

## Research Article

### “E-courses Unified Process” For Development of Online Courses

<sup>1</sup>Abdulaziz Omar Alsadhan, <sup>2</sup>Sami Alhomod and <sup>3</sup>Mohd Mudasir Shafi

<sup>1</sup>Department of Software Engineering, Collage of Information and Computer Sciences,

<sup>2</sup>Department of Management Information Systems, Collage of Business Administration,

<sup>3</sup>Deanship of E-Learning, King Saud University, Riyadh, Saudi Arabia

**Abstract:** With the advancement in computers and technology, traditional way of education has changed from being confined to a classroom to an open anytime, anywhere learning. The system of education and learning has been changed with the introduction of E-Learning system. Over the past few years, there has been a tremendous growth in the development of E-Learning system and applications. There is an increased importance associated with the E-Learning courseware for the successful implementation of educational process. In spite of the importance, there are still some E-Learning courseware that fail to meet the teaching and learning objectives and expectations. These failures can be overcome by the introduction of software development methodology in the development of E-Learning courses. Keeping this idea in mind, this study proposes “E-courses unified process” which is a modification of well-known software development model; the unified process. This proposed process is based on five activities or workflows; requirement gathering, Analysis and design, Content development and assessment, production and implementation and test and Evaluation. Each of these activities is carried out with the four phases of the Unified process which are inception, elaboration, construction and transition.

**Keywords:** E-learning, E-learning courseware, online learning, unified process

## INTRODUCTION

The introduction of information technologies has become an essential part of education and training in educational institutions and establishments (Rosenberg, 2001). New technologies are appearing with each passing day that enhance the level of education and training making them more accessible to the learners and educators. This introduction of Information technologies in education is now the most important means of meeting the needs and expectations of student, universities and society as a whole.

Information technologies in education is now the most important means of meeting the needs and expectations of student, universities and society as a whole. According to Fry (2001), universities must embrace new technological advancements which are capable of transforming educational and business in order to survive in a global higher education market. The constant and rapid development of Information and communication technology has led to the introduction of online E-Learning systems in the system of education. E-Learning is now the main focus of introducing and using new and advanced technologies in the field of higher education. E-Learning has been defined in different literatures in different ways (Wagner *et al.*, 2008). In general, E-Learning can be

defined as an educational system that delivers the information using the Information technology resources like internet, intranet, satellite broadcast and multimedia applications (Albarrak, 2007; Urdan and Weggen, 2000). The main aim of E-Learning systems is to improve the whole educational system and to enhance the interaction between students and teachers (Nycz and Cohen, 2007).

There has been rapid development in learning technologies so as to turn them to advantage in learning. A student who is learning in a way that uses Information and Communication Technologies (ICTs) is using E-learning. With the introduction of new technological initiatives the structure of higher educational institutions has changed over the past decade. Scott (2000) supports this opinion that E-Learning is now facilitating a more flexible learning approach. The impact of E-Learning initiatives has direct effects on the future structure of universities on both strategic and tactical levels. The changing role of Educators, the changeable learning environment and the design of E-Learning facilities all contribute to a potentially more flexible organizational structure. The future delivery of education will be based through E-Learning technology providing teachers with superior teaching tools. The online methods enable more effective education and offer significant advantages

**Corresponding Author:** Mohd Mudasir Shafi, Deanship of Distance and E-Learning, King Saud University, Riyadh, Saudi Arabia

This work is licensed under a Creative Commons Attribution 4.0 International License (URL: <http://creativecommons.org/licenses/by/4.0/>).

over traditional teaching methods. This has been possible by technological implementation based environments such as bulletin boards, virtual lectures and E-Libraries. In an E-Learning environment teachers can offer constant educational support, as students are able to communicate with classmates and lecturers, visit web sites and view course material regardless of their time and location (Singh *et al.*, 2005).

E-Learning is easy to use and it increases the opportunities for lifelong learning (Cobsilen *et al.*, 2010). As the enrolment of students into E-Learning courses continues to increase each day, the creation and delivery of high quality E-courses content is becoming equally important. One of the ways to ensure the successful delivery of E-Learning is to maintain standardization among the design and development of E-courses. Employing a consistent framework for the development of E-courses is important when introducing an E-Learning system. This can effectively make students comfortable with different courses and reduce the time taken by each student to understand the course structure which in turn can allow students to spend more time on understand the content material of the course. Development of E-courses according to a certain framework can ease the production of content as well as take advantage of internet as a teaching and learning tool.

**Research objective:** This study aims to develop E-Learning course based on well-established software development model; the unified process. Specifically, the objectives of the study are:

- Introduce the unified process into the development of E-Learning courseware
- Propose a model for developing E-Learning courses based on the unified Process of software development.

## BACKGROUND AND LITERATURE REVIEW

E-Learning systems are often used in distance learning education in different countries enabling students to obtain degrees online. In 2006, about 3.5 million students in United States were taking online courses at different level of their higher education (Nagy, 2005). According to the recently conducted report by Sloan consortium, Over 6.1 million students in United States have taken an online course during fall 2010. Another result of their study was that over 65% of higher educational institutions regarded online learning as a critical part of their longtime strategy (Organero and Kloos, 2007). The future delivery of education is seen through E-Learning systems providing teachers with superior and enhanced teaching tools.

E-Learning is one of the largest subsectors of global education market. There are a wide variety of E-

Learning definitions. So it's difficult to estimate the size of the E-Learning market (Lam *et al.*, 2008). Global Industry Analysts, Inc. (GIA) in 2012 published a report which estimates the global E-Learning market to reach \$168.8 billion by 2018. However there is a little doubt that E-Learning courses are becoming more popular each day with thousands of students joining the new courses each day (Del Corso *et al.*, 2006). A survey of online courses reveals that most of the courses are mostly text based. A less number of courses are specifically designed for internet that combines smaller components to make a complete online course (Fry, 2001).

There are a number of factors that can have an Impact on the successful development of an online E-Learning. Papp (2000) identified intellectual property, suitability of course content, building E-Learning course, suitability of E-Learning course and measuring the success of E-Learning courses as critical success factors for any E-Learning system.

A review of literature related to E-Learning development indicated Interaction as an important factor that can enhance learning experience. The Interactions were classified by Moore (1989) as student-content, student-instructor and student-student. Later Hillman *et al.* (1994), added another type of instruction and named it as student-interface. Newberry and Logofatu (2008) says that quality of interactions is as important as the quality of content of an online e course. According to Johnson (2007), in order to use technology to its best effect, it's important to carefully plan, manage and execute these interactions.

Chou (2003) identified type of media, exchange of information and interaction between members of class as the dimensions for development of an E-course. Dennen *et al.* (2007) also derived similar dimensions for the development of E-course. According to Newberry and Logofatu (2008), "The content of an online course should be organized around goals and should be presented in a clear and simple manner". The simplicity of the course material and ease of adding information has also been defined as an important dimension into the development of online E-courses.

One of the important elements in the development of an online E-course is the availability of the study guides. Any successful E-course must include a study guide that may include objectives of the course, list of resources needed to complete the course and the description of assignments (Carr-Chellman, 2000). A study guide can be used to organize the student interaction and as well as organize the contents of course.

The importance of online tools to develop the E-Learning has also been discussed. Owston (1997) says that online tools are easy to organize contents and add flexibility to an online learning environment. Online tools also enhance the interaction capabilities of an e

course (Newberry, 2005). In order for an E-course to reach its intended outcome, it's important to organize material (Carr-Chellman, 2000). Proper organization of material ensures that the objectives of an online course are achieved. Good organization of contents in an e-course also ensures better level of communication between faculty and students (Phipps and Merisotis, 2000).

Organero and Kloos (2007) identified Motivational factors as the most important factors for the successful implementation of an E-course. They studied Forums and Assessments as the tools for motivation in E-Learning courses.

An extensive review of literature identified that there are a number of models that have been proposed for the development of E-courses. Tian (2005) presented the design and implementation of E-Learning courses with hierarchical subject structures. He proposed the use of Learning Advancement Management System (LAMS), a web based software for the development of online E-courses. Newberry and Logofatu (2008) proposed the use of templates for the development of E-courses. The development of the templates is based on ADDIE model of E-course development. Chin and Williams (2006) study the example of "University as 21 Global", an online institution offering courses to students and proposed a theoretical framework for E-courses design.

## BACKGROUND OF THE PROBLEM

There are many issues and challenges associated with the development of E-learning. The instances of an E-learning system can fail if it doesn't meet the learner's expectations and teaching goals which may seriously dent the purpose of E-learning and will not serve the purpose for its creation. Some of the issues that can seriously impact the success of an online course are.

**Infrastructural and development issues:** From a software engineering point of view, a robust and rigid analysis, design and development process is needed to deal with the complex processes involved in the development of E-Learning system. Thus choosing a correct development process can be very vital towards the development of the system. The standards must be followed while implementing the technological infrastructure for the development of the course (Fry, 2001).

**Teaching issues:** From a teaching point of view, the E-Learning system must be developed to support the overall learning process for which system is intended to be developed for. If the system is not addressing the learning needs of the educators and students, it will not

achieve its objectives and is bound to fail (Cobsilen *et al.*, 2010).

**Planning issues:** The objectives of any E-learning can't be achieved if there isn't any specific plan regarding the development and distribution of the System. The System developed must cater to the needs of its targeted audience.

**Support issues:** Any E-learning initiative can't be successful if there isn't sufficient support provided to the users of the course. From a student's point of view, an orientation program on how to access and use the course must be conducted. As far as faculty is concerned, training and ownership of the courses must be provided to them. There must also be dedicated online support available at all the times. In sufficient support will result in lack of interest from the users and will ultimately result in under achieving of the objectives for which course was created.

**Issues with accessibility:** The E-Learning system to be developed must be easily accessible to all the people intended to use the course. Lack of easy access may also have a serious impact on the success of the system.

**Evaluation:** Any E-Learning system must be checked for its quality. An initial check on whether educators and students are ready to accept the system must be conducted. The system should also be checked for quality at all the times for continuous system development.

**Lack of standards:** A set of standards must also be followed for the while developing an E-Learning system. The course must not also have an inconsistent look and feel and the guidelines to follow the course must be defined.

## INTRODUCTION TO THE UNIFIED PROCESS

The unified process is an accumulative and iterative design model which is based on UML diagrams and is architecture centric (Jacobson *et al.*, 1999). It's a process of assigning tasks and defining responsibilities within the development of the system. The main goal of the unified process is to ensure high quality systems in a specified time and schedule to meet the needs of the users and other stakeholders. The design of unified process is based on use cases which helps to monitor the changes in the system (Rodriguez-Alsina *et al.*, 2010).

The unified process is based on 4 phases or iterations. These phases are Inception phase, elaboration phase, construction phase and transition phase. There are five activities carried out in the unified process namely requirements, analysis, design, implementation and test (Abdessalem, 2013). The incremental approach of the unified process enables the review and modification of each of the five

activities (requirements, analysis, design, implementation and test) during the following four phases:

**Inception phase:** During this phase, a basic understanding of the system, its functionalities and its possible architecture is established. The inception phase is of high importance to the development of new systems while as in case of modification of existing systems, it's a brief process. The main objectives of this phase are:

- Define the basic architecture of the system to be developed
- Define the scope of the project
- Evaluate project plan, cost and risk involved in the development of the project
- Select the tools and access the project development

**Elaboration phase:** The aim of this phase is to provide a stability to the system architecture. The processes undertaken in this phase are use case diagrams and class diagrams. Analysis is the most important activity of this phase. The main goal of this phase is the risk evaluation of the project along with the following goals:

- Creating an incremental plan for the next phase (Incremental Phase)
- Redefining the architecture of the system
- Provide stability to the system architecture
- Select the components of the system
- Establish a supporting environment for the development of the system

**Construction phase:** During this phase the remaining requirements of the system are understood and a beta

version of the system based on the underlying architecture is produced. By the end of this phase a working system is introduced and an initial testing of the system can be done. The main activities of this phase are design, implementation and test. The main objectives of this phase are:

- Complete development of the prototype of the system
- Testing of the product developed
- Assessment of the product against its delivery to intended users

**Transition phase:** In this phase the system is delivered to its intended users and checked for its acceptance with the intended users. A transition phase goes over a number of iterations before the product is finally accepted. The main objectives of this phase are:

- Delivering the product to user for their acceptance
- Testing the product at end user side
- Getting user feedback
- Incorporating the feedback into the product
- Providing training to the users on the product

### THE "E-COURSES UNIFIED PROCESS" FOR DEVELOPMENT OF E-LEARNING COURSES

In this section we propose the E-courses unified process which can act as a common methodology for the development of online E-courses. This process is based on well-known software development methodology, the unified process. This process is also used case driven, architecture centric and incremental. Each activity in this process is repeated several times and use cases are modified at every iteration (Fig. 1).

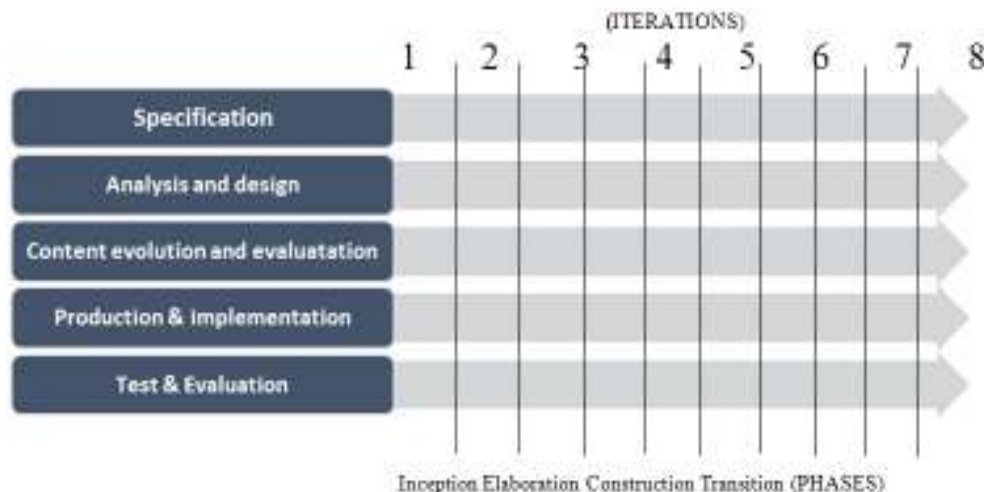


Fig. 1: E-courses unified process

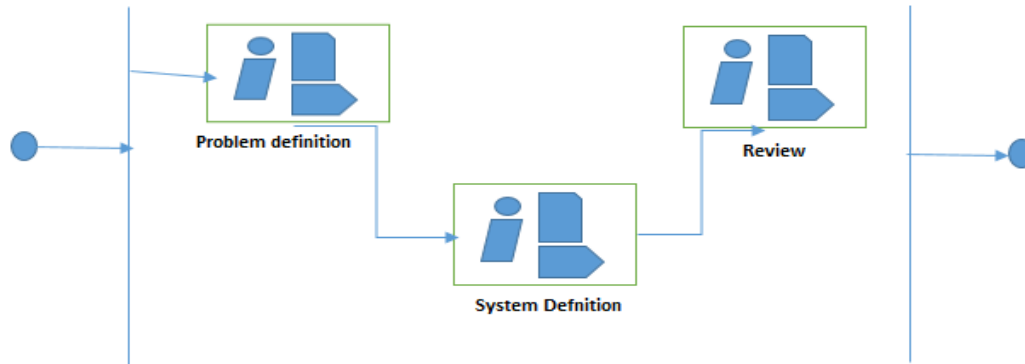


Fig. 2: Specification workflow

In this study we propose modification of the unified process to be used specifically for the development of E-Learning course development. Like any unified process, the proposed “E-courses unified process” has four phases: Inception, Elaboration, construction and transition. In every iteration of a phase five activities happen: requirement gathering, Analysis and design, Content development and assessment, production and implementation and test and Evaluation. Each one of these activities are described below.

**Initial specification:** The aim of this activity is to define the function of the system i.e., defining what the system is intended to do. In this phase the stakeholders of the E-Learning course agree on the description of the course which acts as a blueprint for further development of the course Fig. 2. Illustrates the basic workflow of this activity. The main goals of this activity are:

- Agreement between all stakeholders and developers of the course
- Identifying Actors i.e., users and other systems that may interact and access the system to be developed
- Create use cases describing step by step activities of all stakeholders and the system
- Define the boundaries of the system
- Define the user interface based on the needs of students and educators

There are many ways of categorizing the requirement of a system. One such way of marking the requirements is FRUPS+model proposed by Grady (1992) and Lam *et al.* (2008). FRUPS stands for:

- Functionality
- Usability
- Reliability
- Performance
- Supportability

The+in FRUPS+specifies the other requirements of:

- Design Requirements
- Implementation requirements
- Interface requirements
- Physical requirements

**Analysis and design:** The development of an E-Learning course will hugely depend on the learners intended to use the course. In this phase we will identify the target audience of the course and the content to be developed for the course. The analysis of the content would mean defining the organization and the amount of content to be put in the online course. In this activity we will also identify the environment and the time at which learners will take the course.

All the information gathered under requirements is constantly implemented under the design. In this phase, defining the sequence of achieving the objectives is documented and pictured. This phase also defines the learning objectives which underline the objectives of the course. This activity identifies the media to be used in the course and the delivery strategy of the course content. In case content already exists, then this phase converts the content into online material and tries to improve the quality of the content. The result of this activity is to provide a basic outline on the basis of which course will be developed. At the end of this phase, course structure i.e., chapters, lessons, activities are defined and the delivery method of the course is well understood. Figure 3 outlines the activities happening in this phase.

The aim of this activity is to define high level course goals. The inception phase of this activity determines the feasibility of the system. The elaboration phase defines the initial architecture of the system.

**Content evolution and evaluation:** The basic workflow of this activity is shown in Fig. 4. The major part of this activity is carried out in elaboration phase. In this activity, E-Learning content is actually produced on the basis of the blueprint provided in the analysis and design activity. Depending on the availability of the resources the content may be developed. The developed

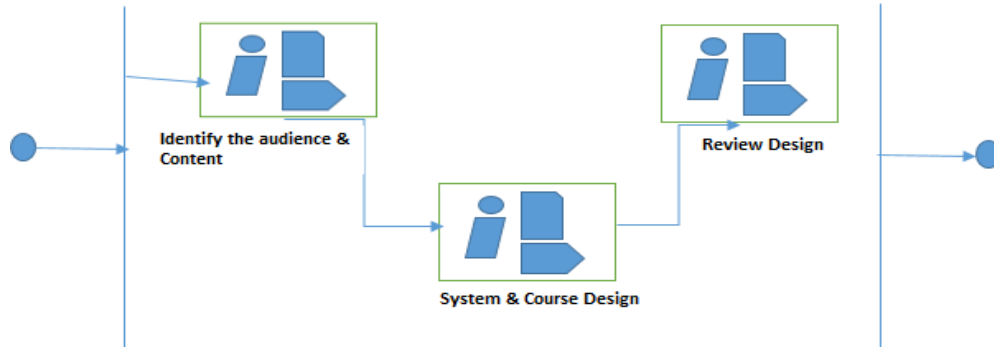


Fig. 3: Analysis and design workflow

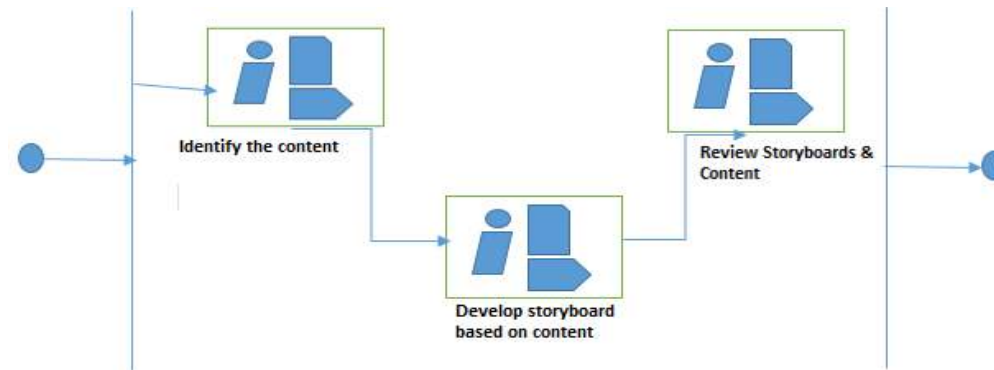


Fig. 4: Content evolution and evaluation

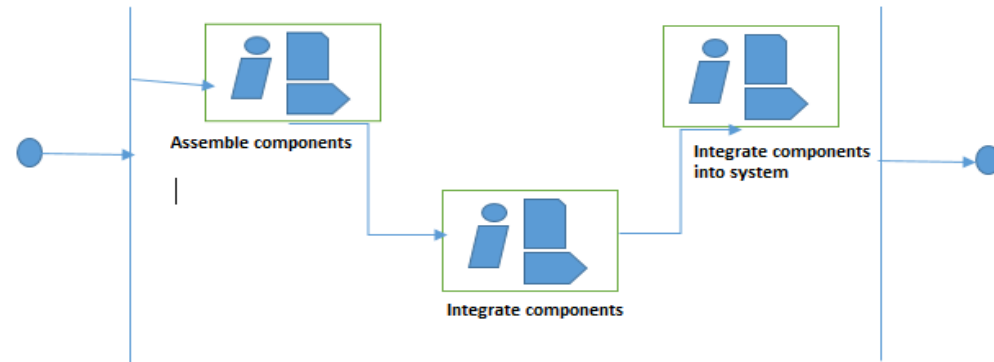


Fig. 5: Production and implementation workflow

content may vary from simpler text documents with no multimedia of interactivity to audio and video files as well as assignments and tests. All the learning objectives defined in the design phase are used to write storyboards which define each and everything that will be shown on screen and everything that will be heard. A separate storyboard is created for each screen. Each storyboard of the screen defines the text, graphics, audio and video to be shown on screen. Storyboards are constantly reviewed by the editor and need the approval of stakeholders and subject matter experts.

**Production and implementation:** The major part of this activity is carried out in construction phase. During

this activity all the agreed storyboards and designs are brought into production and assembled into course. This step involves creation of text, audio, video and media files. Under this activity, already available components can also be reused and implemented in the system, thus making it easier to maintain and possible reuse of the components. With the help of the web developer and some authoring tool, all the media produced is assembled to produce a running and published version of the course. The beta version of the course developed is then delivered to learners by installing it on server and granting access to the learners to the courseware. The workflow of this activity is given in Fig. 5.

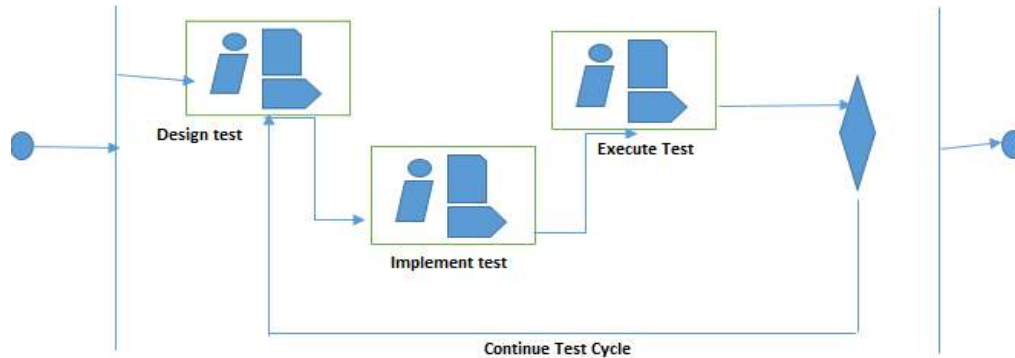


Fig. 6: Test and evaluation workflow

**Test and evaluation:** E-course unified process is an iterative process which means that the system can be tested and evaluated throughout the project. This phase is illustrated in Fig. 6. The main objectives of the testing process is:

- Identifying the defects in the system developed
- Validating the system as per design
- Validating the proper implementation of the requirements
- Ensuring quality if the system developed

Once the courseware is successfully implemented, it must be evaluated for specific purposes. The evaluation of the developed E-course is done to ensure quality of the course. This step involves testing the course once it's online. Under this step the course is evaluated for its acceptability from the user as well as for its functioning. According to Kirkpatrick and Kirkpatrick (2006) evaluation can be done on the basis of learner's reaction, learning, behavior and results.

Learner's reaction can be measured through surveys and questionnaires. Evaluation of learning can be done on the basis of achievement of objectives. Learning can be evaluated through assessments and tests. Behavior can be evaluated on the basis of learner's interest in the course and results can be evaluated on the basis of changes that have occurred in terms of increased quality of the course.

### SUMMARY AND CONCLUSION

The successful development of E-courses is necessary for it to be useful to learners. E-Learning courseware contains a broad aspect of knowledge which can help learners to understand the concepts better throughout their lives and careers. There has been a rapid change in the development of online courses.

E-Learning courses should be developed so that they can cater the need of both teacher and learner. To improve the quality of the E-Learning courseware, there is a need to understand the full lifecycle of the E-Learning course development. Understanding this

lifecycle through an already established software development model enable each stakeholder to understand their role in the development of E-Learning. This requires for a consistent model for the development of E-Learning courses which this study has proposed on the modification of well know software development lifecycle model; the unified process.

The unified process is an architecture centric, accumulative and iterative model based on workflows and UML diagrams. This study proposes a modification of the unified process with the specific aim of understanding and development E-Learning courses. The proposed lifecycle proposed is called "E-courses unified process" and consists of five main activities or workflows. These activities are; requirement gathering, Analysis and design, Content development and assessment, production and implementation and test and Evaluation. Each of these five activities are iterative in nature and are carried out with the unified process phases of iteration, elaboration, construction and transition. The "E-course unified process" can be used in developing E-Learning courses as a software engineering process which can ensure a high quality E-Learning system meeting the needs of all stakeholders (students, educators, administrators etc.) within a specified time and budget with minimum risk of failure of the system.

### REFERENCES

- Abdessalem, W.B., 2013. Unified process for developing e-learning system. Proceeding of 3rd International Conference for e-Learning and Distance Learning, Saudi Arabia.
- Albarrak, A.I., 2007. Designing E-learning systems in medical education: A case study. Proceeding of 6th International Internet Education Conference.
- Carr-Chellman, A., 2000. The ideal online course. Brit. J. Educ. Technol., 31(3): 229-4222
- Chin, S.T.S. and J.B. Williams, 2006. A theoretical framework for effective online course design. MERLOT J. Online Learn. Teach., 2(1).



- Chou, C., 2003. Interactivity and interactive functions in web-based learning systems: A technical framework for designers. *Brit. J. Educ. Technol.*, 34(3): 265-279.
- Cobsilen, K.J., J. Montreal, C.J.P. Tablang and L. Ruiz, 2010. Rational Unified Process (RUP). *SCSIT Res. J.*
- Del Corso, D., L. Forno, G. Morrone and I. Signorile, 2006. Development of didactic design guidelines for the production of e-courses. *Proceedings of the 36th Annual Frontiers in Education Conference*, pp: 12-17.
- Dennen, V.P., A.A. Darabi and L.J. Smith, 2007. Instructor-learner interaction in online courses: The relative perceived importance of particular Instructor actions on performance and satisfaction. *Distance Educ.*, 28(1): 65-79.
- Fry, K., 2001. ELearning markets and providers: Some issues and prospects. *Training Educ.*, 43(4): 233-239.
- Grady, R.B., 1992. *Practical Software Metrics for Project Management and Process Improvement*. Prentice Hall, Englewood Cliffs, NJ.
- Hillman, D.C.A., D.J. Willis and C.N. Gunawardena, 1994. Learner-interface interaction in distance education: An extension of contemporary models and strategies for practitioners. *Am. J. Distance Educ.*, 8-2: 30-42.
- Jacobson, I., G. Booch and J. Rumbaugh, 1999. *The Unified Software Development Process*. Addison-Wesley, Reading, Mass.
- Johnson, E., 2007. Promoting learner-learner interactions through ecological assessments of the online environment. *J. Online Learn. Teach.*, 3(2).
- Kirkpatrick, D.L. and J.D. Kirkpatrick, 2006. *Evaluating Training Programs: The Four Levels*. Berrett-Koehler Publishers, San Francisco.
- Lam, J., K.S. Cheung, J. Ng, J. Yau, W. Seto and T. Im, 2008. Student's needs of e-courses as complement to traditional learning: A Japanese studies e-course case. *Proceeding of IEEE International Symposium on IT in Medicine and Education (ITME, 2008)*, pp: 876-880.
- Moore, M.G., 1989. Three types of interaction. *Am. J. Distance Educ.*, 3(2): 1-7.
- Nagy, A., 2005. The Impact of E-Learning. In: Bruck, P.A., A. Buchholz, Z. Karssen and A. Zerfass (Eds.), *E-Content: Technologies and Perspectives for the European Market*. Springer-Verlag, Berlin, pp: 79-96.
- Newberry, B., 2005. The use of bulletin boards for discussions in online learning. *Int. J. Instruct. Technol. Dist. Learn.*, 2(11).
- Newberry, B. and C. Logofatu, 2008. An online degree program course template development process. *MERLOT J. Online Learn. Teach.*, 4(4).
- Nycz, M. and E. Cohen, 2007. The Basics for Understanding e-Learning. In: Buzzetto-More, N. (Ed.), *Principles of Effective Online Teaching*. Informing Science Press, Santa Rosa, CA, pp: 1-17.
- Organero, M.M. and C.D. Kloos, 2007. Using forums and assessments as motivational tools in e-learning courses: A case study. *Proceeding of the 37th Annual Frontiers in Education Conference*. Milwaukee, WI.
- Owston, R., 1997. The World Wide Web: A technology to enhance teaching and learning? *Educ. Res.*, 26(2): 27-33.
- Papp, R., 2000. Critical success factors for distance learning. *Proceeding of Americas Conference on Information Systems*. Long Beach, California, USA.
- Phipps, R. and J. Merisotis, 2000. *Quality on the Line: Benchmarks for Success in Internet-based Distance Education*. Institute for Higher Education Policy, Washington, DC. Retrieved from: [www.ihep.com/quality.pdf](http://www.ihep.com/quality.pdf).
- Rodriguez-Alsina, A., E. Cespedes-Borras, R. Puig-Fargas, M. Moreno-Berengue and J. Carrabina, 2010. Unified content design for ubiquitous learning: The soldering seminar use case. *Proceeding of 4th IEEE International Conference on E-Learning in Industrial Electronics (ICELIE, 2010)*, pp: 79-83.
- Rosenberg, M., 2001. *E-Learning: Estrategias Para Transmitir Conocimiento En La Era Digital*. McGraw Hill, Bogotá, Colombia.
- Scott, T., 2000. The wired campus. *Business Weekly*, pp: 102.
- Singh, G., J. O'Donoghue and H. Worton, 2005. A study into the effects of e learning on higher education. *J. Univ., Teach. Learn. Practice*, pp: 14-24. Retrieved from: [jutlp.uow.edu.au/2005\\_v02\\_i01/pdf/odonoghue\\_003.pdf](http://jutlp.uow.edu.au/2005_v02_i01/pdf/odonoghue_003.pdf).
- Tian, D., 2005. Progress-based e-learning courses with hierarchical subject structures. *Proceedings of the 5th IEEE International Conference on Advanced Learning Technologies*, pp: 674-676.
- Urduan, T.A. and C.C. Weggen, 2000. *Corporate e-learning: Exploring a new frontier*. WRHAMB RECHT+CO.
- Wagner, N., K. Hassanein and M. Head, 2008. Who is responsible for e-learning success in higher education? A stakeholders' analysis. *Educ. Technol. Soc.*, 11(3): 26-36.