User Interaction-framework for Adaptive ERP Education

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Abstract: Current methods used to learn and understand information systems in a company or in the field of higher education are not sufficient when it is compared to the capabilities of today's technologies. The most common method used to teach and learn the practical issues of an information system is with the help of case studies. However, the learning material in a case study provided to the learner is neither technologically-enhanced nor adapted to the individual knowledge background and learning preferences of a single, individual learner in a group. Adaptive learning environments offer a sufficient way to teach and learn the usage of an information system while it tracks user interactions and adapts the learning content towards the learner's performance. Thus, the lacking integration of an adaptive learning environment with the target information system is a major issue. In this contribution, we are presenting a developed user interaction-framework (UIF) for web-based information systems (WBIS) in order to generate individual tasks for each single learner depending on his specific performance during a hands-on learning process.

1 INTRODUCTION

The complexity of enterprise systems or information systems (IS) in general, as an important part of today's companies, increases more and more. The pervasion of computer supported business processes in today's enterprises affects nearly all business sections and their employees (Konradin, 2011). This is especially the case for Enterprise Resource Planning (ERP) systems, which integrate data, processes and functions of different business departments, such as financial accounting, production or sales and distribution (Gronau, 2010).

At the same time, the resulting, raising need of appropriate learning material and employee trainings needs to be met. In companies, as well as in tertiary education institutes, like universities e.g., it is highly relevant to bring people in contact with these systems in order to ensure an effective use of the different systems (Konstantinidis et al., 2010). Primarily business economics or business informatics people need to be educated in this area, but also engineers or computer scientists should be addressed. Especially the practical use of these systems is an important part of getting people familiarized with the software. Therefore, this hands-on experience needs to be addressed by future learning methods. This trend is also discussed in the literature very well (cf. Hawking et al., 2005; Strong et al., 2006; Cameron, 2008; Winkelmann et al., 2012).

Unfortunately, the existing training methods don't fulfil this higher and specific demand. The current and most common way to learn the practical issues of a system is to conduct case studies. But these case studies lack due to different reasons. First of all, the common case studies do often not have a deeper didactical background. This is because they are mostly created by the software vendors themselves and therefore only include technical or functional issues. Furthermore, existing case studies are paper-based and not technology-enhanced in general. Therefore, the learner cannot benefit from well-known advantages coming from methods like distance learning or community-based approaches. The reuse of learning material is much easier within electronic learning environments (Baumgartner and Kalz, 2005). This is very important, because the systems are changing a lot due to software updates and new software releases. The biggest shortcoming is the ignorance of specific characteristics of each individual learner. Most of the time, the learners have a different background in knowledge and skills, but existing learning material often addresses a

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group of people or students, which are very heterogeneous in their style of learning. Some learners are working on a case study very active and reach the learning target very quick. Some others need more theoretical information about the specific functions in order to complete a task with satisfaction.

2 ADAPTIVE INFORMATION SYSTEM-EDUCATION

According to the literature, intelligent learning systems exist since the beginning of the 1980s (Schulmeister, 2007). Surely, the term *intelligent* has a very vague definition, but starting with the first computer assisted instructional programs, the first *reactive* or *adaptive* systems were developed in that decade. The combination of computer technology with methods from the artificial intelligence (AI) aiming at the improvement of educational instructions can be summarized under the most important software category, called Intelligent Tutoring Systems (ITS) (Gharehchopogh and Khalifelu, 2011). In a general understanding, ITS consist of a model of the knowledge of a specific domain (domain model), a model of the learner who uses the learning system (learner model), a model of the pedagogical strategy (tutor model) and a component which is responsible for the communication of the system with the learner (interface) (Schulmeister, 2007). Therefore, ITS can also be classified as adaptive learning systems, because they react on the basis of the learner behaviour (Brusilovsky, 2001). Reference models of adaptive learning environments such as GRAPPLE, which is used as the basis of the developed UIF, are implementing the basic concepts in order to create a broader environment for the learner and her/his educational life.

The domain of IS is very relevant for a large group of learners in the field of higher education institutes (Peters et al., 2012). Furthermore, the IS education lacks in efficiency due to the described reasons. At the moment, there are no adaptive learning environments existing which focus on this specific IS domain and target group. Therefore it is highly relevant to make use of the named major advantages.

3 OBJECTIVE AND APPROACH

In general, the primary objective of our research was to develop a framework which allows the integration between an adaptive learning environment and a real environment of a WBIS.

In order to achieve this objective we developed a technical solution in a form of a learning system which firstly supports the tracking of user interactions and secondly offers the possibility to display additional information, such as learning instructions or tasks, within that environment. This all should be done without modifying the source code of the target web-based information system. In the research process, existing related systems and approaches were reviewed to identify ways of user interaction tracking and ways to display additional information. After this literature review, we found out, that the proposed UIF can be based on an existing reference model called GRAPPLE which already comes along with some major functionality for an adaptive learning environment, like the design of an adaptation engine or the definition of adaptation rules. Based on that reference model, the theoretical concept of the UIF was designed. In a last step, a UIF prototype was developed in order to proof the underlying concept. The results are presented and discussed in the following section.

4 USER INTERACTION-FRAMEWORK

Nowadays, learning environments have no direct connection between the learning system and the IS itself. As a result, students work with two isolated systems. But both systems contain relevant data which can be used to improve the learning process. By integrating both systems, the learning environment can benefit from the existing data stored in the IS.

According to Figure 1, the design introduces existing components of a learning environment, namely the students, the WBIS, the learning system (LS) and the teacher. In order to overcome the lack of integration the UIF adds three more components to the information flow, namely the configuration file, a browser plug-in and the tracking and displaying script, to directly connect the LS with the WBIS. This allows a way of learning where students are able to receive their learning tasks, additional information and guidance as well as support directly within the targeted WBIS.

From the user interaction point of view, the student operates with the WBIS regularly via web browser which has the UIF-browser-plugin installed. This plugin receives information and tasks from the LS over a displaying script and displays the tasks at the right place directly on top of the WBIS. In addition, the plugin communicates with the LS over the tracking script. This tracking script forwards the student interactions directly through the LS. This enables the LS to instantly evaluate the learning results and students' behaviour in order to adapt the learning process in terms of giving the student a new task or additional help information.

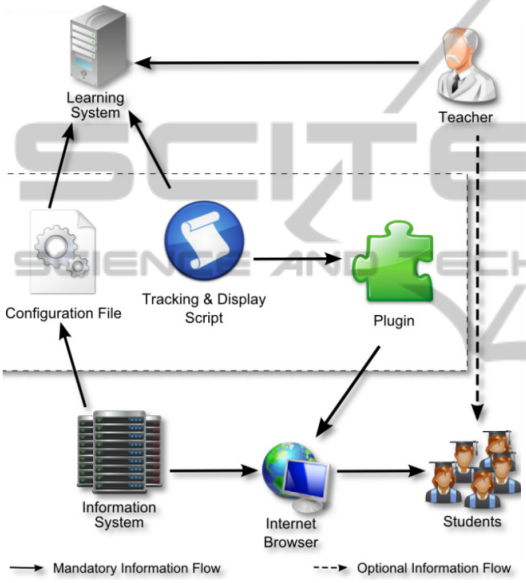

Figure 1: Information Flow.

In order to make use of the UIF the creation of a configuration-file is necessary as an initial step. This file includes the structure of all relevant html-elements of the GUI of the WBIS. This creation needs to be done once for all relevant GUI-elements, which want to be used in the context of a learning scenario. Through this configuration-file the LS *knows* about the structure of the WBIS and is able to allocate html-elements to a function of the WBIS.

The underlying (adaptation) logic is delivered by the GALE (Adaptivity GRAPPLE Adaptive Learning Environment) framework as part of the mentioned GRAPPLE framework. There, it is possible to define adaptation rules, which describe the exact behaviour of the LS. More precisely, the adaption rules deliver a reasoning which exercise will be presented to the student based on the tracked information of the students' performance. As an example, the system can provide positive feedback, if the learner clicks on the correct button within the WBIS according to her/his current task. However, if the user clicks on a wrong button, she/he might get additional information about what was wrong and how the problem can be solved in a next step. Besides these very simple examples, the UIF also allows the definition of more complex adaptation rules in order to provide a more efficient learning experience.

5 UIF PROTOTYPE

This section demonstrates the use of the proof-of-concept prototype within a use case scenario. The chosen WBIS for the prototypical implementation is SAP NetWeaver Portal installed in version 7.02 ABAP Trial Version on a virtual appliance of a Windows Server 2003 R2.

The learning task of the use case scenario is to show the learner how to create a new appointment in the personal calendar of the WBIS in the SAP Easy Access menu. Therefore the UIF will guide the learner through two different ways of doing this (a way represents a certain domain model). The first approach is designed for novice users, showing them how to perform the tasks by using a common navigation path. The second approach is designed to be executed by advanced users and shows how to perform the tasks using a navigation shortcut.

After the login, the learner is located on the SAP Easy Access page. The first domain model is activated and shows the first task. Figure 2 exemplifies how this information is displayed in the learning environment. The UIF tracks when the learner has performed this task and the UIF will display further information on the next pages. After the user has entered some information into the form the UIF shows the next task. In order get an overview about the main idea of the use case scenario, not every single screen of the described use case scenario is shown here. Finally, the user is led back to the SAP Easy Access page.

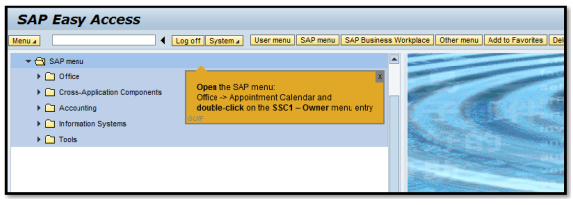

Figure 2: UIF SAP Example 1.

After completing the first task, the second domain model is activated, because the first domain model is

marked as known to the learner. As shown in Figure 3, on the SAP Easy Access page the UIF instructs the learner in a different way. After this interaction has been tracked the next advice will be given by the UIF and so on.

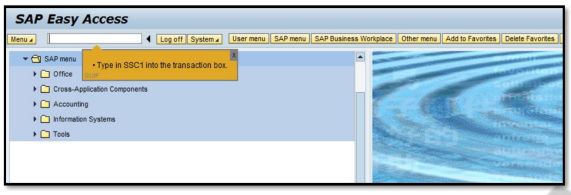

Figure 3: UIF SAP Example 2.

During this example learning session the UIF has shown seven instructions (four in the first and three in the second domain model) and tracked ten interactions (six in the first and four in the second domain model). Finally, the learner has created two appointments in her/his personal calendar in two different ways and mastered two domain models.

6 CONCLUSIONS AND OUTLOOK

In this contribution we presented a UIF which allows the allocation of individual learning tasks to different learners who want to get familiar with the usage of WBIS. Therefore, we presented an integrated approach in order to track the learner's behaviour and display upcoming learning tasks within the information system itself. Based on the learner interaction, the UIF offers the possibility, to allocate different kinds of tasks with regards to previous knowledge and/or learning style, to different types of learners.

The main idea of this contribution is the integration of an adaptive learning environment with a real, existing IS. This system and data integration generates the main benefit of our approach which is mainly the possibility of tracking, collecting and analysing data about the learner's tasks and her/his performance in the system. Furthermore, through this integration, tasks can be displayed context-sensitive on top of the GUI of the WBIS. In summary, we provide an approach which gives the opportunity to learners to gather from hands-on experience in a more efficient way of learning in the field of IS education.

For future work, the prototypical implementation can be enhanced with further functions and use case scenarios in order to conduct a field study together with students. Based on these experimental results, it is possible to enhance the presented qualitative added values of our approach with facts about the quantitative improvements in IS education.

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