



Impact of an Introductory ERP Simulation Game on the Students' Perception of SAP Usability

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Abstract. Enterprise Resource Planning systems are immense environments that are quite hard for novice users to grasp. A new user will judge an unknown system heavily by its usability. This makes it crucial that the introduction of a system portrays the system as being as usable as possible. We used a gamified workshop based on the ERPsim simulation game to introduce students to the SAP Enterprise Resource Planning solution, and then measured the perceived System Usability Scale (SUS) of SAP and its modules. We then compared the usability results with other comparable studies and found them to be higher, which is correlated with the positive effect of gamification that the workshop left on its participants. The results need to be confirmed further, because the preliminary study employs several limitations on the sample size, demographics and different versions of the SAP ERP software used in comparable studies.

Keywords: Gamification · Gamification in higher education · ERPsim
System usability · System Usability Scale

1 Introduction

Enterprise Resource Planning (ERP) are big complex suites of software aimed at helping organizations integrate data & information flow and business processes [1]. The systems cover all functional areas of the company [2] (Manufacturing, Sales & Distribution, Payables, Receivables, Inventory, Accounts, Human Resources, Purchases, etc.). Implementing such a complex system is very cumbersome and [3] notes that 50 to 75% of all US companies experience some degree of failure in implementation of ERP systems. Poor training and user involvement, together with user resistance to changes, are among the main factors [4] leading to failure. These implications mean that the first encounter with the ERP system is of the utmost importance, as an inadequate introduction may leave unrepairable consequences. We propose support of serious games for introducing ERP systems.

According to Marsh's definition [5] "*Serious games are digital games, simulations, virtual environments and mixed reality/media that provide opportunities to engage in*

activities through responsive narrative/story, gameplay or encounters to inform, influence, for well-being, and/or experience to convey meaning.”.

The only difference between serious and video games is their intended purpose; usefulness for serious and entertainment for video games [6]. Serious games have been found more motivating and engaging than traditional methods for conveying knowledge [6]. They are used in numerous fields, and studies found that additional cognitive abilities were gained that would not been attained in a classic non-gaming environment [7]. Serious games utilize the concept of gamification, that is [8] *the use of video game elements in non-gaming systems to improve user experience and user engagement.*

In this paper, we focus on measuring and comparing the system usability score of the SAP ERP system by using the business simulation game ERPsim for introduction to the system. The study was conducted on post-graduate students participating in an ERP course. The students were first introduced to ERPs in a workshop, and then interacted with them through the whole course as a part of computer exercises. We investigated the system usability scale, to decide how students would perceive such a complex system when introduced to it via use of serious games as compared to the normal introduction in other studies where the gamification approach was not used.

We aimed to find the answers to the following question:

Does using the business simulation game ERPsim increase user perception of the SAP ERP system usability?

This research paper is structured as follows. In the Related Works section, similar research is presented in measuring the usability of ERP systems. Subsequently, a quick description and presentation of the workshop execution is given, i.e. how the ERP simulation game was integrated and applied in our environment. The post workshop activities and the ERP course are presented in the fifth chapter. System Usability Scale (SUS), together with the results gathered, are presented in the sixth chapter. In conclusion, the findings are summarized and proposed directions for further research are given.

2 Related Works

We found no studies regarding the use of ERPsim for introduction to the field of ERP Systems, and no field that would measure the usability of learners that were just introduced to the ERP systems as a part of a moderated course.

A study “*Application of Modified Agile Methodology to Improve Usability of SAP ECC*” [9] investigated SAP FIORI user usability perception in a big company, which migrated to a newer version of the system. SAP FIORI is a new user experience (UX); it is role and task-based implementation of SAP S/4 HANA. This is the successor version of SAP ERP which we used. The notable difference between versions is that FIORI is role and task-based, whereas SAP 6.0.8 (our version) is transaction oriented. Based on responses from 103 users, they gave the software an SUS value of 34.47. The value was derived by averaging results from 5 different modules: MM (Materials Management), (Human Capital Management), SD (Sales and Distribution), FI & CO (Financing and Controlling), SCM (Supply Chain Management). A very low score of

usability for the SAP system was measured, even though the main advantage of the FIORI version is a friendlier user interface than in the older, SAP ERP 6.08 version.

The University of Budapest proposed ways for measuring usability of ERP systems from the perspective of its users. They proposed the following existing methods that can be used to measure the usability of ERP systems: Software Usability Measurement Inventory (SUMI), System Usability Scale (SUS), ErgoNorm and IsoMetrics [10], and found all of them appropriate for use. We decided for the use of SUS, due to its simplicity and ability to measure the scores accurately nevertheless. They proposed these measuring scales for the following ERP systems: GUS OS Suite, OpenERP, Orlando, Sage, SAP, WorxSimply, MS Dynamics, infor:com, BMD, FAKTMANN, MKS Goliath and QUIX OFFICE.

3 ERP Workshop

In order to support the first steps in understanding ERP concepts and its' implementation SAP, we began our ERP course with an introductory ERPsim workshop, after which normal lectures and lab exercises were conducted. We finished the course with a final replication of the workshop at the very end of the course. The whole course lasted 15 weeks, 13 were normal lessons and 2 weeks consisted of this gamified workshop.

At the beginning of the course, the students were introduced to SAP ERP software by the use of the ERPsim distribution game [11], a business simulation game. ERPsim is developed by HEC Montréal, it is available for free, but may be used for educational purposes only by certified instructors. The certification itself is free. It is a game where players are split into teams, and each team represents a company which buys water from bottled water producers and sells it to stores. The simulation has 3 regions in which teams compete. The goal is to accumulate the highest profit. The teams have the ability to sell their products at different prices in each region, and they have 6 different products to sell. They can spend their company money on advertisements, and must also plan to order things in advance, since orders need some time for execution.

All the possible actions of a team during a business cycle are shown in Fig. 1. Transactions that are used for monitoring and generating business reports are independent of the business cycle (ZME2N, F.01, ZMB52, ZMARKET, ZVA05, ZVC2), and can reasonably be used at any time to execute the business transactions that have a reasonable order (MD61, MD01, ME59N, ZAD5, VK32) better, as illustrated by the arrows connecting them.

The workshop was conducted in 2017 at the Faculty of Electrical Engineering and Computer Science, University of Maribor, as a part of the Enterprise Resource Planning course. The workshop conducted is described fully in [12]. The same paper reported that using ERPsim for introduction to ERP concepts was beneficial, well accepted by both students, as well as instructors. 18 participants participated in the workshop and survey.

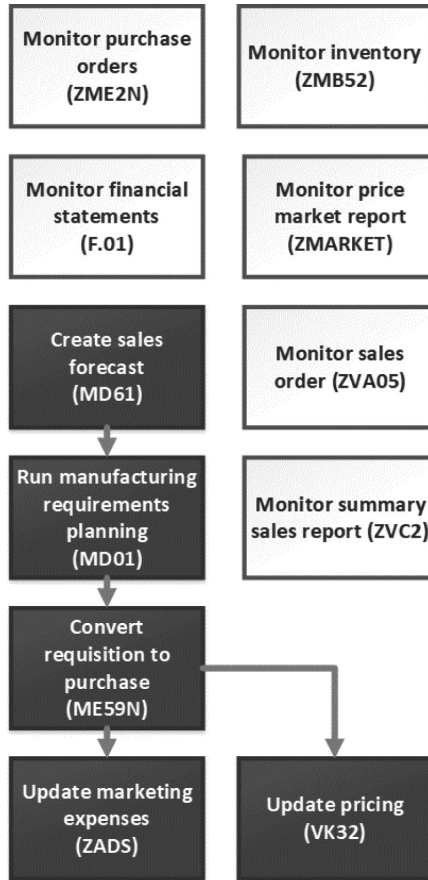


Fig. 1. ERPsim possible actions with their corresponding transactions (adapted from [11])

4 Post Workshop Activities

After the introductory workshop, learners studied MM (Materials Management), SD (Sales and Distribution), PP (Production Planning), CO (Controlling), PS (Project System) and EAM (Enterprise Asset Management) SAP modules as a part of their Enterprise Resource Planning course. These selected modules that the course curriculum requires for students to understand were taught to students by the use of Global Bike Inc 3.0 [13] and the course was executed on SAP ERP version 6.0.8. It is important to note that this remaining part of the course was non-gamified, but we wanted to investigate if the positive effects of the gamified workshop persisted throughout the course. The students, as a part of their course, used not only the transactions learned in the workshop, but also learned using several new transactions on each course session.

Global Bike Inc are sets of study materials and tasks in a fictional bike producing company that students work through to familiarize themselves with the use of the SAP system [14]. Students followed a set of instructions on each selected module, and then completed a short follow up quiz to test their knowledge on the module. The materials were provided by the SAP University Alliance.

5 System Usability Scale

5.1 System Usability

Usability is the quality of interaction between a human and a man-made object. In software, the quality of interaction is described as handling, user friendliness, ease of use and learnability [10]. The ISO/IEC 9126-1 [15] specifies usability as “*The capability of the software product to be understood, learned, used, and attractive to the user, when used under specified conditions*”. Surveys for measuring usability from users’ perspectives are [10]:

- Software Usability Measurement Inventory – measures performance and emotions of users towards the used system. Questions are divided into 5 categories (efficiency, affect, helpfulness, control, learnability) with 10 questions per category.
- System Usability Scale - (described in Sect. 5.2)
- ErgoNorm – two parts. In the first part, users evaluate software on 27 selected items subjectively, and in the second, the experts test the software.
- IsoMetrics – responses from 7 sub-scales with a total of 75 items are required from the user.

5.2 Research Instrument

A System Usability Scale is a 10-item, 5-point Likert scale. Responses used, with values for the Likert scale are: Strongly disagree (0), disagree (1), neither agree nor disagree (2), agree (3) and strongly agree (4). The ten items are divided in two halves. Half of the statements would receive strong agreement, the other half strong disagreement in a perfect solution.

The rated statements were:

1. I think that I would like to use this system (SAP) frequently.
2. I found the system unnecessarily complex.
3. I thought the system was easy to use.
4. I think that I would need the support of a technical person to be able to use this system.
5. I found the various functions in this system were well integrated.
6. I thought there was too much inconsistency in this system.
7. I would imagine that most people would learn to use this system very quickly.
8. I found the system very cumbersome to use.
9. I felt very confident using the system.
10. I needed to learn a lot of things before I could get going with this system.

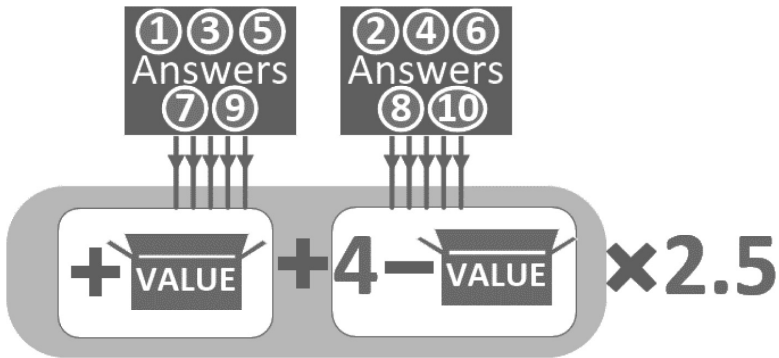


Fig. 2. Calculating SUS - simplified illustration

After collecting answers, the following procedure is used to calculate SUS.

For statements 1, 3, 5, 7, 9, the corresponding answer value is added to the total score, and for statements 2, 4, 6, 8, 10, corresponding answer values are deducted from number 4 for each statement. Finally, we multiply the whole score by a factor of 2.5. Figure 2 illustrates the entire process. The calculated value is the System Usability Score [16].

The value is much more understandable if it has an adjective meaning. [17] connected the values with the following adjective terms:

- Best imaginable (MV¹: 90.9, SD²: 13.4)
- Excellent (MV: 85.5, SD: 11.3)
- Good (MV: 71.4, SD: 12.6)
- Ok (MV: 50.9, SD: 13.8)
- Poor (MV: 35.7, SD: 11.6)
- Awful (MV: 35.7, SD: 10.4)
- Worst imaginable (MV: 12.5, SD: 13.4)

They derived the values by comparing SUS values of different user interfaces from users' questionnaires, and asked those same users to rate the interface on a 7-point Likert scale with corresponding adjective ratings. Attaching meaningful words to the selected intervals makes numbers much more understandable and easier to relate to.

5.3 SUS Workshop Questionnaire Results

After the workshop, students completed the SUS questionnaire. An average SUS value of 59.17 (Fig. 3) was calculated from the workshop results, which would bear an adjective value of "Ok". This value is high compared to other studies investigating SAP usability, [9] reports a value of 34.47 based on responses from 103 users, adjective value of "Poor". This indicates that a complex system such as SAP was initially

¹ MV - Mean Value.

² SD - Standard Deviation.

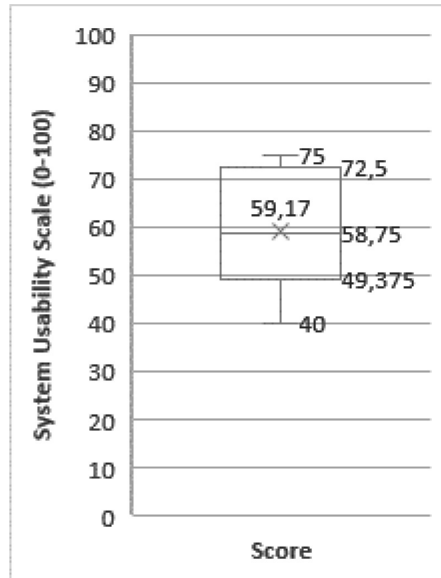


Fig. 3. Calculated SUS value after completing the workshop

perceived as relatively usable by students, when introduced using ERPsim. This is a much better SUS score than when the system is introduced normally (without the use of simulation).

A higher System Usability Score is correlated with greater consumer loyalty and user satisfaction [18] to the system, which leads to lower failure rate of implementing ERP systems, whereas a low SUS score could indicate the opposite; lower user satisfaction, lower loyalty, causing failure in implementing ERP systems. From the questionnaire results, we assume that ERPsim was a crucial positive factor in the more positive usability score compared to the baseline from other studies.

5.4 SUS Course Questionnaire Results

We continued our comparison by performing SUS questionnaires during the course after introducing each module (MM (Materials Management), SD (Sales and Distribution), PP (Production Planning), CO (Controlling), PS (Project System) and EAM (Enterprise Asset Management)) using the Global Bike Inc materials [13] to determine user perception of usability for each module. The SUS questionnaires were performed on the same set of 18 students that participated in the gamified workshop. The corresponding SUS values of each module are presented in Fig. 4 in chronological order. As seen, the average SUS values ranged from 44.56 to 52.13, all close to the adjective value of “Ok”. These are a bit lower values than after the gamified workshop (59.17), but still higher than the average value collected by a similar aforementioned study (34.47) [9].

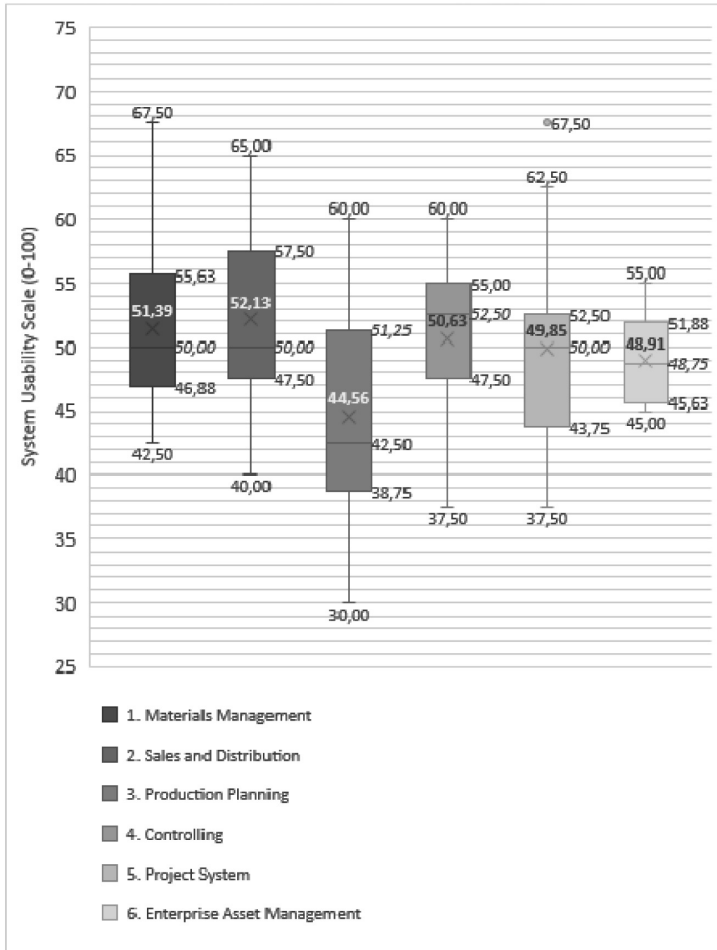


Fig. 4. Calculated SUS values after completing the course modules shown in a boxplot graph (average values are bold and median values are written in italics)

We believe the higher perception of system usability may have been a result of using the introductory gamified workshop, which improved the perception of usability throughout the whole course.

A module by module comparison can be derived partially for three modules that both studies investigated, as seen in Fig. 5. The following limitations for comparison should be considered before comparing the results: The population types; we used students, and they used their employees. Furthermore, they merged comparison for Controlling and Finance modules, whereas our students only met and evaluated the Controlling module, and different versions of SAP software - we used SAP ERP 6.0.8 and they used SAP FIORI. For all students, this was the first contact with ERPs, while the company employees all had prior experience. We found that our students rated

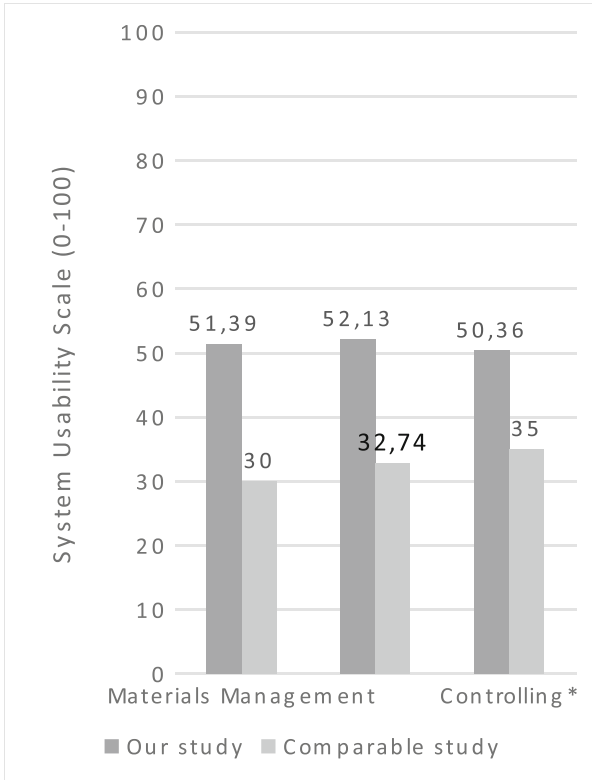


Fig. 5. Comparison of collected average SUS values between our and the comparable study [9]

modules an average of 20 points higher consistently, and were perceived as more usable than collected results in a comparable study found.

This supports our claim that the use of ERPsim increased the students’ perception of usability of the SAP ERP system through the whole course, and higher ratings of SUS persisted even after the simulation. Even without comparing the results, this indicates a success, in that students had no reluctance to using a big complex system later on that does not even have a task oriented interface, and this was the purpose of the introductory ERP workshop.

6 Conclusion

In our case, the use of the business simulation game ERPsim was demonstrated to be an appropriate way of introducing students to SAP ERP. Using the business simulation game ERPsim increased the precepted usability of the system, thus affirming our question. Whereas a study reported [9] anSUS score of 34.47 for SAP ERP when the system was introduced normally, our measured SUS was 59.17 after the workshop. The higher rating persisted, even during the non-gamified part of the course, where they

were found to be, on average, about 20 points higher than results from a comparable study where no gamified elements were used. The difference was likely caused by the benefits of using gamified environments to introduce users to a complex system. The results are preliminary, due to the small sample size ($N = 18$), different versions of SAP used in our and comparable studies, and different demographics; we had students, whereas other studies mentioned were measuring perceived usability on employees who worked with SAP.

Research queries for the future are: *Does using a gamification approach increase perceived usability if users are already familiar with the system? How can the gamification approach used be improved to increase perceived usability of SAP system further in both traditional courses and working environments?*

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