Chapter VI

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The last decade witnessed a dramatic increase in technology incorporated into tertiary education to prepare students for the sophistication of the digital economy. Students are heavily immersed in Web 2.0 technologies (i.e. blogs, twitter, podcasts, wikis, social network sites, virtual 3D worlds, video sharing, photo sharing, etc.). The internet is playing an increasingly important role in not only students’ social life, but also academic (Munoz & Towner, 2012). In this changing scenario, it is imperative for the stakeholders in Higher Education to take a re-look at its next generation infrastructure and technology, to enable it to meet and address social, economic and business opportunities. Such technologies confront instructors and administrators at a time of continued budget retrenchments and rethinking. Adding to this dilemma, bored students are dropping out of classes while pleading for richer and more engaging learning experiences. Given the demand for online learning, the plethora of online technologies to incorporate into teaching, the budgetary problems, and the opportunities for innovation, it is argued that learning environments are facing a "perfect e-storm" (Bonk, 2001). Navigating education requires an understanding of the current state and the future direction of ICT in teaching and learning.

Learning Management Systems (LMS) is changing the way students are getting educated nowadays. Emergence of the Internet has facilitated growth of LMS. This new paradigm has become a critical component in the mission of academic institutions, which includes imparting best education to their students, extending the learning process beyond the classroom, improving measurable student success, attracting talented students to the institute and improving its overall image. A LMS is a software package that enables the management and delivery of online content to learners (Coates, 2005). LMS can also be defined as a software application or Web-based technology used
to plan, implement, and assess a specific learning process (Dougiamas & Taylor, 2003). Different systems have different emphasis but common features include content authoring tools, calendars, syllabi, discussion boards and assessment mechanisms (Hall, 2003; Chapman, 2003).

The present research study plans to explore the effect of the use of LMS activities like Chat, Discussion Forum, Assignment, Glossary and Quiz on Engagement, Motivation and Performance.

6.2 Learning Management System (LMS), engagement, motivation and performance

Under this section, the main parameters of the study are explained. This subsection begins with the LMS and the important features of an LMS like Moodle followed by the other parameters involved in the study like engagement, motivation and performance.

6.2.1 Learning Management System (LMS)

LMSs are at the forefront of online technologies making a serious impression on patterns of learning and teaching in higher education (Coates, 2006). According to Schar and Krueger (2000), an LMS must be capable of handling various delivery modes and automate the cumbersome process of learner enrollment, registration, records, transcripts, schedules and reports, and it must incorporate evaluation, assessment and testing capabilities. The most recommended categories of requirements for LMS systems developed for an academic environment is: course content management, evaluation and communication. The requirements in these categories are the most basic functions of an LMS system and useful for handling the content, further improving the course with information from evaluations of existing courses and making the student feel more involved by improving communication (Faxen, 2011).
6.2.1.1 MOODLE

MOODLE is an acronym for Modular Object Oriented Dynamic Learning Environment, it was designed as an LMS to support and promote users interested in developing constructivist, student-centered learning environments. It is based on the constructivist pedagogy (Dougiamas & Taylor, 2003). As an LMS, MOODLE has three main functions: an authoring tool, an administrative tool, and a means of communication (Peter, 2004). A LMS like MOODLE provides collaborative tools like email, chat, discussion forums, virtual classrooms and reflective journaling features that assist students as they construct knowledge. The aim is to create learning environments centered on students as learners and to offer new learning opportunities all at one place.

In a study done by Aydin and Tirkes (2010), Open Source LMSs were analyzed and it was observed that MOODLE among other LMSs, besides having many needed tools, included features that not only improved pedagogical quality, but also scored high with regards to modular design, interface, and authentication issues. The study thus showed that MOODLE-LMS offers a clear advantage over other LMSs. The plethora of Resources/Utilities and Activities that MOODLE-LMS offers along with the embedded cognitive strategies like a feedback feature makes it an LMS that provides students with a learning advantage.

6.2.2 Engagement

Engagement is mental effort focused on learning and it is a precondition to learning progress (Kuh, 2005; Helme & Clarke, 2001). Measures of student engagement inform many aspects of university education. In higher education, engagement has become a catch-all term most commonly used to describe a compendium of behaviors characterizing students (Krause & Coates, 2008). It has even been suggested that student engagement could be used as an indicator of institutional teaching quality (Kuh, 2001). Measuring engagement and its link to learning is challenging and this is especially true when the term engagement is often used in broad terms to describe a range of behaviours that learners exhibit (Bulger, Mayer, Almeroth, & Blau, 2008). Additionally, engagement is the degree to which learners are engaged with their educational activities and that engagement is positively linked to a host of desired outcomes, including high grades, student satisfaction, and
perseverance. This definition implies the use of three interrelated criteria to assess student engagement levels namely:

- **Cognitive**: The extent to which students are attending to and expending mental effort in the learning tasks encountered.
- **Affective**: The extent to which students are making active responses to the learning tasks presented and their emotional reactions.
- **Behavioral**: The level of students’ investment in and their collaborative actions to the learning tasks and also implies their group work (Chapman, 2003).

### 6.2.3 Motivation

In general terms, student motivation refers to “a student’s willingness, need, desire and compulsion to participate in, and be successful in, the learning process” (Keller & Suzuki, 1988). Numerous factors influence student motivation including parental involvement, teacher motivation and skills, and effective use of technology. Learners should be motivated to learn. It does not matter how effective the online materials are, if learners are not motivated, they will not learn. Keller (1983) has developed a motivational design model that is grounded in expectancy-value theory, reinforcement theory and cognitive evaluation theory. These theories are integrated by means of a systems analysis of when and how each explains the relationship among effort, performance and satisfaction. This model contains four categories of motivational variables: attention, relevance, confidence and satisfaction (ARCS). These were derived from a comprehensive review and synthesis of motivational concepts and research studies.

Given below are the four factors (Keller, 1988):

- **Attention**: Capture the learners’ attention at the start of the lesson and maintain it throughout the lesson.
- **Relevance**: Inform learners’ of the importance of the lesson and how taking the lesson could benefit them.
- **Confidence**: Use strategies such as designing for success and informing learners of the lesson expectations.
- **Satisfaction**: Provide feedback on performance and allow learners to apply what they learn in real-life situations.
6.2.4 Performance

Along with expanded access has come a growing pervasiveness of technology in society. For a generation of young people, technology, particularly the Internet, has assumed a substantial stake in their social and educational lives. Test results are regularly used as the measuring stick for student advancement to the next grade and as a gauge for judging the quality of the college and the educators who work in them. Therefore, efforts to integrate technology into college and classroom practices must not only acknowledge but also provide evidence that technology assists in meeting these accountability demands (Margaret, Katherine, & Robert, 2005). The strongest preference noted in a study done by Buzetto-More (2008), was towards the online submission of assignments, with students overwhelmingly noting that they like having the ability to check their assignment grades online. It has been verified that there is a correlation between academic participation, discussion forums, and grade. The data from mining the LMS in a study by Krause and Coates (2008), demonstrates from the high hit count for all courses that that there is involvement in the courses offered.

6.3 Review of Literature

The review of research discussed in the next section, shows that while the link between engagement and achievement may seem obvious, this issue frequently slips through the cracks in discussions about an institutions reform and improvement. As institutions focus on helping all students achieve high standards, however, reaching out to disengaged and discouraged learners becomes increasingly important. Clearly, students who are not motivated to engage in learning are unlikely to succeed. Moodle as a LMS certainly may affect students' level of engagement in learning. Simply recognizing this power is a critical step in motivating students. By further recognizing how a healthy self-esteem is the foundation for success, which in turn fosters motivation and engagement in students, colleges and teachers can see the connections between their practice and student outcomes.
6.3.1 The LMS - Moodle as an ICT tool to aid learning

It is well known that students are more likely to be interested and attentive and will achieve a wider range of learning outcomes if they can be active and learn by doing. Their engagement with the curriculum will increase as they are afforded opportunities to create their own information and represent their own ideas (Paulson & Faust, 2002).

Chee Mew Leng (2006), in his study has put forth that technology-assisted learning experiences provide opportunities for instructors to implement more effective learning paradigms such as students’ engagement and active construction of knowledge. For many institutions across the globe, the Learning Management System, or LMS, is the most significant enterprise system for teaching and learning. The LMS is the means by which course information is distributed to students. Extensive studies on the use of LMS in European countries done by Paulsen, Keegan, Dias, Paulo, Pimenta, Fritsch, Foller, Micincova, and Oslen (2002), present major extensive findings on the growing use of LMS on campuses across Europe. In their paper, Carbone, Mehta, Powers, and Strahl (2005), have defined each of the functional considerations, features of the LMS system and have grouped under the appropriate considerations like ease of use, diverse educational tools, Implement-ability - Administration Tools/Course Delivery Tools, Supportability and Foreign Language Capabilities.

Among the various LMS available in the market we can categorize them into proprietary and open source software. WebCT and Blackboard have been the pioneers in LMS. But like most proprietary software that are costly initially and then also prove to be expensive in the long run (Antonenko, Toy, & Niederhauser, 2005; Itmazi & Megias, 2005; Stewart, Briton, Gismondi, Heller, Kennesohl, McGreal, & Nelson, 2007). Hence moving to an Open Source Software (OSS) LMS seems like a good option. Also the easy to install, use and the wide support that is given by the open source community is another reason why the market for OSS LMS has many takers especially in academics. As an LMS, Moodle has three main functions: an authoring tool, an administrative tool, and a means of communication (Peter, 2004). With Moodle the potential for classroom teachers and special areas is profound. With educational theory as a backbone, unmatched price and host of benefits, Moodle is an excellent choice to add on-line content. Moodle as an ICT tool has many features expected from a learning platform including: Forums, Content managing (resources), Quizzes with different kinds of questions, Blogs, Wikis, Database activities, Surveys, Chat, Glossaries, Peer assessment, Multi-language support (Dougiamas & Taylor, 2003). In their paper,
Patriacheas and Xenos (2010) focus on the student participation research in distance education forums and investigated the reasons that strengthen or discourage participation. The study revealed that the asynchronous capabilities of electronic forums allows for more thought, reflection and processing of information and provides a high level of interactivity, which encourages collaboration and influences the learning process.

6.3.2 Use of LMS to provide an Engaging Environment to Learn

It has been suggested that student engagement could be used as an indicator of institutional teaching quality (Kuh, 2001). Measuring engagement and its link to learning is challenging and this is especially true when the term engagement is often used in broad terms to describe a range of behaviours that learners exhibit (Buiger, Mayer, Almeroth, & Blau, 2008). Academic content, level of interaction, time-on-task is an often-used measure of student engagement. The logic goes that the more time spent on a particular task, the more engaged the student is with that activity. Much of the research on student engagement focuses on students’ need for a connection with an adult in the college community (Ethan, 2006). This can be done in by the teacher who offers the course by uploading resources, quizzes and posting in discussion forums in Moodle.

Independent studies done by Chen, Lambert, and Guidry (2010) and Kuh (2001, 2005, 2007) to investigate student engagement in face-to-face and web-based learning environments show a general positive relationship between the use the learning technology and student engagement and learning outcomes. Overall, the results of these studies point to a positive relationship between Web-based learning technology use and student engagement and desirable learning outcomes. Not only do students who utilize the Web and Internet technologies in their learning tend to score higher in the traditional student engagement measures (e.g. level of academic challenge, active and collaborative learning, student-faculty interaction, and supportive campus environment), they also are more likely to make use of deep approaches of learning like higher order thinking, reflective learning, and integrative learning in their study and they reported higher gains in general education, practical competence, and personal and social development.

Another exploratory case study done by Beer, Clark, and Jones (2010) aimed at analyzing an academics involvement with the Learning Management System, the students involvement with the LMS, and the links between the
LMS, the academic, and the students shows that LMS are, spaces within which social groups are created, and kept cohesive if the units within the LMS are working together. The tools, the academic, the student and the communication and collaboration spaces that the LMS provides altogether help engagement in the learning process.

6.3.3 Use of LMS to provide a Motivating Environment to Learn

Numerous factors influence student motivation including parental involvement, teacher motivation and skills, and effective use of technology. Learners should be motivated to learn. It does not matter how effective the online materials are, if learners are not motivated, they will not learn. The use of technology inside or outside the classroom tends to make the class more interesting. However, certain design issues affect just how interesting the particular tool creates motivation (Traynor, 2003).

In their paper, Wang and Reeves (2006) have identified four motivational determinants namely challenge, curiosity, control and fantasy that can be integrated into a Web-based learning environment. Each of these four strategies (challenge, curiosity, control, and fantasy) can play a role in the instructional design of Web-LEs; they may complement each other in motivating.

Assessment of learners’ motivation in online environments has been a challenge for both researchers and instructors, and the reason for it is twofold: motivation is an important factor affecting the learning process and explaining individual differences, however it is a factor difficult to evaluate without direct contact with the learner. Motivational patterns, in addition to ability, may influence the way people learn: whether they seek or avoid challenges, persist or withdraw upon difficulties, or whether they use and develop their skills effectively. Different motivational patterns relate to different aspects of the learning process, e.g., achievement goals (performance or mastery), time spent on tasks, performance (Hershkovitz & Nachmias, 2008; Singh, Granville, & Dika, 2002). The more students are motivated to learn, the more likely it is that they will be successful in their efforts. In Moodle-LMS there are Resources/Utilities like Calendar, Journal, Email, Chat, and Quiz with feedback providing knowledge of correct responses and this is found to be superior to programs that require students to answer until they are correct. LMS that includes embedded cognitive strategies provides students with a learning advantage. Most of the above mentioned characteristics are offered in Moodle-LMS environment. A study done by
Siirak, (2011) to find out how students appreciate courses provided in Moodle e-learning environment, found that students felt encouraged and motivated to learn more, they felt that participating in Moodle forums and other activities were very useful to learning.

6.3.4 LMS and Academic Performance

Student activity has clearly demonstrated that they are interacting with the LMS and the academic though there were some discrepancies that need to be researched (Krause & Coates, 2008). Discussion forum activity has been demonstrated to be a sound indicator of future student academic performance (Dawson, 2010; Morris, Finnegan, & Wu, 2005) and level of engagement in socio-constructivist pedagogies (Macfadyen & Dawson, 2010; Bakharia & Dawson, 2011). In their paper to examine the impact of students’ usage behavior while using Moodle in the context of a blended learning academic course Filippidi, Tselios, and Komis, (2010) derived that the recorded students’ interaction practices were significantly correlated to the students’ performance.

6.4 Need for the Study

With the expansion of internet and distance technologies, Learning Management System (LMS) has provided an integrated platform for content, delivery and management of learning, as well as accessibility to a range of users, with the LMS acting as the central component of an enterprise e-learning implementation. LMS is changing the way students are getting educated nowadays. The emergence of the Internet has facilitated growth of LMS. This new paradigm has become a critical component in the mission of academic institutions, which includes imparting best education to their students, extending the learning process beyond the classroom, improving measurable student success, attracting talented students to the institute and improving its overall image. LMS offer enhanced student access to learning materials, straightforward integration of digital content and a range of student interaction and tracking services. Different systems have different emphases but common features include content authoring tools, calendars, syllabi, discussion boards and assessment mechanisms (Hall, 2003; Chapman, 2003).
One of the real values of online LMSs is the extent to which they add value to how students’ engage with their study. Institutions need to identify how to maximize the return on their investments by using LMSs to manage the quality of university education setting out to organize the engagement literature and highlight its gaps for future research (Ray, 2007). Online LMSs can play powerful roles in teaching and learning and represent a major investment by higher education. Engagement measures say much about how LMSs can be used to enhance the campus-based student experience (Coates, 2005). Notwithstanding the same, one pressing requirement with regards to LMS is the understanding of how it may be used to enhance overall student engagement in student learning. This is imperative since more the students are motivated to learn; the more likely they will be successful in their efforts; which then gets reflected in their academic performance. Modular Object Oriented Dynamic Learning Environment (MOODLE), which provides collaborative tools like email, chat, discussion forums, virtual classrooms and blog features, is one of the free, open source software package LMSs, designed using sound pedagogical principles to help educators and researchers to create effective online learning communities.

Marshall’s (2002) research highlights the importance of the learner interacting with his or her environment to attain the goal of learning something new. The need for appropriate, effective environments in many shapes, sizes, and forms is inherent. Establishing relevance to the instructional content is the second component of Keller and Suzuki (1998) ARCS model, a system for improving the motivational appeal of instructional materials.

The open source movement has already had a significant impact in the business world (Wheeler, 2003), and is now drawing the attention of educators around the globe. Current advances in open source online learning environments are a response to the shortcomings of commercial products like WebCT and Blackboard (Young, 2002). With commercial products one can only include elements that the software designers deemed necessary when they developed the program. Open source opens almost limitless capabilities for the user to customize the application by choosing from a variety of options for e-mail, discussion boards, chat, online quizzes, and the other entire elements one might want to include (Dougiamas & Taylor, 2003). A comprehensive LMS like Moodle will not only facilitate learners’ needs in his/her pre-learning, during learning and post learning stage but also offer him/her an enjoyable and satisfying learning experience. This time-tested technology, thus, successfully offers unique, personalized and enriching learning experience to every individual learner, auditory or visual he/she may be, at every stage of his/her learning. Keeping in mind this background knowledge and the researcher’s own experience as a teacher educator; the
researcher felt a need to explore the effectiveness of LMS- Moodle on student engagement, motivation and performance in Higher Education.

6.5 Statement of the Problem

The problem is stated as below:
“A Study of Effectiveness of Learning Management System on Student Engagement, Motivation and Performance in Higher Education”.

6.6 Operational Definitions

The operational definitions of the terms are as follows:

(a) Student Engagement: Participation in the learning activities offered as part of the UG-college program through LMS-Moodle. The three levels of engagement dealt will be the following: cognitive, behavioral and affective.

(b) Motivation: The four conditions proposed by Keller John namely ARCS-Attention, Relevance, Confidence and Satisfaction.

(c) Performance: The academic scores/marks obtained by the student for the intra-semester internal assessment in a particular subject.

(d) Learning Management System (LMS): LMS is a software application that provides an integrated platform for content, delivery, and management of learning, as well as accessibility by a range of users that may include learners, content creators, and administrators Typically, a LMS provides an instructor with a way to create and deliver content, monitor student participation, and assess student performance. Moodle (acronym for Modular Object-Oriented Dynamic Learning Environment) is an LMS that provides an authoring tool, an administrative tool, and a means of communication and interaction, thus providing for an active learning environment.
6.7 Objectives of the Study

The purpose of this study besides trying to find the effectiveness of an LMS like Moodle on student engagement, motivation and academic performance, was also to examine the kind of learning and the interactions that students have in the LMS w.r.t. usage of time spent in interactions and quality of interactions with the LMS features like Chat, Discussion Forum, Glossary, Assignment and Quiz. The present study was conducted keeping in view the following objectives:

1. To study the Effectiveness of LMS for student engagement, motivation and performance.
2. To study the effectiveness of the extent of use of LMS features on student Engagement, Motivation and Academic Performance in the Experimental Group.
3. To find out the relationship between amount of time spent in LMS on student engagement.
4. To find out the relationship between amount of time spent in LMS on student motivation.
5. To find out the relationship between amount of time spent in LMS on student performance.
6. To find out the relationship between the quality of student interaction taking place through LMS and engagement.
7. To find out the relationship between the quality of student interaction taking place through LMS and motivation.
8. To find out the relationship between the quality of student interaction taking place through LMS and performance.
9. To study the type of learning (Synchronous / Asynchronous) taking place through LMS-Moodle in students of the experimental group.

6.8 Hypotheses

The following null and alternative hypotheses were set for the present study:

(a) \( H_0 \): There will be no significant difference between post-test scores of engagement, motivation and performance of the learners in the experimental and control groups.
H₁: There will be a significant difference between post-test scores of engagement, motivation and performance of the learners in the experimental and control groups.

(b) H₀: There will be no significant difference between post-test scores of engagement, motivation and performance of high users and low users (of the experimental group) w.r.t time spent on LMS-Moodle.

H₂: There will be a significant difference between post-test scores of engagement, motivation and performance of high users and low users (of the experimental group) w.r.t time spent on LMS-Moodle.

(c) H₀: There will be no significant difference between post-test scores of engagement and motivation of high achievers and low achievers (of the experimental group) w.r.t post-test and evaluation rubric.

H₃: There will be a significant difference between post-test scores of engagement and motivation of high achievers and low achievers (of the experimental group) w.r.t post-test and evaluation rubric.

6.9 Scope and Limitations

The study is confined only to non-professional undergraduate students studying in colleges affiliated to the Goa University. The Moodle version 1.9 was used for the current study. The study is confined to the use of some LMS features like Chat, Forum, Glossary, Assignment and Quiz. The sample selected for this study consisted of students enrolled in the sixth semester, B.Sc. Computer Science, Undergraduate degree programme offered by Goa University.

6.10 Methodology

Since the present study aims at studying the effectiveness of LMS-Moodle on Student Engagement, Motivation and Performance, the Experimental method being the most suitable has been selected. The Research Design used for this study was the ‘Experimental method’ with ‘post-test only’ design; it will help to fulfill the objectives of the study.
6.10.1 Variables

In Experimentation, the researcher manipulates the Independent Variable and controls all other Extraneous Variables to determine if such manipulation generates changes in the dependent Variables.

6.10.1.1 Independent Variables

In the present study, the independent variable is the LMS Moodle. This comprises of the amount of time spent in LMS Moodle and the quality of interaction taking place through the various features offered by the LMS Moodle like Chat, Forum, Glossary, Assignment and Quiz.

6.10.1.2 Dependent Variables

The dependent variables in the present study are:
   a) Engagement
   b) Motivation
   c) Academic Performance

6.10.1.3 Intervening Variables

Intervening Variables were controlled in the following ways: The two colleges selected for the study were affiliated to the Goa University and accredited by NAAC with the same grade. Before the commencement of the treatment, the students in the experimental and control group were equated on the basis of marks obtained at the Std. XII examination and there was no significant difference found between scores obtained in the two groups. By sharing and following a common session plan between the teachers (having similar qualifications and with similar years of experience), the researcher tried to ensure that the experiment was conducted during the same period in both colleges.
6.10.2 Sample

The number of students in the experimental and control group were 13 each respectively. They were enrolled in a compulsory course titled Software Engineering during the last (sixth) semester (in a six semester B.Sc. Computer Science, Undergraduate degree programme offered by Goa University) for the academic year 2012–2013. There are a limited number of seats (20 only) for this course and admission is done on first cum first serve basis. During the initial months of course commencement, some students leave the course to pursue professional degrees. Hence, when the experiment was conducted there were only 13 students each left in the two groups. The total size of sample selected for the final study was 26 (all students i.e. the entire population admitted to the class were part of the study). In the experimental group there were 4 boys and 9 girls and in the control group there were 6 boys and 7 girls.

6.10.2.1 Sample Selection

The samples for the present study are students of two Under Graduate colleges affiliated to the Goa University. The two colleges randomly selected are affiliated to Goa University and accredited by NAAC with an A grade. There was a considerable distance between the two colleges, with one college located in the North of Goa and the other in the South of Goa (approximately 40 kms). Hence the question of students from both groups sharing experiences with each other was taken care of. One of the colleges represents the experimental group and the other represents the control group. Both groups were taught the course in the conventional environment, with the only difference being students from the experimental group having access to MOODLE-LMS.

6.10.3 Selection of Topic

A regular term paper (in this case Software Engineering) that was offered to students in both the colleges was selected for the purpose of this study. A semester consists of 60 lectures with each lecture being of 45 minutes duration. The treatment was administered for around two months with approximately 25 lectures. Two modules were selected from the syllabus. The
weightage of the syllabus for these topics was 40% i.e. 30 marks out of the total 75 marks. Prior to the commencement of the treatment, the students from the experimental group were exposed to some basic activities and tools of MOODLE through a one week training programme.

6.10.4 Tools

Following tools were used in the study:

a. Scales (Likert type rating scale) on ‘Engagement’ and ‘Motivation’ and a ‘Performance’ test.

b. ‘Evaluation Rubric’ to evaluate extent of use of LMS features and activities.

6.10.4.1 Development of tools

The investigator prepared the scales for engagement and motivation and a test to measure academic performance scores. The investigator used a scoring method similar to that of a rating scale wherein each of the option occupies a pre-established position on the range and accordingly the total score for each student is calculated. The investigator developed the following tools for this study:

- **Engagement Scale:**
  The Engagement Scale was developed for this study by the researcher using a four-point rating scale with 21 different items with an objective to study the cognitive, affective and behavioral aspects of engagement.

- **Motivation Scale:**
  The Motivation Scale was developed by suitably modifying and adapting the motivation scale (ARCS Model) developed by John Keller to this study. The tool was developed using a five-point rating scale with 24 items with an objective to study the attention, relevance, confidence and satisfaction aspects of motivation.

- **Performance Test:**
  The Performance Test was an achievement test with a maximum score of 25 marks. Once the learning objectives were finalized, the blue-print was prepared covering all levels of Bloom’s Taxonomy. The weightage was decided as per the level of objectives. 16% weightage was given to
Remembering, 36% to Understanding, 20% to Application, 16% to Analysis and 12% to Evaluation level objectives. Items at these levels were prepared on all the content-points of the modules that were covered during the treatment period.

- **Evaluation Rubric:**
  The Evaluation Rubric (denoted as ER), for the experimental group was constructed keeping in mind the objectives of the study with an additional focus being to understand the quality of interactions that was taking place through the various activities and resources that the LMS Moodle offers. An attempt was made to know a student’s willingness, need, desire and compulsion to participate in, and be successful in the learning process by offering the student various LMS features which in turn are expected to affect their engagement, motivation and performance. The Rubric was designed and all parameters were well defined to assess five features of the LMS namely Chat, Discussion Forum, Glossary, Assignment and Quiz. The range is from Excellent, Good, Average to Poor. The possible scores range from 1/0 to 4/3 being the highest and best possible score per section, giving a grand total score of points. The Chat feature was evaluated for the parameters of participation, focus and knowledge. The Discussion Forum had three main components namely Quality of Posting, Knowledge Construction and Participation in Forum. Each of these components was again subdivided into smaller sections. The Glossary has two components Participation and the Correctness of meaning of words. The Assignment had Completeness, Understanding, Writing Mechanics and Bibliography as its criteria and the Quiz had Participation and Quality/Performance as its evaluation criteria.

6.10.4.2 Tool Validation by Experts

Once the engagement, motivation scales and performance test were ready, they were given for detail content validity to five experts in the field of Computer Science and Education. The suggestions with respect to scales and corrections with respect to statements were considered and necessary changes were made and incorporated in the engagement and motivation scales. The blue-print was also modified to include the suggestions made by the experts. Thus the content validity for the tools was established before administering them as post-tests to both the groups.
6.10.4.3 Statistical Techniques

Data analysis was done using Mean, Standard Deviation. Analysis of variance i.e. ANOVA (F-ratio) and t-ratio were used to test the null hypothesis and also to test the significance of the difference between the means of the two groups i.e. the post-test of experimental and control groups. The whole data was analyzed on the computer through SPSS-package v 16, to maintain the accuracy of the calculations.

6.11 Conducting the experiment

A common session-wise plan on the topics and learning outcomes of sessions was shared and followed between the control group and experimental group. The treatment for the experimental group comprised of resources and activities made available to the participants through MOODLE-LMS. The teacher in the treatment group made available e-content and resources like presentations and website links to the participants; Activities related to their coursework like Assignments (for submitting), Forums (for interaction among the participants even after the class and participating/sharing views on topics/content related to the module), Quiz (to test the extent of learning), Chat sessions (to discuss topics and difficulties), etc were all made available through MOODLE-LMS. The participants were encouraged to build a Glossary for the modules. All the activities were related to the topics covered in the modules. The participants were expected to access and participate in all the activities that the teacher made available to them via the MOODLE-LMS from time-to-time. At all times, for all their activities in MOODLE-LMS, the participants were able to regulate their time-on-task between the start of the task and the deadlines (if any) for submission of these, as these were displayed in their work area, through the Calendar utility provided in MOODLE.

6.12 Analysis and Interpretation of select data

The total number of students in the study was 26 (all students admitted to the class were part of the study). The number of students in the experimental and control group were 13 each respectively. They were equated on the basis of scores obtained at standard XII examination.
6.12.1 Engagement, Motivation and Academic Performance of students in the two groups

In order to test the hypothesis regarding significance of the difference between post-test scores of the learners in the experimental group and control group, the t-ratio was computed. The table 5.2 in chapter V under section 5.2 presents the relevant statistics. This table shows that there is a significant difference between the engagement, motivation and academic performance scores of the experimental group and control group. It can be stated that the use of LMS-Moodle significantly helps the experimental group students in engagement, motivation and academic performance. Therefore the null hypothesis that there will be no significant difference between post-test scores of engagement, motivation and performance of the learners in the experimental and control groups is rejected.

6.12.2 Effectiveness of the extent of use of LMS features on Engagement, Motivation and Academic Performance in the Experimental Group

The result from the table 5.2 indicates that the LMS-Moodle plays a significant role in engagement, motivation and academic performance of students in the experimental group. Therefore there is a need to study, what features available in the LMS are responsible for affecting these three parameters. The table 5.3 in chapter V under section 5.3 presents the relevant statistics. The results of the correlation between LMS features like Chat, Forum, Glossary, etc. used vis-à-vis Engagement, Motivation and Academic Performance in the Experimental Group shows that there is a correlation between overall LMS features and student engagement, motivation and academic performance. There is a positive relationship between features like Chat, Forum, Assignment, Quiz and student academic performance. There is also a positive relationship between features like Forum, Assignment, Quiz and student motivation. However, Table 5.3 also indicates that among all the mentioned features it is the Forum and Assignment that are very significant to all three parameters namely Engagement, Motivation and Academic Performance. This calls for a more detailed and in depth analysis on the use of these activities by the students in the experimental group. A more detailed analysis of the contribution of Forum and Assignment through the evaluation rubric has reported that all the features of Forum have been used very significantly by the students and hence there is a co-relation with Academic Performance. This
indicates that the use of forums by the students does have a significant relationship with their academic performance. A significant co-efficient of correlation has also been reported for Academic Performance. This indicates that the use of the assignment feature will affect academic performance significantly.

6.12.3 Comparative Analysis of Engagement, Motivation and Academic Performance of Learners in the Experimental Group

In an attempt to study the effect that the nature/type of interaction that the students in the experimental group have with the LMS-Moodle on their engagement, motivation and academic performance, the students have been classified into two major groups based on analysis of Table 5.3. The first Grouping has been done on the basis of (average) time spent per day on Moodle-LMS (Table 5.9 in chapter V under section 5.4.1). The students from the experimental group have been grouped as ‘high users’ (A+) and ‘low users’ (A-). The classification and detailed analysis of this grouping is discussed in Section 6.12.4 below in this chapter.

The second Grouping has been done on the basis of extent of LMS-features used. From Table 5.3 it was found that the type of interaction taking place through the LMS plays a very significant role on Engagement, Motivation and Academic performance of students in the experimental group. Hence the experimental group students have been grouped as ‘high ER scorers’ and ‘low ER scorers’; based on the average scores obtained in the ER.

However, the Table 5.3 also shows a positive correlation between academic performance and ER of students in the experimental group. This significant co-relation can be attributed to the use of activities and resources available in LMS-Moodle by the experimental group. Hence, they were grouped as ‘high AP scorers’ and ‘low AP scorers’; based on the average scores obtained at the post-test on academic performance.

When this grouping was completed, however, it was found that those students who had been grouped as ‘high AP scorers’ in this group were the same students who obtained ‘high ER scores’ and the ‘low AP scorers’ in this group were the same students who obtained ‘low ER scores’.

This result is acceptable because from Table 5.3 we have seen that ER and AP have very significant relationship with $r= 0.913$ (significant at 0.01 level). Hence, in view of this (ER score and post-test score in academic performance) the experimental group has been grouped as ‘high achievers’ (B+) and ‘low
achieves’ (B-); based on average of scores obtained in the ER and academic performance post-test. The classification and detailed analysis of this grouping is discussed below in Section 6.12.8 this chapter below.

### 6.12.4 Classification based on Time Spent on Moodle-LMS

The Moodle logs for the duration of the treatment were studied and the average time (minutes per day) spent by the students was calculated from the course logs. The overall average time spent by students in the experimental group was calculated and found to be 8.02 min/day (see Table 5.8 in chapter V under section 5.4.1). All the students from the Experimental group were grouped on the basis of their average time spent on Moodle-LMS. This group is called Group A and is categorized further as A+ and A-. The A+ are high users who have spent more than average time on Moodle-LMS and the A- are low users who have spent less than average time on Moodle-LMS.

### 6.12.5 Testing significance of the post-test scores of Engagement, Motivation and Performance of the High and Low users

In order to test the hypothesis regarding significance of the difference between Post-test scores of the learners spending more than average time (high users) and less than average time (low users) in Moodle-LMS, the analysis of variance (ANOVA) was employed. Table 5.10 in chapter V under section 5.4.1.1 presents the statistics related to the post-test. The Table 5.10 shows that there is no significant difference in the engagement, motivation, academic performance and ER scores of the students in Group A+ and A- which means that both these groups are benefitting from Moodle-LMS. It can be concluded that students are engaged, motivated and perform better irrespective of the amount of time they spent on the LMS as shown above.

In other words it is the activity time spent in the LMS-Moodle that is a significant contributory factor to their engagement, motivation and academic performance. Since the F-ratio for the difference between the means of the post-tests of both the groups is not significant at 0.05 level, therefore the null hypothesis that there will be a no significant difference between post-test scores of engagement, motivation and performance of high users and low users (of the experimental group) w.r.t time spent on LMS-Moodle is accepted.
To confirm that amount of time per se is not important as shown above, from another viewpoint, if one takes only the low users (in terms of time) of the experimental group i.e. the A- group and compares the effect of engagement, motivation and academic performance of this group with the control group students, as shown in Table 5.11 in chapter V under section 5.4.1.2, the academic performance of the A- experimental group is still significant at the 0.01 level. This shows that LMS-Moodle does play a critical factor (though not significantly in terms of time but in terms of features used i.e activity time spent on contributing to Forums, Assignments, etc).

6.12.6 Comparison of Experimental group and Control Group

A comparison of the effect of Engagement, Management and Academic Performance on Group A- of the Experimental group and the entire Control group shows that it is not the time that is of essence for any significant change/improvement in Engagement, Motivation and Academic Performance, but it is more of the nature/manner/interaction of LMS feature used by students in the A- group that contributes towards their significant improvement in academic performance (over the control group of non-LMS users).

6.12.7 Type of Learning taking place in Experimental Group i.e. A+ and A- users

The Table 5.10 in chapter V under section 5.4.1.2 shows that LMS-Moodle does contribute to learning but not to a sufficient degree. Hence there is a need to analyze what kind and type of learning is taking place through LMS-Moodle. This can be analyzed in two approaches.

Firstly, an analysis was done on the effectiveness of Moodle usage w.r.t all the features that are provided by the LMS-Moodle (discussed in Table 5.12 in chapter V under section 5.4.1.3). The analysis of the learning taking place through scores obtained by A+ and A- users on the LMS features that they use from this table shows that other than Glossary there is no significant difference in the ER scores obtained vis-à-vis different features used in Moodle-LMS by both the groups. This is indicative that irrespective of time spent the ER scores are not significantly different for the two categories i.e A+ and A- users. The different features of Moodle-LMS thus assist significantly the experimental group irrespective of time spent.
In the second approach it was decided to understand learning taking place through the modes (Synchronous and Asynchronous) available in the LMS-Moodle (discussed in Table 5.13 in chapter V under section 5.4.1.4). Moodle-LMS offers various modes of learning through the various activities that are available. In this section, the mode of learning that students in Group A engage in is discussed. The learning modes in Moodle-LMS are classified as Synchronous (taking place through Chat activity, referred as MS); Asynchronous (taking place through Forum and Glossary, referred as MA) and the Evaluation/Assessment (through Assignment and Quiz referred to as ME). These aspects are analyzed in Table 5.13. The analysis of variance of the modes of learning taking place among the A+ and A- users from Table 5.13 shows that amount of time spent on LMS-Moodle does not have any significant bearing on the mode of learning taking place through LMS-Moodle among both the groups. In other words it is the nature of the interaction in Moodle-LMS that is making the difference to engagement, motivation and academic performance.

6.12.8 Classification based on scores obtained in ER and post-test in Academic Performance

The discussions from the previous sections indicate that it is the nature of the interaction in Moodle-LMS that is making the difference to engagement, motivation and academic performance. Hence in order to examine this aspect in more detail, the students from the Experimental group were classified, based on scores obtained in the evaluation rubric. The classification is discussed in chapter V under section 5.4.2 and the table 5.14 presents relevant information related to this grouping. The classification of users in the Experimental group, presented in this table is based on scores obtained in the academic performance post-test. The B+ have above average scores and B- have below average scores in the post-test. Therefore for further discussion purpose B+ and B- are the same students classified on the basis of scores obtained in ER and scores obtained in the post-test of academic performance. They will be called as 'high achievers’ (B+) and 'low achievers’ (B-).
6.12.9 Testing significance of the post-test scores of engagement, motivation and performance of the High achievers and Low achievers

In order to test the hypothesis regarding difference between post-test scores of engagement and motivation of high scorers and low scorers (of the experimental group) w.r.t marks obtained at post-test on performance and scores obtained in the evaluation rubric the analysis of variance (ANOVA) was employed. The Table 5.2 in chapter V under section 5.4.2.1 presents the statistics related to the post-test for B group. The analysis of variance of Engagement, Motivation among Group B users from this table shows that there is no significant difference in the engagement, motivation, academic performance and ER scores of the students in Group B+ and B-which means that both these groups are benefitting from Moodle-LMS. It can be concluded that students are engaged, motivated and perform better irrespective of the amount of time they spent on the LMS as shown above. Since the F-ratio for the difference between the means of the post-tests of both the groups is not significant at 0.05 level, therefore the null hypothesis that there will be no significant difference between post-test scores of engagement and motivation of high scorers and low scorers (of the experimental group) w.r.t post-test and evaluation rubric is accepted.

6.12.10 Type of Learning taking place in Experimental Group i.e. B+ and B- users

To analyze the learning taking place through LMS-Moodle using the two approaches namely (the usage of LMS features and type of learning ) discussed earlier, the t-ratio was computed for each pair of achievers separately for High and Low achievers. The Tables 5.16 and 5.17 in chapter V under section 5.4.2.2 present the relevant statistics.

The analysis of the learning taking place through scores obtained by B+ and B- users on the LMS features that they use and also the time spent by the B group users from Table 5.16 shows that Discussion Forum is an important activity in the LMS-Moodle that does contribute significantly to higher academic performance of B+ users. The other features like Chat, Assignment and Quiz also help significantly towards better academic performance in the B+ group. The time analysis from this table has been also found to be not significant, and this indicates that irrespective of the amount of time they
spend in Moodle-LMS, it is what they do in Moodle-LMS during this period i.e. the quality of interaction that makes a significant difference to their academic performance.

The mode of learning in Group B is analyzed in Table 5.17. The analysis of variance of the modes of learning taking place among the B+ and B- users from this table shows that the B+ group perform well as they are showing more interactions in the Asynchronous mode and take more of Quiz’s and Assignments. This is an important factor that helps them perform better academically. The Synchronous activity like Chat also benefits the B+ group academically.

### 6.13 Results and Conclusions of the study

The current study has established that there is a significant difference between the Engagement, Motivation and Performance levels between students of the experimental group and control group (Table 5.2 in Chapter V). The present study sought to explore the effectiveness of LMS on student engagement, motivation and performance by comparing students who have access to LMS Moodle with those students who did not have access to LMS Moodle. The results from the study have demonstrated gains for treatment groups on key facets of student learning i.e. engagement, motivation and performance over the course of the interventions. Taken together, these findings hold practical implications for stakeholders in Higher Education who are seeking to evaluate the effectiveness of an LMS like Moodle to enhance students’ academic motivation and engagement. These findings, as well have implications for researchers seeking to assess the impact of LMS Moodle on academic outcomes.

The study has reported a significant correlation between overall LMS features and student engagement, motivation and academic performance (Table 5.3 in Chapter V). This positive correlation between the use of technology and measures of engagement found in this study are not surprising because it replicates previous studies wherein student engagement in educationally purposeful activities is positively related to academic outcomes (Hu & Kuh, 2001; Kuh & Hu, 2001; Nelson Laird & Kuh, 2005). This study demonstrates that this positive correlation is persisting even as new technologies like LMS are being introduced and students are entering college with increasingly sophisticated uses for technology and expectations of technology in their lives and on campus. There is a positive relationship between features like Chat,
Forum, Assignment, Quiz and student academic performance. There is also a positive relationship between features like Forum, Assignment, Quiz and student motivation. In the Experimental group, of all the activities that the Moodle-LMS provides, the Discussion Forum and Assignment activities report a significant degree of co-relation on all three parameters namely Engagement, Motivation and Academic Performance. This shows that Forums and Assignment are important features of LMS-Moodle.

For students to reap the benefits of engagement, argues Bensimon (2009), they "Must invest time and effort into academic activities and practices ... that correlate highly with positive educational outcomes". This current study has found that the time spent in LMS-Moodle does not have a significant relation with Engagement, Motivation and Academic Performance (Table 5.11 in Chapter V under section 5.4.1.2). This implies that amount of time spent in Moodle, may not be an important factor but what they do in that time i.e. quality of time spent on the LMS is what is helping the experimental group to get engaged, motivated and perform better. The logic is explained by Kuh (2003), wherein he states that "The more students study a subject, the more they learn about it. Likewise, the more students practice and get feedback on their writing, analyzing, or problem solving, the more adept they become".

An exploratory case study on an initial exploration of the potential of LMS done by Beer, Clark, and Jones, (2010) aimed at analyzing an academics and students involvement with the LMS have suggested that the tools, the academic, the student and the communication and collaboration spaces that the LMS provides altogether need to be investigated. The current study has delved into this aspect and has revealed that when the Experimental group was classified based on the scores obtained in ER and academic performance, it was found that the LMS features like Chat, Discussion Forum and Assignment showed a significant difference w.r.t scores obtained in the academic performance post-test and Evaluation Rubric (Table 5.10 in Chapter V). This implies that these features of the LMS act as contributory factors that help students in the learning process and hence perform academically better. Coates (2005) outlines the necessary conditions from students for the realization of the benefits of engagement. He states that "Students also need to interact with these [optimal] conditions and activities in ways that will lead to productive learning. Students need to expend a certain 'quality of effort'..., to challenge themselves to learn, to interact with new ideas and practices and to practice the communication, organizational and reflective skills that should help them learn and will form an important part of what they take from university education".
Based on increasing requirements for universities to assess their efforts in improving student engagement, this study has suggested a broad definition for engagement that aligns with an established model of educational effectiveness in undergraduate education. It showed that measuring engagement is difficult and that learning environments affect the ways that students engage in their learning. Online learning environments are becoming increasingly common with LMS at the forefront of educational technologies used for online course delivery.

This study has explored student learning using parameters like engagement, motivation and performance captured by LMS that can potentially be used by the Higher Educational Institutions’ for measuring, informing and improving student engagement, motivation and performance. Variables such as time and quality of interaction; LMS features used by students were identified as factors that influence student engagement, motivation and performance and were further identified as factors that require further research before their influence on these three parameters can be fully understood. This study into LMS has shown that while universities are not significantly utilizing captured LMS data to make informed decisions, it has the potential to become an additional resource that can be used to inform and improve students’ engagement, motivation and performance.

Overall, the results of this study point to a positive relationship between Web-based learning technologies used i.e. the LMS-Moodle and student engagement, motivation and desirable learning outcomes. This is imperative since more the students are motivated to learn; the more likely they will be successful in their efforts; which then gets reflected in their academic performance. Not only do students who utilize the LMS in their learning tend to score higher in the traditional student engagement measures (e.g. level of academic challenge, active and collaborative learning and student-faculty interaction), they also are more likely to make use of deep approaches of learning like higher order thinking, reflective learning, and integrative learning in their study and they reported higher gains in general education, practical competence, and personal and social development. Learning in an environment like the MOODLE which is an open source LMS that provides collaborative tools like email, chat, discussion forums, virtual classrooms and blog features, all available free will definitely help educators and researchers to create effective online learning communities. These results are encouraging signs that Internet and Web-based learning technologies continue to have a positive impact on student learning in higher education.
6.14 Suggestions

This study has found a significant difference in the engagement, motivation and academic performance of students using the LMS Moodle. It has also reported that the LMS features especially like Forum, Assignment, Chat and Quiz have a positive relationship with students engagement, motivation and academic performance. Hence, the implication of this work is that efforts must be made to encourage more student interaction with their respective courses in conjunction with encouraging students to adopt a deep approach to their learning. It is suggested that this may be achieved through tutorials, interesting and lecture-linked LMS activities, interactions and sessions and through continuous and suitable assessment methods available in the LMS. The LMS initiative can be currently developed for use as a continuous assessment tool as well as a support for student learning. The links between student approaches and individual patterns of access to Moodle are being investigated and will be reported on in the future.

Student engagement data from the LMS can be presented to students for informational and motivational reasons. If students can be shown the degree of effort required to pass a particular course matched with an indication of their effort till date, it may lead to enhanced effort by the student. This concept is currently being trialed at Purdue University and has reportedly led to a significant increase in student engagement in course where the effort tracking system is in effect (Purdue University, 2009). This is one example of the use of real-time LMS data but it can also be useful over long periods of time. Academic analytics data can provide information that can show teachers how students are using the system and also longitudinal LMS data allows the teacher to visualize student behaviors over time. This can show the influence of changes to the course and the influence specific LMS features have against student engagement. This can potentially provide teaching staff with a new tool through which they can reflect upon their practices and see the effect their practices are having on student engagement and accordingly take measures to improve student engagement in the subject.

The LMS offers a variety of features that are conducive to teacher-student teaching-learning. There is therefore a need to train both the teachers and students in the basic usage of LMS features so that they will be able to manage, participate and use the activities and resources offered by the LMS and thus manage the teaching-learning process and also harness the potential of a collaborative learning that the LMS environment offers. Having an access
to the internet is also an important factor that is conducive to learning with the LMS so that it enables anytime anywhere teaching-learning.

The findings from this study, can be used as an initial exploration to conclude that if MOODLE-LMS does contribute positively towards improving the outcomes in a classroom-like situation (involving students who made use of basic activities under MOODLE), it could likewise be an efficient as well as cost-effective option vis-à-vis higher education through Open Distance Learning (ODL) in a developing country like India with scarcity of infrastructure and trained faculty, and high drop-out rates contributed by factors like long distances, high cost in terms of fees, need for seeking remunerative employment at an earlier age etc. The General Enrollment Ratio (GER) pertaining to higher education in India is currently about 15 percent (Suneja, 2012). Thus, besides improving education directly through enhancement of academic performance, motivation and engagement, MOODLE-LMS could facilitate the expansion of higher education sector itself, by providing access and effective learning opportunities for those deprived from higher education in India. The fact that MOODLE-LMS has no geographical barriers and can be accessed anytime, anywhere, and with faculty not being required to be in one geographical location, makes it all the more valuable for students as well as for the government (as service provider). Due to the fast improvements of distance-learning, the use of open source software provides development of learning tools and educational quality. Also, cost, which is the biggest advantage of e-learning rather than traditional learning environments, is removed by the use of open source e-learning tools (Aydin & Tirkes, 2010). Additionally, MOODLE-LMS besides passing the benefits of higher education to a larger number of individuals can provide better inputs to students through the contribution of expert faculties from even across the world, at no additional cost to students, thereby further enhancing quality education.

6.15 Recommendations for further research

Regardless of the élan of digital learning technologies, whatever be the LMS and digital platform selections, there is a need to know how to use and transform knowledge to consider what constitutes desirable designs for e-learning and e-teaching (Al-Mahmood, 2012). In commercialized LMS platforms, uniformity and standardizations of formalised traditional academe dominate. Whilst we need standards, we also need flexibilities so we do not merely replicate sameness, but embrace, innovations, diversities, and
differences. We need counter-narratives beyond the studies by large multinational digital knowledge companies that have a vested interest in presenting their products enthusiastically; rather, we might seriously consider student expectations from LMSs and their e-lecturers (Steel 2007) to inform design. We need to experiment with how to create sustainable learning/knowledge spaces, keeping these issues alive on our research agendas (Ellis & Goodyear, 2010; Riddle & Howell, 2008). These are questions and issues that need to be raised and addressed for system and policy planners, e-learning and e-teaching designers, and education practitioners. We need to renegotiate — in all sorts of ways and with all sorts of things such as the LMSs — how we go about learning and living. In any educational planning, there is always uncertainty (Ellis & Goodyear, 2010), but if we have at our base a willingness towards sustainable and ecological design then we can find ways to explore and evolve beyond purely market driven technologies towards innovative pedagogical designs that have at their heart user-choice, universal accessibility, and flexibility. To consider a possible e-learning futures, we need to take heed ultimately, of what points out that —The choice is not technology versus no technology, but a wider determination of the concepts and the values that higher education should embody.

The last section of the thesis tries to highlight and implicate research areas on the promises and realities that offer tremendous potential for a sustainable future of using LMS effectively in Higher Education, on the basis of the contributions of the results and conclusions of this study. This section begins by drawing attention to the need for conducting research using a quantitative framework to examine in detail the different student cohorts followed by a discussion on how to create sustainable learning/knowledge space. It then goes on to highlight the need to look into the concerns at the institutional level and teacher perspectives. This section also takes a look at the new entrants into e-learning namely MOOCs. The section concludes by giving recommendations for the developers of Moodle LMS.

6.15.1 Learning analytics

The range of factors that can influence student engagement, motivation and performance within an LMS is vast and contains complex interplays between the factors. While these factors prevent academic analytics becoming a panacea for informing and improving student engagement in online education, it can be a useful indicator of engagement and uses data that is already being captured by existing systems. The following are some examples of how
academic analytics can be used, and might be used, to inform and improve online student engagement.

The LMS capture a lot of data that can be of value in mapping student learning parameters and predicting those at risk, hence paving the way for research into learning analytics of an LMS. The shift to web based e-learning has made it possible to collect a wider range of data from large number of learners. With such large student numbers there is a statistical basis for confidently flagging problem questions and identifying students lagging in progress or achievement. There is also a sustainable business model to support the backend computer systems and analytics development. Such marking systems can issue daily reports to instructors and administrators to make them aware of individuals in need of extra tutoring or counseling. Most LMS contain an asynchronous forum – a text discussion where participants engage in online seminars about assigned topics. Such extended chat sessions leave traces that can be used to analyze the transactions. Each posting is part of a response pattern of who talks to who, who provides high-value messages responded to by many, and who provides low-value messages. By mining this data, the tacit social structure of the class can be quickly visualized using open source tools such as Snapp (Bakharia, 2010). Snapp portrays learners as nodes, linked by lines representing the number of interactions between them.

Nowadays studies (Elias, 2011) have been initiated that suggest that higher education institutions could harness the predictive power of LMS data to develop reporting tools that identify at-risk students and allow for more timely pedagogical interventions. Pedagogically meaningful information can be extracted from LMS-generated student tracking data (popularly known and stored as logs). These logs contain a very important feedback on the usage of LMS by users of the LMS. Findings from such huge repositories can generate a customizable dashboard like reporting tool for educators that will extract and visualize real-time data on student engagement and likelihood of success. For example clicking on a student in the LMS we can generate a time slice for each student that shows the amount of time (duration) spent over an entire course in the LMS, the interactions with the various LMS features, etc.

In the rapidly evolving context of higher education, the availability of a customizable reporting tool that extracts and visualizes real-time data on student engagement and likelihood of success indicating which students are on track and which may need additional help will be an invaluable resource for all contemporary educators. This is particularly true with respect to distance education in which a much higher proportion of interactions are computer-
mediated. For example, the amount of time reading content online can be easily captured by an LMS. When, why and with whom learners are connecting is also logged in discussion forums and social networking sites. Recently, interest in how this data can be used to improve teaching and learning has also seen unprecedented growth and the emergence of the field of learning analytics. In other fields, analytics tools already enable the statistical evaluation of rich data sources and the identification of patterns within the data. These patterns are then used to better predict future events and make informed decisions aimed at improving outcomes.

6.15.2 Computer-mediated communication

This study demonstrated that student learning in Moodle LMS settings fosters engagement, motivation and performance. Perhaps these findings will help us in design of educational technologies that nourish better learning, thereby helping advance the research on computer-mediated communication. It is conceivable that, through this type of research, computer-mediated communication in mathematics and science education will be enhanced when we have better understanding of students’ learning in the context of LMS. The most important merit of this educational study lies in the application in educational settings. The current findings suggest that the way the various features are being used by the students plays an important role on their learning.

6.15.3 Longitudinal studies

Future research needs to be conducted using the same quantitative framework examining in detail the different student cohorts (undergraduate and postgraduate students across all streams and professional courses; and distance learners; and even school students) utilizing Moodle as the LMS; The courses need to be examined through time comparing the one course over all offerings to see whether there are any differences in the data, between terms and years; Further studies can focus on the student learning styles in an LMS environment so that faculty can build/offer course keeping these in mind; research on the collaborative aspect of an LMS environment has huge potential in HE. Longitudinal studies need to be done across various years of a student study life right from the first year (course commencement) to final year (course end) of the student life on campus with focus on finding out: the degree of engagement, motivation and performance; is it increasing or
decreasing; the extent of usage of LMS features and interactions, etc. Various other parameters related to student learning like collaboration, student satisfaction, attitudes, learning outcomes can be carried out. The above studies can be done from the perspectives of gender, age, area and other socio-economic parameters.

### 6.15.4 Institutional level research

LMS is a new concept in which learners can manage their own learning process, collaborate and communicate with others and receive personalized learning. Learners could benefit from not only a single source, but also from many of web 2.0’s tools, add-ons and extensions. In this way LMS can be looked at as not an application but rather a new approach to the use of new technologies for learning (Attwell, 2007). The paradigm shifts in education that affected learning theories/concepts have also changed the role of teacher and learner. Older systems have been discarded and learner autonomy has become important. The information is continually renewing, shifting and increasing. LMS provide an environment that is an easy way to organize information. However, administrators of educational institutions have a negative perception regarding the internet, social networks and online learning. Additionally, these administrators hesitate to implement new concepts and theories such as LMS and connectivism. Faculties are reluctant to use ICT tools in their regular teaching-learning process on campus for various reasons like lack of ICT skills, fearing their diminishing role in imparting education, etc. The study of LMS feature adoption by teaching staff over time is important to universities as it is not the provision of LMS features but their uptake that really determines their educational value (Coates, et al. 2005). It has been shown that teaching staff tend to adopt LMS features along a continuum beginning with content dissemination features and moving to more complex features such as quizzes and evaluation surveys over time, as they gain experience with the new teaching medium (Malikowski, Thompson, & Theis, 2007). The features adopted by teaching staff, such as discussion forums, have an effect on student engagement as they form part of the environment in which student engagement occurs. The importance of teacher reflection is well known and it has been said that improving teaching practice cannot be achieved without teacher converting their teaching practice into knowledge through the process of reflecting upon their practice (McAlpine & Westin, 2004).

Under the circumstances, LMS strengths should be integrated into the teaching-learning process on campus and connectivist learning environments
should be encouraged. Research in this area needs to be carried out to examine how to effectively integrate an LMS into the campus environment taking into account the mindset of all the stakeholders involved and provide a road map for institutions who have not yet initiated any technology usage in their teaching-learning environment on campus. This could be a complete process right from assessing the ICT skills of the faculty and the infrastructure on campus; initiating training programmes and ensuring that the institution is ICT ready; defining a road map for effective LMS usage and integration across all the courses in that institution. At the same time taking regular feedback and evaluation mechanisms on all these initiatives from time to time for continuous improvement and quality assurance in Higher Education has to be defined.

6.15.5 Explore the relationship between MOOCs and LMS

The use of the Web in education has revealed new challenges and looks forward to new aspirations such as MOOCs (Massive Open Online Courses) as a technology-led revolution ushering in a new generation of learning environments. Expected to deliver effective education strategies, pedagogies and practices, which lead to student success, the massive open online courses, considered as the “linux of education”, are increasingly developed by elite US institutions such MIT, Harvard and Stanford by supplying open/distance learning for large online community without paying any fees, MOOCs have the potential to enable free university-level education on an enormous scale (Tabaa, & Medouri, 2013).

A MOOC will be offered and typically spread through an online social network. However, like LMSs, these environments are not student-initiated in practice. A MOOC integrates the connectivity of social networking, the facilitation of an acknowledged expert in a field of study, and a collection of freely accessible online resources. Thus, the emergence of MOOCs in a continuum from Open Educational Resources (OER) to open access, to the results of scientific production, provides anyone, anywhere in the world with the same content available at the most prestigious universities and by the most renowned specialists, for a more structured education and the award of degrees (McAuley, Stewart, Siemens, & Cormier, 2010). Probably the greatest point of similarity between MOOCs and LMSs is when a MOOC builds on the active participation of several thousand “students” who self-organise their engagement according to learning goals, prior knowledge and skills, and common interests (Alvarez, & Olivera-Smith, 2013). However, despite the huge potential afforded by these communication resources among young
people, their use as a learning support remains deficient. We seem to know rather little about how to introduce them to learning in a way that truly acknowledges their peculiarities as a support to communication. Therefore, whether LMSs are capable of boosting the opportunities for joint learning offered by MOOCs needs to be explored further.

6.15.6 Research related other aspects of MOODLE

The rapidly growing interest in Moodle within the e-learning community as an open source Virtual Learning Environment (VLE) suggests that it would be unwise to ignore its likely impact. On the basis of the researcher’s experiences in attempting to understand the Moodle as LMS, it would be unwise to suggest that Moodle is currently a mature product that could compete on an equal footing with proprietary LMS in terms of maturity and functionality. There are several features which the Moodle documentation claims to have that do not function correctly, in particular the content and quiz import procedures. The online help that accompanies Moodle is at best primitive and while Moodle claims that the interface is intuitive, the investigator, a firm supporter of open source e-learning tools and a Computer Science faculty, had difficulty mastering some of the Moodle features. Moodle needs to work on improving its user-interface.

During the evaluation, the investigator moved from being a skeptic, who believed that Moodle adoption would be an unwise move, to an enthusiastic supporter of Moodle, despite its relative immaturity as a product then. The way that Moodle encourages instructors to organize materials sequentially and the tools that Moodle offers instructors and students to encourage regular student participation in course activities, make it an attractive proposition as an institutional solution for supporting e-learning. The claims that Moodle was developed from the ground up with the principles of social constructivism in mind seem to be justified.

For institutions that have no e-learning support tools, the investigator wholeheartedly recommends the adoption of Moodle. For those who are using a different LMS and who are considering moving to Moodle, the researcher suggests a more cautious approach. Regular users of alternative LMS will be reluctant to change and will find that migration requires substantial time and energy. Trying to duplicate the document storage approach of Blackboard and WebCT will not encourage instructors to take advantage of Moodle’s social constructivist approach and will frustrate instructors who have been happily using competitive commercial products. Successful migration will require an
organization to invest in the services of an e-learning exponent who has experience developing courses using Moodle and who is a keen supporter of the constructivist approach that using Moodle encourages. A person who can motivate staff, point out the advantages that Moodle offers and explain best practice for converting courses.

In the end, the investigator would want to echo the statement that further research and development on the integration of LMS into the teaching and learning is needed. We are just starting to understand how students learn using LMS. However, based on these initial works, the LMS is likely to soon become used in a myriad of learning activities.