Critical Success Factors for Enhancing the Effectiveness of E-learning Framework

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Abstract— **The ever increasing internet usage around the world offers enormous potential for harnessing ICT in many disciplines. The technological advancements are making transformations in teaching and learning process in higher educational institutions with introduction of e-learning in a massive scale. The learners today have opportunities and flexibility of learning at anytime, anywhere , and at any pace. However, e-learning is not a panacea and there are issues and challenges as the responsibility of learning shifted from instructor to the learner. There exists gap in research to prove e-learning can be more effective than face-to-face learning that exists in conventional educational settings. Also, there are limited studies to prove the self directed abilities of learners in an e-learning set up. This research study focuses in identifying and understanding the critical factors that can enhance the effectiveness of e-learning framework. The significant factors identified are Faculty Empowerment, Faculty Student Interaction, Automatic collection of user behavior patterns to facilitate continuous improvement and Self Regulation in learning. Learning Theories are helpful in instructional design that promotes self directed learning. There are also other factors like information overload and cognitive load which has to be addressed in online instruction design. This study highlights how these factors can be effectively used to enhance the effectiveness of learning process and to promote self directed learning. Opinion mining and Sentiment analysis of student feedback are used to know the voice of the students. A prototype of e-learning framework was built and experiments conducted and interesting patterns were observed from the experimental results. Some of the tools used in this study are Google Sites, Google Docs and Google Analytics which are light weight and available free.**

Keywords*— *E-learning, Self Regulated Learning, Web Analytics, Sentiment Analysis

I. INTRODUCTION

Technological advancements have triggered innovation and introduction of new technologies in every sphere of human activities. The ever growing internet usage has resulted in usage of Information and communication Technologies (ICT) in Business, Education and many other fields. ICT have enabled digitization of enormous volume of data which are stored in distributed locations in a network which can be accessed by any user. E-learning is defined as pedagogy empowered by digital technology. E-learning offers flexibility to learners for accessing the educational content anytime, anywhere, and at any pace. The learner can browse through the content online any number of times and improve retention and learn fast. In contrast , in face-to-face learning this kind of flexibility is not there. However, there are limitations in e-learning settings due to many problems and challenges the learner has to face. Some of the problems and issues faced in e-learning are summarized below:

A. Problems faced

1) Lack of face-to-face interaction
2) The responsibility of learning has been shifted to the learner.
3) The instructor's role is only the facilitator of learning
4) Disengagement from learning due to cognitive overload and Information overload problems.

B. Research Questions

Q. 1 Can the Faculty Empowerment make a faculty, a facilitator of learning?
Q. 2 Can Self Regulated Learning result in improvement in learning outcome of the learner?
Q. 3 Can Continuous Improvement in the e-learning framework be achieved by providing a framework for faculty student interaction?
Q. 4 Can learner's need be understood by automatic collection of Web usage data?

This study offers solutions to the problems in e-learning by identifying the critical success factors for enhancing the effectiveness of e-learning framework and ascertaining their significance through experimental evidence and empirical data generated in the experimental process in an experimental website.

II RELATED WORK

A. Problems faced in e-learning

Many researchers have noted and discussed the problems and issues faced in e-learning due to factors such as Information Overload, putting the responsibility of learning on the learner and cognitive overload caused by complexity of the content or navigational path selected etc. This may result in disengagement from learning in e-learning settings.

Garry Woodill (2004,2007) discusses causes of failure of e-learning systems such as lack of identification of real problem or need for e-learning and lack of detailed instructional design, focusing on new technology, and not on instructional design, and lack of understanding of learning and teaching process [2].

Zemsky and Massy(2004) are pointing out hurdles that online education will need to overcome due the assumptions such as :

1. If we build it they will come - this is simply not true.
2. The kids will take to e-learning like ducks to water – not quite true as a certain level of preparation is necessary.
3. E-learning will force a change in the way we teach - not by a long shot
4. E -learning will build bridges across learning communities- this remains to be seen [10].

G. Norman(2008) mentions the difficulty of matching the instructional material to the course, and the real dilemma of the portability of these materials across programs. There is little evidence of effectiveness of many CAI (Computer Aided Instruction) materials which is certainly the case. While extolling the virtues of e-learning in terms of efficiency, and arguing for equal effectiveness, he points out that E-learning will never be the universal panacea [5].

Sonia Bergamaschi et al (2010) highlight Information Overload is present everything we do with internet and this excess information stresses internet users out. Since the information available exceeds the user's ability to process it, the users are required to discriminate among useful, redundant , incorrect and meaningless information [6].

Ton de Jong (2010) asserts that cognitive capacity in human working memory is limited and cognitive load theory asserts that learning is hampered when a learning task requires too much capacity than human working memory capacity. The external cognitive load is evoked by Instructional material that does not contribute to learning [7].

Sarah Guri-Rosenblit et al (2009a,2011) points out that there is noticeable gaps in e-learning research and most of the sweeping expectations are not materialized so far. The research findings highlight there is limited research to support claims such as the use of e-learning will transform students into autonomous and self directed learners. The study emphasizes clear and conceptual framework for e-learning research is lacking. They are skeptical about the new technologies would transform learning and teaching processes [3].

As per some research studies , there exists huge research gap in e-learning studies with respect to claim on the self directed ability of online learners and the efficacy of the many new things introduced in the Virtual Learning Environments like chat, online discussion forums etc [4].

B. Solution to Problems

However, there are many research studies highlight offering solutions to enhance the effectiveness of self directed learners. E- learning shifts the responsibility of learning from the instructor to the learner. Many researchers highlight Self Regulation as the key-Indicator that has to be inculcated in an e-learning framework for making e-learning more successful. The following paragraphs stress the importance of self regulation and traces the research work done on the subject by different authors.

Zimmerman (1990) emphasizes learners as individuals should assume responsibility and control for their own acquisition of knowledge and skill. Virtually all researchers agree upon that self regulation depends on continuing feedback of learning effectiveness. He emphasizes 14 self regulated learning strategies that can be adopted by students to enhance their learning outcome. Some of the strategies like a) self-evaluation b) goal setting and planning, c) record keeping, d) self monitoring, e) seeking social assistance and e) reviewing can be effectively adopted by students to promote self regulation in e-learning scenario [9].

Fredi Mampadi et al(2011) suggests a cognitive style approach in designing e-learning systems. (1) Holists approach - to get the clear picture of the subject before going into details. Holists use concept maps (2) Serialists approach - Concentrating one thing at a time. Serailists use Keyword Index[1].

As per David J. Nicol (2006), intelligent self regulation requires that the student has in mind some goals to be achieved against which performance can be compared and assessed. Specific targets, criteria, standards help define goals. Feed back is information about how the student's present state (of learning and performance) relates to these goals and standard. Teachers transmit feedback message to students about what is right and wrong in their academic work, about its strength and weaknesses, and students use this information to make subsequent improvements [17].

Jenifer Rowley et al (2007) in their paper high light that, the key aspect in e-learning is the necessity to focus attention on the student experience of e-learning and to listen to their voices. They recommend a Student Evaluation Questionnaire to gather and understand the most useful aspects in an effective e-learning system as well as to identify the probable areas that can be improved upon [16].

III. LEARNING THEORIES

The development of effective online learning materials should be based on proven and sound learning theories. Learning theories are conceptual framework that describe how information is absorbed, processed, and retained during learning. The delivery medium is not the determining factor in the quality of learning per se, rather course design and pedagogy determines the effectiveness of learning (Rovai, 2002) [22].

TABLE I
Learning Theories

Learning Theories
Behaviorism
➢ Change in knowledge through controlled stimuli/response conditioning. ➢ Learner is dependent on the Instructor for acquiring knowledge. ➢ Learner build initial schema by adapting knowledge from the instructor.
➢ Both positive reinforcement and negative reinforcement increase the probability that the antecedent behavior will happen again. ➢ In contrast, PUNISHMENT (both positive and negative) decreases the likelihood that the antecedent behavior will happen again. ➢ Positive indicates the application of a stimulus; Negative indicates the withholding of a stimulus. ➢ The learning materials to be sequenced : o Simple - Complex o Known - Unknown o Knowledge - Application
Cognitivism
➢ Cognitivism focuses on the inner mental activities – Learning occurs due to activation of mental processes such as thinking, memory, knowing, and problem-solving . ➢ The learner requires assistance to develop prior knowledge and integrate with new knowledge. ➢ Knowledge is stored cognitively as symbols. Learning is the process of connecting symbols in a meaningful and memorable way.
➢ Strategies used should allow learners retrieve existing information from long term memory to make sense of new information. (Use of advanced organizers) ➢ Information should be chunked to prevent overload during processing
Constructivism
➢ Constructivists posits that the learner construct their own knowledge from their experiences. ➢ New knowledge is created through analysis, conceptualization and synthesis of prior knowledge.

The existing learning theories were developed before distributed and networked learning and were used widely by educators. We now have to integrate different theories suitable for the digital age that guides the development of the learning materials for the networked world.

IV. ELEARNING FRAMEWORK

The design, development and maintenance of an effective e-learning system constitute a framework as shown in Fig. 1 which is an UML Use Case diagram. It explains the roles and responsibilities of the users of the e-learning system.

The use case diagram depicts the role of actors and their tasks in designing, implementing and maintaining the e-learning system discussed in this study.

A. The Actors

The actors are those who are using or responsible for the e-learning site. The actor can be a user, external system which has interaction with the e-learning system or a data base. The solid elliptical symbol represents major functionality of such e-learning system. The arrow symbol establishes the relationship between the actor and the functions of e-learning system.

The roles and responsibilities of the actors involved in the e-learning framework are given in Table II.

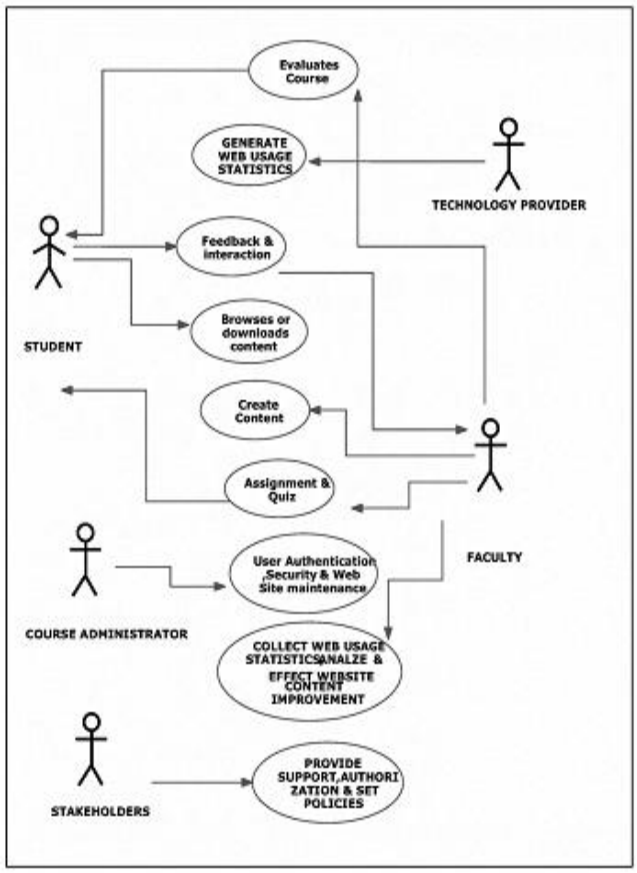

Fig. 1 E-Learning Framework - Use Case Diagram

TABLE II
Roles and Responsibilities of Actors of E-Learning Framework

Sl. No	Actor	Roles & Responsibilities
1	Student	➢ Browses or downloads content and learns ➢ Submits assignment ➢ Gives feed back on course ➢ Participate in quiz & tests
2	Faculty	➢ Designs Instruction ➢ Creates Content ➢ Gives assignment ➢ Evaluate students ➢ Gets Student Feedback ➢ Analyses Web usage statistics ➢ Improves content ➢ Prepares and conduct quiz & tests
3	Course Administrator	➢ Authenticate User ➢ Uploads course content ➢ Maintains the Web Site ➢ Monitors users and their actions ➢ Provide Security
4	Stake Holders	➢ Provides moral and financial support ➢ Authorize users ➢ Set Policies& guidelines
5	Technology Providers	➢ Provide technology support & services for content creation, periodic generation of web usage statistics

V. RESEARCH METHODS

In order to answer the research question, we have built a prototype of e-learning framework which fosters Faculty Empowerment, Self Regulated Learning , Faculty Student Interaction and supports automatic collection and analysis of web log data.

There are powerful tools available to build e-learning setups like Blackboard and Moodle. However, we have used the following tools to build the e-learning framework because they are free and light weight in nature:

1) Google Sites.
2) Google Docs
3) Google Analytics.

ASSUMPTIONS.

The effect of adopting specific learning styles by the individual learner is not included in the study since no definite conclusion can be arrived on improvement on learning outcome due to adoption of specific learning style [22].

A. Faculty Empowerment

Faculty plays an important role in building an e-learning setup and contributes tasks such as content creation, web publishing, interaction with students, understanding their learning needs and striving for continuous improvement by improving content which may ultimately lead to improve learning outcome of students. Fig. 2 shows faculty interaction in an e-learning system.

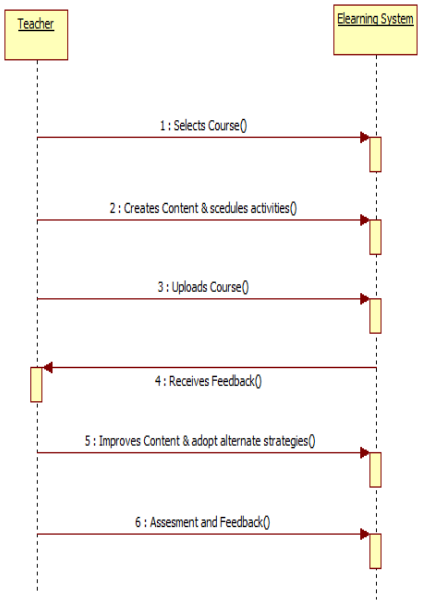

Fig. 2 Faculty Interaction - Sequence Diagram

A1. The content Creation

Experienced faculties are responsible for content creation and detailed instruction design. The real need will be identified and the course material is prepared strictly according to syllabus prescribed by university or institution. Care is taken such that the instructional design caters to needs of students of different calibers.

A2. The Web Publishing

The focus is on instructional design and not on the technology. More emphasis is given to motivational factors so as to relieve boredom for the users which happens while reading and navigating through pages after pages. It has to be ensured that the contents are relevant and follow a logical sequence and it should be interesting.

For example Fig. 3 shows a Quiz on "Compiler Design" course where information is presented both visually and verbally which is used to test the cognitive skills of a student. Here a student need to construct a mental model and has to visualize a Syntax Tree, a DAG and Three Address Code for correctly answering this question. These diagrams serves as a scaffold providing visual clues for eliciting a correct answer. Cognitive Learning Theory explains enhancing learning outcome the student by using his mental faculties and cognitive skills. The skills are acquired by training and practice and is not in-born.

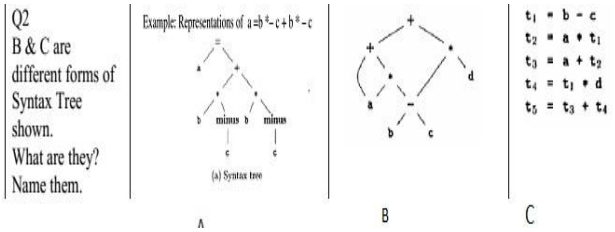

Fig. 3 Compiler-Design-Quiz

B. Faculty Student Interaction

In an e-learning system, the responsibility of learning lies with the learner and the faculty is playing a facilitator role. In an experimental setup, the needs of the students are collected using a feedback system where the students post their comments on the usefulness of the web site asynchronously. Fig. 4 shows the online form for collecting student feedback.

We use Google Forms for collecting student feedback and it is available free and light weight. The comments posted by students are automatically posted in a Spread sheet and it is available online for viewing.

B1. Continuous Improvement

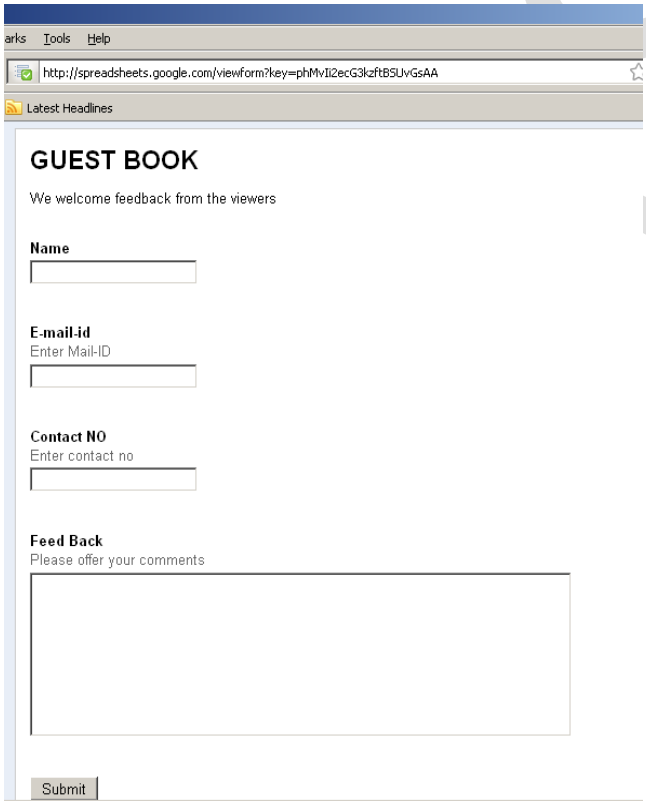

Fig. 4 Student Feedback Form

B1. Continuous Improvement

Based on this feedback, the faculties make improvements to the web site content continuously. Faculty student communication is facilitated by this system through e-Mail and other means. This fulfills by narrowing the gap in faculty-student communications in e-learning in contrast to face-to-face interaction practiced in traditional class room environment. This system also promotes peer-to-peer communication between students and enhances Self Regulated Learning .

The student feedback helps the faculty to understand the learning needs of students.

C. Self Regulated Learning

In the absence of face-to-face interaction in e-learning settings, the responsibility of learning now shifted to the learner and we need to foster self regulated learning among the students which becomes an important factor for improving the learner's performance in learning.

In our study, we have adopted the following method to un derstand and evaluate the self regulatory behavior of students who were continuously using our web site for their learning needs.

TABLE III
Questionnaire on Learning Preferences (Survey-I)

Questionnaire on Learner Preferences	
Web Refer	I refer to web material as additional resource in learning
Download notes	I have referred to educational web sites like edunotes.in to download subject notes
Get Overview	I strongly prefer to get an overview of the subject before start learning
Comfortable in Text	I like to read the subject in text form and comfortable in understanding
Hearing Lectures	I would like to understand the subject by hearing what the lecturer teaches
Visual	I understand the subject better with diagrams, graphs, charts etc than text matter and I like maps to know directions
Multimedia	I like to refer to multimedia content like to video to understand the subject.
Text Important	I consider textual content is important like use cases are text stories in UML notation
Down load important	I prefer downloaded notes of all topics are very important in understanding the subject, exam point of view.
All media important	I consider audio, visual, text, video content and lab exercises are equally important for gaining knowledge

C1. Survey to understand Self Regulatory Behavior

A survey was planned to understand the self regulatory behavior of under graduate students of Information Technology course. Self Regulation Questionnaire of Likert Scale Type was used in the survey.

Two types of Questionnaires are used in the survey. The Table II shows the questionnaire used for collecting Learner preferences which is referred to as Survey-I. The Table III lists the questionnaire used for collecting self regulatory behavior of students which is referred to as Survey-II.

TABLE IV
Self Regulatory Questionnaire
(SURVEY-II)

Goal Setting and Planning	
	I am able to accomplish goals I set for myself.
	I set goals for myself and keep track of my progress.
	Once I have a goal, I can usually plan how to reach it.
Self-Observation	I usually keep track of my progress toward goals.
Self-Evaluation	I tend to compare myself with other people.
Self-Improvement	
	I reward myself for progress toward my goals.
	I can stick to a plan that is working well.
	As soon as I see a problem or challenge, I start looking for possible solutions.
	I have lot of will power.
	I learn from my mistakes.
Self-Monitoring	
	I usually keep track of my progress toward my goals.
	I reward myself for progress toward my goals.
	I am able to accomplish goals, I set for myself.
	I can stick to a plan that is working well.

D. Web Analytics

The entire activities of e-learning site are recorded in web logs and the same is available for analysis and interpretation by Faculty and web Administrator. We use the web analytic tool "Google Analytics" which is free. Google analytics presents various types of visual reports on user behavior like sessions, Page Views, Duration of session etc. A number of useful and interesting patterns on Learner behavior and needs can be arrived at by analyzing different kinds of reports. Web Analytics finds wide applications in E-Commerce Sites for understanding customer behavior and needs. Now the same is extended to e-learning sites for understanding leaner behavior and needs [20],[21].
The next section highlights some charts showing patterns of learner behavior in the web site usage and its interpretations.

VI. RESULTS AND DISCUSSIONS

We present the experimental results obtained in this section on major three aspects of our study involving :

1. Faculty Student Interaction - Sentiment Analysis of Student Feedback
2. Self regulated Learning - Learner Preference Survey, Self regulated Learning, Survey
3. Web Log Analysis - Learner Behavior and Site Usage pattern analysis using Google Analytics

A. Sentiment Analysis

The e-learning set up for our study is in vogue since 2009. Continuous feedback is being collected from the students in different periods. The student feedback data was analyzed to know the student learning states and needs. The method used by us for the analysis is called opinion mining or sentiment analysis. Opinion mining is the area of research that attempts to determine human opinion from text written in natural language in the field of Information Retrieval and Computational Linguistics [12]. According to Bing Lin (Bing et al, 2005) - " Given a set of evaluative text opinions (sentiment) about an object, opinion mining aims to extract attributes and components of the object that have been commented and to determine whether the comments are positive, negative or neutral".

Table V shows Sample n-grams taken from Student Feedback.

TABLE V
N-Grams From Student Feedback

n	Most positive n-grams	Most negative n-grams/Neutral
1	Good	
2	Very useful	
3	It saves time	Add more notes
4	Notes are easily understandable	Need notes for TCP/IP
5	All concepts are really nice Your materials are really amazing	I want Software Testing notes
6	Very useful for preparing for exams	
7		We are unable to attend classes regulary

We used a tool developed at Stanford University for Sentiment Analysis of student feedback. It is based on Recursive Neural Tensor Network Model(RNTN) [14]. The software parses each sentence from the input document and constructs a Sentiment Tree as shown in Fig. 5. For each node in the tree , it predicts five sentiment classes,Very negative to Very positive(--, -, -, +, ++). The root node predicts the result for the whole sentence. Fig. 6-7 show the sentiment trees constructed for sample sentences taken from the student feed back about the e-learning web site used in this study. The model has predicted (+) and (++) for the two feedbacks received from the students.

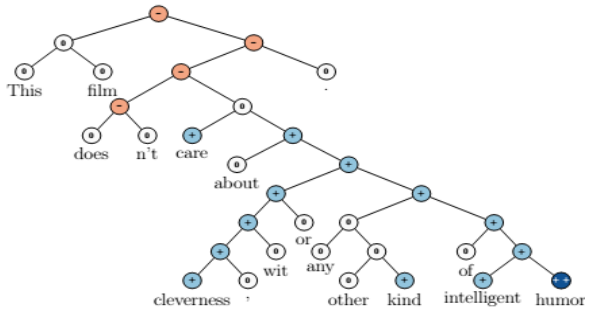

Fig. 5 Sentiment Tree

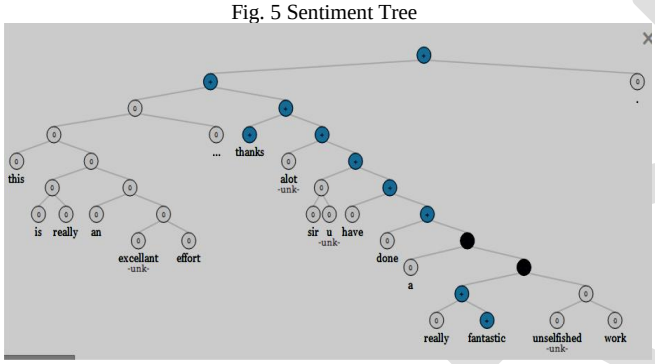

Fig.6 SentimentTree1 - Student Feedback

We also used other tools like 'AlchemiAPI' for analyzing the entire document of student feedback and the polarity of student feedback has been adjudged as positive. As per Joseph Turian (2013)," By using text analysis software and unlocking the potential in unstructured data, smart organizations are capturing value that their competitors do not." [18].

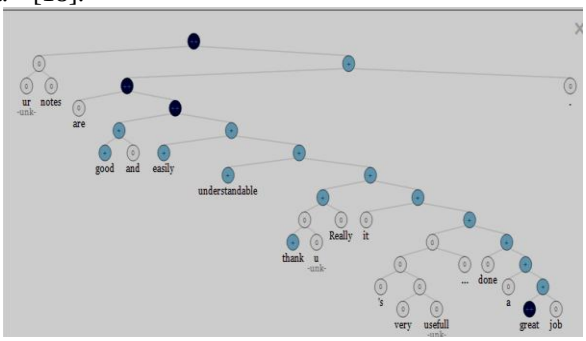

Fig. 7 SentimentTree2 - Student Feedback

B. Self Regulation Analysis

B1. Learning Preference Survey

Fig. 8 shows a plot of learning preferences indicated by two groups of undergraduate students of Information Technology course as per Survey-I. The purpose of Survey-I was to collect information of learning preferences based on 10 criteria mentioned as given in Table III. Group-1 consists of 34 students of Final year class. Group-2 consists 58 students of pre final year class.

The main idea of Survey-I was to collect the voice of the students based on 10 criteria on learning preferences as shown below : (a) Web site referral as an additional resource (b) Downloading notes (c) Getting overview of subject matter (d) Comfort in understanding text material (e) Views on listening to class lectures (f) Importance of visual data (g) Multimedia usage (h) Importance of Text as UML perspective (i) Importance of downloaded contents (j) Importance of different media and Laboratory exercise.

Also Survey-I was conducted on two groups of students so that their responses can be compared.

B1. Survey-I Results

Fig. 8 shows a plot of learning preferences of two groups of undergraduate students of Information Technology course as per Survey-I.

It can be seen from Fig. 8 that majority of students belonging to two groups have responded positively for the criteria on learning preferences. It can be inferred that E-learning framework has a positive impact on the focused group and it helps the students to enhance their learning outcome better than class room lectures.

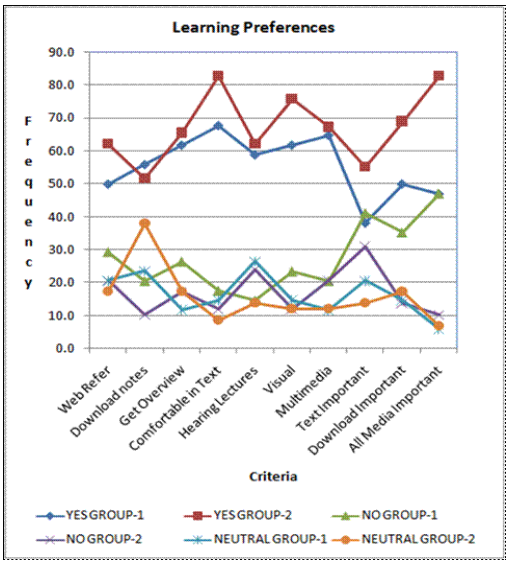

Fig. 8 Student Learning Preferences

B2. Survey on Self Regulatory behavior

Survey-II was conducted to understand the self regulatory behavior of a target group of 58 students of Information Technology course who were in the pre final year. Table IV lists different heading under which questions were prepared. The questions are Likert Scale type with responses 1..5 representing Strongly agree, Agree, Uncertain, Disagree, and Strongly Disagree. These questions were subset of 63 item Self Regulation Questionnaire designed by Brown et al, 1999 [15]. These questions were mapped to the following headings, which were some of the Self Regulated Learning Strategies advocated by Zimmerman [9]. These strategies are (a) Goal setting and planning (b) Self-observation (c) Self-Evaluation (d) Self-Improvement (e) Overt changes in behavior (f) Covert changes in self perception (g) self monitoring (i) seeking social assistance.

B3. Discussion on Responses to Survey-II

Fig. 9 to Fig. 11 show the plots of responses collected for survey-II on the topics as mentioned in Table IV.

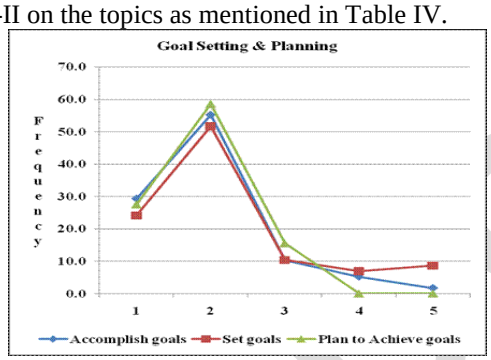

Fig. 9 Goal Setting and Planning

Fig. 9 shows student responses to questions on goal setting and planning. The student's awareness on importance of goal setting and planning is evident from the graph.

Fig. 10 high lights the learner's deliberate attention to his or her own performance to be improved upon.

Fig. 11 conveys responses on importance of Self-Monitoring tasks like sticking to plan, keep track of progress toward achieving goals; setting rewards on goal achievement etc are the learner's perception and commitment toward self regulated learning.

From the above results it is evident that the students are prepared for online learning in the absence of face-to-face interaction and they are motivated to adopt different Self Regulatory learning strategies like Goal Setting and Planning, Self Improvement and Self Monitoring to improve their learning performance. From analyzing these results it is evident that by making the web site interactive and promoting Faculty Student Interaction that helps Continuous Improvement in Content and Web Site Usage as well as the responsibility of learning is shifted to the learner and the Faculty acts as facilitator of learning.

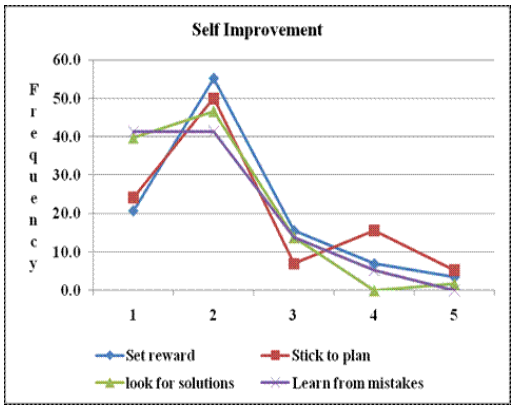

Fig. 10 Self Improvement

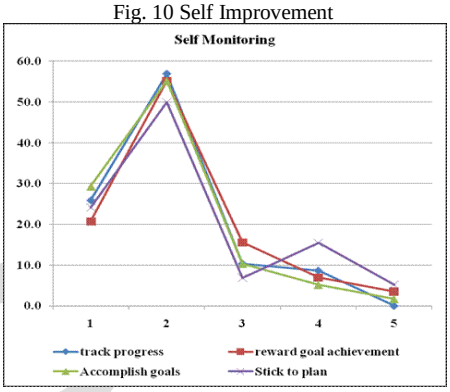

Fig. 11 Self Monitoring

C. Web Analytics

The next important aspect of our study is automatic collection of learner behaviors and needs which will lead to continuous improvement of content and presentation style by the faculties.

We used Google Analytics tool that has automatically collects data on web site usage and presents the information like Sessions, Visits, Page Views, Time on Site etc. It presents Site Usage Statistics in Visual form in various categories and variety of forms so that the web administrators and content presenters get wealth of information showing patterns of site usage. There is ample opportunities available so that the content and site usage can be improved for ultimately augmenting the learning outcome of students [21].

C1. The Analysis of Web Usage Data

Faculties can improve the usefulness of the web site if they get the statistics on web site usage and user behavior. The user behavior patterns can be viewed by faculties using which the faculties can adopt alternate strategies for content redesign and suitably alter the navigational paths used by the students. The following sections highlight analysis of web usage patterns of students in different perspectives. The web usage statistics are automatically collected by Google analytics software and different reporting options are available through which the faculties can collect and get

plots of Visits, Page Views, and time of stay for different periods etc.

The experimental web site is in existence since the year 2009 and the web usage statistics is available for analysis by Faculties and web administrators. The web usage data are analyzed for different periods and the results are discussed in the next section.

Patterns in visitor statistics:

Fig. 12 depicts pages visited by students for referring Object Oriented Analysis course materials in the web site for the period 10th April 2011 to 25th April 2011. Fig. 13 depicts pages visited by students for referring Object Oriented Analysis course materials in the web site for the period 17th May 2012 to 1st June 2012. It can be noted that patterns exist in web site access. Fig. 14 shows the access pattern of the same web site for two years. For example, the course spans from December-2011 to May-2012. It can be seen from the chart that there are peaks and valleys in web access pattern. The Peak occurs during examination period and the page views drastically reduced once the course ends. It can be inferred from Fig. 14 that there was improvement in site usage in the year 2012. That is, more and more students access web material for their study in recent times.

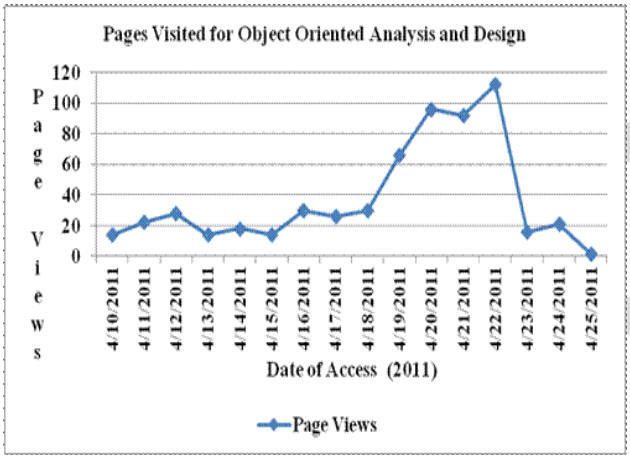

Fig. 12 Page Views for OOAD (April 2011)

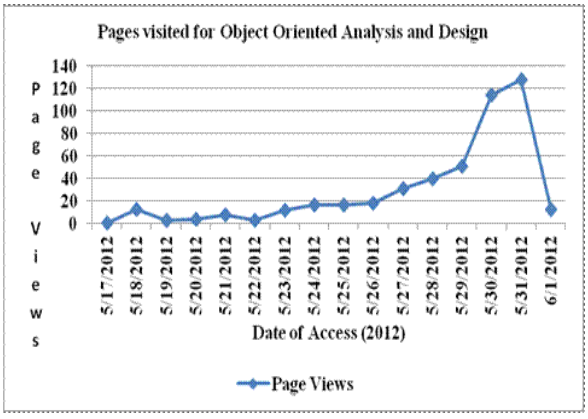

Fig. 13 Page Views for OOAD (May-2012)

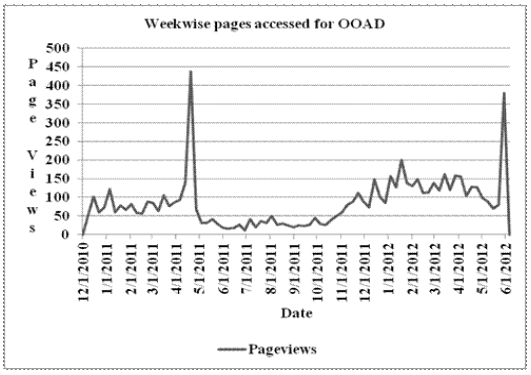

Fig. 14 Site usage statistics for OOAD Course (2011-2012)

Fig. 15 shows plot of access of web pages for the Datawarehousing course during end semester examination period by undergraduate students of Information Technology.

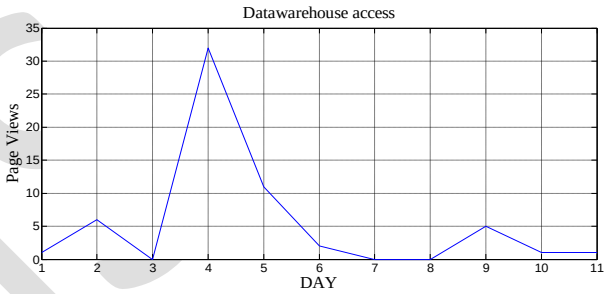

Fig. 15 Site usage statistics for Datawarehouse Course (2013-2014)

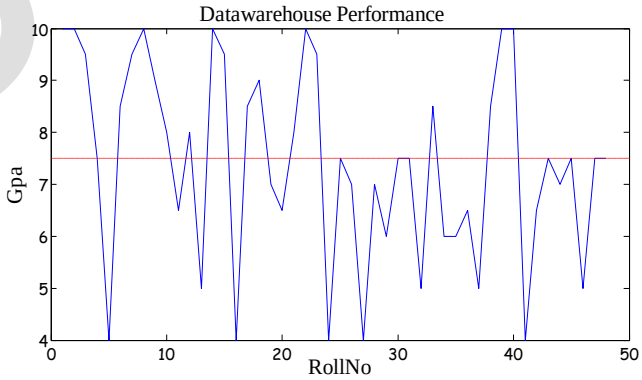

Fig. 16 Student Performance for Datawarehouse Course (2013-2014)

It is inferred from Fig. 15 and Fig. 16 that the student performance improves if class room lectures are augmented with online course content are made available to students. These data are collected for 48 students of Under Graduate course in Informational Technology who have chosen the subject 'Datawarehousing' as elective. For example, the average pass percentage for Datawarehousing course is 74.0% with many students getting a high Gpa due to their habit of accessing the digital content for enhancing their knowledge and learning outcomes.

VII. CONCLUSIONS

This paper discussed on critical factors essential for enhancing the effectiveness of an e-learning framework. The factors are faculty empowerment , Self Regulated Learning ,Faculty Student Interaction and Student Feedback, Automatic collection of web usage data.
An experimental study was made to collect empirical evidence to understand the significance of various factors.

The following are the conclusions arrived at :

1 Students use e-learning in various forms to enrich and enhance their learning experience.
2 In e-learning , the responsibility of learning is shifted from instructor to the learners and the role of faculty is changed as facilitator.
3 In the absence of face-to-face class room settings, faculty student interaction plays an important role which constitutes one of the key Indicators to foster self regulation among students.
4 The Opinion mining and Sentiment analysis of Student Feedback reported positive about the experimental website and it helped to understand learning needs , preferences and views of students.
5 The automatic collection and analysis of web usage data provided interesting patterns on students behavior and learning needs. This helped the faculty to periodically improve content and way of presentation
6 The Pedagogical Principles and Learning Theories help faculties to prepare quality content and improve the content based on student feedback.

FUTURE DIRECTIONS

This experimental study can be scaled up in future for covering larger cross section of students. Educational data mining techniques can be used for analyzing web log data to unfold hidden patterns for continuously improving the e-learning framework. Experimental studies can be planned to physically measure cognitive overload of content , media and its presentation style.

ACKNOWLEDGMENT

We acknowledge various contributors as we have used many of their software tools in our experimental study on our e-learning framework. We also thank SRM University and Hindustan University for immense support and guidance.

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