SAP-related Education – Status Quo and Experiences

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ABSTRACT

Integrating Enterprise Systems solutions in the curriculum of not only universities but all types of institutes of higher learning has been a major challenge for nearly ten years. Enterprise Systems education is surprisingly well documented in a number of papers on Information Systems education. However, most publications in this area report on the individual experiences of an institution or an academic. This paper focuses on the most popular Enterprise System - SAP - and summarizes the outcomes of a global survey on the status quo of SAP-related education. Based on feedback of 305 lecturers and more than 700 students, it reports on the main factors of Enterprise Systems education including, critical success factors, alternative hosting models, and students' perceptions. The results show among others an overall increasing interest in advanced SAP solutions and international collaboration, and a high satisfaction with the concept of using Application Hosting Centers.

Keywords: Enterprise Systems, ERP, SAP, Off-the-shelf software

1. INTRODUCTION

Enterprise Systems (ES) form the core of the application infrastructure of most large organizations. While the initial focus of these solutions was on the integrated support for all intra-organizational processes (logistics, accounting, human resource management), the scope has extended in three directions. First, ES now also cover advanced solutions for inter-organizational processes such as Customer Relationship Management (CRM), Supplier Relationship Management (SRM), and Supplier Chain Management (SCM) (Klaus et al. 2000). Second, complexity-reduced versions of those systems now target the market of small and medium-sized organizations. Third and most recently, the scope of ES extends to the technical integration platform that underlies the landscape of those applications as demonstrated in new ES platforms based on the idea of a Service-oriented Architecture.

The increasing global implementation of ES since 1993 (Chung and Synder 1999; Davenport 1998; Davenport 2000; Rosemann 1999) did not initially correspond with a similar integration of ES into the curricula of universities and other institutes of higher learning (Gable et al. 1997). The consequence was not only a shortage of graduates with a solid understanding of and appreciation for this kind of system, but also a lack of credible academic research on ES

(Eder et al. 1999; Gable 1998). A main reason for this development has been the tremendous complexity of ES, which posed a significant challenge for many institutions. It wasn't until 1997 that ES found their way into the curricula of Business, Information Technology/Information Systems and Engineering schools (Gable and Rosemann 1999).

ES education is an area demanding special attention for a number of reasons (Rosemann and Watson 2002). Students have a strong interest in this subject hoping to gain market driven skills. While this often ensures high attendance, student perceptions and expectations must be managed carefully in that it is not the objective of such initiatives strictly to enhance student skills via training activities. Managing ES is typically comprehensive and complex. The frequency of upgrades and innovations from one software release to the next characterizes the rapidly evolving nature of these IS solutions. Because of the frequency of changes in the functionality within the system, it is often difficult for the lecturer to stay abreast of these changes and to understand the implications of these changes to business practice, as well as research and education. By the time textbooks of satisfying quality are available, there are new system upgrades and innovation cycles to deal with almost making the text book obsolete. ES are used to support the learning of traditional business functions (e.g., accounting, cost management, operations management, human resource

management), contemporary business process analysis (e.g., order-to-cash, plan-to-produce, procure-to-pay, hire-to-retire), and advanced technological solutions (e.g., data and knowledge management, systems administration, application development, Web services).

This paper provides a condensed overview about the status quo of ES education using SAP's solutions as an example. The paper is based on a global survey which was conducted between September 2003 and January 2004 involving responses from 305 lecturers and more than 700 students. It updates and extends a previous global survey on the integration of SAP solutions into the curricula from 1999 (Gable and Rosemann 1999).

The paper is structured as follows. Section 2 briefly summarizes previous related work on ES education. Section 3 provides background information in terms of the survey design and participants in this study. The discussion of current practices and experiences with SAP-related education in section 4 forms the core part of this paper. The perceived major issues and success factors are discussed in section 5. The final section summarizes the findings and provides also a subjective outlook on future challenges in this area.

2. RELATED WORK

While ES were integrated quite late in the curricula in comparison with system implementations in practice, a high number of publications have been published in this area. In fact, until four years ago, publications on ES education formed a large part of all ES-related academic publications (Esteves and Pastor 2001). Comprehensive overview articles on ES education can be found in Watson and Schneider (1999) and Rosemann and Watson (2002). MacKinnon provides a brief overview about SAP-related offerings at 17 universities that are accredited by the Association to Advance Collegiate Schools of Business (MacKinnon 2005).

However, the majority of papers reflect on *individual experiences* within a new program, such as a specific MBA program (Winter 1999), or a certain discipline, such as Information Systems Master of Science programs (Holmes and Hayen 1999a, 1999b). The experiences of Louisiana State University in integrating SAP solutions into their IS curriculum have been documented by Watson and Noguera (1999). Becerra-Fernandez et al. (2000), Elam et al. (1999), Lederer-Antonucci (1999) and Bradford et al. (2003) report on experiences with the integration of ES into the curricula of Business Schools. Foote (1999) describes an SAP-accounting class and other SAP-related courses in the US. Shoemaker (1999) sketches a six-hour introduction to ES for sales and marketing professionals.

The practical nature of SAP solutions motivated many academics to create new educational models based on the notion of problem-based learning and involving current industry problems. Rosemann, Sedera and Sedera (2000), Hawking and McCarthy (2000), Stewart and Rosemann (2000, 2001) and Rosemann et al. (2001) discuss such ways of leveraging *industrial work experiences* and projects for

ES courses. A number of academics contributed to the area of ES education with re-usable teaching cases (e.g., Brown and Vessey (2000). Initially, those case studies were often based on the easily accessible experiences of the ES implementation at the academic's university (Mahrer 1999; Sieber et al. 1999).

The overall impact of reorganizing ES subject matter into existing curricula and the special challenges posed to faculty have been reported by Stewart et al. (1999a, 1999b). The *benefits and pitfalls* of teaching conceptual knowledge with ES as a learning vehicle have been critically evaluated in terms of learning outcomes and effort by Watson and Noguera (1999) and Scott (1999).

An example of a syllabus for the *remote delivery* of an introductory subject via the Internet is given by Holmes and Hayen (1999a). Holmes and Hayen describe the design of a course consisting of 10 lessons which introduce the concepts, fundamentals and framework of ES (see also http://sap.mis.cmich.edu/sap-esoft00.htm). Rosemann (2001) compares effectiveness of the on-campus version of a post-graduate ES class with the corresponding off-campus version. McCarthy and Hawking (2004) discuss current technologies, which facilitate e-learning experiences in the context of ES.

In some cases, the integration of ES into the curricula triggered innovative *international collaborations*. Stewart and Rosemann discuss an increased international collaboration at universities in order to deliver ES education more cost-effectively (Stewart and Rosemann 2001). Klose et al. (2004) report on a joint project between a German and an Australian university in the context of SAP-based supply chain management. Rosemann, Scott and Watson (2000) summarise their experiences in a SAP-based collaboration between two American and one Australian university. Lederer-Antonucci and zur Mühlen (2001) outline the setup and experiences of an award-winning collaboration between an American and a German university. Tracy et al. (2001) report on a SAP-funded initiative related to the setup of a student marketplace.

As this brief overview indicates, most publications in this field reflect individual experiences. The core of all experiences is often similar and can be summarized as challenging for the involved academics and rewarding in terms of students demand. Papers that are actually based on more theoretical models of learning in the context of ES education have been the exception (e.g. Scott 1999).

In summary, ES education is well discussed with a clear focus on papers reporting on individual experiences. However, the majority of these papers could be seen as case studies or action research.

3. BACKGROUND

This research project had the objective to identify the current and global status of the integration of SAP solutions into the curriculum of institutes of higher learning. SAP has been

chosen as an example for an Enterprise System due to its globally market leading status, the wide scope of its functionality, the mature SAP University Alliance Program, the comprehensiveness of the related research, and the support by SAP for this study. A survey was chosen as the research methodology as the focus was on collecting and analyzing a high number of responses in a well-understood domain (Gable 1994).

3.1 Respondent Source and Controls
SAP's Global University Alliance Director developed questions and provided a comprehensive list of lecturers involved in the integration of SAP into the curriculum. SAP also provided funding for an Honor student for the development of an online survey, data collection and data analysis. With this online survey, it was possible to gather cost-effectively and quickly an international view on the current status of the integration of SAP solutions in the curricula. The survey was an extended update of a similar survey from 1999 (Gable and Rosemann 1999).

The main difference between the study conducted in 1999 and the current study is that in addition to collecting information from faculty, information was also collected from students. The lecturers' contacts have been provided by SAP with the attributes name, university and email address. Thus, there was no knowledge about the actual role of those individuals other than that they were members of the SAP University Alliance Program. We gained access to the student responses through these contacts. In the invitation to the lecturers, we included instructions to encourage the involvement of their students in answering the 5 minute survey as part of one of their SAP tutorials.

Country	Number of contacts
Australia	39
Brazil	20
Canada	226
China	9
Czech Republic	6
Finland	14
France	13
Germany	852
India	9
Japan	28
Malaysia	2
Mexico	9
Netherlands	19
New Zealand	17
Philippines	2
Singapore	6
Slovenia	10
Spain	9
Switzerland	14
Thailand	2
UK	6
USA	416
Venezuela	3

Table 1. Invited lecturers per country

A total of 1,731 e-mail contacts has been provided by SAP through their SAP Global University Alliance Program. Table 1 shows the number of contacts per country reflecting the true international character of this study. These are contacts of lecturers currently involved in teaching or administering SAP in their department and or university. To ensure that the lecturers' survey was accurate and that complete control over the respondents existed, an authentication mechanism was put in place for the lecturers' online survey to identify and ensure that the lecturer only entered the response once and that only "invited" lecturers were able to complete the survey. Every respondent had to enter his/her email address before (s)he was able to complete the survey. The students' survey website, however, was only disclosed to the lecturers in their invitation e-mail. It did not include such a control mechanism.

3.2 Survey Design
The survey design was based on three sources. First, the core skeleton of the survey for the lecturers was based on the instrument previously developed and used by Gable and Rosemann in 1999. Second, a significant update of the survey took place based on new system developments (e.g. the development from SAP R/3 → mySAP Business Suite) as well as changes in the mode of system management, i.e. the increased popularity of mySAP Application Hosting Centers. Third, the survey for students was developed from scratch. A pilot test with six Australian lecturers involved in SAP-related education motivated only minor changes.

3.3 The Lecturer's Survey
The lecturer's survey was divided into these six sections:
   (A) Curriculum Implementation Issues
   (B) Learning SAP
   (C) Administering SAP
   (D) Cross-university collaboration
   (E) Impact on public perception
   (F) SAP-related subjects
All the sections inquire about the respondent's overall experience and integration of SAP into the curriculum. In the following, each section is explained in more detail.

3.3.1 Curriculum Implementation Issues: This section consisted of two open-ended questions which were included in the original 1999 survey. The first question explored the major issues as perceived by the lecturers when introducing SAP into the curriculum. The second question captured the perceived success factors for SAP education. The respondent was required to fill in at least one answer for each question and had the opportunity to provide up to four answers for each of the two questions. This data provided qualitative information on the major challenges in establishing and delivering successful ES curricula. The purpose was to confirm issues and success factors as they have been reported in various papers.

3.3.2 Learning SAP: This section captured the lecturer's opinion regarding the best way to comprehend SAP solutions. The focus here was on the different learning instruments and methods for the lecturer and staff involved in SAP education. The data in this case was captured on a

five point Likert scale ranging from 'unimportant' (1) to 'highly important' (5). The following alternatives represent a minor update of the alternatives as included in the 1999 survey.

- SAP training courses
- Workshops
- SAP Innovation Congress
- 3rd party training courses (classroom)
- CBT (Computer Based Training)
- SAP web pages (www.sap.com)
- SAP online help (help.sap.com)
- Hands-on (learning by doing)

A better understanding of the most effective training channels provides valuable guidance for new lecturers in the area of ES education, who regularly face the question of how to comprehend the SAP solutions in a restrictive timeframe. The feedback is also of significant importance for the SAP University Alliance Program.

No.	Option	Context-specific questions
1.	The university hosts own SAP application	• Do you plan to use a UCC in the next 12 months? • Number of staff and people involved in administering the SAP application
2.	The university uses a UCC	• When have you become a member? • Degree of satisfaction with the UCC support in the following dimensions: - response time - quality of response - system performance - value for money
3.	The university is a UCC	• Degree of satisfaction with the UCC in the following dimensions: - response time - quality of response - system performance - value for money
4.	The university uses a third party ASP	• Degree of satisfaction with the ASP's support in the following dimensions: - response time - quality of response - system performance - value for money

Table 2. Questions on my SAP UCCs

3.3.3 Administering SAP:
With the establishment of mySAP University Application Hosting Centers (aka University Competence Centers, UCC), it was important to include a new section, which considered the alternative modes of system management. In September 2003, 13 SAP UCCs existed and it was of high interest to study the utilization of those centers as well as the perceived satisfaction. Four choices were set as options for the respondent:

- The university hosts its own SAP application
- The university uses a UCC (in which case a drop down list with the 13 UCCs was provided)
- The university is a UCC (in which case we asked which UCC they were)
- The university uses a third party Application Service Provider (ASP) (in which case we asked which ASP and if any other parties are involved)

Depending on the selected choice, different sets of questions were presented to the respondent (see Table 2).

The section also included items related to the overall impression of SAP as a corporation.

3.3.4 Cross-university collaboration:
The Global University Alliance Program helped to establish a close peer-to-peer network between the Alliance members. The intent of this section was to capture the actual status of collaborations between the members and the forms of such collaborations. This section is based on a very similar section in the '99 survey.

3.3.5 Impact on public perception:
Also similar to the '99 survey, we included a section on the actual impact of the integration of SAP solutions in the curricula. This section used a five point Likert scale in order to rate the impact on the public perception. The following table details different questions of this section.

No.	Question	Scale
Q17	Increase in student demand	5: substantially 1: not at all
Q18	Increase in employer interest	5: substantially 1: not at all
Q19	Increase in employer demand for students with SAP knowledge	5: substantially 1: not at all
Q20	Reaction of students to SAP introduction	5: positive 1: negative
Q21	Reaction of industry to SAP introduction	5: positive 1: negative
Q22	Reaction of employers to SAP introduction	5: positive 1: negative

Table 3. Questions on the actual impact of the SAP integration

The results of this section provide valuable indicators for the actual success of the SAP initiative. This is measured based on demand and employability of the students and also how receptive students are of the SAP education.

3.3.6 SAP-related subjects:
This section forms the core of the entire survey as it collects detailed data on the individual units taught at the participating institutions. This section had to be substantially revised in comparison with the '99 survey as it investigates the integration of specific SAP solutions into the curricula. This section had to be completed for each unit in which the respondent is either currently

referencing/using SAP or in which he/she plans to reference/use SAP in the future. For each unit, the respondent was required to provide details of the subject in terms of number of hours for lectures/tutorials and consultation. The respondent was also required to indicate the SAP modules the unit touched on and SAP support tools used in the course of this unit. Inputs were measured on a five point Likert scale from "casual" to "in-depth". The data collected in this section provided insights into the detailed design of the curricula and the most popular SAP solutions.

3.4 The Student Survey

A main motivation for the survey was the collection of feedback from the students. In the end, students are the customers of the entire SAP education program. Exploring their feedback is similar to a customer satisfaction study. The student survey was a significantly reduced subset of the lecturer survey with some variations. Students were approached by the lecturers involved in this study within SAP-related tutorials. The web-based design of the survey allowed an easy integration into hands-on sessions with the SAP system. The survey for the students has been very brief and on average it took 5 minutes to complete it. There were no incentives for the students to participate in this survey. There were only two sections in the survey:

    (A) Major Issues and Success Factors
    (B) Learning SAP

3.4.1 Major Issues and Success Factors: Similar to the lecturer survey, this section included only two questions. The first was *"Please list any major issues that you have experienced with learning SAP solutions as part of your courses."* The student was required to provide up to five answers. This allowed us to compare the students' viewpoints with the lecturers' viewpoints. The second question was *"Please list any key success factors you have identified for learning SAP solutions."* Success is viewed very differently by individuals. With the data captured here, we could contrast the students' perspective with the lecturers' perspective.

3.4.2 Learning SAP: Successful ES education requires a deep understanding of the main challenges students face when they are exposed to SAP solutions. This section investigated a few of the main perceptions by students in this context.

4. DATA COLLECTION AND ANALYSIS

4.1 Issues related to the international nature of this study
Data in this study had been gathered from lecturers from all over the world. This gave rise to many problems mainly in terms of language and the different semester structure in the different countries.

In order to increase the user acceptance and the understandability of the survey, it was decided that the two surveys also be translated by native speakers into Spanish and German. Once the data collection phase was completed, translators had to be engaged again to convert qualitative

data back into English to maintain consistency for the entire data analysis.

The next problem was the different semester periods. As students were involved in the data collection, it was important to send out the survey at a time when the students could be approached (e.g. in a tutorial). Furthermore, students had to have a certain experience as consumers of ES education in order to develop an opinion. As German participants formed a significant percentage of the respondents and the German semester timeframe is quite different, we broke the invitation to complete the survey into different phases: global universities and German universities. The non-German participants received the first invitation on 19 September 2003. A reminder was sent out on 1 October 2003. The first invitation to the German participants was sent out on 26 November 2003 followed by a reminder on 8 November 2003.

Qn No.	Question	Scale
Q4	Please rate the ease of use of SAP software.	1: very difficult 5: very easy
Q5	Have you explored the SAP software beyond the classroom experience?	1: not at all 5: very much
Q6	Do you believe your SAP experience added value to your employability?	1: not at all 5: very much
Q7	Did the exposure to SAP software increase your interest in a SAP-related occupation?	1: not at all 5: very much
Q8	Overall, how would you rate your enjoyment of your experience with SAP software?	1: not at all 5: very much
Q9	What is your overall impression of SAP as a corporation?	1: positive 5: negative

Table 4. Questions on Students' Learning of SAP

4.2 Response Rate
4.2.1 Lecturer survey: 109 of the 1731 e-mails sent out did not reach their destination. Either the contact person was no longer with the institution or the e-mail bounced back because of an invalid address. A further 23 contacts replied stating that they do not have any SAP experience and asked to be excluded from the contact list. This leaves 1731-109-23 = 1599 valid contacts. During the course of the survey, 17 additional contacts were included due to recommendations from other contacts increasing the number to 1616. Of these 17 contacts 14 responded to the survey. At the end of the survey, 305 persons responded, which leads to a response rate of 19 %. Of these 305 responses, only 238 completed the entire survey, i.e. 15 %. 20 participants indicated that they do not have any experiences in SAP education and 47 participants did not complete the entire survey. This could be because the person responding was heavily engaged with other tasks while completing the survey or the completion of the survey took longer that the participants expected and they were not able to finish the
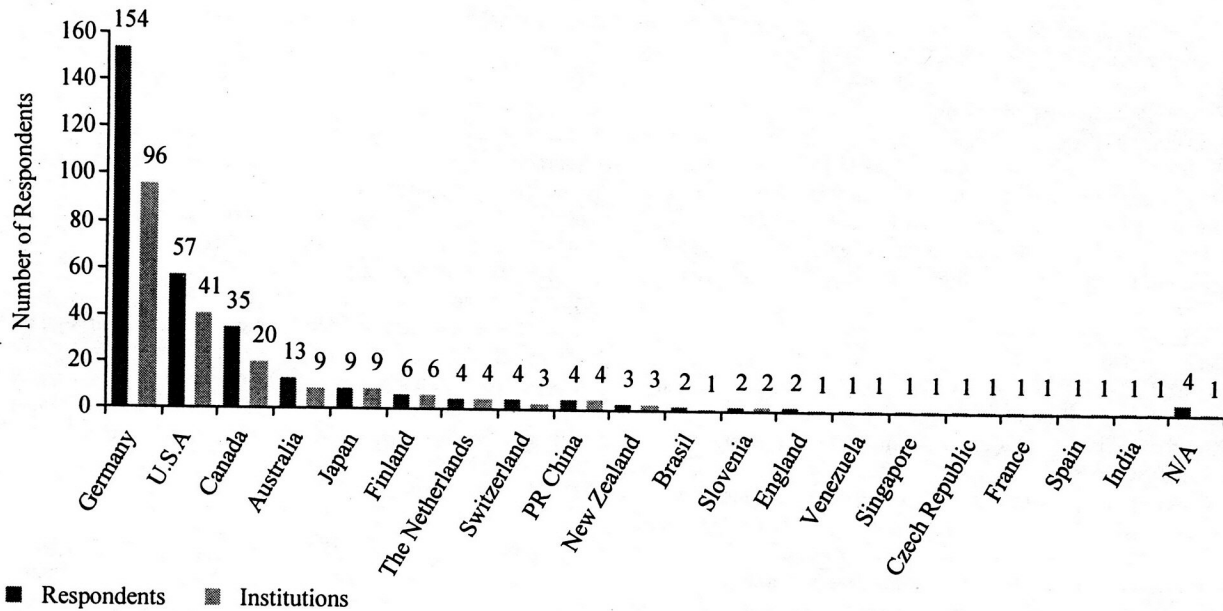
Figure 1. Respondents distribution

survey. Still, 15 % is perceived as an overall satisfying response rate for the following reasons:

- We assume that a significant number of the 1616 contacts were not involved in SAP education, but did not bother replying to our two emails.
- In many cases we had a number of lecturers from the same institution. In some cases, this included more than 10 names. We are aware of a number of cases, in which those individuals pooled their answers.
- The collection of detailed data on the individual units can be quite time consuming, which might have been an issue for some participants.
- Though we already offered the survey in three languages, barriers still may have existed for some regions, for example in Japan or France.

The 305 responses came from 205 different institutions and 19 different countries. 50.5 % of the respondents came from Germany. Participants from Germany also represent 46.8 % of the institutions responding though they only represented 35.3 % of all institutions in the contacts provided by SAP. The absolute high number of responses from Germany can be explained by the long tradition of SAP education in Germany, which goes back to 1993, the mature German SAP University Alliance program with a full time University Alliance manager for more than 10 years, the high number of Fachhochschulen (universities of applied science) involved in SAP education and the overall German roots of SAP. USA comes in second with 18.7 % of the respondents from 20 % of the total institutions that responded. This is followed by Canada with 11.5 % respondents and 9.8 % institutions. Figure 1 provides a detailed view on the regional profile of the individual responses.

4.2.2 The Student Responses: 714 students from 8 different countries participated in the survey. 63 % were German students, 18 % American students, and 13 % Australian students. Since the student's survey was conducted anonymously, many did not include the name of their

institution. As we did not send the questionnaire directly to the students, we are not able to provide a response rate for the students' feedback.
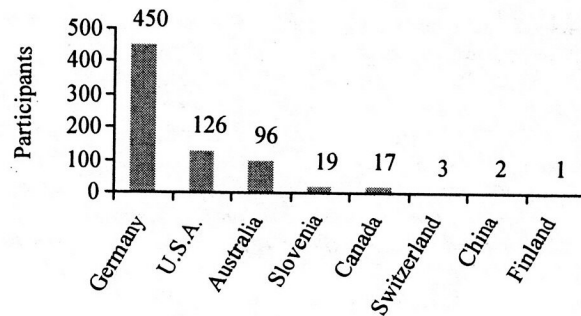

Figure 2. Student's response distribution

The ratio of lecturer to student is exactly *1:3*. Students from 8 different countries responded to the survey and most came from Germany, USA and Australia. Since 50.5 % of the lecturer respondents came from Germany, it is consistent to the result that the majority of students that completed the survey came from Germany as well. The second most responses came from USA also consistent to the lecturer's participation. Since this survey was initiated by an Australian university, we had direct access to lecturers and students in this region. This explains why Australia has 13.45 % of the total student responses. Though we tried to time the survey according to the semester pattern, we had a number of responses from lecturers stating that their university's curriculum time does not coincide with the survey. This means that many of their students may not have sufficient experience in terms of exposure to SAP solutions. Therefore, they were unable to allow the students to respond to the survey.
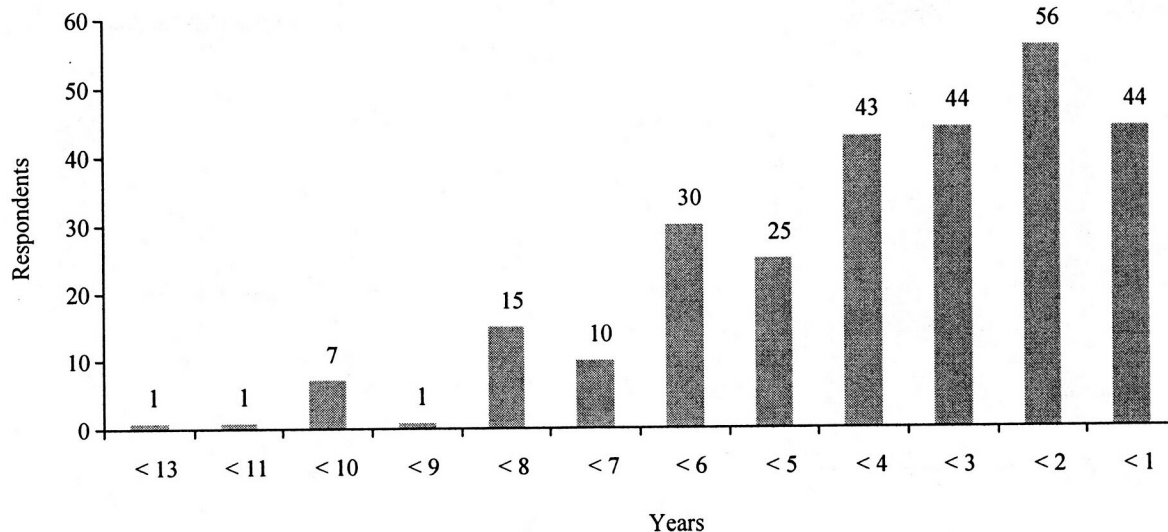
Figure 3. SAP teaching experience in years

4.3 Experiences
The average SAP teaching experience of the responding lecturers is 3.5 years with a 2.24 standard deviation. 50 % of all respondents have less than 3 years experience, 95 % have less than 8 years experience (see Figure 3).

84 % of the respondents have at least 1 year of experience in teaching SAP. This shows that the results captured from the following sections seem to be sufficiently accurate.

Taking an institutions' perspective on the experience with SAP solutions, we found an even higher maturity (Figure 4). The average teaching experience of the 206 responding institutions is 4.3 years with a standard deviation of 2.33. One of Canada's Universities has 13 years of SAP experience, while in Germany some institutions started teaching SAP as early as 1993. The first institutions in the USA followed in 1996. The following chart shows the distribution of the top five country's experience based on the year the country's institutions first implemented SAP solutions.

We also investigated the status of the SAP version currently used. The results suggested that the applications being used were very current with 61 % of the institutions using SAP 4.6 and 31 % using SAP 4.7, the most current version at the time of this survey.

The pattern of distribution shows a general peak from 1998 to 2000. However, it also shows a general steady decline in implementation. This could be one of three reasons:
1. Most institutions have already implemented SAP.
2. There is a decrease in demand for implementing SAP solutions in the curriculum.
3. Not all schools requesting membership in the University Alliance Program are accepted. Increasingly, SAP rejects applications for membership in the University Alliance Program for two reasons. First, an institution does not demonstrate the required commitment (e.g., attending workshops). Second, the

submitted curriculum plan for the integration of SAP into the curriculum lacks the required detail or is overall too weak.
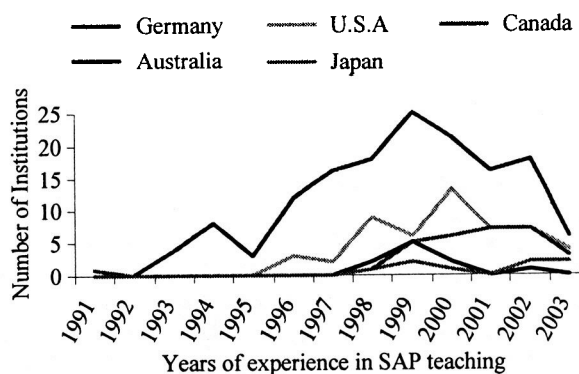

Figure 4. SAP experience by country's institutions

4.4 Learning SAP
One of the key challenges in ES education is to develop the required knowledge of the selected ES solution. Thus, it was interesting to explore how the lecturers rate alternative ways of understanding SAP. Figure 5 shows the results based on a five-point Likert scale with 5 representing 'highly important'. The responses have been analyzed based on the simple arithmetic average knowing that this value has limitations in its validity when using ordinal scales. It is obvious that hands-on experiences are the most important source of knowledge followed by SAP training courses. It is interesting to note that this is the same rating as in our '99 survey, which clearly emphasizes the importance of hands-on experiences and training courses. At the same time, it characterizes the uniqueness of SAP as a curricula subject.

In this section, there was an opportunity to provide other learning avenues. 33 lecturers took this opportunity. Answers other than the given categories were grouped into the following answers:
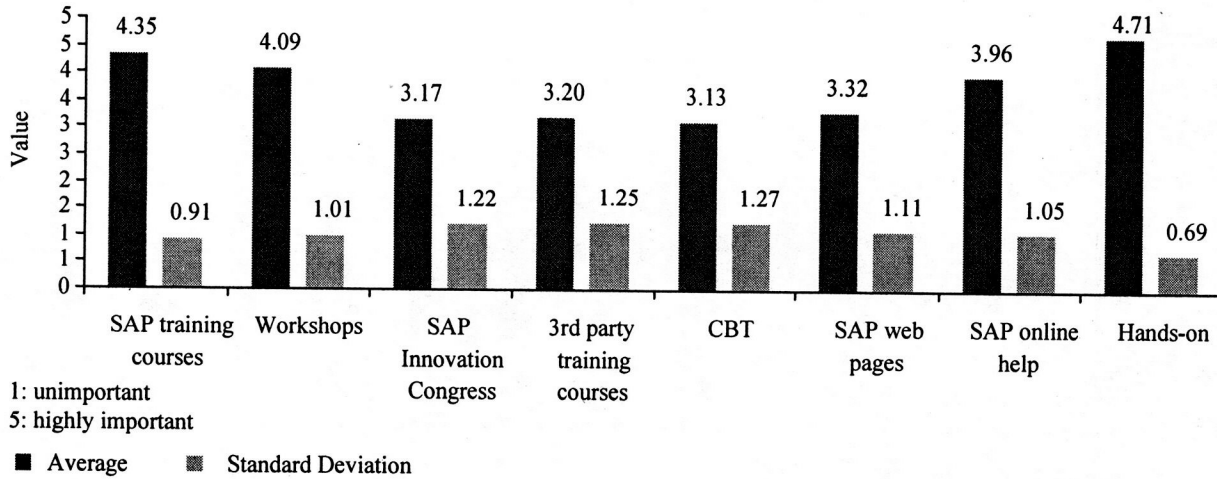
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Figure 5. Learning SAP

1. exchange of experience with peers, trainers, mentors, specialists, consultants
2. literature, self-study
3. other material provided by the SAP University Alliance Program

A detailed breakdown of the answers categorised them into the following top six answers.

- 7 respondents state "training materials" including SAP training materials, books on SAP and other relevant literature
- 6 respondents state "exchange of experience"
- 4 respondents state "consulting with specialists" such as professional SAP consultants
- 3 respondents state "practical experience" such as adopting industry processes and conducting case studies
- 2 respondents state "application help and support"
- 2 respondents state attending "SAP events" such as SAPPHIRE and University Alliance workshops
- There are respondents stating self-study, in-house training, virtual lessons as well as attending faculty workshops

The results show that a number of respondents regard "training materials" and "exchange of experience" as highly important. This is followed by "consulting with specialists" and gaining "practical experience" as the primary training opportunities for learning SAP. All the additional suggestions repeatedly state the need for knowledge exchange through colleagues with common interests. This is seen in "exchange of experience", "consulting with specialists", "application help and support" and "SAP events". All these paradigms have some form of interaction and exchange involving parties of common interest. In this case it is teaching SAP. This is widely known as "communities of practice". These findings seem to support the need to form or join forums.

4.5 Administering SAP

Implementing and continuously maintaining and upgrading a SAP system is a challenging and time consuming activity, which in many cases provided the single most significant hurdle on the way to successful ES education. Thus, it is not a surprise that hosting solutions are of increasing popularity in the context of ES education.

In this section we tried to find out the actual status of how SAP solutions are managed. An institution can either host its own SAP solution, use a SAP UCC, be a SAP UCC itself or use a third party to host SAP. The survey found that approximately 60 % of all participating institutions are a customer of an SAP UCC. Around 30 % of the institutions (still) host their own SAP solution. 22 responses came from universities which are SAP UCC themselves. In total, 285 responses were received in response to this question. Figure 6 shows the detailed results.
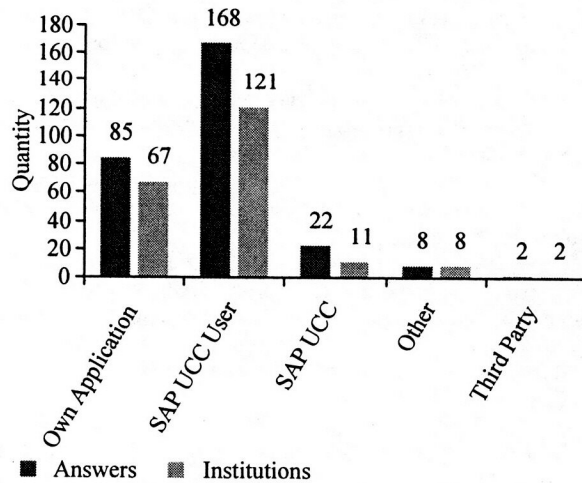

Figure 6. Distribution of SAP solution source

The very high number of SAP UCC customers shows the successful roll-out of this concept. A few respondents stated alternative setups. This included also mixed solutions, e.g. hosting a part of the SAP landscape and accessing a hosted solution for other more specialised components (e.g. CRM, Data Warehousing, and Strategic Enterprise Management). In individual cases, solutions provided by an SAP lab or the official SAP training platform are used.
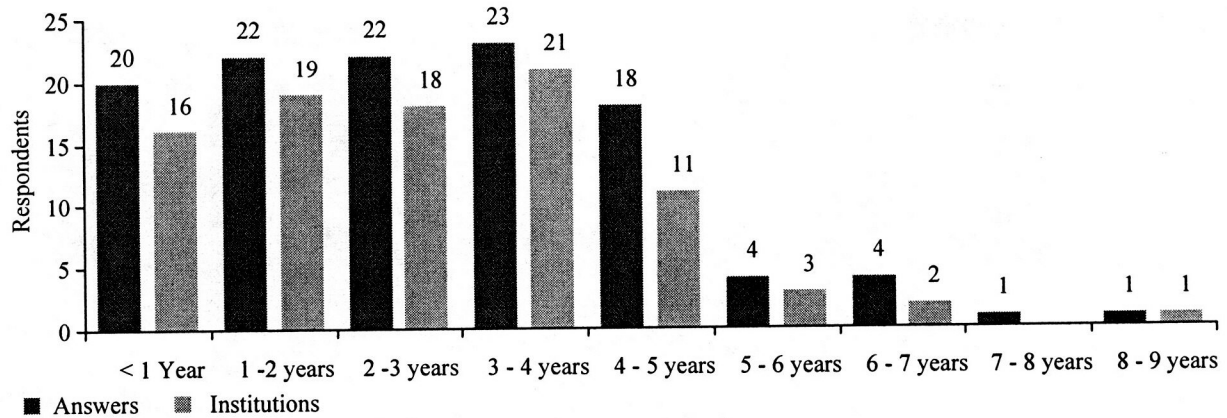
Figure 9. When institutions become a SAP UCC customer

4.6 Hosting the own SAP solution

For the institutions that stated that they host their own SAP solution, we asked whether they would consider using a SAP UCC in the next 12 months. Only 68 of the initial 85 respondents answered this question (Figure 7).
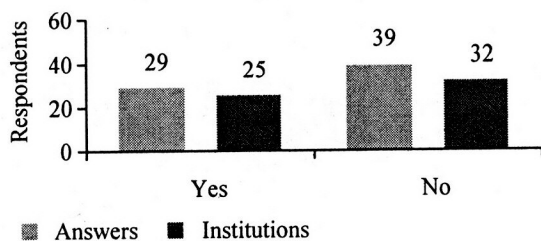

Figure 7. Will you consider being a SAP
UCC customer in the next 12 months?

A narrow majority of those who host their own SAP application stated that they do not plan to use a SAP UCC in the near future. However, 29 respondents from 25 different institutions answered 'yes' to this question, stating that they may consider switching to a SAP UCC. A reason for not switching to a SAP UCC is often the significant investment made into the setup of the own solution.

In addition to the pure demographics, it was interesting to explore how satisfied the respondents were with their onsite SAP administration. Overall, the response indicated reasonable satisfaction in terms of response time, quality of response, and system performance as measured by a five point Likert scale with 1 being 'very satisfied' (Figure 8).

4.6 SAP UCC customers

For those respondents who were customers of an SAP UCC, we asked when they became a member. More than 90 % became an SAP UCC customer in the last five years.

The results show that there was a steady increase of members five years ago (Figure 9).

The interest in a hosted solution is quite consistent over the last five years. The answers come from 115 participants in 91 institutions.
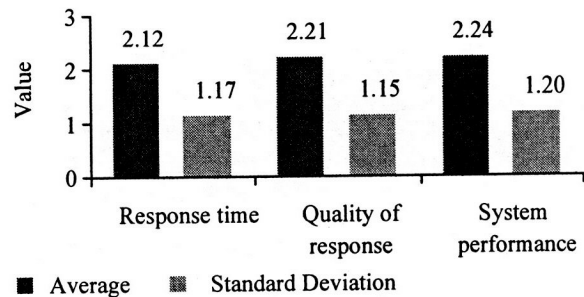

Figure 8. Satisfaction of on site SAP administration
(hosting own application)

Again, we explored the satisfaction of users of an SAP UCC. The satisfaction was measured in terms of response time, quality of response, system performance and also value for money. The feedback came from 16 respondents who are an SAP UCC and 115 SAP UCC customers (Figure 10).

The general trend is that respondents who access SAP solutions through a SAP UCC, which they host themselves tend to be more satisfied with their own performance than their customers. However, it is important to note that in all of the three criteria response time, quality of response and system performance customers of a UCC were more satisfied than those respondents who used their own system. The comparison of Figures 9 and 10 provides a convincing case for UCCs.

4.7 Cross-University Collaboration

The first question in this section was whether the respondents have entered into collaboration with any other institutions in their SAP-related teaching activities. Only 30 % of the respondents answered "yes" for this question and 70 % stated that they do not collaborate with other institutions. Those respondents, who stated that they do
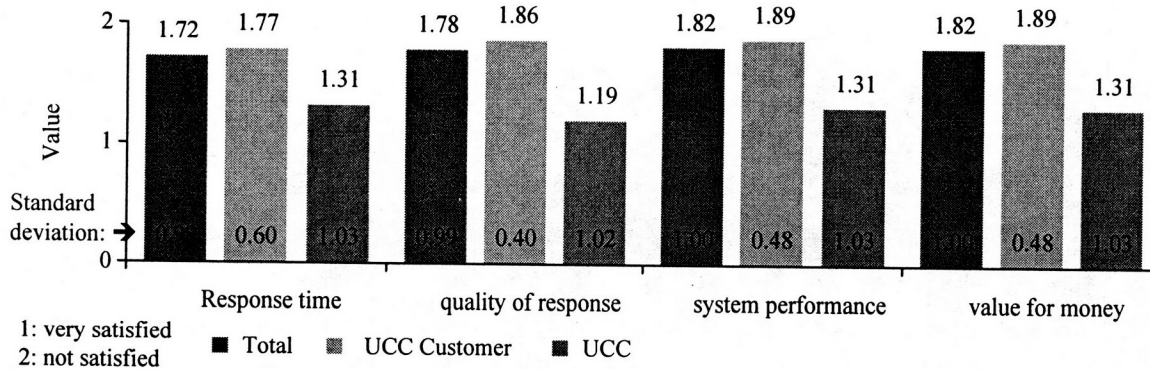
Figure 10. General satisfaction with SAP UCCs

collaborate, had the chance to further specify the exact types of collaboration they experienced. 39 answers were received providing among others the following feedback:

- 15 respondents state "exchange of experience" including exchange of problems and ideas
- 8 respondents state "developing material" including teaching and training material
- 5 respondents state "exchange of material" including teaching and training material
- 4 respondents state "collaborative lectures" such as having collaborative courses and joint lectures
- 2 respondents state "exchange of students and staff"
- 1 respondent state "create practical scenarios" such as depiction of a supply chain with different universities as players in the scenario (see e.g. Klose et al. 2004).

The top two items suggested were "exchange experience" (38 %) and "developing teaching material" (21 %).

The second question extended the first one. We asked the respondents if they would be interested in collaborating with other institutions in their SAP initiative. An impressive majority of 76 % stated that they were interested in collaborating. Only 24 % stated that they were not interested. The following answers are from those respondents who completed this part (140 answers were documented).

- 38 respondents state "exchange of experience" such as sharing teaching experiences and knowledge
- 22 respondents state "exchange of material" including case studies, course material, exercises and virtual learning material
- 19 respondents state "exchange of courses" including exchanging and sharing curriculum
- 18 respondents state "collaborative lectures" such as development of curriculum and conjoint courses
- 18 respondents state "developing material" including teaching material, case studies and exercises
- 8 respondents state "exchange of students and staff" including exchanging faculty members, lecturers and (research) students
- 6 respondents state "research", some suggest research on ES adoption, institutionalization issues, and sharing research opportunities

- 5 respondents state having "regular meetings" such as attending workshops, discussion forums, user groups and seminars
- 4 respondents state collaborating on a "particular SAP module" such as CRM, PS, PM
- 2 respondents state "creating practical scenarios" between schools to simulate actual business and setting up vendors and customers to simulate real-life examples
- Others suggest collaborating on conferences and publications, teaching improvement and special skill set such as process modeling

The results were placed into similar categories and irrelevant and erroneous answers were excluded in the analysis. The clustered results can be categorized into two broad dimensions. The first focuses on collaboration in teaching (54 %). The second focuses on course material (29 %), more specifically, the exchanging of it or its collaborative development.

In the third and final question of this section, we asked if there was collaboration across faculties or colleges *within* their institution in their SAP-related teaching activities. 46 % of the respondents answered "yes" to this question. The following is a list of answers (52 documented) from the respondents who provided further details. 14 respondents state "conjoint lectures" such as coordination of courses and development of case studies

- 13 respondents state "exchange of experience" such as having informal discussion, informal sharing of ideas and advice.
- 11 respondents state collaborating within "specific school or faculty" such as Accounting, Business, Engineering, IS and Mechanical Engineering
- 4 respondents state "conjoint system" such as conjoint use of systems and conjoint administration
- 4 respondents state "developing materials" including coordination of course content, development of teaching materials, training materials and exercises.
- 2 respondents state "lecturer training" such as training and education for staff development

446

- 2 respondents state having "regular meetings" such as organizing interdisciplinary meetings
- 2 respondents state creating "special study program" like collaboration through student internships
- There are a few responses about organizing workshops for students, creating a collaborative unit with faculty and exchange of lecturers.

Yet again the practice of exchanging experiences and conjoint lectures appears (52 %).

The results of this section on collaboration seem to indicate that although many institutions are not currently collaborating with other universities, they are interested in doing so. Many respondents acknowledge the need for such collaborative activities but have not sufficiently engaged in them. While some have collaborated across faculties internally, they still believe that collaborating with other institutions seems to be of great benefit to them.

4.8 Public Perception

This section explored the success of the SAP initiative as measured by public perception. 285 respondents answered this section. The following is a repeat of the questions posed and their respective scales (see also Table 3).

Qn No.	Question	Scale
Q17	Increase in student demand?	5: substantially 1: not at all
Q18	Increase in employer interest?	5: substantially 1: not at all
Q19	Increase in employer demand for students with SAP knowledge	5: substantially 1: not at all
Q20	Reaction of students to SAP introduction	5: positive 1: negative
Q21	Reaction of industry to SAP introduction	5: positive 1: negative
Q22	Reaction of employers to SAP introduction	5: positive 1: negative

Table 5 Questions for impact on public perception of introducing SAP

For question 17, there seems to be a slightly increasing student demand for SAP knowledge after it was introduced into the curriculum and the same is true regarding the increase in employer interest (Figure 11). Question 19 reports a higher rating. The lecturers found that there was an increase in employer demand for students with SAP knowledge; however, the highest ratings came regarding the student's reactions. The lecturers felt that there was a very positive reaction from the students after SAP was introduced into their curriculum. Finally the reactions from the industry and the employers (questions 21 and 22) to the introduction of SAP were perceived as generally quite positive.

4.9 SAP-related Subjects

In this last section of the survey, we captured details on the actual units. In total, 220 respondents answered this section. Overall, we collected details of 660 subjects which have references to SAP, of which 249 have been classified as

under-graduate, 349 as post-graduate and 62 as others including professional training, vocational school, and job training. This implies that the focus tends to be on graduate students instead of under-graduate students.
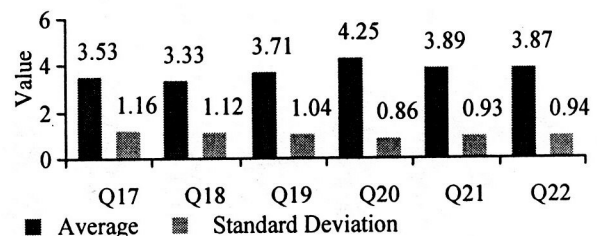

Figure 11. Section E ratings for impact on public perception

In order to evaluate the maturity of the offerings, we asked for each subject when it was first introduced into the curriculum (Figure 12).

The results show that approximately 80 % of all classes were first offered between 1999 and 2003. There was a steady increase in the introduction of SAP-related subjects between the years 1997 and 2000. This result is consistent with the option of universities and schools utilizing the services of a university competency center.

4.10 Details on enrolment and curriculum hours

The respondents were required to enter the number of students enrolled for each subject, its lecture, lab and tutorial hours in total for each semester.

Figure 13 shows the average, the range of values, and the standard deviation of all 660 subjects. The range indicates the highest value given. The lowest was 1 (students enrolled) or 0 (hours). The high deviation and range values seen here seem to indicate two possibilities:

1. The questions we posed to capture this data was understood differently by individual respondents. This could cause inaccuracy in the data for these questions.
2. Due to the diverse nature of this survey in terms of courses offered, the answers entered by individual lecturers may vary. For example, in specialized subjects, the enrolment and hours spent can be very different between an under-graduate's and graduate's curriculum.

Considering possibility two, we classified each average to the different subject categories to compare the distribution.

The trend here seems to be consistent with the majority number of subjects offered by graduate courses. However, the average number of hours cannot be analysed accurately because of the diverse nature of the answers (Figure 14).

4.11 SAP modules used

In this part of the section we presented a list of SAP modules to the respondents and asked for a rating of their usage based on how detailed they would utilize a SAP module. The rating was done on a five point Likert scale with one being "casual review" and five being "in-depth review".
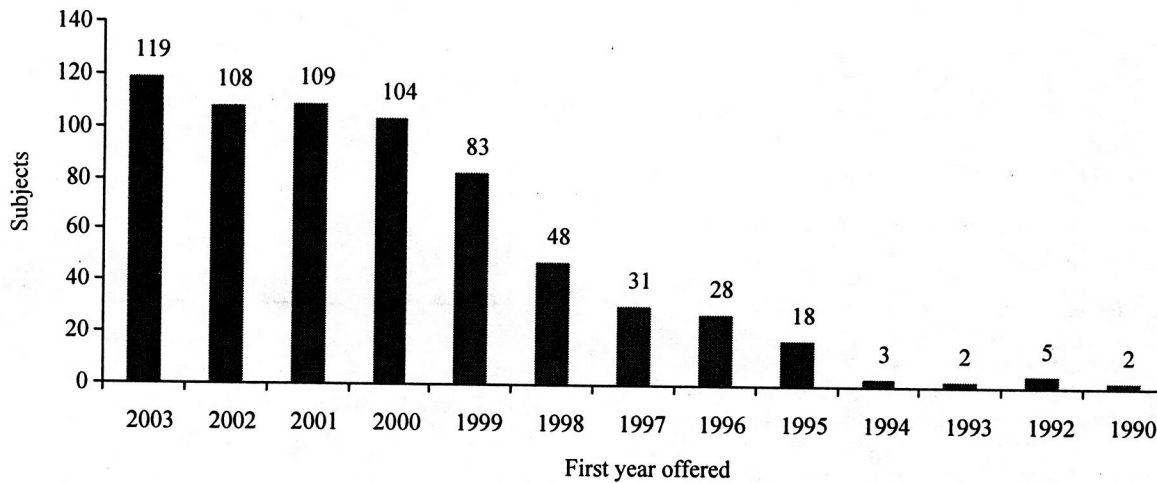
447

Figure 12. Distribution of subject's first introduction in years
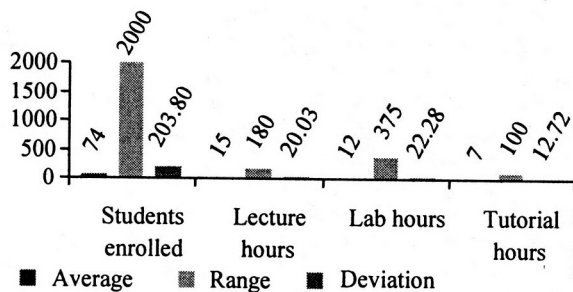

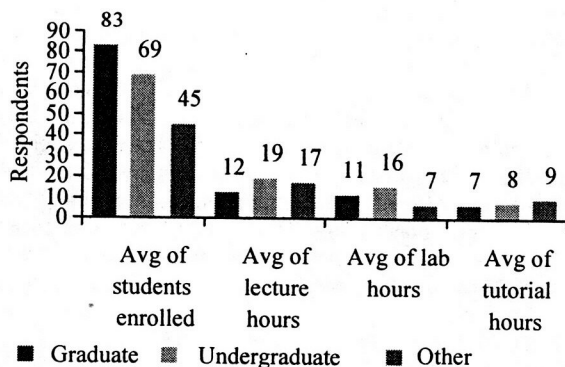**Figure 13. Details of enrollment and curriculum hours**

Figure 14. Details of enrollment and curriculum hours by course category

There was an option for the respondents to answer "N/A" for each module. In the analysis of the data, we also extracted the answers having "N/A" and calculated the number of "N/A" responses in terms of percentage. The averaged results indicate that MM (29 % indicated this module is not available), PP (40 %) and SD (36 %) modules are the most popular solutions. The two least used modules were CRM (80 %) and SRM (84 %), bordering slightly below the two points margin. In general, it is clear that many lecturers have not yet ventured into an "in-depth" study of a SAP module. However, it could also be argued as how much "in-depth" really is in-depth? One lecturer's perceived depth of review of a module may mean a casual review to another lecturer.

The SAP Industry Solutions are practically non-existing in the landscape of SAP education. Only 1 % of the respondents stated that they expose their students to industry solutions which would include banking, automobile, and retail.

4.12 SAP Support Tools
In addition to the implementation of specific functional modules, we explored the integration of additional SAP support tools in the curricula. We asked to respondents to rate the usage of these support tools and also to list any other additional support tools they may have reviewed/used for the purpose of teaching SAP (Figure 16).

Again there was an option for the respondents to answer "not available (N/A)" for each tool listed. In the analysis of the data, we extracted the answers having "N/A" and calculated the number of "N/A" responses in terms of percentage. The averaged results indicate that the top three support tools are IDES (Internet Demonstration and Education System) (24%), the Implementation Guide (IMG) (57 %) and the SAP Reference Models (52 %).

Respondents had the option to mention other tools. Only 3 % of the respondents provided some feedback including ARIS, CBT Modules, Dolphin Group Integration and Configuration, Business Connector, and ALE.

5. MAJOR ISSUES AND SUCCESS FACTORS

In terms of qualitative feedback, we asked the lecturers "Please list any major issues that you have experienced with introducing SAP solutions into your curriculum" and "Please list any key success factors you have identified for teaching SAP solutions".
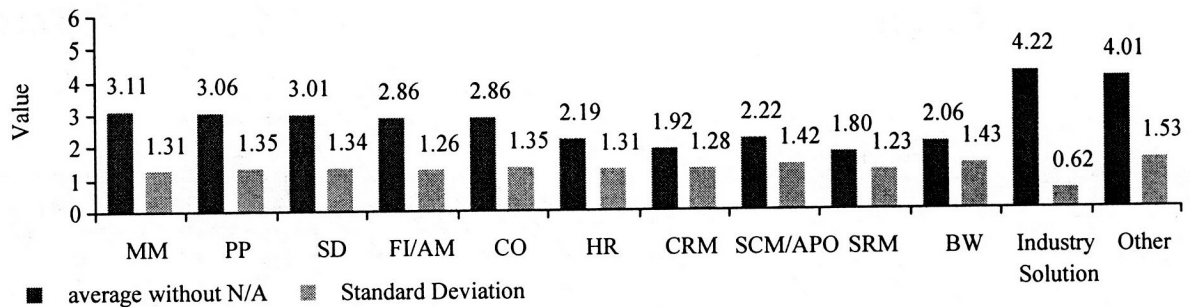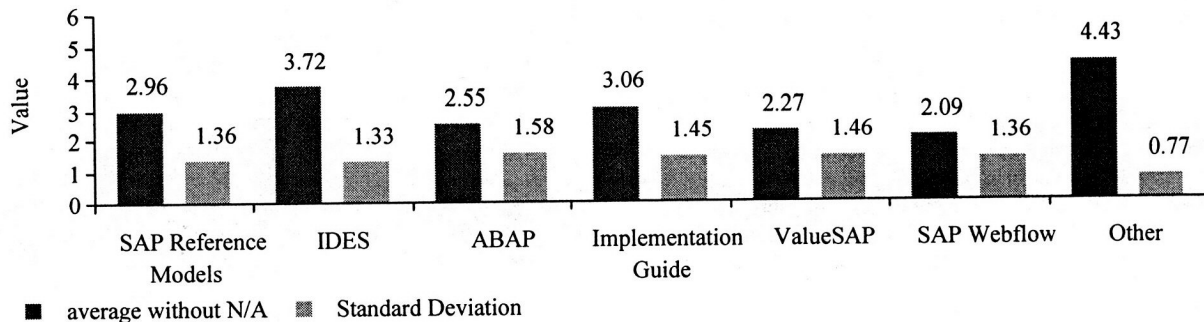
448

Figure 15. Usage ratings of SAP modules

Figure 16. Usage ratings of SAP support tools

The top four issues/obstacles introducing SAP solutions into the curriculum have been:

1. Complexity of the subject - 63 responses (12 %)
The difficulty to comprehend the SAP solutions has clearly been the number one issue. This includes the initial knowledge acquisition as well as continuous knowledge management, i.e. the need to keep up with system changes, upgrades and extensions. Typically, the lecturer has not attended ES classes himself/herself. In addition, this includes issues related to technical support (system administration as well as functional support), system issues (initial setup, system performance, maintenance) as well as training.

2. Developing course material/curriculum -49 responses (9 %)
Another main issue was the quality of material appropriate for tertiary education. Due to the release cycles, SAP-related material tends to be outdated quickly. Many publications are written for industry, simplified, and assume business knowledge. Available material for lecturers is often too much hands-on and lacks conceptual foundation. This item also included the requirement to customize the SAP solution beyond the IDES capabilities for specific needs and the corresponding efforts related to creating business scenarios.

3. Student background/interests - 25 responses (5 %)
The student-related issues had two facets. First, the students' background has been perceived as critical when IT students did not have the required appreciation and understanding for the underlying business scenarios. Second, the overall interest of students in ES-related subjects matters.

4. Faculty support - 21 responses (4 %)
Finally, gaining the required support from the university or faculty has been perceived as a significant issue. This included interest, commitment and acknowledgement (recognition in promotion, teaching relief to comprehend software functionality, etc.).

Furthermore, lack of experienced staff and difficulties in recruiting experienced staff were mentioned as major issues.

In terms of success factors, the lecturers mentioned among others the following factors:
- Employer feedback
- Experienced personnel
- Faculty support (administrative, management)
- Industry liaison
- Industry support
- Job market
- Learning approach
- Lecturer background (SAP experience/industry experience)
- Student enrolment
- Students interests
- Systems support (technical, administration)
- Teaching approach (real-world context, theory and practice)
- Training for lecturers (by SAP/faculty)

The results indicate that the following appear to be the top five key success factors identified for teaching SAP solutions (based on broad content analysis):
- Course materials - 23 responses (5 %)

449

- Faculty support   - 20 responses (4 %)
- Systems support   - 16 responses (3.5 %)
- Students interests   - 13 responses (3 %)
- Training for lecturers - 12 responses (2.5 %)
-

In a similar way, we have asked the students *"Please list any major issues that you have experienced with learning SAP solutions as part of your courses."*

Major issues stated in student responses included quality of course materials (manuals, books available, etc.), complexity of the system (hard to use/understand), system performance (too slow), accessibility of the system, user interface (hard to use/navigate), own motivation to learn (knowing the purpose of learning, etc.), differences in system versions, quality of lecturers and appropriateness of educational approaches (practical exercises, tutorials, etc.). It should be noted, however, that in the actual student responses, a significant number of them (close to 50 %) quoted a specific SAP module as a major issue, e.g. Accounting, Controlling, Logistic, Procurement, etc. or a specific activity such as ABAP, customizing, etc. These responses *are not taken into account* as they do not correspond with the actual context of the question.

The consolidated results indicate that the following appear to be the top five issues students have experienced with learning SAP (based on a broad content analysis):

- Complexity of the system   (8 %)
- System performance   (6 %)
- User interface   (5 %)
- Course materials   (4 %)
- Learning approaches   (4 %)

A list of key success factors stated in student responses:

- Job prospect
- Good instructors
- Class materials
- Learning approaches (hands-on experience, teamwork, etc.)
- Practical application (applying the knowledge in practice)
- Foundation knowledge
- Reduce and manage the complexity, extensive scope, or comprehensiveness of the SAP system for learning purposes

Note: Again a good number of student responses (estimated to be more than 30 %) do not correspond to the actual context of the question, or have no relevance to the key success factors. The results indicate that the following appear to be the top five success factors students have identified for learning SAP solutions (based on broad content analysis):

- Practical application   (8 %)
- Learning approaches   (5 %)
- Class materials   (4 %)
- Job prospect   (4 %)
- Good instructors   (3 %)

6. DISCUSSION AND CONCLUSIONS

This paper reports on the outcomes of a global empirical analysis of the current status of ES education using the SAP solutions as a widely distributed example.

The main outcome of this survey is a definitive sign for an increasing maturity in the field of SAP-related education. In comparison with five years ago, a much larger, more global and most of all more experienced group of lecturers is committed to engaging in such initiatives. Their challenges, however, remain in many areas the same. The willingness to get insights into the rich system functionality requires first of all hands-on experience and material appropriate for tertiary education is still an obstacle. However, the successful establishment of reliable application hosting solutions seems to relieve the burden related to financial and technical system support. Though ES might have been perceived as less popular during the dot.com era, they are now in high demand as indicated by strong students' demand and an overall very positive reaction. The participating lecturers also indicated that they perceived a positive reaction by industry to the introduction of SAP solutions into the curricula.

The results also show that students experienced major issues in (and are thus more concerned with) complexity of the system, system performance, system user interface, course materials, and approaches for learning SAP solutions as part of their courses. It also shows that students regard gaining practical experience, adequate educational approaches, helpful class materials, promising job prospect, and good instructors as key success factors for learning SAP solutions. The actual feedback shows that students are for most part satisfied with the outcomes of SAP education. They believe that having SAP as part of their curriculum makes them more recruitable. Overall, they also have a positive impression of SAP as a corporation.

Comparing the results between lecturers and students, it seems that students experience more systems-related issues (such as complexity, performance, and user interface) than the course-related issues (such as different learning approaches), which have a total of 19 % and 8 % respectively. Lecturers, on the other hand, seem to experience more course-related issues (including faculty and student related) than the systems-related issues, which account for 22 % and 8 % respectively.

With respect to success factors, students appear to be more concerned with "why and how to learn" rather than "what to learn", which account for 13 % for the former and 4 % for the latter. The former relates to knowing the purpose of learning, applying the knowledge in practice, acquiring hands-on experience while latter relates to better or improved class materials. A possible interpretation for the focus on the "why and how" instead of the "what" might be that students appreciate any form of SAP exposure. They understand the richness of the system and the demand to explore efficient ways to quickly comprehend this solution.

The outcome of this study also provides interesting insights into the future roadmap of education in the area of ES. From

a number of possible predictions, we like to point out two: (1), the model of hosted solutions seems to be the core infrastructure for SAP-related activities. It can be expected that the use of hosting centers will be soon *the only way* to get hands-on access to SAP solutions. Future contracts between the involved parties will have to reflect the increasing complexity in the SAP landscape. UCC customers will also expect a fair and transparent price mechanism, which takes student numbers, type of students, intensity of use, etc. into account. Besides contractual issues, UCCs will also have to be selective as they continue to be exposed to an increasing number of SAP solutions. As a consequence, it can be expected, that UCCs will increasingly collaborate. This could mean that individual universities will use SAP-related services from a network of globally distributed UCCs. (2), the data indicated that collaboration and global knowledge exchange between universities will be the next wave which can be observed in this market. A marketplace could be established, which facilitates the exchange of course material, case studies, assignment, exams, and overall experiences. However, competition between universities, intellectual property, reimbursement models, etc. will be key challenges which have to be addressed in such a market for educational material related to SAP.

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APPENDIX: ABBREVIATIONS

AHC	-	Application Hosting Center
AM	-	Asset Management
APO	-	Advanced Planner & Optimizer
CBT	-	Computer-based Training
BW	-	Business Warehouse
CO	-	Controlling
CRM	-	Customer Relationship Management
ERP	-	Enterprise Resource Planning
ES	-	Enterprise Systems
FI	-	Financial Accounting
HR	-	Human Resource Management
IDES	-	Internet Demonstration & Education System
IMG	-	Implementation Guide
MM	-	Materials Management
PM	-	Plant Maintenance
PP	-	Production Planning & Control
PS	-	Project System
SCM	-	Supply Chain Management
SD	-	Sales & Distribution
SRM		Supplier Relationship Management
UCC	-	University Competence Center

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