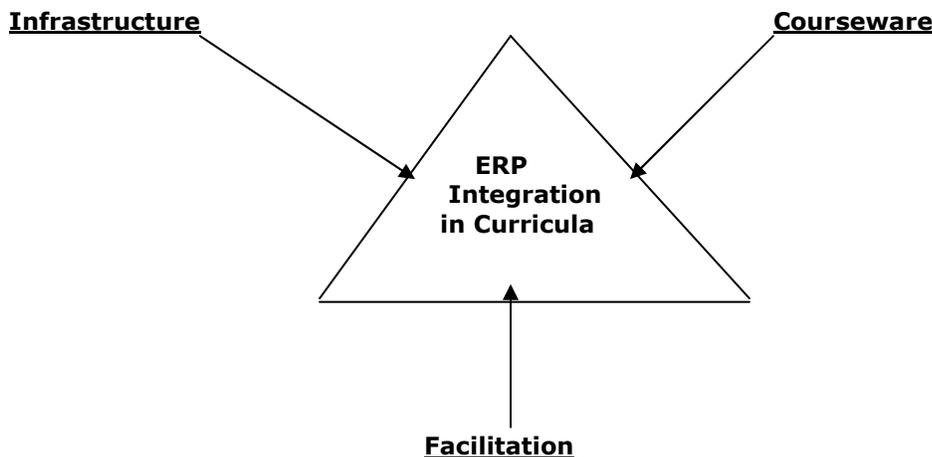


Fig. 1. Major areas of concern for successful ERP integration in curricula

The SAP AG university alliance offers comprehensive support to the partnering university: a complimentary copy of SAP's R/3 system, sponsored training (100 person-days), installation assistance, and also complimentary data for a multinational model data that operates on SAP R/3 called IDES (Internet Demonstration and Evaluation System). It is to be noted that

the courses SAP AG offers are designed for skill based training in industry and therefore not viable for direct use in curricular courses.

In the next three sections, the authors address these three components by highlighting the critical issues in the establishment of the infrastructure,

describing a professionally designed courseware, and sharing their experience in using the courseware. In the final section, they attempt to project the future use of ERP in curricula as the new generations of ERP products that target the Small Medium Business (SMB) market evolve.

2. INFRASTRUCTURE

The basic resources needed for using any ERP in a curriculum include a facility for the faculty members and students to access the ERP system, a core of ERP trained faculty members, and suitable courseware. The first two, which constitute the infrastructure, are addressed in this section, while courseware is addressed in the next. Access to SAP is achieved by having a system on campus or by remotely using an already established facility at a University Competence Center (UCC). The authors collectively have experience in establishing both environments. In 1998-99, one author coordinated the activities for establishing an SAP R/3 system facility on campus under the university alliance initiative in New Zealand and another, in 1999, coordinated the establishment of a remote access to a designated UCC in USA.

2.1 Establishing the infrastructure

When the business faculty (a.k.a. Business College) in a tertiary institution (a.k.a. university) in New Zealand was approached by the Sapient College for alliance in 1997, the faculty was putting in place new curricula in several of its departments. After contemplating on the proposal, a few members from the business faculty attended presentations on the potentials of SAP R/3 in facilitating several of their programs. The initial programs targeted were bachelors in computing systems, bachelors in business systems, and graduate diplomas in financial management, human resource management, and sales management. Specifically, in the two bachelors programs the following courses were identified as potential beneficiaries of this initiative: accounting information systems, business operations, business systems, HR management, international marketing, and management information systems. A team of four faculty members was formed which directly reported to the Dean of the business faculty. The team consisted of members

from Information Technology Services (ITS) and departments of computing, marketing, and accounting – with one of them designated as the project coordinator to liaise with SAP. The team's responsibility was to set up the SAP system infrastructure, plan the initial training of faculty members, and support personnel to start the program. These initial objectives were realized successfully as planned. The factors that contributed to the successful establishment of the infrastructure are discussed below along with a few key lessons learned in maintaining the alliance.

2.2 Success factors

The key success factors, in this instance, were leadership, planning, and coordination. The major contributor for the success was the strong commitment from the Dean of the faculty. She mobilized the financial resources required in the partnership agreement, provided the necessary visibility to the initiative so as to attract faculty members' participation, and empowered the team to directly deal with other concerned units such as legal counsel and marketing within the organization cutting across departmental silos.

2.2.1 Planning: The ITS director was included on the team from the beginning of the project. This resulted in ensuring a platform (operating system and database management system) that met both SAP R/3's requirements and the ITS' standards. This also helped in ensuring that there were no technical incompatibilities. The pre- and post-installation activities were carefully planned to enable the training of two systems support personnel ahead of the actual system installation. The training addressed the intended operating system (Solaris) and database management system (MS SQL Server) on which SAP R/3 was to run. Such planning alleviated considerable problems that are normally faced during the system installation.

2.2.2 Coordination: All the communications with the Sapient College and SAP AG were handled through the project coordinator. This helped in avoiding miscommunications or oversights. This coordinator also planned all the training, both for system support and the SAP R/3 functional modules. The Sapient College had allocated 100 person-days of free training (travel, accommodations and

per diem came from faculty development budgets). The coordinator also kept all the faculty members informed of the project progress. In order for the departments to have equal ownership in the project, it was planned from the beginning that the coordinator's position would be periodically rotated between all departments in the faculty.

2.2.3 Training: Soon after signing the agreement, three team members attended the university forum organized by the Sapient College. This forum provided an opportunity for them to meet with colleagues from other universities who were already using (or in the process of using) SAP R/3 in their curricula. Lessons from the forum participants experiences (Lee, 1998) helped the team plan their infrastructure better. The importance of faculty-wide participation and need for developing relevant courseware with appropriate cases were stressed. The difficulties in using IDES, along with possible remedies, were also shared.

Initially, five faculty members from different departments were trained on the SAP R/3 overview module. In addition, plans were put in place for training faculty members in various SAP R/3 modules such as financial accounting, production planning, human resource and sales and distribution. A computing faculty member was also trained on ABAP/4 (Advanced Business Application Programming 4th Generation). Later, another person with SAP R/3 experience from industry was co-opted to help enhance the incorporation of SAP in curricula.

2.3 Continuity

The established facility was mainly used in business systems and accounting system courses initially. The initiative did not take off as expected, even though this partnership program started successfully and met the expectations of both organizations. After a few years the partnership started experiencing difficulties. Such erosions in partnership could happen due to lapses in any of the following:

- It is important to maintain good liaison with the ERP vendor and carry out the updates periodically. This would include budget provisions for upgrades and updates.

- The leadership should continue to nurture the ERP initiative by providing continued faculty training until some stability is realized.
- Faculty members have varied interests and hence assigning ERP responsibilities must be based on the faculty member's overall development plan.
- Rotation of coordinator's role and providing for contingencies due to faculty turnover is critical.
- Even though there was a lack of appropriate courseware directly available from SAP AG, contacts with other schools helped to address this shortage. (Most often material from other universities may have to be customized to suit the course requirements.)

In addition, one has to allocate time for the faculty learning phase. This perhaps was the most underestimated effort in the whole partnership initiative. The authors address this shortfall in Section 3 by discussing a courseware that is organized in a modular fashion which facilitates for the faculty become comfortable or at least familiar with the system in a short period. In the next sub-section, we consider the remote access type of infrastructure.

2.4. Remote Access to an UCC

One of the authors in the business college of a mid-western state university in the USA has used SAP R/3 for the past three years through remote access to the UCC setup at the University of Missouri Columbia (Mizzou). The client university paid an annual fee of \$8,000 for this remote access. The lab computers at the client end had the necessary software (SAP GUI 4.6) to log into Mizzou's SAP R/3 server. The university coordinator liaised with Mizzou for establishing the necessary client numbers, account numbers and passwords for the students and the faculty. This arrangement was relatively inexpensive to set up as it avoided the expenses and efforts in establishing and maintaining a resident system. However, the system response was a problem at times and ensuring proper system availability required considerable effort on the part of the university coordinator.

Only one faculty member was initially trained on SAP R/3 overview of configuration and integration. The support from SAP AG on such training was somewhat limited. The training programs conducted at UCC did not address the requirements of the participant but focused on ABAP/4. However, other knowledgeable course participants (in this instance, Dr Gail Corbitt, Chico, CA) guided the other participants in using Accelerated SAP (ASAP). Usually such contacts with faculty members from other universities help fill training gaps and also offer tested course material such as the one licensed by third party contractors as described in the next section.

3. COURSEWARE

Since products like IDES can be difficult to use for beginners, there is a need to develop courseware suitable for the curriculum under consideration. One of the authors has consulting experience in SAP R/3 and very knowledgeable in the use of a courseware designed to configure and implement the SAP R/3 environment for use in undergraduate business curricula. The configuration and integration course introduces the students to *integrated business processes* in a modular fashion using SAP R/3. In this, the students first focus on learning the basic business processes and understanding the process interactions from an interdisciplinary perspective. The course case study takes the students through all the business processes using exercises in SAP R/3. The features of the configuration and integration course are described in the following.

3.1 Case study

The configuration and integration courseware uses a fictitious sporting goods company with its headquarters in Sioux Falls, SD, where all the manufacturing, distribution, financial, human resources, sale and marketing groups, and purchasing departments are located. The company makes and sells baseball uniforms, buys and sells baseball equipment such as baseballs, cleats, gloves, and hats. This simple case dealing with a few products but requiring all the major business processes is used to build the required exercises in SAP R/3.

SAP R/3 uses the organizational structure as the anchor to tie everything together. There are three primary elements that control the system: organizational structures, master data and transaction rules. The master data records hold all the characteristics of the products, vendors, customers, and accounts. Master data is specific to the organizational structure. The rules are set according to the organizational structure and master data. Tolerances and conditions specific to particular activities are dependant upon the relationship between the master data and the organizational structure. The students create each aspect as they progress, allowing them to grasp the structure and significance of the relationships. This process generates a continuous flow of learning elements throughout the course.

3.2 Courseware features

This courseware contains both lecture material and hands-on exercises and is organized for delivery in three phases to mimic a three-phase corporate implementation rollout strategy. Every phase offers a three-step sequence: learn the process using an already configured model, take part in the class discussion of the concerned business processes, and finally configure a new model. It is to be noted that this approach is very much in line with the second part of the 4th KnowDule suggested in the tutorial *Using ERP Systems in Education* by Watson and Schneider (Watson, 1999). It also provides support tools in the form of error messages to recover from mistakes when carrying out the configurations.

The exercises are suitable for individual or teamwork. The students will be able to construct a functioning company operating on an integrated SAP R/3 environment. The exercises guide the students through the configuration and creation of organizational structures, master data and transaction rules for the company. At the culmination of each configuration effort the exercises test the transactions to ensure that portion functions as expected. This ensures that mistakes are identified before the students have moved on. This also reinforces the fact that sequence is important. Just as the foundation must be in place before construction of a building can continue, a

company code must exist before a plant can be assigned to the company.

3.2.1 Phases: Phase one is to implement the financial and material management functionality enabling the company to do basic procurement, inventory management and financial accounting activities. The financial decisions at this point set the foundation for the company's reporting environment. The students create a corporate chart of accounts and the key documents required by law. General ledger, balance sheet, profit & loss, and reconciliation accounts are created. Specific accounts for enabling the reconciliation of individual vendor and customer accounts into a consolidated report are also created. Students run transactions and follow the traditional T account audit trails. As the process flow progresses, the account activity is monitored such as Goods receipt (inventory accounts), Invoice receipt (GR/IR account), Vendor (Accounts payable), bank payments, and simultaneous reconciliation account activity.

Phase two extends the first implementation to enable the production and controlling functionality, providing the company with the capability to manufacture product and track costs. Phase three completes the implementation by adding the customer aspects of sales, pricing and distribution. This phased approach allows the project to mature in a manageable progression. The organizational structure of the company is established first by creating the various elements and then mapping the relationship that each has to the other. This provides a great opportunity to explain the importance of how companies collect and report information based upon the relationships among the different entities of an organization.

3.2.2 Organization: The initial section is designed as a level-setting experience to bring everyone up to a basic standard level of exposure and understanding. Throughout the course unique terminology is explained and interpreted to ensure that all participants are on the same sheet of music as they start to orchestrate the symphony of an integrated enterprise. A general overview explains the game plan and the system that will be used to facilitate the building of an integrated business process environment.

Finally the administrative section culminates with the students logging onto a configured SAP R/3 system to learn how to navigate and identify the characteristics of the system by completing a typical procurement cycle. Navigational tips and tricks are shared throughout the course to assist the students in learning how set default information and use the system help functions.

3.2.3 Intended Pedagogical steps: This courseware takes into consideration the usual learning process of first reviewing a completed process, then constructing the environment, and finally testing the environment. Each phase is introduced by executing common end-user process flow transactions in a configured environment. This is followed by a discussion on the respective business process and a demonstration of the functionality and prerequisite configuration for that functionality. The students then complete the exercises for configuring and testing their individual company. The process of building their own environment forces the students to negotiate through the details of each aspect of concern for that area.

3.2.4 Support tools: Obviously, because SAP is an actual business application and not an academic simulation tool, the process is very heavy in the minutiae of reality and therefore provides an incredible platform for real issues to arise during the testing efforts. Roughly translated this means that when the students test their systems and find errors, they have to figure out where the mistake or missed step is by reverse engineering (working backwards through each step) until they find the problem. Error messages help to point them to the conflict, but unless they understand the process the messages will seem cryptic. The pre-configured environment provides the students as well as instructors a security blanket in that they can always use it as a reference to see what a working environment looks like and what settings are required to make the system work properly.

3.3 Big Picture

The real power of this courseware is in providing the inter-disciplinary exposure and understanding that is gained by individuals who are from specific functional disciplines. In today's competitive marketplace it is essential to have a good understanding of

the big picture. This experience forces each team to build the key functional areas of a company from the ground up. The students see first hand how the building blocks created in configuration are applied to daily business transactions. The reality of normal business process flow interaction is real time due to the integrated nature of SAP. For instance, the impact of a particular setting in accounting is immediately realized when executing goods movements. In the following, a successful application of the configuration and integration course in an MIS curriculum is discussed.

4. FACILITATION

The undergraduate MIS students in a mid-western state university (in USA) use the configuration and integration courseware in their Systems Implementation and Practice, a senior level course. One of the authors with basic training in SAP R/3 overview and configuration & integration has been facilitating this course for the past three years using a remote link to an UCC SAP R/3 server at the University of Missouri (Mizzou) at Columbia. The students in these classes were all MIS seniors who have completed, in addition to most of the required MIS courses, all the core (basic) courses required of any business major.

This course was chosen to let students practice the integration of the various functional information systems taught in different courses using SAP R/3. Using the tools offered in the exercises, the students go through the configuration and integration of different functional modules for a model company. The configured environment was available on a Mizzou server. However, Mizzou provided the technical support for the SAP R/3 system, but not for the configured courseware. Each student gets a copy of the course material (exercise book) for a fee of \$60 paid to the third party contractor, who provided the necessary application related support. In addition to the course materials, SAP exercises on human resources and quality control were downloaded from the UCCs at Milwaukee, WI, and Chico, CA. The textbook used in this course was, *Enterprise Integration*, by Sandoe, Corbitt and Boykin (Sandoe, et al 2001)

4.1 Course Objectives

The course objectives were:

- Provide practical exercises in the configuration of core business processes in the areas of: Financial accounting (FI), Internal controlling (CO), Procurement and Inventory management (MM), Product manufacturing and Planning (PP), and Sales and distribution (SD)
- Develop an understanding of basic business processes in an integrated environment
- Gain a high level understanding of functionality and integration of the core SAP modules
- Configure and validate an operating company environment
- Demonstrate the power of integration
- Identify and understand integration points and concerns

4.2 Realities

The facilitation of the course follows the guidelines provided. The above objectives are realized as the students, working individually or in pairs, carry out all the exercises under the three phases. The exercises for configuring and testing the company model and class exams constitute the assessment for the course.

Even though the configuration and integration course is a well-organized product and it works well when the instructions are followed very closely. However, when the students make some basic mistakes, it takes considerable amount of time for the instructor to debug. Certainly the initial training a facilitator goes through does cover the possible mistakes the users might make. The fact that SAP R/3 support and the course support are from two different sources does make the facilitation difficult when problems are encountered. Remote access compounds the problem through slow response and, at times, total system blackouts at the UCC-end. In order to ensure good system response, the classes meet during evening hours. In spite of these difficulties, most of the students completed all the 211 exercises of the course.

4.4 Student Feedback

During the first two occasions the course was offered, only informal feedback was gathered. The students complained about the system response time and the complexity of the product. However, their response indicated that they did recognize the value of getting an exposure to an ERP product that has a very high market share. The last time the course was offered there were 29 students in the class. A formal questionnaire with a five-point progressive scale was used to gather their perceptions concerning the features of the course. (See Appendix-A for the format of this questionnaire.) The questionnaire had two parts: one examining how well SAP R/3 and the course materials helped them in achieving the course objectives (configuring and integrating business processes) and the other on use related issues of SAP R/3 and the case study.

At the end of the course, 24 students responded to the questionnaire. The results

are presented in Table 1. Even though the ratings were above three for all the functional related features, the use-related features all had a mean between two and three. Certainly the use of SAP R/3 and this courseware seemed to have achieved all the objectives of the course. Specifically, the students indicated that the combined use of SAP R/3 and the courseware enhanced their learning of the *functionality and integration of core SAP R/3 and realization of the integrating capabilities of SAP R/3*. Besides, it enhanced their *understanding of basic business process in an integrated environment*. The students were not overwhelmed by the number of exercise (211) since each exercise addressed a specific issue and was well modularized. The students were rather critical about the lack of sufficient help facilities to recover from errors. Both the graphical user interface (GUI) and ease of use were rated poorly, which is expected of a complex product whose genesis is in a client server environment.

Configuring & integrating business processes	Mean	StDev.
Configuring Financial Accounting (FI)	3.27	0.88
Configuring Internal Controlling (CO)	3.27	0.94
Configuring Procurement and Inventory Management (MM)	3.36	0.9
Configuring Product Manufacturing and Planning (PP)	3.18	0.91
Configuring Sales and Distribution (SD)	3.4	0.9
Understanding of basic business process in an integrated environment	3.4	1.1
Functionality of Core SAP modules	3.5	0.9
Integration of Core SAP modules	3.5	0.9
Configuring an operating company	3.2	0.9
Validation of an operating company environment	3.3	0.8
Realizing the integrating capabilities of SAP	3.5	1.1
Identifying Integration points within SAP	3.3	1.0
Product (SAP R/3 and course) features	Mean	StDev.
Size of the company used in the case	2.5	1.2
Sequencing of the modules	2.8	1.2
Number of exercises per module	3.1	1.1
Ease of use	2.2	1.1
Relevance of help files	2.3	1.1
GUI (convenient to navigate and intuitive)	2.95	1.29
Simulating real world application	2.95	1.07

Table 1. Student perception of using SAP R/3 and course materials

5. CONCLUSION

The authors through their collective experience have described a model,

consisting of three major components, for successfully integrating ERP in curricula. In this they share several of their practical experiences in addition to addressing the

following six success factors listed in (Watson, 1999, pp38): *high-level academic commitment, ERP faculty team, faculty training, student input for curricula development, ERP industrial advisory group, physical facility and pilot implementation.* The authors suggest the following factors based on their experience: inclusion of IT support personnel in the team, rotation of coordinator's role to enhance faculty-wide buy in, development of courseware (perhaps with help from personnel in industry) to meet the curricula requirements, and continued high-level support to accommodate faculty development. The successful incorporation of ERP products in college-wide curricula requires the provision of some incentives for getting the faculty members involved.

The predicted ERP market collapse after Y2K did not take place as midsize companies started considering ERPs (Kumar 2000). In general ERP adoptions, being expensive and painful, may not attract smaller companies unless viable alternatives are offered, designed specifically for the small medium businesses (SMBs). Products like SAP Business-One (SAP, 2004) and Microsoft Business Solution – Navision (Microsoft, 2004) are some of the products that target SMBs. In the case of SAP AG, they plan to offer SMB products suitable for migration to SAP R/3 (by providing *hooks*) as the companies grow. The Oracle Corporation offers Oracle ERP for an annual license fee of \$3,000. The SMB products perhaps could become more suitable for incorporation into the curricula in view of their low cost and perhaps ease of use.

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Appendix-A: Systems Implementation and Practice

This survey is designed to evaluate students learning in the cross-listed Systems Implementation and Practice (MI 464) course intended for Management Information Systems (MIS) students. Please complete the following questions.

Indicate your major: MIS Other (pls. specify)_____

IT related work experience: 0-1 years 2-3 years 3-5 years over 5 years

Type of IT related work:

Circle the number that indicates the extent to which this ERP program (SAP R/3) helped you in providing practical experiences in dealing with the core business processes.					
	Very Little	Some what	Notice able	A lot	Quite a lot
Configuring & integrating business processes					
Configuring Financial Accounting (FI)	1	2	3	4	5
Configuring Internal Controlling (CO)	1	2	3	4	5
Configuring Procurement and Inventory Management (MM)	1	2	3	4	5
Configuring Product Manufacturing and Planning (PP)	1	2	3	4	5
Configuring Sales and Distribution (SD)	1	2	3	4	5
Understanding of basic business process in an integrated environment	1	2	3	4	5
Functionality of Core SAP modules	1	2	3	4	5
Integration of Core SAP modules	1	2	3	4	5
Configuring an operating company	1	2	3	4	5
Validation of an operating company environment	1	2	3	4	5
Realizing the integrating capabilities of SAP	1	2	3	4	5
Identifying Integration points within SAP	1	2	3	4	5

Circle the number that indicates the extent to which the following issues about the courseware mattered in the learning process					
Product features	Defin- itely Disagree	Disagree	Not Sure	Agree	Defin- itely Agree
Size of the company used in the case	1	2	3	4	5
Sequencing of the modules	1	2	3	4	5
Number of exercises per module	1	2	3	4	5
Ease of use	1	2	3	4	5
Relevance of help files	1	2	3	4	5
GUI (convenient to navigate and intuitive)	1	2	3	4	5
Simulating real world application	1	2	3	4	5