

Integrating SAP to Information Systems Curriculum: Design and Delivery

ming.wang@calstatela.edu
Department of Information systems
California State University
Los Angeles, CA 90032, USA

ABSTRACT

Information Systems (IS) education is being transformed from the segmented applications toward the integrated enterprise-wide system software Enterprise Resource Planning (ERP). ERP is a platform that integrates all business functions with its centralized data repository shared by all the business operations in the enterprise. This tremendous change has led to teaching ERP applications becoming an important issue in information systems education. This paper presents a comprehensive approach to teaching SAP which includes the course design, course delivery and learning outcomes. SAP is utilized as an ERP software tool in the course. The course emphasizes on teaching SAP implementation as a whole process of transforming business procedures to organization wide requirements. The paper concludes with suggestions to those who seek to use SAP as a tool to teach ERP in the area of enterprise system integration.

Keywords: ERP, Enterprise Resource Planning, SAP, IS curriculum, business processes

1. INTRODUCTION

ERP systems are generic and packaged software systems that provide comprehensive functionality and business process integration across the enterprise. These enterprise-wide software systems offer significant potential benefits, as suggested by the growing scholarly literature that seeks to conceptualize and measure types of organizational outcomes, business impacts, and return on investment among ERP adopting enterprises. SAP is an ERP product that has been utilized very popularly in the industry and academics. SAP is complex, learning curve is steep and its implementation is critical and challenging for many SAP educators. Unlike other computer applications, SAP includes the multidisciplinary scope of enterprise system concepts that requires internal cross-disciplinary coordination. Learners must acquire and understand cross functional business processes while implementing the SAP software.

There are a number of efforts that have been made to incorporate SAP implementation into IS curriculum (Davis, &

Comeau; 2004; Pellerin, R. and Hadaya, P., 2006). Some SAP educators have responded to the challenges by using case teaching approach to recreate the organizational context within which ERP implementations are conducted. The case study approach usually achieves in more process-oriented thinking than traditional or functional teaching approach does. This approach allows students to develop high-order reasoning skills with hands-on experience (Hackney et al. 2003, Fedorowicz et al. 2004) which in turn increases their motivation and interest in the subject. But, these teaching cases rarely allow students to experience all the challenges of the whole process of changing business processes. Instead of teaching solely on configuration activities, IS educators should focus on teaching topics that reflect the complex reality of SAP implementation.

By recognizing the limitations of case teaching methodology, the authors proposed a comprehensive framework to teaching SAP implementation which includes SAP infrastructure, implementation methodology, process modeling, business process reengineering and configuration and SAP

landscape to corresponding SAP hands-on activities. At the end, the authors conducted an evaluation questionnaire to explore learning outcomes and students' reaction to the course. In the conclusion, the authors offer several suggestions to those who seek to teach enterprise integration education. The paper is intended to serve as a useful teaching resource for those IS educators who are interested in teaching ERP/SAP implementation. The remaining paper is organized in four sections: course design, course content, course activities and conclusion.

2. COURSE DESIGN

The SAP Fundamentals course has been taught to senior undergraduates and graduates in the Department of Information Systems for four quarters during the 2007-2008 year. The goal is to teach students to understand business-centric information system and be able to implement SAP software. After successful completion of this course students should be able to:

- Understand SAP system infrastructure, functionality and components
- Reengineer SAP business process procedures to the organization's requirements
- Utilize process modeling tools to describe and improve business processes
- Configure an SAP system to meet the business requirements in an organization

The proposed framework for teaching SAP implementation is presented in Appendix I. Introduction of each new SAP topic is followed by a set of SAP hands-on activities. ERP business process concepts are based on the contents in the textbooks (Hayen, 2007; Monk & Wagner 2008). SAP hands-on activities are on based on the electronic downloads from the SAP University Alliance Curriculum Innovation Web site.

3. COURSE CONTENT

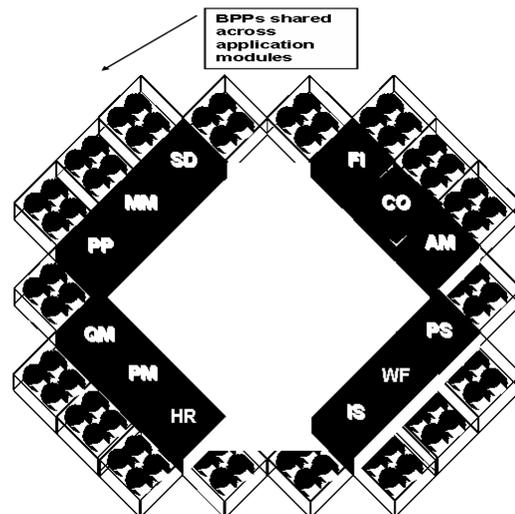
SAP Infrastructure and Components

SAP infrastructure consists of application modules and business process procedures (BPPs). Each application module is a collection of a number of related business process procedures (BPPs), as illustrated in Figure 1. BPPs are the real programs that

provide the functionality of the SAP System. Many of these BPPs are used by more than one of the application modules. Business processes and business functionality found in the organization are built with these application modules and BPPs. The twelve application modules are organized into the following four categories.

- The financial management application modules include Financial Accounting (FI), Controlling (CO), Fixed Asset Management (AM) and Project System (PS).
- The logistic modules include Sales & Distribution (SD), Material Management (MM), Production Planning (PP), Quality Management (QM) and Plant Maintenance (PM).
- The Human Resources (HR) module supports human capital management (HCM), payroll and the planning and control of personnel activities.
- Workflow (WF) and Industry Solutions (IS) are known as the Common Systems. The remaining modules are known as primary application modules, and WF integrates the functionality of these modules.

Figure 1 Business process procedures (BPPs) shared across application modules



SAP Enterprise software integrates the core business processes found in an organization. Each business process consists of business application modules. Thus, SAP business processes are accomplished via a very comprehensive set of BPPs available within

the various application modules, as illustrated in Figure 2. The following business processes can be used to illustrate the supply chain management processes.

- Manufacturing Planning and Execution.
- Procurement (purchasing).
- Financial/management accounting
- Customer Sales Order Management

Figure 2 Application modules integrated to business processes

R/3 Application Module	Business Process			
	Manufacturing	Customer Order Management	Procurement	Financial Management
Sales & Distribution (SD)	X	X		
Materials Mgmt. (MM)	X	X	X	
Production Planning (PP)	X	X	X	
Quality Management (QM)	X			
Plant Maintenance (PM)			X	
Human Resources (HR)	X			
Financial Accounting (FI)	X	X	X	X
Controlling (CO)	X	X	X	X
Fixed Asset Mgmt. (AM)				X

Business Process Reengineering (BPR)

Business Process Reengineering (BPR) transforms organization operations to entirely new and more effective business processes. BPR is primarily cross-functional in its focus. BPR involves questioning assumptions. In the mid 1990s, especially workflow management systems were considered as a significant contributor to improved process efficiency. BPR is usually utilized in the Blueprint Phase.

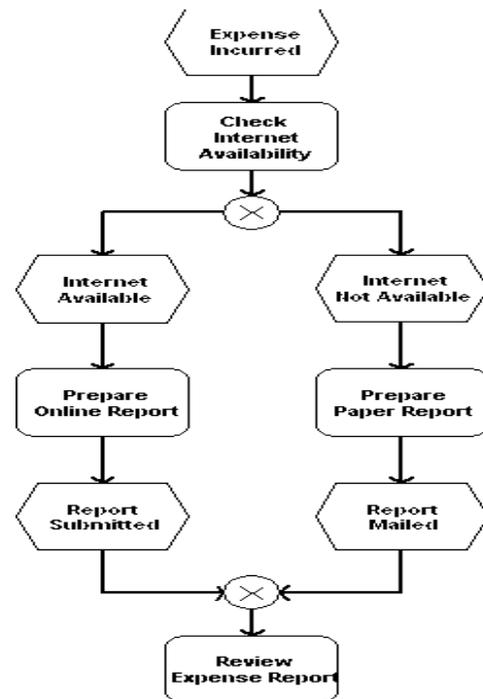
There are numerous BPR approaches and they each differ according to the magnitude of the change and the change effort involved. Selecting the right model to teach BPR is thus a difficult task. We adopted the model developed by Guha et.al. (1993). This BPR model consists of six phases: 1) Envision new processes, 2) Initiating change, 3) process diagnosis, 4) process redesign, 5) reconstruction and 6) process monitoring.

Business Process Modeling

A process model is a graphical illustration of the business processes. It is a set of

communication means that can be utilized by the ERP/SAP team members for BPR in the Blueprint phase. Two types of commonly used graphical representations are the Deployment Flowchart and Event Process Chain (EPC) Diagrams. They can both visually illustrate the process requirements and potential improvements that make the business processes more efficient. The deployment flowchart uses the symbols of basic flowchart representing the flow of goods or data among individual roles or departments of an organization. The deployment flowchart is also referred to as a swimlane chart. Another widely used modeling tool is called the hierarchical modeling flowchart which provides the flexibility of describing processes in more or less details. EPC is another graphical diagram that can be utilized to describe the process driven structure of enterprise systems. Unlike flowcharting, EPC enforces a strict structure using the structure: event-function-event: for an event, its object + past participle; for a function, its verb + object. Figure 3 illustrates an EPC diagram with two XOR connectors showing that a salesperson can submit his/her expense report online (Monk & Wagner, 2008).

Figure 3 Event process chain (EPC) diagram

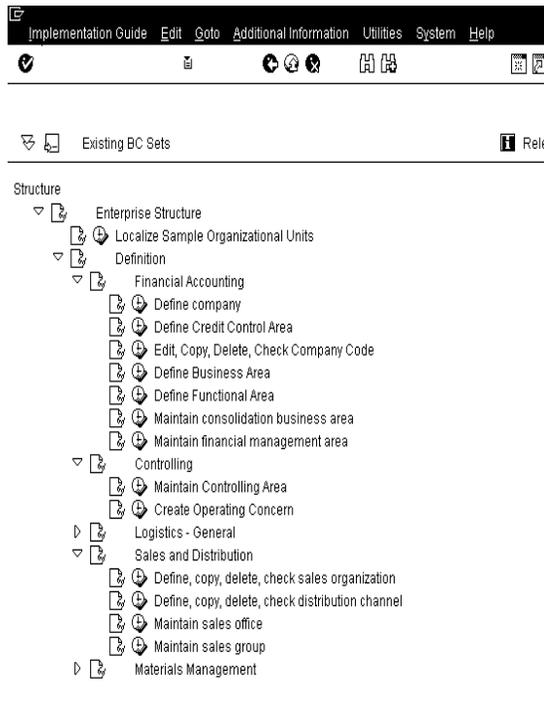


SAP Configuration

The completed reference model is known as the Enterprise Model when the configuration activities have matched the business requirements to the processing available in the Reference Structure. The Implementation Guide (IMG) is a SAP system tool for actually making the settings that configure the R/3 System to meet a company's requirements. The SAP IMG is an integral part of the R/3 System that is used in the configuration of the R/3 System. About 80 percent of a typical SAP system installation is handled by the IMG configuration setting. Another 10 percent are enhancement of ABAP tools and appended structure, while 10 percent are customer developed via ABAP tools.

A Project IMG is a subset of the Reference IMG that contains the documentation for selected IMG components that are implemented as part of the specific configuration project. The Project IMG in Figure 4 facilitates the establishment of the organization arrangement during a company's configuration by using IMG.

Figure 4 SAP Implementation Guide (IMG)

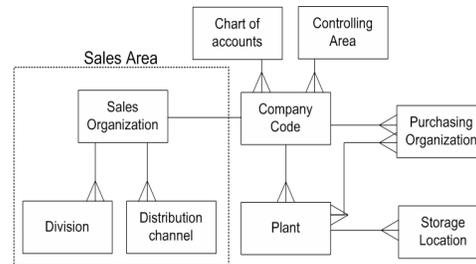


Organization Structure

The SAP Enterprise Structure can be represented by an organizational diagram in Figure 5, which is a model of the relationships among various SAP system organizational elements.

- The organizational diagram represents the organizational structure implemented within the SAP R/3 System.
- This organizational structure is a required prior to any SAP configuration, regardless of the number of applications modules that are implemented for a particular company.
- The available organizational elements are the same whether the SAP R/3 System is being implemented for manufacturing or service related industry.

Figure 5 Organization diagram



ABAP Development Workbench

The ABAP (Advanced Business Application Programming) Development Workbench is an integrated set of fourth-generation tools, which support the implementation of critical client/server applications, or add-ons to standard R/3 System modules. This is where customer developed processes takes place. This toolset is especially suited to R/3 System installations that require enhancements to standard R/3 business applications with customized add-on functionality. The major components of the ABAP Development Workbench include ABAP Programming Language, ABAP Dictionary, ABAP Editor, ABAP Function Library, Data Modeler and R/3 Repository.

ERP Implementation Methodology

Accelerated SAP (ASAP) is a System Development Life Cycle (SDLC) methodology

that has been created to guide the rapid implementation of the SAP Enterprise System. It is a computer systems analysis and design methodology and tools provided by SAP AG. This methodology seeks to standardize and expedite the typical SAP implementation. It has proven to be effective when implementing the ERP/SAP solution across industries and different customer environments.

From an academic point of view, the use of the methodology has significant value as it is aligned with industrial standards and procedures defined in Project Management Body of Knowledge (PMBOK) Guide. The *PMBOK Guide* is an internationally recognized standard (IEEE Std. 1490-2003) that provides the fundamentals of project management as they apply to a wide range of projects, including construction, software, engineering, automotive, etc. This guide is consistent with other management standards such as International Organization for Standardization (ISO) 9000 and the Software Engineering Institute's Capability Maturity Model® Integration (CMMI).

In practice, ASAP makes it easier to assign consulting tasks among different projects effectively and to provide an increased level of consistency. The Solution Manager is the SAP platform that delivers the ASAP methodology.

1. Project Preparation – Define the project's scope. Organize the team, the vendors and hardware.
2. Business Blueprint – Define the business process requirements; discuss configuration, discuss data migration.
3. Realization – Configure the system, write middleware interfaces, develop ABAP code.
4. Final Preparation includes testing and training.
5. Go Live – Begin using the system.

System Landscape

The landscaping is the environment where customization activities of configuration are actually performed, tested and released to production. The configuration activities take place in the Development System. The Development System includes customizing client, testing client unit, sandboxing (prototyping) client and developing customer

processes. SAP recommends an organization set up its system for development system, quality testing system, and then production system. So each change to the system, such as software upgrades and releases, can be tested fully before being released into production. The transport directory is the mechanism to load and test these changes. The system landscape in Figure 8 contains all the SAP Systems that are installed for an organization. It consists of three systems, whose SAP Systems are linked by transport routes.

4. CLASS ACTIVITIES

SAP technical hands-on activities are discussed in the following four sections.

SAP Navigation

Navigation in the ERP/SAP system is very important for students who have never used the system before. The most obvious learning need in adoption of an ERP system is to acquire operational capability with the software. Navigation and systems operations are concerned with the actual use of the SAP system that focuses on how to utilize the software and perform business transactions. Navigation activities start with log-on to SAP, creation of multiple sessions, and use of title bar, menu bar, status bar, command field, functions of different icons and help.

Implementation Exercises

The laboratory course materials were adapted from the implementation of an integrated business scenario provided by SAP University Alliance. Fitter Snacker scenario is designed to introduce implementation of integrated business processes through configuration of a small manufacturing with production approach called "make-to-stock". The case introduces students to learn the basics of business process integration by individually configuring a snack bar company in the SAP environment. The Fitter Snacker Client represents the fictitious Fitter Snacker Company that is used as an example in the textbook ((Monk and Wagner, 2007). Exercises for the Fitter Snacker Client match with examples used in the textbook. Students will configure the FI, MM and CO modules of the SAP system using

instructions organized into 9 modules. At the end of these modules, students will produce a printout of their G/L accounts, vendors and purchasing information records, respectively, to demonstrate their progress. After completion of Module 9, students will test their configurations with two sets of transaction exercises called Testing Task 1 (TT1) and Testing Task 2 (TT2). In TT1, students perform a range of accounting transactions as a basic test of their FI and CO configuration. In TT2, students complete the transactions to purchase, receive and pay for raw materials, validating their configuration of the MM module. After TT1 and TT2 have been performed, students will configure the PP module using the instructions in Modules 10 and 11, then test this configuration using TT3 and TT4. In TT3, the students set up and run MRP to create planned orders, while in TT4 the students convert planned orders into production orders, which they process to produce 7 cases of completed NRG-A bars. With both TT3 and TT4, the students produce a printout of the Stock/Requirements list for the appropriate material to validate their configuration. After TT3 and TT4 have been performed, the students will configure the SD module using the instructions in Modules 12 and 13. The SD configuration is validated by TT5, which is a sales order processing exercise that has the students sell snack bars produced in TT4 to a customer configured in Module 13. In TT5, the students hand in a printout of the Document Flow to show they have successfully completed TT5.

Implementation Project

After Fitter Snacker Company is configured, students are assigned to configure the Marshall Muffler Company using the Fitter Snacker documentation modules as a guide and data provided from a preliminary site visit to Marshall Muffler. The primary goal of the configuration project is to produce a customized SAP system that can manage the purchase of raw materials, production and sales of mufflers for the Marshall Muffler Company.

Simulation Game

The Muesli Simulation game provides the SAP environment for students to experience

an integrated enterprise system. Students are divided into teams. Each team operates a make-to-stock manufacturing plant that interacts with the suppliers and customers by sending and receiving orders, delivering their products and completing the whole cash-to-cash cycle. Students get the opportunity to make strategic decisions for recipe (product design), sale forecasts, production improvements, timing of production release. At the end of the game, raw materials and finished goods inventory will be sold out at a reduced price. Team members may renegotiate their bank loan with the bank at the end of each quarter. Interest is calculated quarterly and will be charged automatically at the end of a quarter. Customers do not change throughout the game, hence you may learn from past their behaviour. The company (team) displaying the highest equity value (shareholder capital) at the end of the simulation wins the game. As a make-to-stock manufacturing company, there are four of processes that must be performed (i) the planning process, (ii) the procurement process, (iii) the production process, and (iv) the sales process. Each process can be decomposed into transactions. To complete the four operational processes mentioned above, a total of fourteen transactions must be performed. Most of the transactions involved in these processes are operational in nature, such as to purchase materials or to deliver finished products (ERPsim, 2008). The four operational processes with fourteen transactions are illustrated in Appendix II.

5. CONCLUSION

The goal of the paper is to propose a comprehensive teaching approach which ties SAP fundamental knowledge to SAP implementation activities. Hands-on experience learning enables students to navigate in some areas of the SAP system, execute tasks, and learn some SAP technical skills, but provide no understanding of why tasks are being performed. The laboratory manuals focus on step by step instruction on task completion, not on business logic (Scott and Sugar, 2004). Thus, hands-on learning experience has limited value unless it reinforced with the in class discussion and review. The combination of hands-on laboratory learning and business process concepts learning via reading, discussion,

and case study is powerful and effective approach to learn SAP fundamentals. It is a challenge to balance the two streams and relate the laboratory learning with business process integration in the course.

The purpose of the paper is to shift the teaching focus of SAP implementation from SAP technical issues to organization transformation process. The proposed framework takes into consideration of the various disciplines and different types of competencies needed to effectively transform business processes in an organization. Learning by doing activities make students motivated to learn new materials by themselves. One of the most important features of the comprehensive framework is that it focuses students' attention on the organization transformation process rather than on the technical aspects of SAP systems only. The paper highlights the needs to tighten the SAP laboratory manuals to the business logic so that the students are able to understand why they are learning the SAP laboratory materials and how the system actually works, rather than simply following the laboratory manuals and learning to operate on the computers.

6. ACKNOWLEDGEMENTS

The authors would like to thank Professor Roger Hayen, Professor Ellen Monk and Professor Bret Wagner for their ERP/SAP textbooks. We are also grateful to the SAP University Alliance Program for providing us SAP software, server hosting and high quality SAP laboratory materials.

7. REFERENCES

- Davis, Charles and Jana Comeau, (2004) "Enterprise Integration in Business Education: Design and Outcomes of a Capstone ERP-based Undergraduate e-Business Management Course". *Journal of Information Systems Education*, 15 (3), pp. 287-99.
- ERPsims 2008 Tutorial Web Site: <http://web.hec.ca/erpsim/tutorialerpsim>
- Fedorowicz, Jane; Ulric J. Gelinis; Catherine Usoff;; George Hachey (2004) "Twelve Tips for Successfully Integrating Enterprise Systems Across the Curriculum". *Journal of Information Systems Education*, 15 (3), pp. 235-44
- Guha, S.; Kettinger, W.J. and Teng, T.C., (1993) "Business Process Reengineering: Building a Comprehensive Methodology", *Information Systems Management*
- Hackney, R., McMaster, T. and Harris, A. (2003) "Using cases as a teaching tool in IS Education" *Journal of Information Systems Education* v. 14 (3), pp. 229-234
- Hayen, Roger. *SAP R/3 Enterprise Software: an Introduction*, McGraw-Hill, 2007
- Monk, Ellen and Bret Wagner, *Concepts in Enterprise Resource Planning*, 3rd.Course Technology, 2008.
- Nelson, Robert J., and Ido Millet (2001), "A Foundation Course in ERP and Business Processes: Rationale, Design, and Educational Outcomes." *Proceedings of the Seventh Americas Conference on Information Systems*, Miami, pp. 992-997.
- Noguera, José H., & Edward Watson (2004), "Effectiveness of Using an Enterprise System to Teach Process-Centered Concepts in Business Education." *Journal of Enterprise Information Management*, 17 (1), pp. 56-74.
- Pellerin, Robert and Pierre Hadaya, (2006) "An innovative framework for terracing reengineering and ERP implementation concepts", *Innovation Monograph II: Enterprise resource planning: Teaching and research*, pp 13-20.
- Seethamraju, Ravi C. (2002), "Trials and tribulations in the design and delivery of innovative business course in enterprise resource planning in Australia," *Proceedings of the 17th Annual Conference of the International Academy for Information Management (IAIM)*, Barcelona, pp. 237-249.
- Scott, Judy E. and Don Sugar (2004), "Perceived Effectiveness of ERP Training Manuals". *Proceedings of the Tenth American Conference on Information systems*, New York, pp. 211-3215

Appendix I Proposed framework for teaching ERP/SAP implementation

ERP Business Process Concepts	SAP Hands-on Technical Activities
ERP infrastructure and components	SAP interface navigation
ERP Core business processes	Application modules & business process procedures implementation
Business process reengineering (BPR)	Application modules Process modeling diagrams
Implementation methodology roadmap	Accelerated SAP
Enterprise model and organization structure	Fitter Snacker Configuration: Implementation Guide (IMG)
General ledger and controlling	Fitter Snacker Configuration: financial accounting
Organization structure	Business area customization
ERP Landscape systems	Testing Fitter Snacker configuration
Integrated business operations	ERPSim Simulation game

Appendix II Four Integrated business processes with 14 transactions (ERPSim, 2008)

