Components of e-Learning for Enterprise Systems' Education in Developing Countries

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Abstract
Education in the field of science and technology is problematic in South Africa. In the field of Enterprise Systems, Higher Education Institutions (HEIs) are not producing the skills required by industry and there is a shortage of skills in the marketplace. New approaches to learning, specifically e-learning, can transform the learning process and provide easy access for students to interactive media and other learning components anywhere and at any time. However, the level of success of these components is not always known and there is limited research regarding the design considerations for e-learning components. The purpose of this paper is to investigate the design, acceptance and the success of interactive media, assessments and gamification components in e-learning projects. A case study approach was adopted and the case was a project conducted in South Africa to improve Information Systems' education levels in developing countries. An Enterprise Resource Planning (ERP) systems course was presented as part of this project. Several criteria were considered in the design of an ERP e-Learning Environment (ERPeL). Components such as interactive media, gamification and m-learning were incorporated in the ERPeL. Overall the ERPeL and its components were rated positively by participants and a deeper knowledge of the design criteria and success of interactive, e-learning components was obtained.

Keywords
ERP education, e-learning, m-learning, enterprise systems.

Introduction
Although many African countries have had independence for more than 50 years, the education quality gap is still severe (Manji, Jal, Badisang, & Opoku-Mensah, 2015). The attainment and quality of education and learning is still separated by wealth and gender. The shortage of high school learners that are doing subjects such as mathematics and

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science at school level has resulted in less students being eligible for a qualification in Information and Communication Technologies (ICT), Computer Science (CS) and Information Systems (IS) related courses (Deloitte, 2014), resulting in skills shortages in these fields (Calitz, Evert, & Cullen, 2015). There is a desperate need for IS professionals that have experience and exposure to Enterprise Systems (ES) and particularly Enterprise Resource Planning (ERP) systems (Ram, Wu, & Tagg, 2014; Scholtz, Calitz, & Cilliers, 2013). ERP courses have been introduced into only a few Higher Education Institutions (HEIs) in South Africa and only a small percentage of these provide hands-on training. One of the challenges with ERP systems' education is the shortage of educational resources (Seethamraju, 2007) and limited availability of instruction content and demonstration data (Ask, Juell-skielse, Magnusson, Olsen, & Päivärinta, 2008) which are amplified in developing countries due to lack of infrastructure and access to devices and technology (Bhuasiri, Xaymoungkhoun, Zo, Jeung, & Ciganek, 2012).

To potentially address and minimise the gap that exists between the ERP competencies required by industry and those provided by HEIs, ERP vendors have created strategic, academic alliance programmes (Springer, Ross, & Humann, 2007). SYSPRO is one such ERP vendor that has formed alliances with South African HEIs and also provides online certifications for both students and industry professionals (SYSPRO, 2015). These academic alliances allow access to training resources and online assessments and certifications. However, training material provided by ERP vendors is usually not suitable for use in HEIs since the material and content is mostly vendor specific (Surendran, Somarajan, & Colton, 2006). Vendor training material is therefore not always suited to HEI curricula which is required to incorporate formal and abstract knowledge and skills that need to align with specified aims and outcomes. ERP vendor training material is usually non-scientific, very practical and sometimes lacks a theoretical basis. Therefore there is a need for material that is scientific with a balance between theoretical concepts and practical application.

A recent trend in learning approaches is e-learning, which is still in its early stages of development and usage in developing countries (Bhuasiri et al., 2012). e-Learning approaches experience their own unique set of challenges including infrastructure, resources, information access and connectivity, with these problems even more prevalent in developing countries. In developing countries, e-learning can be the difference between basic learning and no learning at all. Nawaz (2013) states that *"e-learning is a blessing in disguise*", and is helping developing countries to address their educational problems. On the other hand, in a developed country, e-learning is used to cultivate an effective knowledge economy and enhance lifelong learning (Bhuasiri et al., 2012). However, people that live in developed countries often do not have an accurate understanding of the profiles of users in developing countries, since their mental model frames of reference and experience with technology can differ substantially (Toyama, 2010).

Due to the expense and time pressures associated with e-learning, the reuse of e-learning content is being increasingly encouraged (Siqueira, Braz, & Melo, 2007). M-learning has been identified as a possible solution that can potentially close education gaps (Manji et al., 2015). The use of mobile phones as education tools for information access and interaction in HEIs has not been realised to its full potential (Chipangura, van Biljon, & Botha, 2014). Research has indicated that the prospect of mobile phones to be used as a

medium of learning and education is tenfold, especially in developing countries. According to the *e-Learning Africa Report 2015* (Manji et al., 2015), the mobile market shows significant progress and is deemed one of the more affordable forms of technology for millions of African children and young adults. The report states that the mobile phone will have as large an impact on Africa as the Industrial Revolution had on Europe; however, this could be constrained by the lack of a fixed bandwidth in this continent. By increasing HEI and industry collaboration the divide between theory and practice can be narrowed (Ananthanarayanan, Gnanappa, & Chellamuthu, 2014). The Developing and Strengthening Industry-driven Knowledge-transfer between developing Countries (DASIK) project is a collaboration between industry and HEIs in South Africa and aims to provide training and education in the field of ICT for both industry delegates and students. However, whilst there are various e-learning initiatives available on the continent of Africa, it is still far from e-learning readiness (Manji et al., 2015). There is good potential for e-learning to address IS and ERP education needs in Africa, but in order for this to be possible, additional research related to the components and factors impacting e-learning success is required.

The purpose of this paper was to investigate the components that can be used to improve the success of e-learning projects, particularly with regard to ERP systems. Design and evaluation criteria were identified that can provide a more in-depth understanding of learner preferences with regard to interactive components. These criteria were used to guide the design of the interactive learning components that were developed as part of the DASIK ERP e-learning project. Components developed for this e-learning environment were interactive media, m-learning, assessments and gamification elements (badges). The next section of this paper addresses relevant literature and related work. The research methodology adopted for this study is discussed after the literature. The fourth section presents the analysis of the results of the case study and then lastly some conclusions and recommendations are made.

Literature and Related Work

Components of e-Learning

e-Learning is distance learning that is conducted when the instructor and student are divided by time and space (Liaw & Huang, 2013). Learning occurs with the use of online learning technologies which use the Internet for access to learning materials, where interaction with peers, instructors and the content can occur and where users can obtain support (Farahat, 2012). There is great demand for e-learning in HEIs (Liaw & Huang, 2013) and since e-learning material and resources are available electronically they can be updated and shared with ease, which too promotes reuse (Dalveren, 2014). e-Learning uses the Internet to conduct and convey learning that makes use of audio, video and interactive activities (Akkoyunlu & Soylu, 2008). Typically used for the presentation of courses, e-learning increases the reach of students and promotes learning and access to content anywhere and at any time. The use of text, images, audio and video in e-learning content has been beneficial to the learning experience (Da Silva, Freire, & De Arruda, 2013) and interactive components and learning environments that make use of more visually stimulating material have seen to attract the attention of learners (Sun & Cheng, 2007) and to increase retention (Dalveren, 2014).

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e-Learning can be used as an umbrella term that incorporates the use of a variety of tools, technologies and approaches. Learning Management Systems (LMS) are seen as e-learning systems that are used for online courses and encourage online collaboration, communication between users, progress tracking and content sharing (Islam, 2013). The term Content Management System (CMS) is sometimes used interchangeably with LMS; however, a CMS is usually used when referring to systems that provide mere information retrieval tasks such as assessing course information and lecture notes. On the other hand, an LMS makes use of a collection of more advanced features to assist and support learning (Islam, 2013), thus presenting content in a variety of formats and providing for different forms of assessment (Kaliski, Booker, & Schumann, 2012). An LMS supports the delivery of learning material that is readily available for e-learning projects (McGill, Klobas, & Renzi, 2014). An LMS has the potential to enhance the quality of higher education and promote a learner-centred approach. The majority of HEIs have adopted an LMS for presenting their programmes.

One of the biggest challenges in e-learning is developing content that is of a high quality and not too expensive and time consuming (Siqueira et al., 2007). However, the excessive use of multimedia can result in distraction and a decrease in learning retention. Ineffective teaching and training are reported to be a result of poor management and poor content delivery (Benjamin & Orodho, 2014). Content availability and adequacy often negatively impact the success, including the effectiveness of instructors and individual students. Kok (2013) identifies that not only is the design of content important, but the design of an entire and comprehensive learning experience is even more important. Effective learning content can be problematic, since there is an assortment of needs from various students which need to be met and achieved with the use of new approaches to learning (Lim, Morris, & Kupritz, 2007). Thus, user satisfaction and improvement to the level of learning needs to be measured.

e-Learning can provide immediate flexible delivery of course material and improved accessibility off-campus (McGill et al., 2014). e-Learning focuses on content delivery where learning resources can easily be created to address educational needs (Monika, 2013). The quality of content that is used and produced to support learning (Siqueira et al., 2007) and the proper management thereof plays a vital role in e-learning efficiency (Nedungadi & Raman, 2012). The development, maintenance and content updates also involve management and these tasks are noticeably expensive and time consuming. The reuse of content can reduce costs. One benefit of e-learning is that it can increase the usefulness and acceptance of the learning experience (Scholtz & Kapeso, 2014). However, design considerations such as video length, quality and interaction optimisation need to be adhered to when designing e-learning multimedia (Dalveren, 2014; Scholtz & Kapeso, 2014). Visualisations have been identified to enrich learning and education (Plass, Homer, & Hayward, 2009). Visualisation can bring great potential for learning and education enhancement; however, extensive mental effort may be needed to be able to process them properly (Plass et al., 2009).

Successful learning is endorsed by assessment-centred learning (Monika, 2013; Nordin, Embi, & Yunus, 2010). An additional component of e-learning is gamification and gamification elements can be used with e-learning to assist with learning and also with information retention (Pasterfield, 2014). Gamification is also said to increase engagement

and motivation as well as add fun and nurture team spirit and competition. Gamification is also said to contribute towards stimulation of students and thus improve the quality of work produced and knowledge acquired (Labrador & Villegas, 2014). e-Learning courses are linear in structure and thus can easily be gamified where exercises can be transformed into competitive stages or dynamic games where rewards can be received (Todor & Pitica, 2013). There are three main gamification elements, namely: points, badges and leader boards (Meder, Plumbaum, & Hopfgartner, 2013). These elements encompass different types of motivation with instant rewards evident in being awarded points and badges (short term goals) and evidence of competition in the form of a leader board (long term goals). Content factors are audio and video plug-ins, multimedia and authoring services and tools and the user interface (Bhuasiri et al., 2012).

With the increase in popularity, usage and accessibility to smartphones, so too increased the need for e-learning environments to be accessed from these devices (Dalveren, 2014). Thus, e-learning is seen to encompass m-learning (Kumar, 2013). M-learning promotes portable learning devices where learning can occur on the move. Not only is m-learning beneficial in terms of mobility, it is also able to improve the broader learning experience (Kumar, 2013; Vinu, Sherimon, & Krishnan, 2011). Another benefit of m-learning is its flexibility since it does not restrict users based on factors such as age, gender, geography, time or space. M-learning content usually encourages flexibility and adaptability specific to the mobile learning environment where learning content can be changed to suit the device being used (Nedungadi & Raman, 2012). Due to the smaller screen sizes of mobile devices, careful consideration needs to be given to screen design (Nordin et al., 2010). The content should also be appropriate for use and delivery in the context of mobile devices (Little, 2013). Collaboration and interaction are provided amongst users with m-learning and learning opportunities for users in different geographical locations are created (Uzunboylu, Cavus, & Ercag, 2009).

The three dimensions of education proposed by Siqueira et al. (2007), namely content, pedagogy and technology (Figure 1) are used to classify the different components that should be included in an e-learning project. Content should include videos, text-based guides, assessments, multimedia, interactive features and online certifications. A mixture of pedagogical approaches such as F2F, blended and e-learning can be used. The technology category consists of e-learning specific systems, m-learning applications, an LMS and learning content development tools.

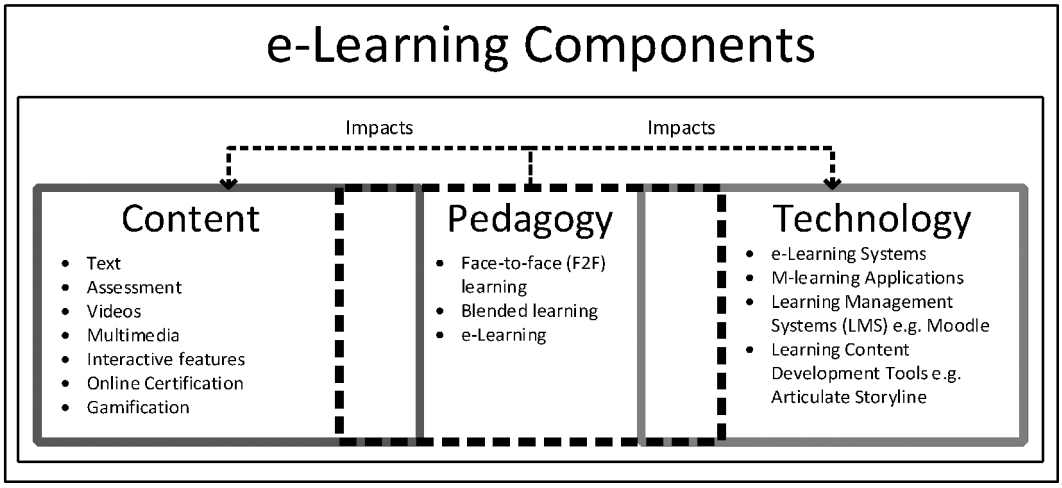

Figure 1. Components of e-Learning for ERP Systems Education (Author's Own Contribution)

Research Methodology

Research question and objectives

The main research question of this study is:

What are the components of successful e-learning in an ERP environment?

The aim of this study is therefore to determine what e-learning components should be used in an ERP environment and how to design these components in order to ensure the success of these components and of the e-learning project. In order to fully answer and address the research question of this study, three supplementary research objectives have been identified:

RO_1: To identify criteria that can be used to design and evaluate e-learning components;
RO_2: To design e-learning components for ERP courses; and
RO_3: To evaluate the success of e-learning components in an ERP course in South Africa.

Acceptance, specifically user acceptance towards new IS, technology and online learning is considered as one of the factors affecting the success of these technologies and systems (Farahat, 2012). However, acceptance does not provide sufficient insight into the effectiveness of interactive e-learning components and more detailed evaluation criteria such as those proposed by Plass et al. (2009) are required. For the purposes of this study the success of components of e-learning will serve as an umbrella term and consider effectiveness, acceptance, usability and user satisfaction.

Design-Based Research and Case Study

This study falls in the field of educational technology, and therefore adopted the Design-Based Research (DBR) methodology, a variant of Design Science Research (DSR) (De Villiers & Harpur, 2013). DBR is the research paradigm of choice when it comes to e-learning. DBR is known for merging the theoretical design of learning environments with that of empirical educational research (The Design-Based Research Collective, 2003). DBR emphasises the importance and necessity of the building of theories and development of design principles that are able to guide, inform and improve research and

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practice in the education context (Anderson & Shattuck, 2012). One guideline for DBR is that it should be iterative and implemented in a real-world context (van Wyk & de Villiers, 2014). The context and case study in this research was the DASIK Introduction to ERP systems course that was presented over five consecutive days.

The ERP course was designed for novice ERP users. In addition to some theoretical content, the course covered the hands-on training of the SYSPRO ERP system. A combination of e-learning and F2F learning was adopted in a blended learning approach. SYSPRO allows free access and availability to learning material and mediums from a variety of educational offerings such as e-learning systems and modules (SYSPRO, 2014). The SYSPRO online e-learning systems and modules have interactive self-assessments. However, one of the drawbacks of the self-assessments is that the marks are never recorded and users can easily see the answers without attempting the assessment. Thus, users often do not receive a true reflection or indication of their understanding and progress. The participants of the course consisted of students, academic staff and delegates from industry. The course served as a cycle of the DBR process in the larger study and is the focus of this paper. The participants gave informed voluntary consent for their information and opinions to be reported. Convenience sampling was used since all participants were delegates of the DASIK ERP course.

ERP e-Learning Environment

The ERP e-Learning Environment (ERPeL) consisted of several components. It was designed based on the literature review and the components of e-learning identified as important for e-learning success. In line with the iterative nature of DBR, the ERPeL was considered to be 40 percent of the final product. Thus, only certain components were included in the design of ERPeL in this study in order to address the learning outcomes of the course. Feedback was obtained from the participants in order to improve the e-learning environment and provide opportunity for improvement in the next iteration of the DBR.

Learning Management System

Moodle (Modular Object-Oriented Dynamic Learning Environment) is a flexible and integrated online LMS that is used for learning and for the generation of customised learning environments (Moodle, 2014). Moodle is used for the design and creation of online hybrid courses and involves the combining of F2F teaching with that of online activities (Islam, 2013). Conveniently Moodle is open source and is thus frequently used to support teaching and learning (Deng & Judith, 2013). Features of Moodle include assessment, grading, submission, forums, file uploads and various other features. Moodle is also known for encouraging interaction and collaboration amongst online course users (Amandu, Muliira, & Fronda, 2013). Moodle was the LMS of choice and forms a vital part of the ERPeL (Table 1).

Learning Outcome	E-LEARNING COMPONENT	
	Multimedia Content	Assessment
An Introduction to ERP Systems Part 1	Video	Quiz 1 (Standard Moodle Quiz)
An Introduction to ERP Systems Part 2	Video	Quiz 2 (SCORM Assessment)
SYSPRO Case Study	Video	

Introducing Inventory and the Require-Procure-Pay process	Interactive (SCORM package) M-Learning Application	Quiz 3 (Standard Moodle Quiz)
Inventory Control	Video	
The Prospect-Transact-Care process	Video	Quiz 4 (Standard Moodle Quiz)
ALL	Gamification (Badges)	

Table 1. Learning Outcomes and Components

Videos

Six videos were developed based on the learning outcomes. The following design principles were applied and taken into consideration when designing the videos (Plass et al., 2009): 1) split-attention principle; 2) cognitive principle; 3) cueing principle; 4) representation type principle; 5) colour coding principle and 6) integration of multiple dynamic visual representations principle. The split-attention principle was applied to the videos as follows: the information was integrated and made use of animations that were carefully considered and labels were placed next to the relevant objects, diagrams and figures. The cognitive principles as described by Rogers, Sharp and Preece (2011), were also taken into consideration when designing the learning content elements and consists of attention, perception, memory and learning. An easy to understand language style was used in the audio and the actors were given names and faces (avatars) to make them easier to relate to. One of the videos was an interactive video where control over the learning was given to the users and they could select headings and labels for more detailed explanations. SCORM (Shareable Content Object Reference Model) is a set of standards, technical and instructional that provide systems such as LMSs with runtime specifications on how courses can be launched and reports generated (Ghirardini, 2011). Metadata standards are also provided that are used for the creating and publishing of courses, lessons and topics and it is these standards that ensure that the content is properly uploaded and accessible. A number of LMSs stipulate that SCORM compliance is a requirement for delivery output.

One of the problems with the ERP resources available, is that they are vendor specific. Therefore the aim of the videos was to impart the theoretical foundation of introductory ERP concepts that are not vendor specific. Once the main learning outcomes and content was determined, scripts were written, slide designs were created and audio recordings were made. Articulate Storyline was used for media, graphic and content arrangements, transitions, animations and to record the audio (voice-overs). Camtasia was then used to record the on-screen activities, for editing and to finally publish the videos.

Gamification

The gamification component consisted of badges and a leader board. However, in this study the leader board had not yet been implemented. Badges were generated and awarded to users based on their completion of specified tasks and activities. The badges were created in Microsoft PowerPoint with the use of shapes and added into the Moodle LMS where specific criteria were used for awarding of badges and allocated. Depending on the level of conformity with the specified criteria determined whether a badge was awarded to a specific user or not.

Assessment

There were two forms of assessment created, namely: standard Moodle quizzes and a SCORM assessment. The three Moodle quizzes were created using Moodle templates and the one SCORM assessment was generated in Articulate Storyline. Google Chrome was adopted as the browser of choice for using SCORM packages, to ensure that they work properly. SCORM packages give immediate feedback after each question, as opposed to a Moodle quiz that generally only gives feedback afterwards (delayed) unless a specific setting is enabled.

M-learning

SYSPRO Latte is a m-learning application which was designed and developed by Kapeso (2014) to assist with the training of SYSPRO users. There are a number of components that are included in SYSPRO Latte, namely: theoretical content, video tutorials, assessments and a hands-on simulation of the SYSPRO Require-Procure-Pay business process. The simulation allows users to perform a SYSPRO task in a replicated, simulated environment exactly as if they were doing it in the actual SYSPRO system. SYSPRO Latte was developed on an Android platform and its main feature is the hands-on simulation that focuses on creating a purchase order by using either the beginner or advanced mode (Kapeso, 2014). The beginner mode provides hints in red blocks that advise and assist the user in completing the task (Figure 2). The steps needed to complete the task are shown in the left pane and a green tick shows that the specific step has been completed. When the task has been successfully completed a message is shown on the screen. Those users that have more advanced ERP knowledge and skills are able to perform the hands-on simulation in the advanced mode which has no hints or steps. From evaluations conducted in a previous study by Kapeso (2014) the interactive, simulation of SYSPRO Latte was considered to be the most liked feature of the whole application. This confirms that interactivity is an important factor of success for m-learning (Scholtz & Kapeso, 2014).

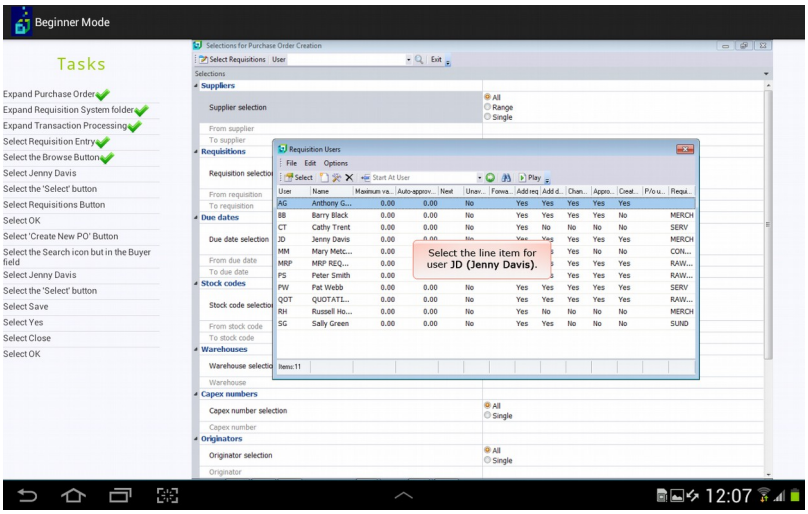

Figure 2. Sample Screen of SYSPRO Latte M-learning Application Hands-On Simulation (Beginner Mode)

Validity of study and data analysis

Data was collected by means of online questionnaires that were distributed over the duration of the course. The questionnaires were based on a subset of the criteria proposed by Ssemugabi and de Villiers (2010) for the evaluation of web-based e-learning

applications (Table 2). The selected criteria were: 1) relevance of site content to the learner and the learning process; 2) level of learner control; and 3) support for personally significant approaches to learning. In both questionnaires, the closed-ended questions were ranked using a 7-point Likert scale where the participants had to rank the given criteria and statements from 1 to 7, where 1 indicated *Strongly disagree* and 7 indicated *Strongly agree*. For the duration of this study the following statistical ranges are applied: negative [1 to 3.6), neutral [3.6 to 4.4] and positive (4.4 to 7]. Both quantitative and qualitative data were collected and analysed, thus indicating the use of a mixed methods approach (Saunders, Lewis, & Thornhill, 2009).

Criteria
Relevance of site content to the learner and the learning process
Level of learner control
Support for personally significant approaches to learning

Table 2. Criteria for evaluating e-learning (Adapted from Ssemugabi & De Villiers, 2010)

Qualitative data was thematically analysed in order to determine common themes within the data (Braun & Clarke, 2006). Cronbach Alpha coefficients were calculated in order to determine internal reliability of the responses from the measuring instruments (Appendix A). Overall the reliability of the ERPeL and the e-learning learning content is good (α = 0.75) since all Cronbach Alpha values were greater than 0.6. The overall reliability of the m-learning factors was excellent (α = 0.91). The criteria "*Relevance of site content to the learner and the learning process"* does not have a coefficient score because one of the items which makes up this criteria had the same response for all cases.

Results and Discussion

A total of 29 people registered online for the DASIK ERP course and participants were from HEIs and industry with varying levels of experience and expertise; however, all had less than 3 years of ERP experience and were thus classified as novice ERP users. Of the 29 registered delegates 24 agreed to take part in the study of which 11 were students, seven were industry ERP users and six were academic staff.

ERPeL evaluation

The ERPeL and the components were evaluated by the 24 participants using the three criteria proposed (Table 2). The results revealed that there were no criteria or sub-criteria rated in the negative range. Overall, the criterion *"Relevance of the ERPeL site content to the learner and the learning process"* was the highest rated of the three criteria for both the overall e-learning environment (μ = 6.46) and for the m-learning app (μ = 6.38) (Table 3). It can therefore be deduced that the ERPeL and the associated components were positively accepted. The highest ranking sub-criterion of the ERPeL evaluation was the fact the material did not contain any biases (μ = 6.7). The second highest sub-criterion was *'Content is engaging, relevant, appropriate and clear to learners using the site".* The lowest ranking criteria was the ability to customise the ERPeL for personal learning strategies (μ = 4.58); however, this was still ranked positively. These results are significant to HEIs in South Africa, since e-learning is still relatively in the early stages of adoption at HEIs in developing countries. Thus, the students find this new initiative of learning to be positive because it different to the usual face-to-fact lectures and means of instruction they are used to.

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Criteria	e-Learning Evaluation (n = 24)		M-learning Evaluation (n = 8)	
	Mean	S.D.	Mean	S.D.
Relevance of site content to the learner and the learning process	**6.46**	**0.64**	**6.38**	**0.58**
Content is engaging, relevant, appropriate and clear to learners using the WBL site.	6.21	0.72	5.75	1.16
The material has no biases such as racial and gender biases, which may be deemed offensive.	6.71	0.55	7.00	0.00
Level of learner control	**5.52**	**1.03**	**5.78**	**0.89**
Apart from controlling the interactions with the site, learners have some freedom to direct their learning, either individually or collaboratively, and to have a sense of ownership of it.	5.83	0.96	5.88	1.13
Learners are given some control of the content they learn, how it is learned, and the sequence of units.	5.83	0.96	6.00	0.93
Individual learners can customise the site to suit their personal learning strategies.	4.58	0.97	5.25	1.49
Where appropriate, learners take the initiative regarding the methods, time, place, content, and sequence of learning.	5.83	1.24	6.00	1.07
Support for personally significant approaches to learning	**5.64**	**0.89**	**6.18**	**0.71**
There are multiple representations and varying views of learning artefacts and tasks.	5.25	1.03	5.75	1.04
The site supports different strategies for learning and indicates clearly which styles it supports.	5.38	1.17	5.75	1.16
The site is used in combination with other mediums of instruction to support learning	5.79	0.78	6.50	0.76
Metacognition (the ability of a learner to plan, monitor and evaluate his/her own cognitive skills) is encouraged.	5.96	0.69	6.50	0.53
Learning activities are scaffolded by learner support and by optional additional information.	5.83	0.76	6.38	0.92

Table 3. Quantitative Evaluation Results

From the evaluation of the **assessments**, the majority (67%) of the participants preferred the *Normal* [standard] *Moodle Quiz (Quiz 1 for Video 1)* and the remaining (33%) participants preferred the *SCORM Assessment (Quiz 2 for Video 2).* Of those that preferred the *Standard Moodle Quiz,* five responses stated that it was due to the fact they are able to see their progress during a quiz and it allows for questions and answers to be revisited before submitting for grading. However, those participants that preferred the *SCORM Assessment* indicated it was because of the immediate feedback after each question and the indication of whether the question was incorrect or correct. Seven of the positive responses regarding the standard Moodle quiz related to the theme of being able to re-visit questions and answers, go back and forth, skip and change. On the other hand, the most frequently reported negative feature (6 responses) was the interface of the standard Moodle quiz and its lack of visual appeal and use of colour. Six participants stated that they found the interface of the SCORM assessment to be more appealing in terms of the use of colours, general layout and its interactivity.

The **videos** were well received by the participants and 100% of participants responded that they would like access to more videos. From the thematic analysis of the qualitative data regarding the videos it was determined that the highest ranking positive feature was quality and clarity of the video audio. Five participants stated that they did not like the

presenters' voices that were heard (the audio). It can be deduced that the participants had varying opinions when it came to the videos, especially since the most positive and negative feature have been identified as the same thing, in this case the audio of the videos. HEI students are growing up in an era where technology is rife and consistently changing, with the watching of videos for educational and entertainment purposes being very common. This trend is not only noted in South Africa, but also on a global front.

In terms of the evaluation of the **badges**, motivation was the most popular positive feature cited. However, two participants felt that only being awarded badges based on completion was a negative feature. The majority (88%) of the participants liked the idea of working towards a badge or reward, whilst three participants disagreed with this statement. Since the adoption of e-learning has been slow in developing countries such as South Africa, the use of gamification to assist with learning is still a relatively new concept. Thus, students have not been exposed to the use of electronic rewards in the form of badges. With the adoption of e-learning starting at junior school, the implementation of badges might improve motivation and completion amongst HEI students in the years to come. Finally, in terms of the evaluation of the **e-learning environment** more than half (58%) of the participants preferred the ERPeL used and the remainder (42%) indicated that they prefer a more traditional, F2F environment. This close-to-even split, could be due to the fact that e-learning is still in the early stages of adoption in South Africa.

M-learning evaluation

The SYSPRO Latte m-learning application was evaluated by 29 participants based on the adapted set of criteria. A tablet computer was provided with the SYSPRO Latte m-learning application pre-installed. Participants were required to read the theoretical content, watch the videos, work through the hands-on simulation and complete the online, evaluation questionnaire. The highest-rated criterion was *"The material has no biases"* (μ = 7.00). The lowest-rated criteria were that individual learners can customise SYSPRO Latte to suit their personal learning strategies and this was still in the positive range (μ = 5.25). All criteria were rated in the positive range. The participants identified the following themes related to the positive features of SYSPRO Latte: ease of use, interactivity, mobility, usability and the self-paced nature of the application which also allows for self-paced learning. Features that were disliked were problems with the font size and no zoom capability.

Conclusions and Recommendations

This study is the second cycle of evaluations which forms parts of a larger research study that will involve the design, development and implementation of a comprehensive ERPeL for ERP education. Tools and technologies were investigated and the main components implemented were the Moodle LMS and the SYSPRO Latte m-learning application. The components were designed taking into account design considerations proposed by Plass et al. (2009) in order to ensure success. A subset of the criteria for e-learning proposed by Ssemugabi and De Villiers (2010) was successfully used in the DASIK e-learning project to evaluate the e-learning components. The feedback obtained can be used to provide a more in-depth knowledge and understanding of what encourages and motivates learners to learn and which e-learning components provide a high level of learner control and support for learner-centred approaches. The results and findings indicate that there are

some recommended improvements that can be taken into consideration when planning for the next phase and cycle in the larger research study. Some of the recommended improvements were the design and development of new badges for the next evaluation cycle; consider using badges for achievement as well as for completion and not just either/or and to provide a zoom capability for SYSPRO Latte. There are various alternative uses for badges (gamification elements). Competition was the only use explored in this study. Additional alternative uses that can be explored include participation, group work, peer help and soft skills. The results of the study indicate that additional research into the success factors and design criteria for interactive media for learning is required. Therefore, it is noted that a variety of components was used ranging from face-to-face to pure e-learning where learners were placed in the centre of the learning process. Evidently a blended learning approach was adopted which promoted learner-centred learning.

When considering the results of this study where evaluations occurred in the context of a developing country, being South Africa, it is apparent that problems were experiences with Internet connectivity which is an evident problem. Since the use of LMS and e-learning hugely relies on Internet access and bandwidth, problems with the Internet can be seen as a hindering factor of the use and adoption of e-learning in developing countries. There are still gaps between those individuals who have access to technology and device. This too affects e-learning and specifically m-learning. Devices such as tablets and smartphones are basic requirements for m-learning. Various restrictions are evident, more so in developing countries, when it comes to e-learning adoption where infrastructure for the use and implementation of e-learning initiatives is poor or even non-existent. Thus, it is vital that proper infrastructure, access to devices and Internet connectivity are provided in order for the components that are proposed in this study to be successful used in ES education. Finally, this paper also highlights the fact that access to technology, devices and infrastructure plays a major role in the successful outcome, implementation and adoption of e-learning.

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Appendix A: Cronbach Alpha Coefficients

< 0.50	Unacceptable
0.50 - 0.59	Poor
0.60 - 0.69	Acceptable
0.70 - 0.79	Good
0.80 +	Excellent

Table A1. Cronbach Alpha Coefficient Guidelines (Venter, 2015)

Criteria	**ERPeL Evaluation (n = 24)**	**M-learning Evaluation (Group n = 8)**
	α	**α**
0.76Relevance of site content to the learner and the learning process	0.64	N/A
Support for personally significant approaches to learning0.69 Level of learner control	0.85	0.84
Overall	0.75	0.91

Table A2. Cronbach's Alpha Coefficients