CONCLUSION AND SUGGESTIONS

- The study in retrospect
- Major findings
- Conclusions based on major findings
- Tenability of hypotheses
- Educational implications of the study
- Suggestions for further research
This chapter deals with the important findings of the study and their educational implications. It also includes the recommendations based on the findings of the study and the suggestions for further research in the area of the study.

The Study in Retrospect

“DEVELOPMENT AND VALIDATION OF MOODLE BASED LEARNING MANAGEMENT SYSTEM IN PHYSICS FOR SECONDARY SCHOOL STUDENTS OF KERALA.”

Objectives of the study

The following are the objectives of the study

- To develop and validate a Moodle based Learning Management System in Physics for secondary school students of Kerala.
- To tryout the developed Moodle based Learning Management System on Secondary School students of Kerala for the whole sample and the relevant subsamples.
- To compare the effectiveness of the developed Moodle based Learning Management System in achievement in Physics for the whole sample and relevant sub samples of Secondary School students of Kerala.
- To compare the achievement in Physics of students taught through Moodle based Learning Management System with that of the students
who were taught through the existing method of teaching with respect to the whole sample and the relevant subsamples of secondary school students of Kerala.

**Hypotheses of the study**

The following hypotheses were set for the study.

- There exists significant difference in achievement in Physics of students taught through Moodle based Learning Management System and that of the students taught through the existing method of teaching.

- The Moodle based Learning Management System is effective in the teaching of Physics as evidenced by gain score analysis of Secondary School Students.

- The mean post-test scores in Physics achievement of experimental and control groups differ significantly, with advantage to the experimental group, when the effect of pre-test score is controlled.

- The Moodle based Learning Management System is effective in teaching of Physics for Secondary School Students as evidenced by trend analysis.
Methodology

The methodologies used for the development of the software and validation process of the software are given below.

Software development

Different steps were followed in the development of Moodle based Learning Management System (M-LMS). They include requirement analysis, software design, software selection, development of M-LMS, selection and arrangement of a topic for validation.

Validation of the software

The below given steps were followed in the validation procedure of the developed Moodle based Learning Management System (M-LMS).

Design of the study

Experimental design and trend analysis were used in the study to check the effectiveness of M-LMS.

Experimental design

The design selected for the experiment is the pretest-posttest non-equivalent groups design. Four experimental groups and one control group were utilised in the experiment.
Trend analysis

For trend analysis, three different achievement tests were conducted on each of the four groups. First test was conducted before the implementation of M-LMS based learning. The second test was administered immediately after the implementation of M-LMS. The third test was used after the completion of one more unit but without the experimental treatment.

Variables in the experiment

The independent, dependent and control variables used in the experiment have been explained below.

Independent variable

The independent variables selected for the study were two Learning methods using M-LMS and the existing method of teaching.

Dependent variable

Dependent variable selected for the study was achievement in Physics.

Control variable

The variable controlled by the study was the initial status of the students in terms of achievement in Physics as measured by pretest.
Sample selected for the study

The effectiveness of the material in classroom was tested by selecting samples from secondary school pupils of Kerala. Five independent groups were selected from 9th standard. Four groups were taught using M-LMS. The fifth group was taught with the existing method of teaching.

Tools used for the study

The newly developed M-LMS was the major tool used in the study. Other tools used for the study were three achievement tests in different topics in Physics.

Statistical techniques used for the study

The techniques of data analysis in the study were the following.

- Test of significance of difference between means.
- Analysis of Variance (ANOVA)
- Analysis of Covariance (ANCOVA)
Conclusion and Suggestions

Major Findings

The major findings of the study are presented below.

Comparison of experimental and control groups in physics achievement before the experimental treatment.

- No significant differences were found in the mean pretest scores of achievement in physics of each of the four experimental groups and the control group.

- No significant differences were found in the mean pretest scores of achievement in Physics among boys of each of the experimental groups and the control group.

- No significant differences were found in the mean pretest scores of achievement in Physics among girls of each of the experimental groups and the control group.

- No significant differences were found in the mean pretest scores of achievement in physics among experimental groups.

Comparison of experimental and control groups in Physics achievement after the experimental treatment.

- Significant differences were found in the mean post test scores of achievement in Physics in three out of the four experimental groups to
the control group in the post experimental status of achievement in Physics.

• Significant differences were found in three out of the four experimental groups to the control group in the post experimental status of achievement in Physics.

• It is found that the subsamples of boys of three out of four experimental groups were superior to the corresponding control group in the post experimental status of achievement in Physics.

• It is revealed that performance of girls belonging to all the experimental groups and the control group were similar with respect to their post experimental status of achievement in Physics.

• No significant differences were found in the mean posttest scores of achievement in physics among experimental groups. This indicates that the performances of all the four experimental groups were similar in their post-experimental status of achievement in Physics.

Comparison of gain scores in Physics achievement of the experimental and control groups

• Each of the four experimental groups do significantly differ the with control group in their mean gain scores of achievement in Physics.
Conclusion and Suggestions 190

- It is found that there exist significant differences in the mean gain scores of each of the experimental group and the control group.

- It is revealed that there exist a significant difference in the mean gain scores of achievement in physics of each of the experimental and control groups among the subsample pairs of boys.

- It is revealed that there is a significant difference in the mean gain scores of achievement in physics of girls of each experimental group with that of the control group.

- No significant differences were found in the mean gain scores of achievement in physics among experimental groups.

Comparison of pretest and posttest scores of experimental groups and the control group using ANCOVA

- Each experimental group and the control group do significantly differ in their mean gain scores of achievement in Physics after controlling for their pre-test scores on achievement in physics.

Comparison of Achievement Scores through Trend Analysis

- There exist a significant difference in the mean scores of Test 1 and Test 2, Test 2 has a higher mean score.
• There exist a significant difference in the mean scores of Test 2 and Test 3, Test 2 has a higher mean score.

• There exist a significant difference in the mean scores of Test 1 and Test 3 in the case of girls and Total sample, Test 3 has a higher mean score.

Conclusions Based on Major Findings

The first part of the study was the development of MOODLE based Learning Management System (M-LMS). Server programs, web based programming languages, animation programs, Database Management Systems (DBMS) and features of web management systems were utilised for the development of M-LMS. Thus, modern communication technologies like discussion forums, wiki editing, blogging, online chatting, online assignment submission etc. were included in the software. Teacher Controlled Entry forms (TCE) were attached in the software to add the relevant academic details to the software storage space.

The second part of the study deals with the validation procedure of the developed M-LMS. Experimental study and trend analysis were conducted for the completion of validation procedure.

The experiment part of the study tested the effectiveness of the M-LMS with respect to Physics achievement. Comparisons of pretest mean
scores of the M-LMS utilized groups with control group yielded that the groups do not differ significantly on their achievement in Physics (Finding 1-4). Thus, all the four experimental groups and control group were statistically comparable initially on their achievement in Physics.

Post-test score means’ comparison of the M-LMS utilized (Experimental) groups and control group revealed that the M-LMS improved the achievement in Physics for three out of four experimental groups significantly (Finding 5-9).

A comparison of the mean gain scores of the M-LMS utilized groups with control group revealed that the M-LMS improved the achievement in Physics for all the four experimental groups significantly (Finding 10-14). After adjusting the initial differences that existed among the groups on the respective depended variable measured, the mean gain score comparison reveals Learning through M-LMS is more effective than conventional learning in Physics achievement (Findings 15).

The trend analysis part of the study also tested the effectiveness of M-LMS by focusing the same group with different tests. The achievement scores in Physics immediately after the treatment (Test 2) were compared with the achievement scores of the topic before and after the treatment of each of the experimental groups.
A comparison of the mean scores of Test 2 (The test immediately after M-LMS unit) and Test 1 (The test after the unit covered through Conventional method and before the use of M-LMS based unit) yielded that learning through M-LMS improved the performance in Physics achievement. The comparison of the mean scores of Test 2 and Test 3 (The test after the unit covered through Conventional method and after the use of M-LMS based unit) also revealed that learning through M-LMS improved the performance in Physics achievement. Thus, the findings after trend analysis also exposed that Learning through M-LMS is more effective than conventional learning in Physics achievement (Findings 16-18).

There exist a significant difference in the mean scores of Test 1 and Test 3 in the case of girls and Total sample. At the same time there is no significant difference exists in the case of boys. It indicates that the strategies and leaning styles used in M-LMS were utilized by the students in an unstructured way on their regular learning sessions also. It also indicates the effect of M-LMS in their learning.

**Tenability of Hypotheses**

Tenability of the hypotheses formulated for the study was verified in view of the findings and are given below.

- First hypothesis states that “There exists significant difference in achievement in Physics of students taught through Moodle based
Conclusion and Suggestions

Learning Management System and that of the students taught through the existing method of teaching."

The analysis of the data revealed that no significant differences existed in the mean pretest scores of achievement in Physics of boys, girls and total sample of each experimental group with that of the control group. It can be inferred that the performance of the total sample and subsamples belonging to each experimental group and the control group was similar with respect to their pre experimental status of achievement in Physics.

No significant differences were found in the mean pretest scores of achievement in physics among experimental groups when they compared separately.

The mean posttest score in Physics achievement of each experimental group was compared separately with the mean posttest scores of the control group. It is found that three out of the four experimental groups were superior to the control group in the post experimental status of achievement in Physics. The hypothesis is substantiated in the case of experimental group 1, experimental group 2, experimental group 4, and not substantiated in the case of experimental group 3 for total sample.

The analysis revealed that the subsamples of boys of three out of four experimental groups were superior to the control group boys in the post
experimntal status of achievement in Physics. Hence, the hypothesis can be substantiated in the case of experimental group 1, experimental group 3, experimental group 4, and not substantiated in the case of experimental group 2 for boys.

It is found that the performance of girls belonging to each experimental group and the control group was similar with respect to their post experimental status of achievement in Physics. Hence in this case, the hypothesis is not substantiated as per the analysis of data.

- Second hypothesis states that “The Moodle based Learning Management System is effective in the teaching of Physics as evidenced by gain score analysis of Secondary School Students.”

The gain score analysis proved that, there exists significant difference in the mean gain scores of each experimental group and the control group in all the four cases. Hence, the hypothesis is substantiated as per the finding of the study.

- Third hypothesis states that “The mean post-test scores in Physics achievement of experimental and control groups differ significantly, with advantage to the experimental group, when the effect of pre-test score is controlled.”
Analysis of data revealed that the mean Post test scores of each experimental group and the control group differ significantly after they have been adjusted for the difference in their pre-test achievement scores in all conditions. Hence, the hypothesis is substantiated as per the findings of the study.

- Fourth hypothesis states that “The Moodle based Learning Management System is effective in teaching of Physics for secondary school students as evidenced by trend analysis.”

The analysis revealed that the mean achievement scores in Physics immediately after the treatment (Test 2) is significantly higher than the Physics achievement scores before the treatment (Test 1). Similarly, the mean achievement scores in Physics immediately after the treatment (Test 2) is significantly higher than the Physics achievement scores of the unit after the treatment unit (Test 3). It is revealed that the performance in Test 2 is superior to Test 1 and Test 3. That is, the performance of the students after getting Moodle based LMS is superior to the previous achievement test in Physics and the achievement test conducted on the unit after the treatment unit. It may be because of the unstructured use of the strategies included in M-LMS for the learning of new topic. So the hypothesis can be substantiated as per the findings of trend analysis also.
Educational Implications of the Study

The study was to develop and validate a web based learning management system which can be utilized many of the modern communication strategies. The investigator organized many components like discussion forums, online chat facility, wiki facility, online assignment facility, blogging facility and much more under one roof, in the name M-LMS.

The study revealed the effectiveness of M-LMS based learning over the existing method of learning. The suggestions and educational implications put forth here are broad and are based on the findings from the analysis and from the review of related studies and are listed below.

- The developed M-LMS software used by the experimental group utilized the facilities included in it. At the same time the control group completed the topic in conventional class room set up. Finally, experimental group became better achievers. It may be because of the following difference in strategy.
  
a. Online discussion forums were used in M-LMS, which is more accountable than ordinary class room discussions used in conventional class rooms.
b. The students involved in the M-LMS based class were forced to participate in the computer based discussions because of the presence of his peers in the discussion which is visible to all.

c. Chat facility included in the M-LMS environment helped the users by providing lonely querying of their doubts, without the interference of his peers that is happening in a normal classroom environment.

d. Immediate and intermediate feedbacks provided and published by the M-LMS encouraged the students to perform better. These types of feedback strategies are not easy in a conventional classroom setup.

e. Potential of communication strategies used in social media can be used to enhance the quality of education at secondary school level. Effective integration of modern communication technologies into teaching-learning process would enable educational institutions to cater to the needs of the present day student.

f. Group activities included in the M-LMS were class blogs, wiki editing and Discussion forums. These facilities help to identify the presence of an individual in a group. So, the individual would be forced to participate in the group activities.
The outcome of the study put forth some suggestions towards the government, teacher educators and curriculum developers. They are:

g. The investigator hopes that this study may provide guidelines for the Government to implement ICT enabled education in secondary schools of Kerala state. The result of the study may support the Government’s initiatives to introduce learning resource repository in Kerala in an organized manner.

h. The government may take effort to implement these types of management technologies, which is used in M-LMS, in schools to improve the accountability of educational system.

i. The government may take effort to implement learning management technologies which is used in M-LMS in schools to arrange the learning materials to the learner anytime anywhere.

j. The government shall also take necessary steps to provide sufficient number of computers, internet access and LMS support to all schools in the state for enhanced learning.

k. Frequent faculty improvement programmes and in-service training programmes may be given for making the teacher resourceful to use modern technologies. Government shall offer
incentives to teachers who implement the new methods of instruction in their classrooms and contribute to enhance ICT enabled teaching-learning strategies.

1. Curriculum developers may consider the findings of the study to integrate the modern web based LMS technologies with existing learning strategies.

m. Educational administrators would consider the assessment and evaluation techniques used in the study to improve the present evaluation procedure. Educational administrators would take steps for further research for implementing the new subjective test strategies used in M-LMS.

n. Government may take efforts to implement these types of management technologies, which is used in M-LMS, in open schools to improve its functioning.

- The findings of the study present some important suggestions to teachers’ and parents’ community also. The following can be considered in this regard.

o. In the present study, individual as well as group activities that perform in our conventional classrooms can be successfully
implemented in a web based environment. It can be utilized to overcome the time barriers in the conventional classrooms.

The feedback technology used in the present study would help the parents to know the performance of the students from anywhere anytime basis. So state guidance cell would consider these types of features to improve the functioning PTA.

**Suggestions for Further Research**

- The study is limited to the discipline ‘Physics’. It can be conducted in other disciplines also.

- The effectiveness of the strategy in higher education can be tested. The communication aspects of the strategy can very well be exploited to develop the social relationships and responsibilities of the students in higher education. Studies may be conducted on this aspect of the strategy also.

- Apart from the regular students, the effectiveness of the M-LMS based strategy in differently abled students can be tested in Kerala context largely in integrated educational scenario.

- Nowadays, different communication technologies are available for differently abled students. It was not utilized in the present LMS. Studies can be conducted after including such components to the LMS.
Conclusion and Suggestions

- Studies may be conducted to test the effectiveness of the M-LMS based learning in improving the communication skill, social skills and socially responsible behavior of the students.

- The attitude of teachers, students and parents towards M-LMS can be studied.

- The effect of M-LMS in Affective and Psychomotor Domains can be studied.

- Many teachers are using modern communication technologies independently in their teaching learning process. The effectiveness of using these independently and in an integrated platform like M-LMS can be studied.

- The effectiveness of the strategy can be tested after selecting a sample of open school students. The communication aspects and learning material deployment through this strategy can very well be exploited to develop the learning styles, social relationships and responsibilities of the students in open schools.