

Teaching ERP systems: Results of a survey at research-oriented universities and universities of applied sciences in Germany

Christian Leyh

Chair of Information Systems, esp. IS in Manufacturing and Commerce
Technische Universität Dresden
Dresden, 01062, Germany
Christian.Leyh@tu-dresden.de

ABSTRACT

Because of the increasing importance of enterprise resource planning (ERP) systems and their educational value, as well as the rapidly-changing ERP market, many universities use, or want to use, ERP systems for their courses. The aim of these courses is to teach and demonstrate different ERP-related concepts and processes. To support these courses, some ERP manufacturers co-operate closely with universities and offer their systems and resources for academic teaching. However, there are very few empirical insights on system usage in academia. Therefore, we developed a questionnaire to determine the current status of ERP system usage and integration in courses at IS chairs of German-speaking, research-oriented universities (response rate 41.4%) and universities of applied sciences (response rate 53.1%). The results show that, among the respondents, more than two-thirds of the universities and nearly all of the universities of applied sciences use ERP systems practically in their courses. Though, almost every university chair (35 out of 38) and every professor/lecturer at the universities of applied sciences (47 out of 47) that are providing practical courses for students are using at least SAP ERP systems. In comparison with a former study we could show that the taught ERP functionalities have shifted throughout the last years from selected transactions towards selected modules or even towards the complete ERP system's core.

Keywords: Enterprise resource planning (ERP), System integration, System use, Diversity

1. MOTIVATION

Today, standardized enterprise resource planning (ERP) systems are being used in a majority of enterprises. For example, more than 92 percent of all German industrial enterprises use ERP systems (Konradin, 2009). Due to this strong demand, there are many ERP systems with different technologies and philosophies available on the market. Therefore, the ERP market is strongly fragmented, especially when focusing on systems that target small and medium-sized enterprises (SMEs) (Winkelmann, 2010; Winkelmann & Klose, 2008). The growing multitude of software manufacturers and systems is making it more and more difficult for enterprises that use or want to use ERP systems to find the "right" software and then to hire the appropriate specialists for the selected system. Also, for future investment decisions concerning the adoption, upgrade, or alteration of ERP systems, it is important to possess the appropriate, specialized knowledge and skills in the enterprise (Winkelmann & Matzner, 2009). This is essential since errors during the selection, implementation, or maintenance of ERP systems can cause financial disadvantages or disasters, leading to insolvencies of the affected enterprises (e.g., Barker & Frolick, 2003; Hsu, Sylvestre & Sayed, 2006). In order to prevent this, it is necessary for universities to transfer specialized knowledge

to their students and graduates through, in particular, courses in the field of information systems (Venkatesh, 2008). Therefore, ERP systems have been used in the academic world for more than a decade.

Because of the increasing importance of ERP systems and their educational value, many universities use or want to apply ERP systems practically in courses (Seethamraju, 2007) in order to teach and demonstrate different concepts and processes (Magal & Word, 2009). To support these courses, some ERP manufacturers co-operate closely with universities and offer their systems and resources for academic teaching. One of the goals of using ERP systems in courses is to prepare students for their career by giving them at least an introduction to ERP systems. A further goal, promoted by ERP manufacturers themselves (especially by making their systems available for university courses), is for students to learn about the products as early as possible since later they, as graduates, will work with these systems or will hold enterprise positions that influence ERP investment decisions. Therefore, it is necessary for universities to offer the appropriate systems, processes, and suitable courses for their students (Brehm, Haak & Peters, 2009; Fedorowicz, Gelinias, Usoff & Hachey, 2004; Winkelmann & Leyh, 2010).

The need to provide this knowledge through university courses and, above all, the possibilities of using these

systems themselves in courses are frequently discussed in literature (e.g., Antonucci, Corbitt, Stewart & Harris, 2004; Boyle, 2007; Boyle & Strong, 2006; Fedorowicz et al., 2004; Hawking, McCarthy & Stein, 2004; Leger, 2006; Leyh, 2010; Leyh, Strahringer & Winkelmann, 2012; Peslak, 2005; Sager, Mensching, Corbitt & Connolly, 2006; Stewart, Rosemann & Hawking, 2000; Winkelmann & Leyh, 2010). These discussions clearly point out that ERP systems are or should be an important component of university curricula in information system-related subjects and courses. However, this is not a trivial task, as Noguera & Watson (1999) discuss. Because there is no standardized approach, the choice of systems and their number, as well as the structure and number of ERP courses, differ from university to university (Seethamraju, 2007). For example, for teaching the respective systems, the lecturer has to be familiar with the system's concepts and its practical usage. Thus, the choice of one or more ERP systems for a course strongly depends on the knowledge and experience of the lecturers themselves. Additionally, the variety of ERP systems used in courses is limited by the manufacturers' willingness to provide their systems. This results in a situation in which only a small variety of systems and software manufacturers are represented at universities in spite of the heterogeneous ERP market.

In particular, the software manufacturer SAP (informal name of the company SAP AG) is represented in numerous universities through its University Alliances program. With more than 400 partner universities participating in this program, SAP ERP systems are probably the most widely-used systems in study courses worldwide (Hawking et al., 2004; Pellerin & Hadaya, 2008). Smaller systems are rarely used in teaching; yet, a more diversified integration of ERP systems into education is advisable, especially from the viewpoint of SMEs. Also, the argument for introducing students to more than one or two large systems in order to ensure a market overview supports this demand (Leyh, 2010; Leyh, Strahringer & Winkelmann, 2012; Winkelmann & Leyh, 2010). Additionally, the differences between SMEs and large-scale companies (Welsh & White, 1981) will be illustrated to students because they are reflected in the appropriate design of the respective systems (Winkelmann & Klose, 2008). Furthermore, by teaching various ERP systems, the students' awareness of functional approaches, process support, interface ergonomics, and architectural concepts will increase. In addition, the usage of more than one ERP system in the curricula enables the students to obtain knowledge of the respective systems in depth and at the same time to get an overview of ERP systems in breadth (Leyh & Strahringer, 2011). Of course, ERP systems and their concepts can also be described theoretically without direct system access. However, the promotion of the learning experience and understanding is better facilitated through the use of real systems (Watson & Schneider, 1999). Yet, choosing the "right" number of ERP systems is difficult since too many systems can lead to student confusion or misunderstanding. However, there are hardly any empirical insights on system usage in academia. From the study of Bradford, Vijayaraman, & Chandra (2003), a survey on the usage in U.S. business schools exists, but this is outdated; there are no recent surveys. Thus, with the rapidly-changing ERP market, more recent studies are needed, especially since

the European situation, where SAP's predominance is even stronger, is different from that of the situation for U.S. business schools. Therefore, this research studied the situation of German-speaking countries and tried to explore how diversified the usage of ERP systems in German study courses is. This leads to the following research question:

Which ERP systems are used in teaching in German-speaking universities and which didactical (teaching) methods are employed in presenting these ERP systems?

For this purpose, we developed a questionnaire with the goal of determining the current status of ERP system usage and its integration in study courses at information systems (IS) chairs of German-speaking, research-oriented universities in Germany, Austria, and Switzerland and at universities of applied sciences in Germany. This questionnaire contained questions about the extent of ERP usage in courses, the reasons for using or not using ERP systems, didactic aspects of the different ERP course programs, and the qualifications and experience of the lecturers. Therefore, the data was gathered in two separate steps. First, in the summer of 2010, we sent the questionnaire to all of the chairs affiliated with the field of information systems at German-speaking, research-oriented universities in Germany, Austria, and Switzerland. Afterwards, in the summer of 2011, the questionnaire was sent to professors and lecturers affiliated with the field of IS at universities of applied sciences in Germany.

Research-oriented universities are structured more hierarchically than universities of applied sciences. Here, we addressed the chair holders in the field of IS. But it was possible that the email was forwarded to the lecturers or research assistants of the chair for answering the questionnaire. In German-speaking countries almost all university professors are appointed as chair holders. Thus, we were able to address nearly all professors in the field of IS. Compared to research-oriented universities, universities of applied sciences in Germany teach more practical topics. They are more focused on practical aspects and are not as focused on research. They can be compared with technical colleges in Canada or polytechnics in Britain. They are not organizationally structured in the way of research-oriented universities as professors are not responsible for teaching staff apart from themselves. Therefore, we directly addressed the professors or lecturers.

Selected results of this survey are described within this paper. Therefore, the paper is structured as follows. Following this introduction, we describe how the questionnaire was developed and how the samples of university chairs and professors/lecturers were chosen. Then, the main section follows, where selected results of the survey are presented and discussed in detail. Finally, we address the limitations and summarize the overall approach and major findings.

2. RESEARCH METHODOLOGY – WEB-BASED SURVEY

For data collection, we decided to use a standardized questionnaire which was administered electronically. We selected this procedure for the convenience of the

respondents and for economic efficiency. Additionally, a standardized questionnaire has the advantage of higher objectivity, comparability, and reliability (Bortz & Doering, 2009).

In a previous empirical study (see Leyh, Betge & Strahringer, 2010), we compared different online survey tools (criteria: price, tool handling, service, and support),

and, therefore, chose the page “onlineumfragen.com” as the provider for our web-based survey considering our experience with this tool in other studies (e.g., Leyh et al., 2010; Leyh & Huebler, 2011). The screenshot in Figure 1 provides an impression of the web-based questionnaire’s look and feel.

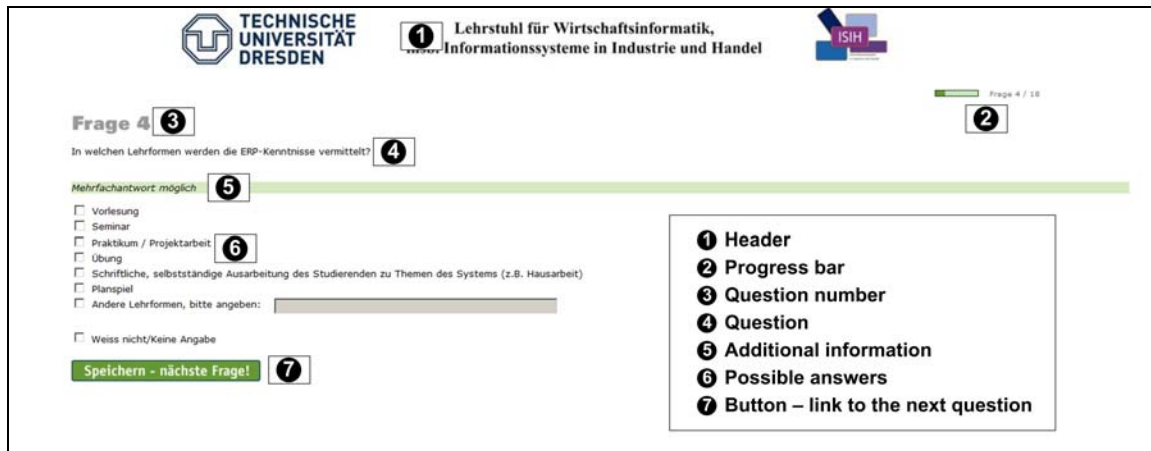


Figure 1. Design of the questionnaire

The questionnaire is structured into two thematic sections and one demographic section. The first section deals with teaching ERP topics in general and the second section is about the ERP systems deployed in courses. Finally, the last section is intended to collect some demographic data. The questionnaire in its entirety is not included in this paper and is available upon request.

We pre-tested the questionnaire in the summer of 2010 with various members of an IS department from one university who were later excluded from the final study. The questionnaire was adapted on the basis of feedback and comments and was made available to the chairs of German-speaking universities in the summer of 2010. Then, the professors and lecturers of the universities of applied sciences were invited to participate in this survey in the summer of 2011.

The sample of 2010 consisted of 222 German-speaking university chairs who are affiliated with the field of information systems from 73 research-oriented universities. These participants were derived from two sources of data: one database that listed all of the universities with study courses in the field of IS (Project IFWIS, 2008) and, to check the database results for completeness, a list of all German-speaking university chairs in the field of IS (WI, 2010).

The sample of 2011 consisted of 177 professors or lecturers at universities of applied sciences who are responsible for ERP courses or related subjects and courses. These participants were derived from 72 universities of applied sciences. They were chosen through two sequenced steps. First, using a database for IS courses at German universities of applied sciences (AK WI, 2011), all relevant universities of applied sciences were identified. Second, we scanned the respective homepages of the identified universities of applied sciences to get the names and contact

data of the professors and lecturers responsible for ERP or similar courses.

3. RESULTS OF THE WEB-BASED SURVEY

3.1 German-speaking, research-oriented universities – selected results

As our exploratory approach focused on the differences and similarities of ERP usage in study courses, no hypotheses were developed for this investigation. Thus, we considered descriptive statistics as adequate in providing and discussing the results of the survey. The questionnaire was available online between July 28, 2010, and September 3, 2010. The link to it was sent directly to the 222 participants at the German-speaking universities. Additionally, within an interval of two weeks each, we sent two reminder e-mails.

The initial return rate was 46.4% (see Table 1). After screening the answers, 11 questionnaires had to be excluded from the analysis since they were incomplete or duplicates.

Sample size	222
Returns	103
Return rate	46.4%
Excluded returns	11
Usable returns	92
Return rate (usable)	41.4%

Table 1. Return rates

Thus, the return rate based on usable returns was 41.4%. As the contact information of the chairs was taken directly from the respective homepages, there were no losses due to errors in the e-mail address list. The 92 usable returns were distributed from among 50 universities. Therefore, we received a per-university return rate of 68.5% (50 out of 73 universities).

Years of experience with ERP systems	University chairs
More than 20 years	5
Between 16 and 20 years	8
Between 11 and 15 years	8
Between 6 and 10 years	18
Between 0 and 5 years	26
	65

Table 2. Participants' experience with ERP systems (n=65)

The years of experience of the participating university chairs is shown in Table 2. However, the question regarding experience was optional and only 65 out of 92 participants answered this question.

3.1.1 Teaching ERP topics in general: Among the 92 participants, almost two-thirds (59 university chairs) were teaching ERP topics in general. It is interesting to see that although 63 chairs had experience with ERP systems, not all of these chairs were teaching ERP topics.

In the following analysis, we mainly focus on the 59 participants who were teaching ERP topics. Among those 59 participants, topics such as ERP integration concepts and ERP business basics were mainly taught in the study courses. As Table 3 shows, these topics were followed by technical aspects of ERP systems as well as ERP system usage, whereas ERP configuration and implementation were not mentioned as often. Apart from total numbers, figures are differentiated along the three types of study programs in Germany. The Bachelor program in Germany typically is a three year undergraduate program with two additional years in the master program; the Diploma program is an old university program that is equivalent to a combination of Bachelor and Master studies within a single program.

	Business basics	Technical aspects	ERP integration concepts	ERP system configuration	ERP system usage
(1) Bachelor	45	32	35	16	29
(2) Master	24	21	34	20	24
(3) Diploma	22	18	24	14	19
Sum (1 to 3)	91	71	93	50	72
Not taught	4	12	5	17	14

Table 3. ERP topic distribution according to study programs (multiple answers allowed, n=59)

Our investigation resulted in a large variety of teaching methods which are used in order to familiarize students with ERP knowledge and skills (see Table 4).

Teaching methods	Absolute frequency	Relative frequency
Lectures	50	85%
Practical exercises	36	61%
Case Studies	29	49%
Projects	23	39%
Seminars	20	34%
Assignment paper	14	24%
Simulation games	4	7%
Other teaching	4	7%

Table 4. Teaching methods (multiple answers allowed, n=59)

The question on the employed teaching methods was mostly answered with "lectures." Eighty-five percent of all of the participants who were involved in ERP topics use ERP at least in their lectures. Practical exercises and case studies were mentioned by 36 and 29 participants (see Table 4).

Therefore, lectures and practical exercises can be seen as the typical methods employed, whereas the other methods mentioned allow for a deeper learning experience. For example, case studies help students to not only understand enhanced ERP system functionality but also to strengthen their individual soft skills like problem-solving or teamwork.

Rosemann & Watson (2002) use the different teaching methods to distinguish the depth and extent of ERP knowledge that is obtainable within a university's curriculum. As a starting point, typically, ERP knowledge is obtained without practical exercises (the so-called PowerPoint beginning). It is possible to provide general information on ERP systems in the form of lectures. However, teaching ERP topics without practical exercises is a limited method. The practical application of knowledge is extremely important for students in order to understand ERP systems and ERP implementation concepts more comprehensively and deeply (Watson & Schneider, 1999). Therefore, in addition to the question on which teaching methods are used in the curricula, we asked how many teaching methods are used.

The results show that 85% of the participants used more than one method for teaching ERP topics. Nearly one-third of the chairs used even more than three teaching methods (see Figure 2).

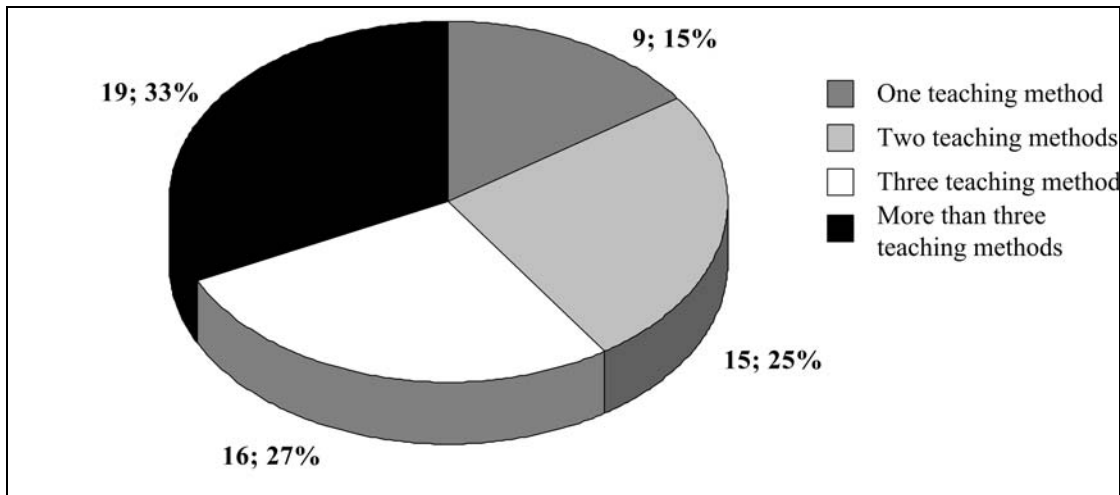


Figure 2. Frequency of teaching methods (n=59)

3.1.2 ERP systems in study courses: In addition to our investigation of ERP teaching methods, our survey also sought to determine which ERP systems were being used in study courses. Therefore, the 59 participants actually teaching ERP topics were asked whether or not they also used ERP systems practically. Out of these 59 participants, 38 (64%) were using ERP systems practically (e.g., in computer lab exercises, projects, independent teaching formats, etc.). Additionally, the results show that the ERP systems and functionalities that were used focused on the industry sector (84%), followed by the retailing sector (50%). Only a few institutions focused on other sectors such as the financial sector (13%), public administration (5%), health services (3%), communication (3%), or the service sector (3%).

The question of which ERP systems are used within the different study courses was answered quite in line with our expectations. As shown in Figure 3, a majority of the participants who were teaching ERP systems practically were using SAP ERP systems (35 out of 38; 92%). Other ERP systems used were Microsoft Dynamics NAV and AX (39%), Semiramis (10%), and ProAlpha (10%).

Also, Figure 3 shows that, in general, more than one ERP system was used. Thus, many participants who used ERP systems in teaching employed different systems. This fact supports the demand mentioned in our motivation. The results presented a variety of employed ERP systems besides the top four. Other systems mentioned were Godesys SO, Infor, SAGE ClassicLine, and SAGE OfficeLine Evolution, in addition to open source ERP systems like OpenERP, Compiere, or SQL Ledger. Above all, the 38 participants gave 74 answers to the question about which ERP systems they used.

Only 25 out of 38 participants answered positively when asked if the used ERP systems were suitable and appropriate for study courses. These 25 participants were especially satisfied with the ERP manufacturers' support and with the extensive instructional and educational material available. On the other hand, 13 of them were not satisfied with their systems. This was mainly due to the high complexity of the respective ERP systems and the extent of the needed resources, effort, and budget.

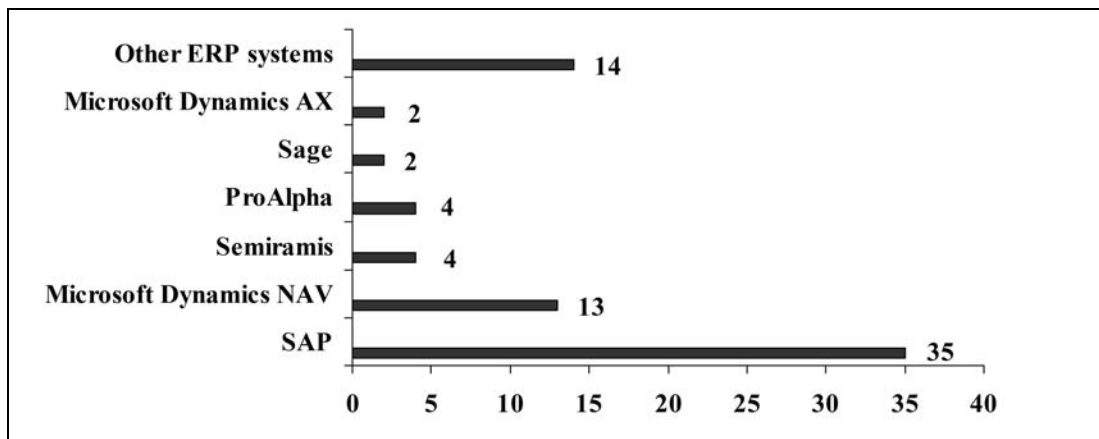


Figure 3. Frequently used ERP systems (multiple answers allowed, n=38)

ERP manufacturers' support as well as access to documentation is often only granted if the university is a member of the manufacturer's university program, e.g., the SAP University Alliances or the Microsoft Business Solution Academic Alliance (MBSAA). Within our survey, 26 out of 38 participants were members of the SAP University Alliances (see Table 5). The second and third most employed programs were the MBSAA (9/38) and the Oracle University (3/38).

University programs of ERP manufacturers	Absolute frequency	Relative frequency (n=38)
SAP University Alliances	26	68%
Microsoft Business Solutions Academic Alliance (MBSAA)	9	23%
Oracle University	3	8%
Semiramis Research & Service (SeReS) Unit	1	3%
Other memberships	2	5%
No memberships	9	23%

Table 5. University program memberships (multiple answers allowed, n=38)

These results are not surprising since SAP, Microsoft, and Oracle are big players in the ERP market and together capture approximately 56.2% of the German ERP market (Konradin, 2009) and about 65% of the world-wide ERP market (Jacobson, Shepherd, D'Aquila & Carter, 2007). Nine out of the 38 participants were teaching ERP systems without being partners in a university program. Also, the results show that, although three participants were members of Oracle's university program, their ERP system was not mentioned to be practically used in study courses (see Figure 3). Additionally, the results show that about 26% of these 38 participants are members of at least two or more university programs.

One of the last questions focused on the needs or requests to use (additional) ERP systems. All 92 participants were asked whether they would like to use a first ERP system or implement additional systems if they already use one. The results are shown in Table 6. The number of participants who would like to integrate (additional) ERP systems in the curriculum (39) nearly equals the number of those that do not want to change the current ERP system usage (41). The follow-up question about which ERP systems would be preferred, if available without any costs, was answered by 31 participants. Here, 21 would like to use SAP ERP systems, five would like to use Microsoft ERP systems (Dynamics NAV or Dynamics AX), four would like to use the Oracle Enterprise system, and one would like to use the SAGE ERP systems.

Teaching ERP topics	Request for (additional) ERP systems	Frequency	
Yes	Yes	36	42.4%
No	Yes	3	
Yes	No	18	44.6%
No	No	23	
Yes	No answer	5	13%
No	No answer	7	
		92	

Table 6. Demand for additional ERP systems

3.2 Universities of applied sciences – selected results

The questionnaire was online between July 21, 2011 and September 1, 2011. Again, the link for the survey was sent directly to the 177 participants at the universities of applied sciences in Germany. Additionally, within an interval of two weeks each, we sent two reminder e-mails.

The initial return rate was 55.4% (see Table 7). After screening the answers, only four questionnaires had to be excluded from the analysis. Thus, the return rate based on usable returns was 53.1%.

Sample size	177
Returns	98
Return rate	55.4%
Excluded returns	4
Usable returns	94
Return rate (usable)	53.1%

Table 7. Return rates

The 94 usable returns were distributed from among 54 universities of applied sciences. Therefore, we received a per-university return rate of 75% (54 out of 72 universities).

Years of experience with ERP systems	Professors / Lecturers
More than 20 years	0
Between 16 and 20 years	11
Between 11 and 15 years	15
Between 6 and 10 years	24
Between 0 and 5 years	37
	87

Table 8. Participants' experience with ERP systems (n=87)

The years of experience of the participating professors or lecturers is shown in Table 8. Here, none of the participants had more than 20 years experience with ERP systems.

3.2.1 Teaching ERP topics in general: Among the 94 participants from the universities of applied sciences, 84 were teaching ERP topics in general. This is a rate of 89%.

Again, in the following analysis, we mainly focus on the 84 participants who were teaching ERP topics. Among those participants, the most often taught ERP topic in courses was ERP system usage. The number of this topic exceeds the number of the following topics (ERP integration concepts/92 and Business basics/82) by far (see Table 9).

	Business basics	Technical aspects	ERP integration concepts	ERP system configuration	ERP system usage
(1) Bachelor	68	52	57	51	76
(2) Master	10	16	32	24	33
(3) Diploma	4	2	3	3	4
Sum (1 to 3)	82	70	92	78	113
Not taught	5	8	7	10	1

Table 9. ERP topic distribution according to study programs (multiple answers allowed, n=84)

Teaching methods	Absolute frequency	Relative frequency (n=84)
Lectures	78	93%
Practical exercises	70	83%
Projects	45	54%
Seminars	24	29%
Assignment paper	27	32%
Simulation games	5	6%
Other teaching methods	8	10%

Table 10. Teaching methods (multiple answers allowed, n=84)

Again, the investigation resulted in a large variety of teaching methods being used (see Table 10). The participants from the universities of applied sciences mostly answered

this question with “lectures.” Seventy-eight of the participants who were involved in ERP topics use at least lectures as a teaching method. Following the lectures, practical exercises and projects were mentioned by 70 and 45 participants (see Table 10). Again, lectures and practical exercises can be seen as the typical methods employed at the universities of applied-sciences.

Resulting from that, almost every participant (81 out of 84) at the universities of applied-sciences used more than one method for teaching ERP topics. Again, similar to the chairs at the research-oriented universities, one-third of the participants at the universities of applied sciences used more than three teaching methods (see Figure 4).

3.2.2 ERP systems in study courses: From the 84 participants of the universities of applied sciences, 78 (93%) used ERP systems practically (e.g., in computer lab exercises, projects, independent teaching formats, etc.). The results show that the ERP systems and functionalities that were used focus on the industry sector (82%), followed again by the retailing sector (36%), the financial sector (8%), public administration (3%), and health services (1%).

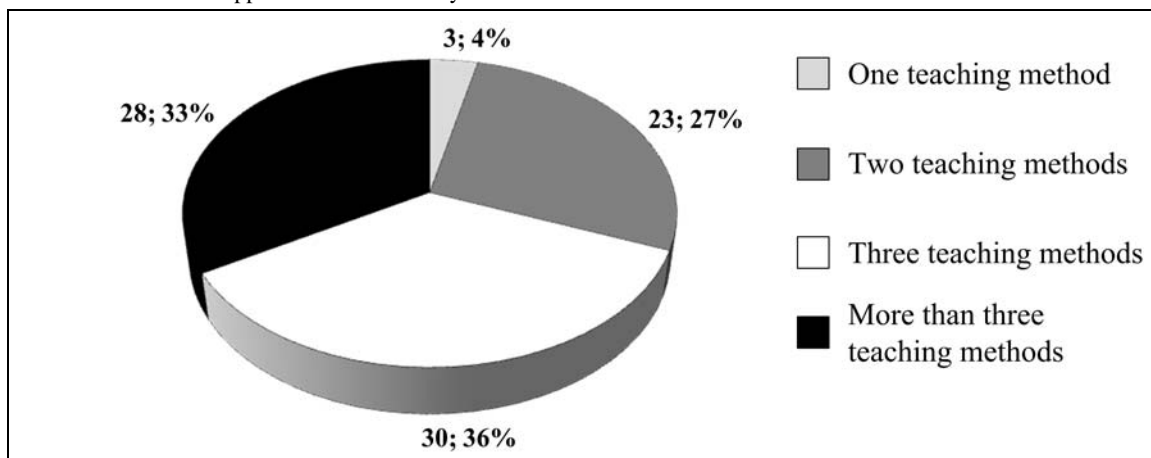


Figure 4. Frequency of teaching methods (n=84)

The question of which ERP systems are used within the different study courses was answered again according to our expectations. As shown in Figure 5, nearly all of the participants at the universities of applied sciences who were teaching ERP systems practically were using SAP ERP systems (77 out of 78; 99%). Other ERP systems used were Microsoft Dynamics NAV and AX (37%), Semiramis (5%), and many other systems were often mentioned only once.

According to Figure 5, many participants who used ERP systems in teaching employed different systems. The results from the universities of applied sciences present nearly the same variety of employed ERP systems as the research-oriented universities. Often, Open Source ERP systems were used in addition to one or two proprietary systems. Above all, the 78 participants gave 133 answers to the question about which ERP systems they used.

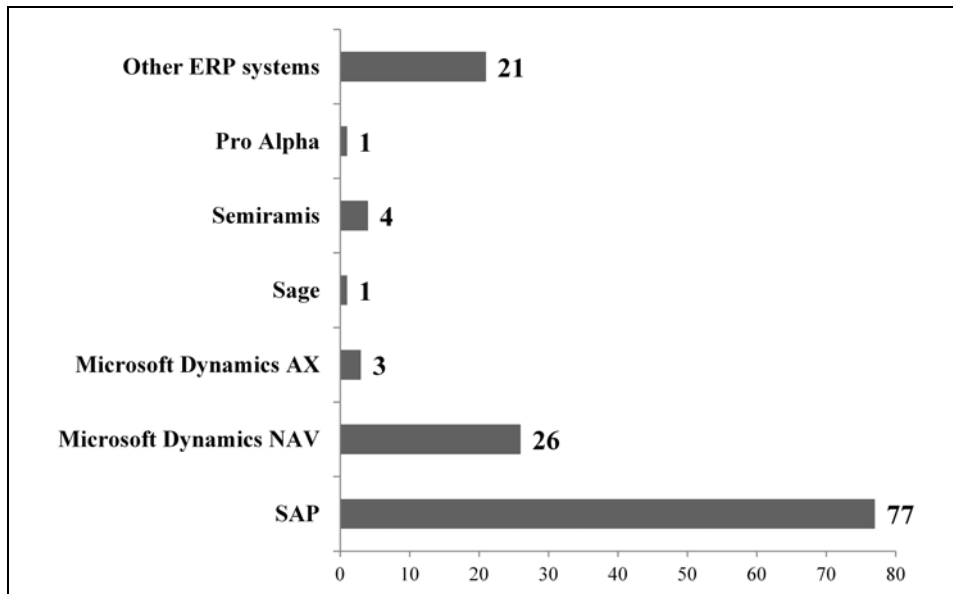


Figure 5. Frequently used ERP systems (multiple answers allowed, n=78)

A large number of participants were satisfied with their systems. Fifty-five out of 75 participants answered this question positively. On the other hand, 20 of them were not satisfied with their systems. Again, this was mainly due to the high complexity of the respective ERP systems and the extent of the needed resources, effort, and budget.

Within this investigation, 73 out of 78 participants were members of the SAP University Alliances (see Table 11).

The second and third most employed programs are similar to the survey at the research-oriented universities the MBSAA (30/78) and the Oracle University (9/78). Additionally, the results show that some participants were members of at least two or more university programs.

Again, we asked all participants if they wanted to integrate (more) ERP systems in their curriculum. The results are shown in Table 12.

University programs of ERP manufacturers	Absolute frequency	Relative frequency (n=78)
SAP University Alliances	73	94%
Microsoft Business Solutions Academic Alliance (MBSAA)	30	38%
Oracle University	9	12%
Semiramis Research & Service (SeReS) Unit	5	6%
Other memberships	5	6%
No memberships	3	4%

Table 11. University program memberships (multiple answers allowed, n=78)

Teaching ERP systems	Request for (additional) ERP systems	Frequency	
Yes	Yes	40	43.6%
No	Yes	1	
Yes	No	35	43.6%
No	No	6	
Yes	No answer	9	13%
No	No answer	3	
		94	

Table 12. Demand for additional ERP systems

Here, the number of participants who wanted to integrate additional ERP systems in the curriculum (41) equals the

number of those who do not want to change the current ERP system usage (41). The follow-up question of which ERP systems would be preferred, if available without any costs, was answered by only 26 participants with multiple answers. For example, 11 would like to use Microsoft ERP systems and would like to integrate (more) SAP ERP systems (e.g., SAP Business by Design), followed by Oracle Enterprise systems (5) and SAGE ERP systems (2). Other systems mentioned were Infor, Peoplesoft and some unspecific answers without clear naming of an ERP system.

4. DISCUSSION, CONCLUSION AND LIMITATIONS

Regarding our research question concerning what ERP systems are taught in German-speaking, research-oriented universities and in universities of applied sciences and how these systems are used, our survey showed that among 92 university chairs at research-oriented universities, 59 were teaching ERP topics. Of these 59 chairs, only 38 were teaching ERP systems practically and therefore provided their students an insight into selected systems. Among the universities of applied sciences, the survey showed that out of 94 participants, 84 were teaching ERP topics and among them, 78 professors and lecturers were using ERP systems practically in their courses. This shows that teaching ERP topics and concepts is done with a more practical focus on universities of applied sciences than at research-oriented universities.

Additionally, to compare our results with some aspects of the study of Bradford et al. (2003), we examined what actual ERP system functionalities were taught within the courses (see Figure 6). Bradford et al. (2003) reported that, in 28% of the universities, only limited transactions within the ERP systems were taught, which reflects the lowest level of ERP system usage (see Rosemann & Watson, 2002). In our survey, out of the 34 participants of the research-oriented universities that answered this question, only one (3%) taught ERP systems on the most limited level. Within the courses at the universities of applied sciences, again only one out of 86 answers (1%) was given regarding this level of teaching ERP systems. As Rosemann & Watson (2002) describe, the use of at least a comprehensive module was the dominant teaching approach used throughout the universities. Our survey supports this statement at least to some degree, since 16 participants of the research-oriented universities out of 34 (47%) used mainly one or more selected modules within their respective ERP systems (see study of Bradford et al., 2003: 29%). However, out of the 86 answers from the professors and lecturers at the universities of applied sciences, just 29 (34%) used selected modules. Here, the top answer was "ERP system's core" (operational core processes as well as administrative support processes) with 40 out of 86 answers (46%). At the research-oriented universities, the core functionality of an ERP system was also taught often, by 14 out of 34 participants (41%), which is nearly the same amount as with selected modules. In the study of Bradford et al. (2003), the percentage of teaching the ERP system's core functionalities was the highest as well, at 31%. However, teaching extended ERP system functions, e.g., configuration or tailoring of the respective systems, was done less often; within our investigation, only

9% of the participants at the research-oriented universities were teaching these aspects (see study of Bradford et al., 2003: 12%). According to Rosemann & Watson (2002), the reasons for this are, above all, the lack of educational material for teaching extended ERP functions, the low amount of support from ERP manufacturers, the lecturers' lack of experience with these specific functions, and the high effort required for implementation and maintenance. Hence, the participants from the universities of applied sciences were teaching extended functionalities more often with 16 out of 86 answers (19%).

Our results obviously show that the majority of the participants who were teaching ERP systems used at least several selected modules or the complete ERP systems' core functionalities instead of teaching single or limited transactions. This tendency can be explained from two perspectives. On the one hand, the universities have collected a fair amount of practical experience since they have been employing ERP systems for several years now. Thus, they have recognized that teaching single transactions does not provide the needed insight. On the other hand, the partnership between universities and ERP manufacturers has been optimized continuously throughout the past years. The types of co-operation are becoming more and more flexible and cover a wider range of systems and functionalities. Both the provided ERP systems as well as the manufacturers' support (hosting the ERP systems, instructional and educational materials, and documentations, etc.) are much better and have become more effective.

As expected, due to its strong influence and predominance, SAP ERP systems are the most often used systems in German-speaking, research-oriented universities and universities of applied sciences. Almost every university chair, professor or lecturer that is providing practical ERP courses for students is using SAP ERP systems; although other ERP systems are used in courses, they are employed less often than SAP ERP systems. Thus, we can point out that at least some variety of ERP systems is provided for the students since many participants often use more than one system in their curricula. However, around 30% of the participants of both surveys are not satisfied with the ERP systems that are being used, often due to high maintenance and costs as well as little support from ERP manufacturers.

Our study shows that teaching ERP topics and using ERP systems practically in courses are important aspects confronting universities. Thus, the universities show a high level of willingness to deal with ERP topics and systems and the associated requirements. The results of our investigation imply that ERP systems in courses have a high importance. However, regarding the rapidly changing and evolving ERP market, providing a wider market overview would be advisable. Besides SAP, there are many other ERP system manufacturers (especially manufacturers for SMEs). In some universities, these systems are already employed, but not all manufacturers provide their systems and resources to all universities. Here, knowledge transfers between universities which are using different ERP systems seem reasonable and would be helpful regarding the usage and employment of ERP systems and regarding the contact and support of different ERP manufacturers.

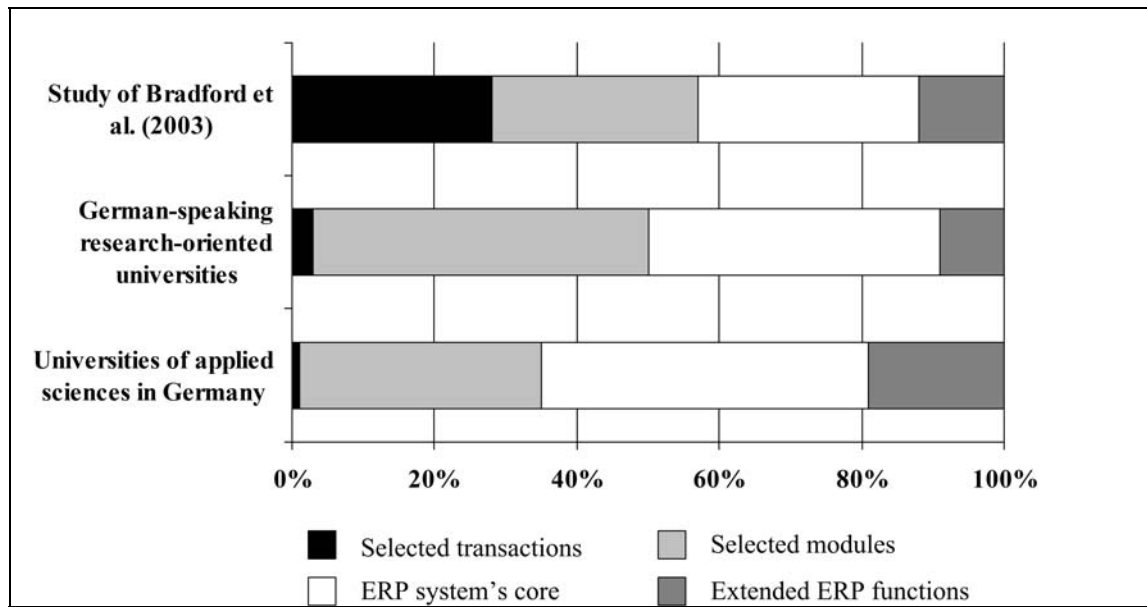


Figure 6. Comparison to Bradford et al., 2003 (Our survey n=34 / n=86)

To address the limitations of our study, we did not receive answers from all of the German-speaking university chairs at the research-oriented universities and from the professors and lecturers at the universities of applied sciences within the field of IS. Additionally, we only focused on German-speaking universities due to our cultural background. Here, further investigations addressing universities in other European countries or even a wider international focus could deliver valuable results. Our survey should be seen as an initial study regarding the usage of ERP systems in courses in German-speaking universities. Subsequent investigations should be done in the next years to determine the further development and the changes in ERP usage practically in courses.

5. REFERENCES

- AK WI (2011). Studienführer Wirtschaftsinformatik an Fachhochschulen. retrieved 1st July 2011 from <http://www.akwi.de/studienfuehrer/>.
- Antonucci, Y. L., Corbitt, G., Stewart, G., & Harris, A. L. (2004). "Enterprise systems education: Where are we? Where are we going?" *Journal of Information Systems Education*, Vol. 15, No. 3, pp. 227-234.
- Barker, T., & Frolick, M. N. (2003). "ERP implementation failure: A case study." *Information Systems Management*, Vol. 20, No. 4, pp. 43-49.
- Bortz, J., & Doering, N. (2009). *Forschungsmethoden und Evaluation für Human- und Sozialwissenschaftler* (4th edition). Springer, Heidelberg, Germany.
- Boyle, T. A. (2007). "Computers-for-edu: An Advanced Business Application Programming (ABAP) Teaching Case." *Journal of Information Systems Education*, Vol. 18, No. 3, pp. 283-296.
- Boyle, T. A., & Strong, S. E. (2006). "Skill requirements of ERP graduates." *Journal of Information Systems Education*, Vol. 17, No. 4, pp. 403-412.
- Bradford, M., Vijayaraman, B. S., & Chandra, A. (2003). "The status of ERP integration in business school curricula: results of a survey of business schools." *Communications of the Association for Information Systems*, Vol. 12, No. 1, pp. 437-456.
- Brehm, N., Haak, L., & Peters, D. (2009). "Using FERP Systems to introduce web service-based ERP Systems in higher education." In Abramowicz, W., & Flejter, D. (Eds.), *Business Information Systems Workshops: BIS 2009 International Workshops, Poznan, Poland, April 27-29, 2009, Revised Papers: 37*. Springer, Berlin.
- Fedorowicz, J., Gelinias, U. J. J., Usoff, C., & Hachey, G. (2004). "Twelve tips for successfully integrating enterprise systems across the curriculum." *Journal of Information Systems Education*, Vol. 15, No. 3, pp. 235-244.
- Hawking, P., McCarthy, B., & Stein, A. (2004). "Second wave ERP education." *Journal of Information Systems Education*, Vol. 15, No. 3, pp. 327-332.
- Hsu, K., Sylvestre, J., & Sayed, E. N. (2006). "Avoiding ERP Pitfalls." *The Journal of Corporate Accounting & Finance*, Vol. 17, No. 4, pp. 67-74.
- Konradin Business GmbH (2009). *Konradin ERP-Studie 2009: Einsatz von ERP-Lösungen in der Industrie*. Konradin Mediengruppe, Leinfelden-Echterdingen.
- Leger, P.-M. (2006). "Using a Simulation Game Approach to Teach Enterprise Resource Planning Concepts." *Journal of Information Systems Education*, Vol. 17, No. 4, pp. 441-448.
- Leyh, C. (2010). "From teaching large-scale ERP systems to additionally teaching medium-sized systems." *Proceedings of the 11th International Conference on Informatics Education and Research*, St. Louis - Missouri, U.S.A.
- Leyh, C., Betge, A., & Strahinger, S. (2010). "Nutzung von ERP-Systemen und RFID-Technologie in klein- und mittelständischen Unternehmen - Eine explorative empirische Untersuchung sächsischer KMU." *Dresdner*

- Beiträge zur Wirtschaftsinformatik, No. 54/10. Technische Universität Dresden, Dresden, Germany.
- Leyh, C., & Huebler, P. (2011). "Nutzung von ERP-Systemen in sächsischen klein- und mittelständischen Unternehmen - Eine explorative empirische Untersuchung." Dresdner Beiträge zur Wirtschaftsinformatik, No. 59/11. Technische Universität Dresden, Dresden, Germany.
- Leyh, C., & Strahringer, S. (2011). "Vermittlung von ERP-Kenntnissen in Tiefe und Breite: Erfahrungen mit einem ERP-Projektseminar an der TU Dresden." In Heiß, H.-U., Pepper, P., Schlingloff, H., & Schneider, J. (Eds.), Tagungsband zur INFORMATIK 2011 (GI - Lecture Notes in Informatics - Volume P-192). Gesellschaft für Informatik, Bonn, Germany.
- Leyh, C., Strahringer, S., & Winkelmann, A. (2012). "Towards Diversity in ERP Education – The Example of an ERP Curriculum." In Møller, C., & Chaudhry, S. (Eds.), Re-conceptualizing Enterprise Information Systems - 5th IFIPWG 8.9 Working Conference, CONFENIS 2011 Aalborg, Denmark, October 16-18, 2011 Revised Selected Papers (Lecture Notes in Business Information Processing, LNBIP, Vol. 105). Springer, Heidelberg, Part 5, pp. 182-200.
- Magal, S. R., & Word, J. (2009). *Essentials of Business Processes and Information Systems*. Wiley Publishing, Hoboken, NJ, U.S.A.
- Noguera, J. H., & Watson, E. F. (1999). "Effectiveness of using an enterprise system to teach process-centered concepts in business education." Proceedings of the 5th Annual Americas Conference on Information Systems, Milwaukee.
- Pellerin, R., & Hadaya, P. (2008). "Proposing a new framework and an innovative approach to teaching reengineering and ERP implementation concepts." *Journal of Information Systems Education*, Vol. 19, No. 1, pp. 65-73.
- Peslak, A. R. (2005). "A twelve-step, multiple course approach to teaching enterprise resource planning." *Journal of Information Systems Education*, Vol. 16, No. 2, pp. 147-155.
- Project IFWIS (2008). Studiengänge und Lehrstühle im Fach Wirtschaftsinformatik (WI) bzw. Information Systems (IS), retrieved 12th June 2010 from <http://www.wi-inf.uni-duisburg-essen.de/FGFrank/ifwis/public/>.
- Rosemann, M., & Watson, E. (2002). "Integrating Enterprise Systems in the University Curriculum." *Communications of the AIS*, Vol. 8, No. 1, pp. 200-218.
- Sager, J., Mensching, J., Corbitt, G., & Connolly, J. (2006). "Market Power of ERP Education – An Investigative Analysis." *Journal of Information Systems Education*, Vol. 17, No. 2, pp.151-162.
- Seethamraju, R. (2007). "Enterprise systems software in business school curriculum – Evaluation of design and delivery." *Journal of Information Systems Education*, Vol. 18, No. 1, pp. 69-83.
- Stewart, G., Rosemann, M., & Hawking, P. (2000). "Collaborative ERP curriculum developing using industry process models." Proceedings of the 6th Annual Americas Conference on Information Systems, Long Beach.
- Venkatesh, V. (2008). "One-Size-Does-Not-Fit-All: Teaching MBA students different ERP implementation strategies." *Journal of Information Systems Education*, Vol. 19, No. 2, pp. 141-146.
- Watson, E. E., & Schneider, H. (1999). "Using ERP systems in education." *Communications of the AIS*, Vol. 1, No. 2.
- Welsh, J.-A., & White, J.-F. (1981). "A small business is not a little big business." *Harvard Business Review*, Vol. 59, No. 4, pp. 18-32.
- WI (2010). Studienführer Wirtschaftsinformatik, retrieved 15th June 2010 from <http://www.wirtschaftsinformatik.de/index.php;do=st/site=wi/sid=a3ae4282209d93b977161d800433e1ee>.
- Winkelmann, A. (2010). "Dynamic Reconfiguration of ERP Systems - Design of Information Systems and Information Models." Post-Doctoral Thesis, Muenster, Germany.
- Winkelmann, A., & Klose, K. (2008). "Experiences while selecting, adapting and implementing ERP systems in SMEs: a case study." Proceedings of the 14th Americas Conference on Information Systems, Toronto.
- Winkelmann, A., & Leyh, C. (2010). "Teaching ERP systems: A multi-perspective view on the ERP system market." *Journal of Information Systems Education*, Vol. 21, No. 2, pp. 233-240.
- Winkelmann, A., & Matzner, M. (2009). "Teaching medium sized ERP systems – a problem-based learning approach." In Papadopoulos, G. A., Wojtkowski, W., Wojtkowski, W. G., Wrycza, S., & Zupancic, J. (Eds.), *Information Systems Development: Towards a Service Provision Society*. Springer, New York, pp. 891-901.

AUTHOR BIOGRAPHIES

Christian Leyh is research assistant at the Chair of Information Systems; esp. IS in Manufacturing and Commerce at the Technische Universität Dresden. He graduated from the University of Applied Science Schmalkalden information systems program and completed his Masters Degree in business and engineering at the Steinbeis University Berlin. Currently, he teaches in both the undergraduate and graduate IS programs. His research interests are centered within the field of ERP systems, esp. ERP systems for small and medium sized enterprises.





No matter how sophisticated the technology, it still takes people!™



STATEMENT OF PEER REVIEW INTEGRITY

All papers published in the Journal of Information Systems Education have undergone rigorous peer review. This includes an initial editor screening and double-blind refereeing by three or more expert referees.

Copyright ©2012 by the Education Special Interest Group (EDSIG) of the Association of Information Technology Professionals. Permission to make digital or hard copies of all or part of this journal for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial use. All copies must bear this notice and full citation. Permission from the Editor is required to post to servers, redistribute to lists, or utilize in a for-profit or commercial use. Permission requests should be sent to the Editor-in-Chief, Journal of Information Systems Education, editor@jise.org.

ISSN 1055-3096