CHAPTER 1

INTRODUCTION
1.0 INTRODUCTION

The present era, known as the Digital Era is characterized by converging media that facilitates instant communication among people around the world transcending geographical barriers. This has created unprecedented opportunities in terms of productivity gain, speed, knowledge diffusion, across individuals, organizations, and all sectors where people can collaborate with one another for the betterment of society as a whole. The ever increasing internet usage has facilitated transformations taking place in in business, banking, commerce, e-payment, and e-Learning in day-to-day life. Moreover, the world is moving towards the digital age and there is a great amount of motivation for the universities, colleges, and all type of institutions to avail eLearning as part of the teaching and learning process. The technological changes has also triggered to reap its benefits such as improved productivity, faster rate of learning, scalability as well as cost considerations with respect to the learning processes. There are numerous benefits with e-Learning when compared with the traditional learning mechanisms, as the learners have the great flexibility in using any device anywhere and anytime. This research work focuses on developing an effective e-Learning framework to harness the opportunities as well as bridge the gaps in research and addressing major problems and challenges faced in e-Learning today as reported in the literature.

1.1 BACKGROUND AND MOTIVATION

There exists a need for developing an effective e-Learning Framework to harness opportunities created by the ever increasing usage of Information and communication technologies. The framework should be useful in higher Education institutions as well as address problems faced in online learning
scenarios, like student disengagement that happens due to lack of face-to-face interaction. Students and faculties have to be geared to take on new roles, especially the accountability of learning relies more on the students than faculties. The following sections provide a brief introduction on the evolution of e-Learning, problem outline, suggested solutions, and current e-Learning trends and tools.

1.2 EVOLUTION OF E-LEARNING

This section briefs the historical timeline of e-Learning evolution. The first self-testing machine was introduced in the year 1924. In continuation, the teaching machine was invented to enable schools to follow programmed instruction. Later Computer Based Training was introduced for automated teaching called PLATO-Programmed Logic. Earlier computer systems were used mainly to deliver the information to students without any interaction. Later open universities came into existence in Europe and USA and made use of e-Learning for distance education. People are empowered when they acquire knowledge and skills needed in continuing in their professions. One can constantly update his/her knowledge, skill, and skill sets in a particular field or domain by resorting to continuous learning principle. There are many avenues available for an individual in adopting continuous learning, they include:

- Seeking help when more clarifications are needed to understand something
- Learning by observation of what experts do in accomplishing a task
- Exploring new or alternative ways of doing a thing
- Practicing a task repeatedly helps one to reinforce concepts already known for long term benefits.
- Attending conferences, seminars, workshops helps one network with professionals and experts as well as knowledge sharing
Social networking helps one to constantly update knowledge by way of networking with contacts, peers, friends, family members, and professional experts. This mode of communication using electronic media facilitates instant knowledge sharing and it is termed as electronic Word of Mouth Communication (eWOM).

e-Learning was accepted as an effective method for corporate learning and it happened in a progressive way. CISCO, a successful networking company who was instrumental in the Internet revolution to stay, and grow, introduced e-Learning to train its employees and partners. According to Tom Kelly and Nader Nanjiani (2004), the benefits accrued by the company by the introduction of e-Learning in the period 1997-2002 are immense and Table 1.1 summarizes Productivity gains during the same period.

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Three Waves of E-Learning Adoption a CISCO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wave-1</td>
</tr>
<tr>
<td>Financial</td>
<td>$24 million</td>
</tr>
<tr>
<td>Business–competitive</td>
<td>Reduced time</td>
</tr>
<tr>
<td>advantages</td>
<td>and expenses,</td>
</tr>
<tr>
<td></td>
<td>Faster time</td>
</tr>
<tr>
<td></td>
<td>to competency</td>
</tr>
</tbody>
</table>

Table 1.1: E-Learning gains of CISCO during 1997-2002

Revolutions are happening in academic settings around the world with universities introducing online courses using technology integration in learning. Universities are getting empowered in this process and they expand their student
base beyond their campuses by offering massive open online courses. Students from any part of the world can enroll themselves in such courses, and get certified on successful course completion. Harvard and MIT have introduced free online courses with student enrollment in lakhs handled by teams of renowned professors. Course era is a platform which has been used by many universities for hosting free online courses. The course completion certificates are empowering students and faculties as they are recognized by many companies and corporations all over the world.

1.3 PROBLEM OUTLINE

The major shift in the education paradigm in Universities and Educational Institutions today is to introduce e-Learning for the courses offered by them with an objective to keep abreast with technology as well as to reap the benefits of e-Learning and to meet the ever-growing aspirations of technology savvy students. However, e-Learning is not a panacea. The following are some of the key challenges and issues faced in e-Learning today:

- The absence of direct interaction with faculties and student disengagement.
- Learning process shifted away from the instructor to the learner.
- Faculty’s role changed as a facilitator of learning.
- Lack of effective e-Learning Frameworks in addressing these issues.
- Student disengagement from the online learning process.
- Limited and minimal e-Learning Frameworks in vogue.

Many recent research studies highlight the gap in research in addressing e-Learning problems and issues. A major need exists today to identify the latent factors and driving forces that lead to success in e-Learning portals.
1.4 SOLUTIONS TO THE PROBLEM

This research work addresses these problems by evolving an effective e-Learning Framework with the identification of the determinant factors associated with it. The proposed Framework and the key factors have been validated through multiple experiments in real situations by constructing two experimental prototypes implemented through a Single-Faculty and a Multi-Faculty e-Learning Model. The experimental results were compared with a few conceptual e-Learning Frameworks in vogue across the globe and the results proved positive in many aspects on the effectiveness of proposed e-Learning Framework.

1.4.1 EVOLUTION OF AN EFFECTIVE E-LEARNING FRAMEWORK

The development of a new e-Learning Framework is an iterative process and it is based on the continuous improvement principle and the framework is built in stages. The following sections highlight the various stages.

1.4.1.1 E-LEARNING FRAMEWORK

The introduction of digital technologies have strong influence on changes that are happening in producer-consumer association existing between Teachers-Students, Stakeholders-Students, Technology providers-Institutions, and Course Administrators-Students. There are high expectations from students that the online courses meet their needs as well as technological aspects. Also the faculties’ expectations are also have to be fulfilled by technology providers. The institutions also offer courses that are student-centric. So an e-Learning Framework should take into consideration on various driving forces such that makes an e-Learning system successful. Fig. 1.1 depicts the Use Case Diagram for an e-Learning Framework. The diagram shows important actors in the e-Learning system and how they interact with the system.
The key actors are Student, Faculty, Course Administrator, Technology Provider, and Stakeholders. Table 1.1 shows the roles and responsibilities of the key actors.
Table 1.2: Roles and Responsibilities of Actors

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Actor</th>
<th>Roles &amp; Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Student</td>
<td>☐ Browses or downloads the content and learns &lt;br&gt;☐ Submits assignment &lt;br&gt;☐ Gives feedback on course &lt;br&gt;☐ Participates in Quiz &amp; tests</td>
</tr>
<tr>
<td>2</td>
<td>Faculty</td>
<td>☐ Designs Instruction &lt;br&gt;☐ Creates Content &lt;br&gt;☐ Gives assignment &lt;br&gt;☐ Evaluates students &lt;br&gt;☐ Gets Student Feedback &lt;br&gt;☐ Analyses Web usage statistics &lt;br&gt;☐ Improves content &lt;br&gt;☐ Prepares and conducts Quiz &amp; tests</td>
</tr>
<tr>
<td>3</td>
<td>Course Administrator</td>
<td>☐ Authenticates User &lt;br&gt;☐ Uploads course content &lt;br&gt;☐ Maintains the Web Site &lt;br&gt;☐ Monitors users and their actions &lt;br&gt;☐ Provides Security</td>
</tr>
<tr>
<td>4</td>
<td>Stake Holders</td>
<td>☐ Provides moral and financial support &lt;br&gt;☐ Authorizes users &lt;br&gt;☐ Sets Policies &amp; Guidelines</td>
</tr>
<tr>
<td>5</td>
<td>Technology Providers</td>
<td>☐ Provide technology support &amp; services for content creation, periodic generation of web usage statistics</td>
</tr>
</tbody>
</table>
As the first step, an effective e-Learning Framework has been evolved by the provision of faculty-student-interaction by creating a communication channel between faculties and students which would facilitate improvement in student engagement in the online courses.

The next activity is to identify important self-regulating learning strategies by making an exploratory study on the self-regulating habits of the students. In the light of changing the role of faculties in online learning scenarios, this research work identified faculties as facilitators of learning who contribute their efforts in instruction design, web hosting, assessment and student monitoring activities. The two tools that aid faculties in successfully incorporating these roles are the Sentiment Analysis of Student Feedback and Web Usage Pattern Analysis. The faculties will be able to understand the student needs as well as the satisfaction and motivation level of students while pursuing the online course. Based on the student’s sentiments, the course can be redesigned by the faculties and the web content will be redeployed. The iterative process of refining the web content is a continuous process and ultimately it contributes to user satisfaction, ease-of-use, and validation of all functionalities.

1.4.1.2 INCORPORATION OF SOCIAL NETWORKING

The advent of Social Networking sites like Facebook, LinkedIn etc. has created opportunities for people to get connected with friends, relatives, and professionals and enrich their lives by sharing information and Knowledge. In online learning, students can establish a connection with faculties, peers, and professionals and get clarified about subject related doubts. By incorporating these collaborating features in E-Learning settings, the learning outcomes of students undergoing online courses can be enhanced. The theoretical basis for this type of
collaborative learning is called connectivism, which is the Learning theory introduced by Siemens and Downes (2005).

1.4.1.3 COURSE INTERACTION MODEL

Since students and faculties in the current online scenarios are separated, the new learning paradigms mandate the redefinition of the role of faculties as the facilitators of online learning. Faculties now have to take up the active role of not only Instruction Designers, but also act as the content provider for online courses with taking up additional responsibilities of web hosting and monitoring student performance as well as taking part in collaborative activities. This research work proposes a Multi-Faculty Model where multiple faculties can contribute resources and collaborate with groups of students enrolled in an online course.

Figure 1.2: The Course Interaction Model

This helps to improve the learning outcome of students and make an e-Learning portal more effective. Fig. 1.2 shows a course interaction model for online courses. Various types of interactions possible in an online course are faculty-
student, student-student, and faculty-faculty. A multi-faculty model enhances student retention and performance because of collaborative support by faculties in providing learning materials. Online collaborative tools facilitate faculty-student interaction and peer-peer interaction.

1.5 RESEARCH CONTRIBUTIONS

The following are some of the major contributions of this research work. This research work addressed problems faced in e-Learning systems today and contributed to knowledge addition in e-Learning Research by evolving an effective e-Learning Framework that works on the Multi-Faculty Model. This work also identified the critical factors that drive success in e-Learning Portals, namely, Faculty Empowerment, Self-Regulated Learning, Faculty-Student Interaction, Sentiment Analysis of student feedback and automatic collection of web usage data. Experimental studies were conducted by building two prototype websites with single faculty and Multi-faculty implementations. Analysis of Data gathered in the study using Multivariate Analysis using IBM Software SPSS Statistics and SPSS AMOS empirically proved the validity of assumptions and Theoretical Models proposed constituting the Self-Regulating e-Learning Framework.

This research work contributed to identifying and designing a Survey Instrument on Social Networking. Important factors that promote student empowerment in online social networking sites were identified, namely, Expert Opinion Seeking, Networking with contacts, and Notifications. This research work also contributed to e-Learning research by developing a Multi-Faculty Self-Regulating e-Learning Framework.
1.6 CURRENT E-LEARNING TRENDS

Digital learning is the fastest growing sector in enrollment trends in higher education today. Universities and educational institutions are engaged in capacity building to gear up for digitally mediated pedagogy. There is rapidly increasing demand for just-in-time learning options and hybrid teaching solutions that reduce reliance on traditional classroom teaching. In today’s world, everything people do is mediated by some form of reliance on Information Technology with technological infrastructure served by high-speed communication networks. Today’s learners are deemed as technology savvy and are looking out for global digital higher education. Digital Learning, Mobile Learning Application, and MOOCs are some of the technology-driven trends that transcend geographical barriers and are triggering the transformation in the teaching and learning process. The current online course administration policies stipulate that assessment or corrections for student works are done online. Students are compelled to submit their assignments and other submissions online. The following section gives an overview of Learning Management Systems and their functionalities. Two existing popular Open source and commercial learning management systems, Moodle and Blackboard systems are discussed and compared.

1.6.1 LMS and KMS

A Learning Management System (LMS), is an online course administration software used for the deployment and maintenance of educational content and courseware in online portals and the targeted audience is online students. The interactive features of an LMS facilitate faculties to create and maintain courses online and allow students to register and access and navigate through the course content during the course tenure. The interactive features of an LMS help faculties and students in getting connected in the virtual classroom and an LMS
promotes faculty-student interaction in many ways, and assessment and feedbacks are the core tasks that make e-Learning portals more effective. An LMS enables course materials to be shared and facilitates lecturers and students to communicate using question answer sessions and other forums. With the Internet facilities available 24 hours a day, students have the flexibility of learning with no limitations on time and location as well as the device. A learning management system facilitates the instructor to perform many tasks such as deploying and announcing the course, conducting tests, monitoring assignments, tracking student progress, offering feedbacks and periodic interventions. LMSs augment learning experience of students enrolled in regular courses conducted in traditional brick and mortar classrooms and also serve as portals for a fully online course. Blended learning is via media between fully online and traditional courses offered in brick and mortar classroom settings, and it keeps the best of the two worlds. In recent times, the introduction of technology in learning has changed the instructors’ role in the teaching and learning process. Since, in an online course, the instructors have no direct contact with the students their role has been changed as facilitators of learning. Now the instructor’s role rests in instruction design and development of online course materials as well as to hosting and maintaining course web sites (Zastrocky et al., 2007). LMSs have become an important means of communication between students and online course instructors.

There are many advantages in using an LMS because of the flexibility it offers to students such as studying at their own pace without time constraints. Irrespective of how the LMS is being used, it serves as a central location where a student submits his or her course work, a lecturer evaluates and notifies grades, and student needs to contact the course website for all his needs. Online students can get connected in this virtual classroom to interact with one another or with the
instructor at any time (Squillante et al., 2014). Knowledge management systems (KMS) refer to a class of information systems applied to manage organizational knowledge. A knowledge management system is an IT-based system used to run, maintain and augment the organizational processes of knowledge, including generation, storage, retrieval, exchange, and application to do knowledge based task units to improve institutional and personal productivity and the capacity to innovate.

**KNOWLEDGE ASSETS**

The concept of knowledge assets are useful in defining Knowledge-based organizational resources. *Knowledge assets* include knowledge resources within an organization as well as those held by its customers, suppliers, and partners. *Knowledge assets* are the “know how” that a typical organization possesses and there are many ways in which it is useful to an organization like day-to-day decision making. It is deemed as an investment and it is vital for organizational growth. *Knowledge assets* are considered vital for organizational survival and they are deemed as critical components needed for an organization’s growth. They are instrumental in creating a value for the stakeholders. They help in sustaining organizational success in terms of continual performance improvement. Learning Object repositories play a vital role in the sharing and reuse of learning materials in electronic form among the academic community. User-generated digital content in web 2.0 communities comes under the purview of Knowledge Management Systems. These are new knowledge developed often by a small, informal, and self-organized network of professionals (Levy, M., 2009). Knowledge developed in academic practice is constructed by Instructors based on their experience about students’ learning and evidence of their learning achievement. This type of knowledge can be considered as tacit since it calls for additional efforts to be codified and exchanged (Alavi, M. and Tiwana, A., 2003).
Table 1.3 compares many aspects of e-Learning and Knowledge Management. The main similarity between both disciplines is that they share a common objective of promoting learning and facilitating knowledge transfer involving people, individuals, students, and organizations. Judrups, J. (2015) discussed on E-Learning adoption in knowledge Management using a KM and EL Technology Integration Model. According to him the task performance of the knowledge seeker can be measured and returned to the Knowledge Repository as feedback. This could help learners and the teachers to determine whether the learning goals have been achieved. The Instructional designer is responsible for preparing knowledge for learning needs by adding assignments and assessments. E-Learning is helpful in organizational learning and lifelong learning. Knowledge Management focuses on retaining organizational memory to be kept in explicit form so as to enable the work forces to stay current and enhance their knowledge level. Organizations can take up Business pressures that may be created due to staff turnovers and retirements. The new employees can easily fit into the new job and will be able to take up challenging roles.

Table 1.3: Comparison of E-Learning and Knowledge Management

<table>
<thead>
<tr>
<th>E-LEARNING</th>
<th>KNOWLEDGE MANAGEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>❑ Promotes enhancement in learning</td>
<td>❑ Promotes knowledge transfer.</td>
</tr>
<tr>
<td>❑ e-Learning transcends the traditional learning environment by removing geographical, and time constraints by applying technology in education. It is non-linear.</td>
<td>❑ Knowledge management retains the best practices and promotes organizational learning.</td>
</tr>
<tr>
<td>❑ e-learning supports sharing knowledge among people and promotes converting tacit knowledge: wiki, blogs, etc.</td>
<td>❑ Knowledge management focuses on the organization's memory aids in complex decision making.</td>
</tr>
</tbody>
</table>
1.6.2 MOODLE VS BLACKBOARD

Educational Institutions and Stakeholders today have to realign their course offerings with the current technology in vogue and a need exists today to satisfy the expectations of technology savvy students. Two types of LMS cater to the demand for online courses in educational institutions. The first type is commercial, which gives a comprehensive solution at a high cost. The second type is open source software which comes free with a basic module, but add-ons come with additional cost. ‘MOODLE’ and ‘BLACKBOARD’ are two popular LMSs which are patronized in major schools and educational institutions in many countries because of their proven capabilities and wide usage. Moodle is a free open-source software and Blackboard is an expensive commercial LMS product which is proprietary. The following sections discuss the detailed comparison of Moodle and Blackboard and their impact in online education today. Educational institutions can choose any of these LMS solutions after analyzing in detail the pros and cons by making a cost-benefit analysis.

Moodle is a powerful LMS which is free and open. But it calls for many hours of programming effort and customization to cater to the specific needs of the clients. The basic modules come free, but the client needs to spend for an inclusion of extra features. According to recent research findings, Moodle is the most sought after product in educational institutions with student enrollment between 1000 and 2000. According to Kotzer, S. et al. (2012), the design of Moodle LMS was based on socio-constructivist principle and it permits collaborative interaction among learners.

The important learning tasks that Moodle offers are:

- Monitoring Grade
- Student roster and attendance capture
One of the main shortcomings of the Moodle system is its complexity which calls for a long set-up time to bring it live, and additional time needed for fine tuning. There are many external services available which provide help for the Moodle set up as well as customizing it, but they are with additional cost. Moodle is the most sought after LMS software by educational institutions and its implementation and usage help them in achieving their mission and goals. However, Moodle implementation calls for the services of at least one qualified IT specialist, the requirement of an independent server and associated hardware. In spite of Moodle being available free of cost, additional expenses and overheads are of high value. In short, Moodle is a free and widely used LMS, but it needs expertise and programming efforts to make it operational. It needs a full-time faculty in order to customize and tailor to adapt to diverse needs, which can be expensive and may need a long time and efforts to bring it live. One of Moodle’s strengths is the collaborative tools available and the facility it offers to the users to form online learning communities to interact and collaborate with.

Blackboard is a leading LMS with industry-strength software and its solutions are comprehensive, but it comes with a very high cost. The full pricing details of Blackboard are not publicly available, and the overall cost is fixed based on the number of licenses the client has to purchase. Blackboard has a strong customer base spreading across many schools and institutions with high resource availability. Blackboard supports an excellent provision for course creation where
an instructor can upload course materials and resources. The learners can easily access the educational resources that satisfy their educational needs. However, the cost associated with the Blackboard, are hidden and additional training or post installation services may be required, and it may raise the cost to an unacceptable level. Some of the distinct features of Blackboard are:

- Provision of Exam engine
- Provision of multiple formats
- Administrative controls
- Import/export of data
- Student grading
- Student portal
- Skills tracking

Overall, Blackboard is well suited for academic institutions, but it comes at a high cost. Moodle course design is based on socio-constructivist pedagogy. It creates an atmosphere that facilitates collaborative interaction among learners. Moodle fosters interactive learning through constructivism. The application of information and communication technology helps to enhance faculty-student communication. Here there is freedom for faculties to add or change content according to the needs of students.

1.6.2.1 COMPARISON OF BLACKBOARD AND MOODLE

Table 1.4 shows the comparison of the LMSs Moodle and Blackboard in different aspects which can be helpful in choosing a particular LMS that suits one’s needs.
Table 1.4: Comparison of Moodle and Blackboard LMSs

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Moodle</th>
<th>Blackboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost Implication</td>
<td>Free open source</td>
<td>Proprietary</td>
</tr>
<tr>
<td>Assignment</td>
<td>Page level monitoring</td>
<td>Weekly activity</td>
</tr>
<tr>
<td>Aspects/Plug-ins</td>
<td>Few options, One needs to create new plug-ins</td>
<td>Extra aspects come with additional cost</td>
</tr>
<tr>
<td>Product/Supplier</td>
<td>Many collaborating firms and suppliers</td>
<td>Only one supplier</td>
</tr>
<tr>
<td>Collaborative tools</td>
<td>Discussion Forums</td>
<td>Forums, and online Technical Support</td>
</tr>
<tr>
<td>Mobile app support</td>
<td>free (My Moodle app)</td>
<td>Free (Blackboard Mobile app)</td>
</tr>
</tbody>
</table>

1.6.3 ADDIE MODEL

Designing E-Learning course material plays an important role as the entire online learning success rests on the way the content is presented. The evaluation of the e-Learning content is becoming a necessity before launching an online course. It helps both the learners and course developers in maintaining quality as well as the selection of the best course. The most followed Instruction model in course evaluation is the ADDIE model (Robert Marice Branch, 2009; Beatrice Ghirardini, 2011; Sri Surya, S., 2013). The ADDIE model guides the instructors and course developers starting from the course design stage to the course launch stage for effectively designing an online course. The ADDIE model can form a basis for online course development and the process involves the sequence of five stages, Analysis, Design, Development, Implementation, and Evaluation as
shown in Fig. 1.3. Most of the current course design models are extensions of the ADDIE model. Prototypes are often used while developing online courses. The prototype can be tested and continuous feedback on the problems encountered helps in identifying the potential problems earlier. This approach results in cost, time, and effort savings. Learning theories serve as the foundation for the design of instructional materials. These theories are Behaviorist theory, Cognitivist theory, Constructivist theory, and Connectivist theory. These theories help the course developers to organize the instructional materials in different sequences in order to improve student learning outcomes. Fig. 1.3 shows the important stages of the ADDIE Model and the following sections give an overview of each stage.

1.6.3.1 ANALYSIS

The analysis should start with a real learning need, current skill or expertise level of learners, the theoretical or professional skills to be acquired and the subject area in which training is needed.

1.6.3.2 E-LEARNING COURSE DEVELOPMENT

The learning process involves assimilation of knowledge by the learner by adopting various instructional strategies and processes and absorbing a number of related categories of chunked information. Table 1.5 identifies four major types of content: facts, procedures, concepts, principles. By providing content in different forms reinforces the concepts as well as emphasizes the practical aspects and thus makes the learning process more effective. Fig. 1.4 gives an overview of a typical Course Structure.
Figure 1.3: The ADDIE model for e-Learning
Table 1.5: Categories of Learning Content

<table>
<thead>
<tr>
<th>Category</th>
<th>Meaning</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Facts</strong></td>
<td>Truths as distinct from opinions or falsehood</td>
<td>Jupiter is the largest planet in the solar system.</td>
</tr>
<tr>
<td><strong>Procedures</strong></td>
<td>Step-by-step instruction to achieve some result. The results of procedural learning is that we are able to perform some procedure</td>
<td>Motor skills – Handwork and hand eye coordination</td>
</tr>
<tr>
<td><strong>Concepts</strong></td>
<td>An abstract or generic idea generated from particular instances</td>
<td>The concept of gravity</td>
</tr>
<tr>
<td><strong>Principles</strong></td>
<td>Laws observed in nature or a fundamental or general law of truth from which others are derived. A principle (or rule) relates two concepts</td>
<td>Ex1: Data expands to fill the space available for storage. Ex2: The work expands to fill the available time.</td>
</tr>
</tbody>
</table>

Figure 1.4  A Course Structure
1.6.3.3 LEARNING SEQUENCING

Explaining the concepts with suitable examples reinforces an understanding of the concepts. Learning sequencing can be planned by introducing simple concepts first and then providing examples to reinforce the understanding of concepts (Fig. 1.5). For experienced learners, the learning sequence can be organized in a different way. First, a case study or example may be introduced and the learners are given opportunities for critical thinking that may help them to understand the theoretical concepts better.

![Learning Content Sequencing Diagram](image)

**Figure 1.5 Learning content sequencing**

A theory can be illustrated with examples of task achievement and it reduces the gaps in understanding the concepts by the learner.

1.6.3.4. ASSESSMENT

Assessment is an important phase of an online course and a student has to take tests, attend quizzes periodically and get immediate feedback on the results.
Course administrators come to know how far the course has helped the students to acquire the desired level of proficiency.

**Table 1.6: Developing Test Questions**

<table>
<thead>
<tr>
<th>Category</th>
<th>TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fact</td>
<td>Test for knowledge retention</td>
</tr>
<tr>
<td>Concept</td>
<td>Test for Conceptual Knowledge</td>
</tr>
<tr>
<td>Algorithm or Procedure</td>
<td>Practicing a dry run or ability to perform a procedure</td>
</tr>
<tr>
<td>Principle</td>
<td>Understanding of the principles behind an example</td>
</tr>
</tbody>
</table>

Table 1.6 summarizes the guidelines for developing test questions by instructors in different category levels which form a prerequisite for designing an effective online course. Table 1.7 lists a comparison of test question types with the merits and demerits of each type.

**Table 1.7: Comparison of Test Question Types**

<table>
<thead>
<tr>
<th>Question Type</th>
<th>Merits</th>
<th>Demerits</th>
</tr>
</thead>
<tbody>
<tr>
<td>True or False</td>
<td>simplicity</td>
<td>Probability of wrong answer = 0.5</td>
</tr>
<tr>
<td>Multiple choice</td>
<td>Stimulates thinking</td>
<td>More efforts needed for preparation</td>
</tr>
<tr>
<td>Matching</td>
<td>Simple cognitive ability</td>
<td>Learner has to guess</td>
</tr>
<tr>
<td>Fill in the blanks</td>
<td>Traditional</td>
<td>Difficult to evaluate</td>
</tr>
<tr>
<td>Brief answer</td>
<td>Learner writes solution</td>
<td>Difficult to evaluate5</td>
</tr>
<tr>
<td></td>
<td>using simple text</td>
<td></td>
</tr>
</tbody>
</table>
1.6.3.5 COMPOSITION OF AN ONLINE COURSE

Fig. 1.6 shows a typical online course consists of the following steps:

1. Course Launching
2. Prerequisite knowledge
3. Cyclic Learning Process
4. Summative assessment
5. Course Completion

![Diagram of online course components]

**Figure 1.6: Elements of an Online Course**

1.6.3.6 COURSE LAUNCHING

Course introduction gives an overview of the course objectives and the schedule of Instruction. It should motivate and grab the attention of learners. This event can be announced on the course website or by sending messages to all participants through e-mails.

1.6.3.7 LEARNING PROCESS

A course overview with concept maps and links to appropriate learning objects can facilitate a learner to initiate the self-learning process. Self-learning is promoted by following these steps:
- Browsing the content in the form of a simple text, image, video, and audio clip.
- Working out assignments and solving quizzes.
- Sharing Experiences: Participants can exchange course related ideas and share their experiences with group members.
- Questions and Answers: Learners can post questions and elicit answers from subject experts.
- Discussion Forums: Online facilitators can initiate discussions on the specific subjects and elicit responses.

1.6.3.8 COURSE COMPLETION

At the end of an online course, feedbacks from the learners are collected regarding the users’ perceptions on the course. This serves as an opportunity for instruction designers and course administrators for identifying problems faced by the users. Actions can be taken to improve the course by properly understanding the users’ needs. This makes the online course more effective.

1.7 MASSIVE OPEN ONLINE COURSES (MOOCs)

A MOOC is an online course hosted on the web by some reputed universities where an unlimited number of participants can enroll in the course. MOOCs are scalable and characterized by massive enrollment of students for each course. The main goal of MOOCs is providing online education opportunities to anybody in the world who has internet access and they can pursue an online course without facing geographical limitations or other any other reason that is stopping them from earning a degree from traditional institutions. MOOCs adopt different learning strategies for their online courses as traditional pedagogical strategies that work in a face-to-face setting do not fit well into an online course. MOOCs are characterized by three features namely they are massive, open, and online in
their course delivery. Massiveness implies infinite scalability. Virtually there can be unlimited enrollments for a course. MOOC courses are open to all those who want to take the course across the globe and the learners can access the course using any device like a desktop, PC, or a mobile device with internet connection. The major types of MOOCs are cMOOC and xMOOC. cMOOCs are characterized by mass communication and interaction where learners can contribute content and the course content is not fixed. It is based on Connectivism Model. In contrast, xMOOCs are based on behaviorist approach to instruction. xMOOC differ significantly from the structure of cMOOC in the way of accessing the course content. With xMOOC, the participants work independently rather than in a collaborative mode with peers. MOOCs are in a nascent state and have to resolve major challenges and issues like managing achievement and attrition of course participants.

1.8 WEB 2.0

Web 2.0 is the outcome of a continuous evaluation of web technologies that have reached the current state reflecting an interactive web. Web 2.0 promotes user contributions in terms of the collective intelligence of collaborative users across the world. The strong point of Web 2.0 is social connectivity and it deviates from the earlier web which was called a static Web. Web 2.0 fosters interactivity, community-oriented access, content-sharing, and collaboration. Web 2.0 promotes Social Networking activities like microblogging, social bookmarking, and wikis. The important constituents of web 2.0 are:

- **Wikis**: Allow contribution from web users who can add or edit content.
- **Cloud Computing**: This is an emerging field using cloud-based infrastructure - web apps and cloud computing replacing programs and services which are locally-installed.
- **Mobile Computing** has become pervasive with millions of users using smartphones and provided with internet access that operates based on Wi-Fi networks.

- **Social networking**: Enables individuals getting connected with friends, professionals, and social contacts. Facebook, Twitter, LinkedIn, and Google+ are the prominent social networking sites among the world community especially youngsters,

- **User-generated content**: The users are permitted to add content of any type, including multimedia content.

- **Content Aggregation**: Sharing content organized around different domains and themes. Content aggregation sites include Reddit, Digg, Pinterest, and Instagram.

The foundation of Web 2.0 is built on Ajax and applications such as Eclipse and RSS. Rich Web technologies are used in making Web 2.0 applications operational, they include JavaScript, Microsoft Silverlight, and Adobe Flash. Web 2.0 applications use the technique of the decentralized download methodology in which the server load is shared by the content downloader. The heavily downloaded material is becoming more accessible by this process and BitTorrent’s success is attributed to this method.

### 1.8.1 WEB 3.0

Web 2.0 technologies constitute an intermediate stage and moving towards web 3.0 with the intention implementing semantic web concepts. Tim Berners-Lee, suggests the possibility of designing an intelligent Web offering services in more intuitive ways and can satisfy the user’s needs. Berners-Lee observes that in spite of powerful search engine capabilities using indexes for searching of the
Web's content, their abilities are limited by not being able to get the relevant pages that the user actually needs. He seeks help from authors and developers, in person or as a team, who can add self-descriptions or tags which can enable easy classification as well as retrieval in a form that is more relevant to a user. Web 3.0 will use markup languages XML, OWL, XHML, and RDF with metadata for the publishing of web resources. W3C Web Services group has developed specifications for Web 2.0 with semantic annotations.

Figure 1.7 summarizes the evolution of Web 2.0 in chronological order. Figure 1.8 depicts how the web applications are partitioned into the syntactic web, semantic web, and the pragmatic web. Web 2.0 is an improvement that happened over experiences gained from the past as shown below:

Figure 1.7: Evolution of the Web
1.9 LEARNING THEORIES

Learning theories offer an explanation on how people learn and they are useful in the creation of learning environments. Mechlova E. et al. (2012) discuss four learning theories namely, Behaviorism, Cognitivism, Constructivism, and Connectivism, which are relevant for designing courses in Technology Enhanced Learning. Fig. 1.9 and 1.10 pictorially compares these theories for their relevance and suitability for their application in the digital age. The following sections give the summary of definitions, features, and applicability of four learning theories in the context of their usefulness in the e-Learning course design.

1.9.1 BEHAVIORISM

Behaviorism posits that Learning is a process of reacting to external stimuli. It is assumed that Instructor support is needed for acquiring knowledge by learners.
Both positive and negative reinforcements increase the probability that the particular behavior will repeat. In contrast, *punishment* (both positive and negative) decreases the probability of certain behaviors from happening. Application or withholding of a stimulus depicts either a positive or negative reinforcement. Behaviorism can be applied in the instructional design. The course material is to be sequenced based on the categories, Simple – Complex, Known – Unknown, and Knowledge – Application

1.9.2 COGNITIVISM

Cognitivism is based on the mental processes – Learning happens due to triggering or stimulation of thought processes such as thinking, and reflecting. Knowledge is represented by symbols. Learning is the process of linking symbols in such a way as to produce meaning and remembering things. The new information is assigned meaning based on referring to information stored in long-term memory. Sophisticated organizers use this principle. Chunking information helps to prevent information overload while mental processing

1.9.3 CONSTRUCTIVISM

Constructivists posit that the learners construct their own knowledge from their experiences. New knowledge is created through analysis, conceptualization, and synthesis with current knowledge.

1.9.4 CONNECTIVISM

Connectivism is a learning theory promoted by Stephen Downes and George Siemens (2005). It is more relevant for the electronic age. It helps the learners to proceed with complex learning by adapting to the fast changing social digital scenarios. Fig. 1.11 depicts different aspects of Connectivism and its relevance in digital age
Figure 1.9: Learning theories for the digital age.

Figure 1.10: Connectivism and Epistemologies
1.10 **UML MODELING**

As part of the initial phase of the research work, the UML Use Case Diagram has been constructed to differentiate the roles and responsibilities of the proposed e-Learning system. The main actors in an e-Learning system are the Student, Faculty, Course Administrator, Technology Provider, and Stakeholders. The e-learning framework is complex. There are limitations to the human capacity to understand complexity. Experiments by psychologists such as Miller suggest that the maximum number of chunks of information that an individual can simultaneously comprehend is an order of seven, plus or minus two. This channel capacity seems to be related to the capacity of short-term memory. The proposed e-Learning framework can be better explained using UML Modeling. Constructing a model allows the designer to focus on the big picture of how the components of an e-learning system interact. The role of UML is to visualize, specify, construct, and document the artifacts of the proposed software-intensive
system. An e-Learning system can be easily conceptualized by identifying the domain concepts and relations and generate concept map.

1.10.1 DOMAIN MODEL

A typical e-Learning system is represented by the following important concepts: (Student, Teacher, Course Administrator, Course, Content, Topic, Class, Goals, Learning Strategies, Test, Assignment, and Assessment). The e-learning framework can be constructed from these basic elements and UML modeling facilitates viewing the system from different perspectives. Fig. 1.12 depicts a UML Domain Model for the e-Learning Framework under discussion. Using a domain model, one can understand and visualize business concepts and relationships in an e-Learning system easily. It is a static view and it explains the domain concepts and serves as a visual dictionary. It also shows an abstraction of conceptual classes, and how they are related to each other. For example, the concepts Teacher and Content have a semantic relationship that involves connections among their instances. A Teacher designs and creates Content and the Course-Administrator deploys the Content on the web. The student sets goals and prepares schedules for his learning. He goes through the content at his own pace and adopts different learning strategies in learning. The student goes through different phases of the Assignment, Test, Assessment and Feedback cycle. The student monitors his own progress and adopts different strategies to enhance his learning outcome.
**Figure 1.12: UML Domain Model for eLearning Framework**

### 1.10.2 ACTIVITY DIAGRAM

Fig. 1.13 depicts a UML activity diagram which describes the workflow behavior of an e-Learning system. It shows the flow of control from activity to activity in the system.
An activity is some task which needs to be done. For example, some of the typical activities in an e-Learning system include a) Register for a Course, b) Set goals, c) Prepare Learning Schedule and adopt learning strategies.
1.10.3 SEQUENCE DIAGRAM

Fig. 1.14 shows a sequence diagram. It shows how a student is interacting with an e-Learning system. A learner using an e-learning system, registers for a course, sets goals, accesses the content, takes a test, and gets a feedback. In a self-regulated learning system, the learner adopts different strategies to improve upon his learning outcome. The learning cycle is represented as a feedback loop in this diagram and finally, the student completes the course. The control aspects of an e-learning system are better modeled using different UML diagrams.

1.10.4 STATE MACHINE DIAGRAM

A UML State Machine Diagram illustrates the interesting events and states of an object and the behavior of the object in reaction to an event. Fig. 1.15 depicts a UML State Machine Diagram for a Self-Regulated Learner in a typical learning cycle. It shows how a learner’s action triggers him to transition from one state to another. For example, a learner at any moment in time will be in any one of the states like enrolled, self-learning, passed, failed, and certified etc., in his learning cycle. A transition from one state to another state occurs, based on events which are triggering the change. For example, the event of ‘accessing the web content’ by a learner, triggers changing the state of the learner, from enrolled to self-learning, in which the real learning should take place.

Similarly, adopting different learning strategies like self-monitoring, self-evaluation etc. triggers further opportunities for improvement in learning. Finally, a learner transitions to a state ‘certified’ on passing a final examination. Hence, self-regulated learning can be easily modeled using the UML State Machine Diagram for effective control.
In spite of these benefits, there are many challenges and issues, that need to be addressed in e-Learning settings.
The problems faced in e-Learning today that need to be addressed are, lack of face-to-face interactions and student disengagement, shifting of responsibility of learning to the learners, changing faculty roles as facilitators of learning, and lack of effective e-Learning Frameworks. This research work introduces an effective self-regulating e-Learning Framework based on Deming’s Continuous Improvement model that addresses these problems. The main purpose of this research work is to validate the proposed e-Learning framework through experimental evidence by identifying key factors that drive success in e-Learning portals. Various research methods and tools used in this research work are the Sentiment Analysis of Student Feedback, Web Usage Pattern Analysis, Social Network Analysis, and Multi-Faculty Model. The various statistical tools and techniques used are Multivariate Data analysis using IBM SPSS, and IBM AMOS.
1.11 LIMITATIONS AND PRACTICAL IMPLICATIONS

Some of the limitations of this research work are briefed below:

(a) The proposed Framework does not cater to multi-institutional e-Learning portals and additional experiments have to be done to verify and include this feature.

(b) The framework has to be tested for repeatability using other e-Learning portals.

(c) More experiments have to be done to study the effect of various online collaborative tools on learning outcome improvement and student retention in online learning portals.

The practical implications based on the outcomes of this research work are:

(a) This research work guides implementation of e-Learning portals which will improve its effectiveness.

(b) The factors identified in this research work will have an impact on design and development of websites that will improve student retention in e-Learning portals.

(c) Higher educational institutions and stakeholders can develop and host online courses which will satisfy needs of the students and ensure higher learning outcome and successful course completions.

1.12 ORGANIZATION OF CHAPTERS

Chapter 1 presents the transformations taking place in higher education institutions with the introduction of e-Learning and the problems faced in e-Learning today. The chapter highlights the proposed self-regulating e-Learning framework and its experimental validation using the sentiment analysis, web usage pattern analysis, integration of Social Networking, Multi-Faculty approach and Multivariate data analysis. This chapter also discusses the theoretical
foundations needed for an e-Learning Framework using learning theories and UML Modeling. Chapter 2 presents the review of the literature on e-Learning highlighting the state-of-the-art concepts, methods, technologies and existing e-Learning frameworks which are relevant today as observed by e-Learning researchers. It discusses the opportunities and potential as well as major problems needing solutions for making the e-Learning framework more effective. The chapter reviews various approaches and tools that can be integrated into e-Learning settings like the Sentiment Analysis, Web usage pattern analysis, Multivariate data analysis. This chapter reviews the current Social Networking literature in the context of using it in online learning scenarios. Chapter 3 presents the main and specific objectives of this research work. This chapter explains the scope of the problem and its solutions. It presents the proposed self-regulating e-Learning framework and evolution of a multi-faculty model supporting the framework.

Chapter 4 presents the experimental design, development of Questionnaires and Instruments, and the Analytic tools used. The phases of experimental design are SRL Survey, Exploratory Factor Analysis, Sentiment Analysis techniques, and tools used, Web usage pattern analysis, Social Networking survey and Validation of Multi-Faculty Model. Chapter 5 presents the experimental results. Chapter 6 presents the discussion on results. Chapter 7 summarizes the results of the experiments carried out and the conclusions drawn from this research work. Chapter 8 presents the future work to be carried out for exploring further this field of research. Chapter 9 lists the references cited in this thesis report highlighting the views of researchers on the current technologies and trends, challenges and issues as well as research gaps in the field.