

# **Educational Software Development – Users Requirement Analysis**

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## **ABSTRACT**

Though various studies were conducted in software development methodologies, still there are some inconsistency between the educational requirements and software dynamics. Software Development Life Cycle (SDLC) provides various phases to develop software based on user requirements. The basic idea of this research is to identify the gaps between the educational requirements and software potentials. This research identifies the common requirements of educational software for its maximum usage in the educational processes with its complete capabilities. A viewpoint hierarchy for entities of educational software has been defined in this paper. Also, system models using SDLC analysis phase in educators and learners perspectives have been defined and constructed.

## **Keywords**

Educational Software; Educational Processes; Software Development Life Cycle (SDLC); Educational Software System Model

## **1. INTRODUCTION**

### **1.1. General Introduction**

#### *1.1.1. Educational Software*

The technological developments have changed the educational processes from traditional methods to contemporary methods. Various researches and studies were conducted for the development of these educational processes with the help of educational technology. Advanced educational software, hypermedia, mobile technology and e-learning tools have smoothed the teaching and learning processes. Different adaptive methods are developed and applied in the teaching and learning methods. Costa et al (2009) [10], Kanuka et al (1999) [16], Riley (2007) [19], Prensky (2003) [21] had conducted researches on educational software requirements and development techniques in various perspectives. Educational technology has a profound effect on creating a student-centered learning environment. There are numerous areas in which educational technology has been used to improve and meet the unique needs for students (Flemmer) [12].

Though educational software used widespread, it is not being used with its full features and potentials. This is due to the gaps between the educational requirements and software dynamics. Software Development Life Cycle (SDLC) states various

methods of software development with different phases. The analysis phase of software development life cycle (SDLC) has to concentrate more on studying these gaps and provide necessary facilities. The SDLC analysis phase should identify a proper remedy and eliminate these gaps.

#### *1.1.2. Software Development Life Cycle (SDLC)*

Various methods are followed in SDLC for software development and design with different phases. Braude, J. E., (2010) [8], Conger, Sue., (2008) [9], Sommerville, Ian., (2009) [23], Hoffer et al (2009) [13] had discussed the software development life cycle in detail. But the major phase identified common to all these methods are: Planning, Analyzing, Designing, Testing and Implementing and Maintenance. In analysis phase, the user requirements, system requirements, domain requirements, cost requirements and various other requirements of developing and designing software are studied and analyzed. As the educational software requirements differ with respect to different levels and types of education, the analyses have to be conducted in various perspectives. But in all levels and types of education there are some common requirements that the educational software should possess.

This paper identifies the common requirements of educational software in educators and learners perspectives. An educational software viewpoint hierarchy has been defined in this paper that will help the developers and analysts in educational software development processes. Also, a system model using SDLC analysis phase in educators and learners perspectives has been defined and constructed.

## **1.2. Statement of Problem**

Though the educational software development methodologies follow SDLC the analysis phase need to concentrate more on user requirements in educators and learners perspectives. Currently available educational software features do not match to educators and learners requirements in every aspect. Minimum common requirements of all educational users need to be analyzed and satisfied. The SDLC analysis phase needs to address the discrepancies between educational needs and software dynamics to optimize the educational software usage in educational activities.

### 1.3. Research Questions

- 1) In what outlooks educational software requirements need to be analyzed in SDLC analysis phase to meet the educational software requirements?
- 2) What are the common requirements of educational software for different levels and types of education?
- 3) What systems model shall satisfy the educational software requirements in different perspectives?
- 4) What major requirements of educators and learners have to be considered while developing educational hypermedia?

## 2. LITERATURE REVIEW

Honey (2001)[1] expressed that to be effective educational software must accomplish three things. It must: Build upon what we know from research about the key areas of knowledge acquisition, Address real challenges that teachers are facing, and make the task at hand easier to accomplish, be applicable across multiple contexts and multiple curricula by addressing core learning challenges, not curriculum specific skills and tasks.

King (2002) [2] said that it will be difficult for the teachers to keep up the new technology at such a rapid rate today with it on their own. This made the professional development of teachers more urgent. Focusing on educators engaged in educational technology as adult learners leads to teacher education and faculty development initiatives that can build on best practice from the field of adult education.

Khalifa et al (2000) [3] had discussed about the educational computer software criteria. According to them, the main factor to providing a better learning experience lies in choosing software that successfully combines education and entertainment. The only way to know how learners will use a particular course of a piece of software and what problems they experience is to study them using it.

Gurell (2008) [4] has conducted a case study in the development of OER handbook on the website WikiEducator. He concluded that the future success of open text development will be based on its ability to derive the best tools and practices of “Web 2.0” technologies. Open source software development has intriguing parallels that offer a perspective on how collaborative projects can be successfully managed and coordinated. Although it is important to note that creativity should still be considered a part of the By improving on these processes, and contextualizing them for open education, an important part of achieving critical mass will be reached.

O’Sullivan and Samarawickrema (2008) [5] said that a technology of education entails thinking about all dimensions of the design of teaching and learning environments. The teaching and learning process constitutes a complex interrelated system of people and resources interacting with people as students to achieve their desired learning outcomes.

Solomonidou (2009) [6] introduces constructivist views of learning as a theoretical background to inform the design, implementation and evaluation of quality interactive multimedia educational software. He reviews various constructivist views of learning and also constructivist technology-mediated learning.

He proposes an approach to design and evaluation of constructivist educational software.

Alkhafaji and Sriram (2010) [7] suggested that the hypermedia technologies must provide maximum amount of resources and supporting materials to effectively improve teaching / learning processes. It should be interactive and attractive. As hypermedia facilitates the complex learning processes involving a large range of activities, they should be used in the classrooms to provide adequate understanding of the subjects to the students. Irrespective of the students’ level, all the students should get benefits out of the hypermedia technology.

Williamson and et al (2003) [24] states that developing educational software requires a complex environment and range of specialized skills. The ideas that lie behind the successful software are drawn from a broad pool of talent and, as mobility increases, ideas are disseminated through informal and new work practices into wider community.

## 3. RESEARCH METHODOLOGY

To conduct this study, some primary data were collected from the educators and learners to identify the end user requirements. More secondary data were analyzed to define the common user requirements of educational software. Various researches conducted by different authors related to educational software development were studied thoroughly and the user requirements were recognized. Software development Life Cycle (SDLC) phases were studied and analyzed with respect to various perspectives.

### 3.1. Primary Data Collection

Students studying in different levels of education viz diploma and bachelor were interviewed to identify the learners requirements. Out of 80 students, 20 (25%) were conducted face – to – face interview. Other students were asked to address their requirements through email and other modes. As the students of diploma and bachelor levels face problems in using educational software, the students of diploma and bachelor levels were considered for the research. Table 1 shows the number of students interviewed, their levels of study and gender.

**Table 1: Gender – wise and Level – Wise Analysis**

	Male	Female	Total
<b>Diploma</b>	10	33	43
<b>Bachelor</b>	9	28	37
<b>Total</b>	19	61	80

All diploma level students were at their final semester of course completion. They were studying 3<sup>rd</sup> year of their studies. All bachelor level students were at their final semester with 5<sup>th</sup> year studies in the college. Out of 43 diploma level students, 11.7% were studying Business Administration Courses, 62.8% were studying Information Systems as major, and 25.5% were studying Information Technology as major. Nearly 61% of the bachelor level students were studying Information Technology major and the remaining were Information Systems.

Nearly 90% of the students preferred blackboard traditional teaching method for quantitative courses. 73.7% of the students preferred a combination of traditional and contemporary teaching method for theoretical subjects. Only 26.3% of the

students knew about different educational software. All the bachelor students were studied different software development life cycle (SDLC) processes in Software Engineering course. All the diploma level students were studied the SDLC in System Analysis and Designs course.

The students were asked to identify their requirements for the educational software as learner’s perspectives. The students were asked to provide their requirements in any educational

software with respect to following: the contents, assessment methods, materials required, resources required and any other related requirements. The data collected were tabulated for analysis purpose. Table 2 shows the learners requirements in any educational software.

**Table 2: Requirement Analysis – Learners Perspectives**

Content	Assessments	Materials	Resources	Other
Easy to understand	Multiple Choice	Chapters Printouts	Assignments, case study links	Different diagrams for related topics
Easy links to open	Case Study	Q & A	Article links	Easy access to ILO’s
Reference book contents	Assignments	Previous Question Papers	Book author resources	Understandable Language
	Tests	Reference books chapters	Chapter related links	Translation tools to mother tongue
	Quizzes		Research paper links	
	Exams		Library resources	
			Reference books links	

To know the educators requirements, the instructors with different qualifications, teaching various levels of students were interviewed. Table 3 shows the number of educators interviewed and their qualification.

**Table 3: Educator’s Qualification Analysis**

	Bachelor’s	Master’s	Ph.D’s	Total
Language	1	3	0	4
IT	0	2	1	3
Business	0	1	2	3
Total	1	6	3	10

The language teachers were teaching English at foundation and diploma level. All of them were using some educational software in their language teaching. IT educators were teaching diploma and bachelor level programs. They were having very good background of using and developing educational software.

The business educators were also handling diploma and bachelor level courses.

The teachers were interviewed to identify their requirements for the educational software on educator’s perspectives. They were also asked to categorise their views about the contents provided in the currently available educational software, assessment methods required, kinds of materials they require, the resources required and any other related requirements with respect to teaching. The data collected were tabulated for analysis purpose. Table 4 shows the educators requirements in any educational software.

90% educators said that uploading the available materials to the educational software is a drawback in using them. The language teachers preferred traditional way of teaching at foundation level, as the students’ background in using such software would be nearly zero. Apart from that, they suggested that the language background and understanding capacity plays a vital role in using such educational software. The English language teachers preferred to use educational software only for listening parts of studies.

**Table 4: Educational Software requirements – Educators Perspectives**

Content	Assessments	Materials	Resources	Other
Links to different resources	Multiple Choice	Chapters links	Assignments, case study links	Different diagrams for related topics
Links to Reference book contents	Case Study	Different document types (ppt, doc, pdf)	Article links	Links to ILO’s and corresponding sample contents
Related contents in internet resources	Assignments	Reference books chapters and resources	Book author resources	Meanings
	Tests	Previous Question Papers	Chapter related links	Easy upload tools
	Quizzes		Research paper links	
	Exams		Library resources	
			Reference books links	

The IT and Business educators preferred a combination of traditional blackboard teaching and modern teaching methods. They suggested that the educational software should provide easy links to already existing different types of documents like PowerPoint, MS Word, PDF and other formats directly. As all the educators have some administrative duties also, data transfer to the educational software has become additional burden. They suggest that the educational software must provide feasible tools for data transfer.

### 3.2. Secondary Data Analysis

Various researches conducted on educational software development were studied for identifying the common requirements. Some available educational software's were analyzed on educators and learners perspectives. Some free educational software's are checked for their features. Language teaching software was analyzed with respect to educational requirements.

Paula Filho (2001) [20] designed and implemented the Praxis educational software development process. He proposed the following Architecture, Team Orientation, Project Cycle Time, Standards and Practices, Student Support and Instructor Support as the set of requirements of educational processes for software development.

Newby et al (2011) [18] defined an integrated set of teaching and learning tools for educational technology that would enable educators to create a variety of meaningful learning experiences for their students. The SDLC discussed by Dix et al (2008) [11], Jalote (2010) [14], Jawadekar (2010) [15], Marsic (2005) [17] were analyzed and used to develop the system model. Design of educational multimedia rarely starts from scratch, but rather by attempting to reuse existing software. Although redesign has been an issue in research on evaluation and on learning objects, how it should be carried out in a principled way has remained relatively unexplored (Puustinen et al) (2006) [22].

## 4. EDUCATIONAL SOFTWARE REQUIREMENTS AND SYSTEM MODEL

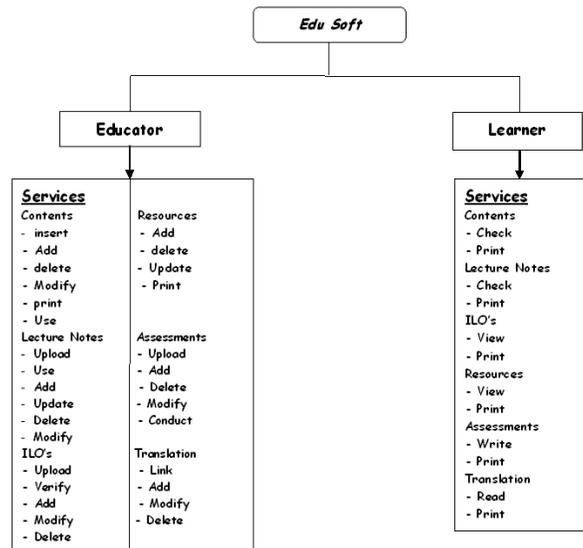
### 4.1. User Requirements

The major educational software users are the educators and the learners. The requirement analysis needs to be conducted separately for each type of the user. The analysis should also include the cost requirements of installing such educational software. Feasibility study, environmental analysis and domain analysis should be conducted in order to identify the exact requirements of the educational system being followed. The educational requirements vary according to the mode of study. All these factors have to be considered while developing educational software.

The research analysis shows that the educators and learners requirements differ with respect to the usage and viewpoint. A study was conducted to identify the common requirements of educational software. Figure 1 shows the viewpoint hierarchy of the educational software requirements in both educators and learners perspectives.

It was observed that the educational software should provide the following services to meet the educator's and learner's

perceptions. The major services identified are: Contents, Lecture Notes, ILO's, Resources, Assessments and Translation.



**Fig 1: Viewpoint Hierarchy of Educational Software requirements**

#### 4.1.1. Services Required – Educator's Perspectives

According to teacher's perspectives, the educational software should provide services to upload contents. Also, it should provide facilities to add new topics, modify the uploaded contents, delete some portions and insert new topics. Apart from that it should provide facilities to print the contents and one click access to the content.

The educational software must provide facilities to upload the lecture notes which are in different file format. As indented learning outcomes (ILOs) need to be explained during the corresponding lectures, the educational software should provide proper tools to access ILOs. The facilities to update, delete and add the resources have to be provided in the software. Different assessment methods should be provided to measure subject, knowledge, understanding and transferable skills. A major requirement that has to be considered is translation of difficult words to easily understandable language.

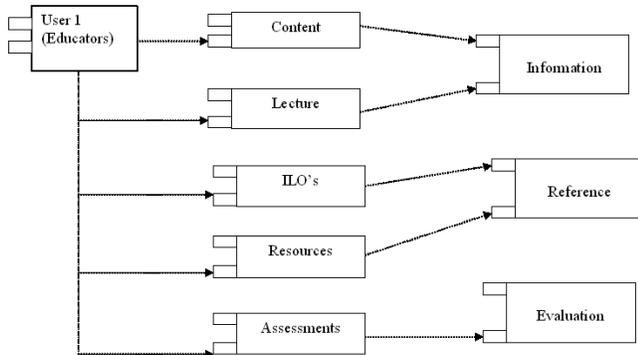
#### 4.1.2. Services Required – Learner's Perspectives

According to the learners, the educational software must provide facilities and services to view and print the contents, lecture notes, ILOs and Assessments as and when required. A translation tool for difficult words to their mother tongue to understand must be provided in order to achieve the required subject goals.

It was identified that the educator's requirements are more than the learner's requirements based on the usage. As educators need to use the software with different context and content the educational software must provide necessary tools for uncomplicated handling of the software in all environments. The services listed in the viewpoint hierarchy, the educators services are basic requirements of any educational software. The educators should have enough authoring and permission to make

necessary changes and updates based on the course requirements.

## 4.2. Software Design – Educator’s Perspectives



**Fig 2: System Design – Educator’s Perspectives**

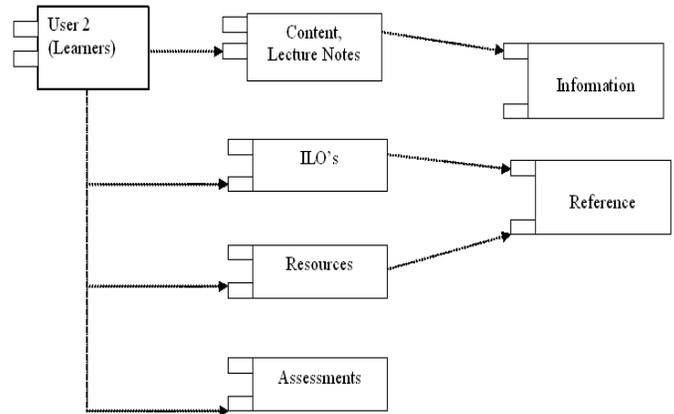
The educators are defined as user 1 for the research purposes. It was observed that the educators’ perceptions on educational software are not exactly matching to the currently available software in some or the other ways. The educator’s major requirements are content management and lecture requirements. As the needs of educational systems differ in different environment, the educators have made to change their teaching strategies that suit to the processes. The educational software should help the educators to balance their teaching methods and provide necessary tools and techniques for easy adaptation. Figure 2 gives the general requirements of the educational software system, its components and their relationships in educator’s perspectives.

## 4.3. Software Design – Learner’s Perspectives

The students are considered as second level users of the educational software in research perspectives. On learners’ point of view, the educational software should assist them to get the subject knowledge easily. The educational software should motivate the learners towards studies. The learners should have the facilities to refer to the contents with respect to various courses. Figure 3 shows the general requirements of the educational software system, its components and their relationships in learner’s perspectives.

## 5. CONCLUSION

The usage of educational software in teaching and learning processes depends in balancing the software potentials with educational requirements. The user requirements of educational software depend on the mode of study. As the educational processes change with respect to type and levels of the educational system, the research identifies some common requirements of general educational software. Educators and learners requirements of the educational software should be harmonized with the available technology in order to increase the usage in educational processes.



**Fig 3: System Design – Learners Perspectives**

Thus, the analysis phase of SDLC should analyze the software requirements in long term objectives. The system model identified during the research exhibits that the educators and learners requirements of educational software do not vary in conceptual ways, but only in usage. This research identified that the content management, lecture notes and teaching tools, intended learning outcomes (ILO’s), various resource for the course content, reference books links, resource facilities and different assessment techniques are the common requirements in any level and type of educational system. All these prime factors should be considered while analyzing the educational software requirements to facilitate the necessary tools and techniques in the software.

## 6. LIMITATIONS AND FUTURE SCOPE

The common requirements identified may vary in different contextual and conceptual usage of the educational software and educational environments. An extensive study may be conducted with respect to different educational systems and environments. This research may further studied intensively with quantitative analysis and prototype may be defined for the educational software. The study may also be conducted with other various perspectives and environments to identify the common requirements of educational software system in educational processes.

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## 8. REFERENCES

- [1]. Honey, M., (2001) – “Testimony and Statement for the Record” – presented before Labor, HHS, and Education Appropriations Subcommittee, United States Senate – 2001
- [2]. King., P.K., (2002) – “Educational technology professional development as transformative learning opportunities” - Computers & Education 39 (2002) 283–297 - Elsevier Science Ltd.

- [3]. Khalifa, Said., Bloor, Chris., Middelton, Walter., Jones, Chris., (2000) – “Educational computer software, technical, criteria, and Quality”
- [4]. Gurell, Seth. (2008) – “*Applying Software Development Paradigms to Open Educational Software*” – eLearning Papers - N° 10 • September 2008 • ISSN 1887-1542
- [5]. O’Sullivan, Mary Low., and Samarawickrema, Gayani., (2008) - “Changing learning and teaching relationships in the educational technology landscape” - Proceedings ascilite Melbourne 2008:
- [6]. Solomonidou, Christina., (2009) – “Constructivist design and evaluation of interactive educational software: a research-based approach and examples” - The Journal for Open and Distance Education and Educational Technology - Volume 5, Number 1, 2009 - ISSN: 1791-9312
- [7]. Alkhafaji, Salah., Sriram. B (2010) – “Educational Hypermedia Development Methodologies” – Presented in First Joint Scientific Symposium Committee, CAS, Sultanate of Oman on 13<sup>th</sup> April 2010 in Sohar University, Sultanate of Oman – Conference Proceedings PP: 8 – 24
- [8]. Braude, J. E., (2010) – Software Engineering – An Object Oriented Perspective – Wiley
- [9]. Conger, Sue., (2008) – The New Software Engineering – Global Text
- [10]. Costa, A.P., Loureiro, M.J., Reis, L.P., (2009) - “Development Methodologies for Educational Software: The Practical Case of Courseware SER<sub>E</sub>” - International Conference on Education and New Learning Technologies (EDULEARN09)
- [11]. Dix, Alan., Finlay, Janet., Abowed, D.G., Beale, Russell., (2008) – Human Computer Interaction – 3e – Pearson Education
- [12]. Flemmer, Chip., - Technology's Influence on SCLEs – Visited and Retrieved on 16.03.2011 from <https://sites.google.com/a/boisestate.edu/edtech504/flemmer>
- [13]. Hoffer, J. A., George, J. F., Valacich, J.S., (2009) – Modern Systems Analysis and Design – 5e – Pearson Education
- [14]. Jalote, Pankaj (2010) – Software Engineering A Precise Approach – Wiley India Private Ltd
- [15]. Jawadekar, W.S., (2010) – Software Engineering – McGraw Hill – ISBN: 0-07-058371-4
- [16]. Kanuka , Heather., Anderson, Terry., (1999) - Using Constructivism in Technology-Mediated Learning: Constructing Order out of the Chaos in the Literature - Radical Pedagogy - ISSN: 1524-6345 Visited and retrieved from [http://radicalpedagogy.icaap.org/content/issue1\\_2/02kanuka1\\_2.html](http://radicalpedagogy.icaap.org/content/issue1_2/02kanuka1_2.html) on 16.03.2011
- [17]. Marsic, Ivan., (2005) – Software Engineering – Rutgers University
- [18]. Newby, T.J., Stepich, D.A., Russell, J.D., Lehman, J.D., Leftwich, A.O., (2011) – “Instructor’s Manual for Test Bank for Educational Technology for Teaching and Learning” – 4e – Pearson Education – ISBN: 13: 978 – 0 – 13 – 70561 – 8
- [19]. Riley, D. (2007). “Educational Technology and Practice: Types and Timescales of Change” Educational Technology & Society, 10 (1), 85-93.
- [20]. Paula Filho, W.P., (2001) – “Requirements for an Educational Software Development Process” – ITICSE 2001 – 6/01 – ACM ISBN: 1 – 58113 – 330 - 8
- [21]. Prensky, Marc., (2003) –“Proposal for Educational Software Development Sites - An open source tool to create the learning software we need”
- [22]. Puustinen, M., Baker, M., Lund, K., (2006) – “*GESTALT: a framework for redesign of educational software*” – Journal of Computer Assisted Learning - 22 pp34 – 46 – Blackwell Publishing Ltd
- [23]. Sommerville, Ian., (2009) – Software Engineering – 8e – Pearson Education
- [24]. Williamson, A., Kennedy, D. M., McNaught, C. and DeSouza, R. (2003). Issues of intellectual capital and intellectual property in educational software development teams. Australian Journal of Educational Technology, 19(3), 339-355.  
<http://www.ascilite.org.au/ajet/ajet19/williamson.html>

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