THE DEVELOPMENT OF A LEARNING MANAGEMENT SYSTEMFOR KINDERGARTNERS WITH LEARNING DISABILITIES

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Thematic Paper
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ABSTRACT

The objectives of this study are to analyze the total efficiency and user satisfaction of Learning Management Systems (LMS) for kindergarten and early elementary students with and without Learning Disabilities (LD). In this study the researcher created 2-dimensional multimedia lessons in order to develop the LMS. User information data was subsequently collected via the Internet. The LMS efficiency was analyzed by six experts of Technology of Information System Management (TISM) at Mahidol University, and LMS satisfaction was evaluated by nine teachers from the Taweewattana School. A statistical analysis was performed to calculate the Arithmetic Mean and Standard Deviation of the data set.

Results revealed that the efficiency and satisfaction to LMS was at a satisfactory level. The efficiency of LMS makes it appropriate tool for students to review their lessons and tests at virtually any time or location with Internet connectivity, depending upon their own skills and academic requirements.

KEY WORDS: LEARNING MANAGEMENT SYSTEM (LMS) / E-LEARNING
             / LEARNING DISABILITIES (LD) / SPECIAL CHILDREN / SLOW
             LEARNER

85 pages

การพัฒนาระบบจัดการเรียนการสอนสำหรับนักเรียนอนุบาลที่มีความบกพร่องทางการเรียนรู้

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KINDERGARTNERS WITH LEARNING DISABILITIES

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บทคัดย่อ

การศึกษาครั้งนี้ มีวัตถุประสงค์เพื่อพัฒนาและหาประสิทธิภาพรวมถึงความพึงพอใจ
ของผู้ใช้งานต่อระบบจัดการเรียนการสอนสำหรับนักเรียนอนุบาลหรือประถมต้นกลุ่มเสี่ยงที่จะเป็น
เด็กที่มีความบกพร่องทางการเรียนรู้ รวมถึงนักเรียนปกติก็สามารถเข้ามาเรียนรู้ได้เช่นเดียวกัน ซึ่ง
เนื้อหาบทเรียนและแบบฝึกหัดทั้งหมดจะขึ้นอยู่กับครูผู้สร้างสรรค์ผลงานเพื่อเด็กเหล่านี้   ใน
การศึกษาครั้งนี้ผู้วิจัยได้สร้างสรรค์บทเรียนมัลติมีเดียแบบสองมิติ และพัฒนาระบบจัดการเรียนการ
สอนบนเครือข่ายอินเตอร์เน็ต โดยนำไปให้ผู้เชี่ยวชาญ 6 ท่าน ด้านเทคโนโลยีและการจัดการระบบ
สารสนเทศจากมหาวิทยาลัยมหิดล ประเมินประสิทธิภาพของระบบ และนำไปให้ครูผู้มี
ประสบการณ์สอนนักเรียนที่มีความบกพร่องทางการเรียนรู้ 9   ท่าน ที่โรงเรียนคลองทวีวัฒนา
ประเมินความพึงพอใจของระบบ โดยวิเคราะห์ข้อมูลสถิติเป็นค่าเฉลี่ยเลขคณิต (Mean) และส่วน
เบี่ยงเบนมาตรฐาน (SD)

ผลการประเมินพบว่าประสิทธิภาพและความพึงพอใจต่อระบบจัดการเรียนการสอน
อยู่ในระดับดี มีประสิทธิภาพในการเป็นสื่อเสริมให้กับนักเรียนได้ทบทวนบทเรียนและแบบฝึกหัด
ได้ทุกที่ ทุกเวลา ตามอัธยาศัย นักเรียนสามารถเรียนซ้ำ ย้ำ ทวน ได้หลายครั้ง ขึ้นอยู่กับศักยภาพและ
ความต้องการของนักเรียนเอง

85 หน้า

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CHAPTER I
INTRODUCTION

1.1Background

The policy announced by the Office of the Basic Education Commission in 2011emphasizes that all children receive a quality education and acquire the capacity for self motivated life long learning. Furthermore, children with special needs must get help in appropriate educational programs, techniques, methods and instructional media, as well as innovations that will help them develop individual learning [1].The increase in the number of children with learning disabilities (LD)–the kind of children with special needs [2] has affected instructional management in the classroom.It is difficult for school administrators and teachers to completely understand the special needs of students with learning disabilities, especially when the disability is not an obvious one. This particularly refers to children whose physically appearance is like that of children in general in their class but who have some difficulty learning, for example they cannot read, summarize, spell words or calculate, even though, their intelligence seems similar to that of other children in the same class.

Although teachers try to provide good schooling they find that a student's learning does not develop as expected. It is especially problematic in terms of learning activities. However, if problem solving or improving students'level of knowledge and skills use only one format it is not effective nor can it help to increase their level of achievement. The teacher needs to adjust the teaching process by using variousand recentformats so that children with learning disabilities can access those that suit them. [3, 4, 5]

Recently, E-learning has been integrated into learning and teaching so that learning platforms can be accessed with ease, rapidly, and at anytime and anywhere convenient to a learner, in other words is Asynchronous Learning. Online instructional media have become a popular and up to date tool in education as both a supplement to classroom learning and for self-study.

In this study, the researcher interests to design and develop web application for learning of students with learning disabilities (LD), also known as E-learning, that with the functions of delivering the courses, supporting collaboration, assessing the learner performance, recording learner data, and generating reports to maximize the effectiveness of the entire learning organization in order to students with learning disabilities and normal students in the same class at the early elementary level or kindergarten in Thailand. Learners can study lessons and repeat tests as many times as they want which should improve their skills; in this case their math skills.

This web application orLearning Management System (LMS), integrates text, colorful graphics, and interactive multimedia to generate interest, motivation and effective learning. It uses animations (two-dimensional, 2-D) to provide dynamic visualizations which are important component of multimedia learning environments. Moreover, it has a Graphic User Interface (GUI) and navigation bar that is easy to use for real time reporting student school-records. Student parents can write comments on the web board to help their children to use the web application and view their children's school-records. Teachers can create lessons and tests and add them to ordelete them from the LMS. Administrators can specify access rights and manage theLMS.

1.2 Statement of Problem

There is a lack of an appropriate innovation for the instruction of students with learning disabilitiesusing the web application (LMS) that can support their learning.

1.3 Objectives

1. Todesign and develop a prototype of the LMS for students with learning disabilities.

2. To increase the efficiency of theLMS.

3. To study user satisfaction.

1.4 Goal

1. The performance of the LMS is considered good level from the expert review.

2. The user satisfaction is considered good or better.

1.5 Research Concept

1.5.1 Population and Sample

- **Population**

Teachers who are teaching or have a teaching experience of students with LD in kindergartner or early elementary school.

- **Sample**

The sample was obtained by Purposive Sampling and consisted of nine teachers who have an experience teaching or are teaching students with learning disabilities at the Klongtaweewattana School, Department of Education, Bangkok Metropolitan Administration.

1.5.2 Scope of Content

1) All contents are designed in multimedia format and consists of graphic images, animation, audio and text. These are suitable for students with learning disabilities studying in the kindergarten and early elementary level.

2) The lesson and test use relevant material.

2.1 The instructional method of mathematics for children with learningdisabilities. [6]

2.2 The improvement of disabilities in mathematics series 2: Number. [7]

2.3 Introduction to Mathematics for Grade 1. [8]

2.4 Technique method and media for the Students with Learning Disabilitiesin Mathematics vol5. [9]

3)The lessons and tests cover the following subjects:

    3.1 Lesson1: Touch Math

    3.2 Lesson2: Dot Addition

    3.3 Lesson3: Light Running

    3.4 Lesson4: The meaning of the counting number 1-10

1.5.3 Scope of web application

1) LMS supports browser Internet Explorer 7 or newer.

2) Teacher can add lesson and test into LMS, also remove them too.

3) LMS can report real time student's school-record.

4) LMS uses Thai language presentation.

5) LMS and database use open software (AppServ 2.5.9)

6) LMS collects data via Internet network.

7) LMS presents content about counting number of mathematics grade1 that students with or without LD can learn together.

1.5.4 Variable of Study

1)Independent variableis LMS.

2) Dependentvariableincluding:

- Efficiency of the LMS
- Satisfaction of users of the LMS

1.6 Expected Results

1. Suitable LMS.
2. EfficientLMS.
3. Interesting LMS.
4. User friendly of LMS.

CHAPTER II
LITERATURE REVIEW

2.1 Learning Disabilities (LD)

2.1.1 Definitions of Learning Disability

Learning Disabilities affect both children and adults. It generally affects more boys than girls. The disabilities are neurological disorders that make it difficult to acquire academic and social skills. It's a neurological disorder that affects the brain's ability to receive, process, store, and respond to information.

Table 2.1 Definition of Learning Disability

Proposed By	Key Components
Kirk (1962)	• Retardation, delay, or disorder in a psychological process • Possible cerebral dysfunction • Excludes other causes
Batemen (1965)	• Ignored causation • Focused on children • Introduced the concept of discrepancy
Task Forces I and II (Clements, 1966)	• Task Force I (mainly medical) • Task Force II (mainly educational) • May/may not have central nervous system dysfunctions • Excludes other causes
National Advisory Committee on Handicapped Children (1969) Northwestern University	• Continues the notion of discrepancy • More educationally oriented • Mentions special education techniques

(Kass&Myklebust, 1969)	• Does not mention causation • Focuses only on children
U.S Office of Education (1976)	• Introduces the term *severe discrepancy* • List area in which the discrepancy can be manifested
U.S Office of Education (1977)	• More precise • Includes terms previously employed • Most widely used
National Joint Committee on Learning Disabilities (1981; Revised 1988)	• Introduces the notion that learning disabilities exist across the life span • May occur coincidentally with other disabilities
Learning Disabilities Association of America (1986) (Previously ACLD)	• Provides no examples of the types of learning disabilities • Does not include coexisting conditions
Interagency Committee on Learning Disabilities (1987)	• Adds social skills • Recognizes the wide variety of coexisting conditions
U.S. Office of Education (1977)	• Assumes average intellectual ability • Significant discrepancy • Exclusionary clause • Central nervous system dysfunction
U.S. Office of Education (2004)	• The same as 1977 • Students do not have to demonstrate a discrepancy between intellectual and academic functioning

The current definition of learning disabilities is a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which may manifest itself in an imperfect ability to listen, think, speak, read, write, spell or to do mathematical calculations. The term includes such

conditions as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, and development aphasia. The term does not include children learning problems that are primarily the result of visual, hearing, or motor handicaps, or mental retardation, or emotional disturbance, or environmental, cultural, or economic disadvantage. [10]

2.1.2 Common learning disabilities

- **Dyslexia** – a language-based disability in which a person has trouble understanding written words. It may also be referred to as reading disability or reading disorder.

- **Dyscalculia** – a mathematical disability in which a person has a difficult time solving arithmetic problems and grasping math concepts.

- **Dysgraphia**– a writing disability in which a person finds it hard to form letters or write within a defined space.

- **Auditory and Visual Processing Disorders** – sensory disabilities in which a person has difficulty understanding language despite normal hearing and vision.

- **Nonverbal Learning Disabilities** – a neurological disorder which originates in the right hemisphere of the brain, causing problems with visual-spatial, intuitive, organizational, evaluative and holistic processing functions.

2.1.3 Learning Disabilities in mathematics

Learning Disability in Mathematics is called Dyscalculia. It is a term referring to a wide range of life-long learning disabilities involving math. The individual lacks math proficiency in one or several areas. Specific types of dyscalculia have been identified in the literature:

1) Verbal dyscalculia (oral language)---a math disorder in retrieving mathematics labels, terms, and symbols

2) Practognostic dyscalculia---(practo = doing; Gnostic = knowing; i.e., knowing by doing) a math disorder in applying math concepts when using manipulative objects in the environment (either visual or three dimentional)

3) Lexical dyscalculia (reading)---a math disorder that involves impaired reading of math vocabulary and symbols

4) Graphical dyscalculia (writing)---a math disorder that is an impairment in the writing of mathematics symbols, equations, and other relevant language terms

5) Ideognostical dyscalculia (ideas)---a math disorder that centers on impaired mathematical thinking or impaired conceptualizations (the ideas) in mathematics

6) Operational dyscalculia (operations)---a math disorder focusing on impaired applications of algorithms to the four basic math operations $(+,-, \times, \div)$. [11]

2.1.4 Various Math Learning Disabilities

1) Conceptual understanding

2) Written number symbol system

3) Procedural steps of computation

4) Application of arithmetic skills

5) Poor calculation strategies

6) Counting sequences

7) Language of math

8) Basic number facts

9) Problem solving

10) Lack of automaticity

11) Poor word problem strategies [12]

2.2 The Cognitive Theory of Multimedia Learning (CTML)

The cognitive theory of multimedia learning is based on three cognitive science principles of learning: the human information processing system includes dual channels for visual/pictorial and auditory/verbal processing each channel has limited capacity for processing and active learning entails carrying out a coordinated set of cognitive processes during learning. The cognitive theory of multimedia learning specifies five cognitive processes in multimedia learning: selecting relevant words from the presented text or narration, selecting relevant images from the presented illustrations, organizing the selected words into a coherent verbal representation,

organizing selected images into a coherent pictorial representation, and integrating the pictorial and verbal representations and prior knowledge. Multimedia instructional messages should be designed to prime these processes.

2.2.1 A Multimedia Instructional Message.

A multimedia instructional message is a communication containing words and pictures intended to foster learning. The communication can be delivered using any medium, including paper or computer. Words can include printed words or spoken words; pictures can include static graphics – such as illustrations or photos or dynamic graphics – such as animation or video clips. This definition is broad enough to include textbook chapters, online lessons containing animation and narration, and interactive simulation games.

2.2.2 Three Memory Stores in Multimedia Learning

Figure 2.1 presents a cognitive model of multimedia learning intended to represent the human information-processing system. The boxes represent memory stores, including sensory memory, working memory and long-term memory. Pictures and words come in from the outside world as a multimedia presentation (indicated at the left side of the figure) and enter sensory memory through the eyes and ears (indicated in the sensory memory box). Sensory memory allows for pictures and printed text to be held as exact visual images for a very brief time period in a visual sensory memory (at the top) and for spoken words and other sounds to be held as exact auditory images for a very brief time period in an auditory sensory memory (at the bottom). The arrow from picture to eyes corresponds to a picture being registered in the eyes, the arrow from words to ears corresponds to spoken text being registered in the ears, and the arrow from words to eyes corresponds to printed text being registered in the eyes.

The central work of multimedia learning takes place in working memory so let's focus there. Working memory is used for temporal holding and manipulating knowledge in active consciousness. [13]
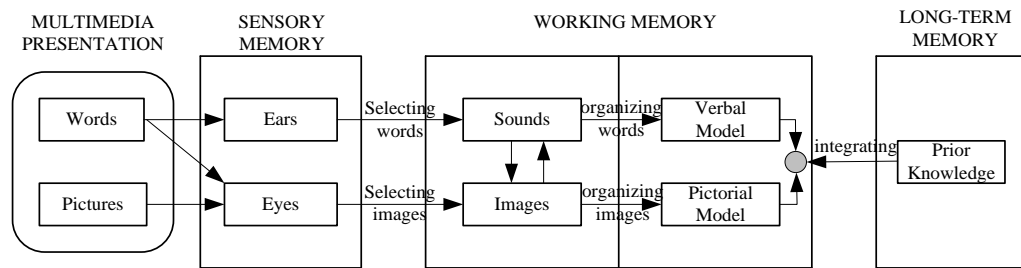
Figure 2.1 Mayer's cognitive theory of multimedia learning

Processing of Pictures

Processing of Spoken Words

Processing of Printed Words
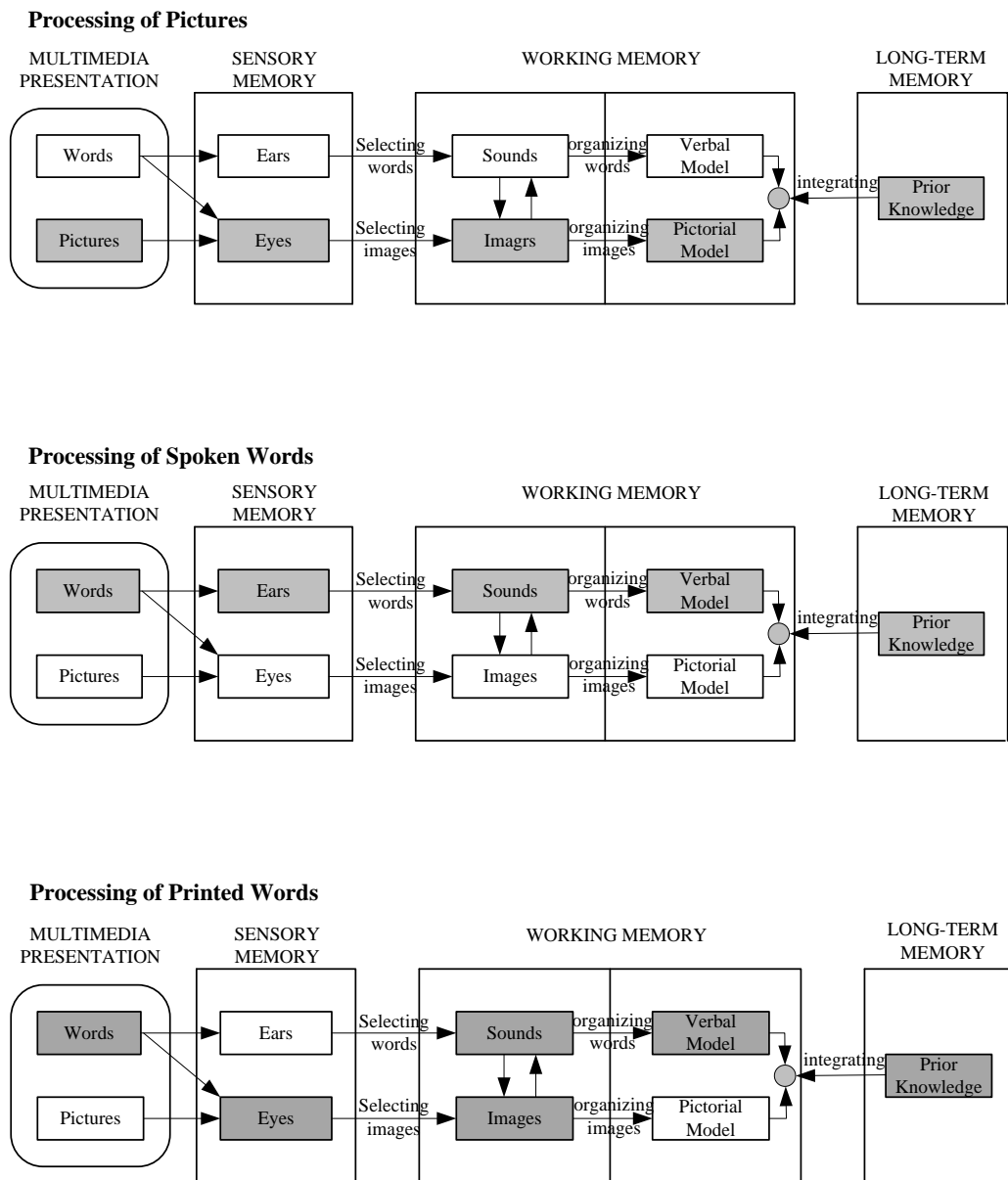
Figure 2.2 Processing of pictures, spoken words, and printed words

Table 2.2 Five Cognitive Processes in the Cognitive Theory of Multimedia Learning

Process	*Description*
Selecting words	Learner pats attention to relevant words in a multimedia message to create sounds in working memory
Selecting images	Learner pats attention to relevant pictures in a multimedia message to create images in working memory
Organizing words	Learner builds connections among selected words to create a coherent verbal model in working memory
Organizing images	Learner builds connections among selected images to create a coherent pictorial model in working memory
Integrating	Learner builds connections between verbal and pictorial models and with prior knowledge

Ten Research-Based Principles of Multimedia Learning

1. Multimedia Principle: People learn better from words and pictures than from words alone.

2. Contiguity Principle: People learn better when corresponding words and pictures are presented near rather than far from each other in time or on the screen.

3. Coherence Principle: People learn better when extraneous words, pictures, and sounds are excluded rather than included.

4. Modality Principle: People learn better from words and pictures when words are spoken rather than printed.

5. Redundancy Principle: People learn better from animation and narration than from animation, narration, and on-screen text.

6. Personalization Principle: People learn better when words are presented in conversational style rather than formal style.

7. Voice Principle: People learn better when words are spoken in a non-accented human voice than in machine voice or accented voice.

8. Signaling Principle: People learn better when the voice signals important words rather than when they are no signals.

9. Interactivity Principle: People learn better when they can control the place of presentation than when they receive a continuous presentation.

10.Pretraining Principle: People learn better when they receive pretraining on each component rather than no pretraining. [14]

2.3 Web applications

Increasingly, software applications are built using web technologies and made accessible via web browsers. They are commonly referred to as web application, or hosted applications-applications based on a software as a service (SaaS) model or cloud computing. These web applications differ from more traditional websites in that their emphasis is on allowing users to accomplish tasks such as send email, make travel reservation, pay bills, buy products, etc. Websites, on the other hand, are content oriented and are designed to facilitate browsing and consumption of rather static information.

Typically, the only software users need to access and use web applications is a browser such as Internet Explorer, Firefox, Safari, and Opera. Users do not need to download and install separate software to use different web applications, although there are instances when they have to download helper applications or plug-in modules to access all or part of a web application.

Moreover, because both the application and information are stored on servers of the application's providers and not on users' computers, users can access web applications from almost anywhere, as long as the computer they use has a web browser and Internet connectivity.

Web applications are considered to be a form of "cloud computing" because applications and files are hosted in the Internet "cloud" which consists of computers and servers, all linked together and made accessible via the Internet.

SaaS is a software application delivery model where a software vender develops a Web-native software application and hosts and operates it (either independently or through a third party) for use by customers over the Internet. Customers do not pay for owning the software; they subscribe to it and pay a regular subscription fee for using it. [15]
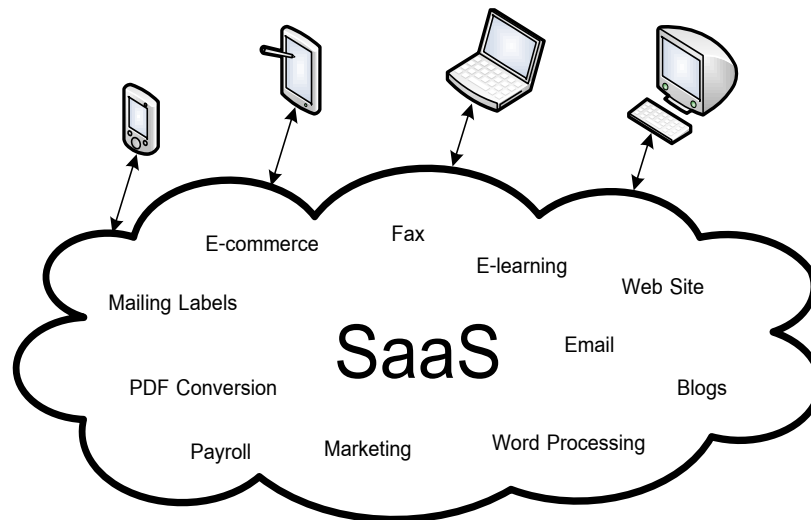
Figure 2.3 SaaS (Software as a Service)

2.4 Multimedia

2.4.1 Definitions of Multimedia

Multimedia is made up of the terms 'multi' meaning more than one and 'media' meaning some distinct carrier of information. So multimedia is something that is composed of more than one medium.

A multimedia system is a system that is interactive and uses more than one medium in an integrated way. The media are rich media involved are text, layout, colors, photo-quality, graphics, animation, sound and video. Multimedia systems are dynamic that the images we see on the screen and the sounds we here change. Interactive, in this context, means that the user can interact with the system. [16]

2.4.2 2D Animation

2D Animation uses bitmap and vector graphics to create and edit the animated images. This is done by sequencing consecutive images or frames that simulate motion by each image showing the next in a gradual progression of steps. The eye can be fooled into perceiving motion when these consecutive images are shown at a rate of 24 frames per second or faster. The creation of moving pictures in a two-dimensional artistic space that focuses on creating characters, storyboards and

backgrounds in two-dimensional environments. In 2D animation, the figures move up and down, left and right. They do not appear to move toward or away from the viewer.

2D animators user a combination of creative skills and specialty computer programs to create images that have the appearance to movement. [17]

2.4.3 Flash Animation

Adobe Flash is a powerful, efficient tool for creating sophisticated animation that offers visitors a high-tech experience. Flash has file browser support on current Macintosh and Windows operating system. The program can be utilized to create an entire Flash Web site or to generate quick loading, scalable vector animations, which adjust to different browser sizes without degrading quality.

Flash simulates motion via fast-paced presentation of changing static images. The changing images are recorded in frames in the timeline. The animation process is accomplished in Flash by means of either frame-by-frame animation or animation with tweening. An image must be created for each frame in frame-by-frame animation. In animation with tweening, however, only a beginning and an ending frame need be created; Flash will create the frames in between.

2.5 The Usable Guidelines Multimedia for Web Delivery

- Identify high-bandwidth areas. Let your visitors know file sizes, format, and estimated time required to download. Do not risk annoying visitors or making them feel their time is being wasted.

- Create home pages that give visitors a choice of high-or low-bandwidth content.

- List any necessary plug-ins and provide links to locations where they can be acquired.

- Provide brief explanations of what visitors will see or hear to help them determine if they really do what to access the multimedia.

- Offer low-bandwidth alternatives such as audio instead of video. Do not, for instance, waste bandwidth on an uninteresting video clip with little action, when an audio clip alone will convey the real content of value.

- When developing original multimedia, break audio or video files into short segments to create smaller files. Visitors will also be able to choose the segments they want to listen to, rather than having to listen to one long file. [18]

2.6 Related Research

(1) You-Jin Seo and Honguk Woo, 2010, studied in topic The identification, implemation, and evaluation of critical user interface design features of computer-assisted instruction programs in mathematics for students with learning disabilities. In this research is based on the identified features and guidelines, a multimedia computer-assisted instruction program, 'Math Explorer' which delivers addition and subtraction word problem-solving instruction for students with learning disabilities at the early elementary level, was design and developed.

The result from research indicated that the critical user interface design features and guidelines in mathematics computer-assisted instruction programs would be essential for facilitating the mathematical learning of students with learning disabilities. [19]

(2) Grant D. Fryia, Renatawachowiak-Smolikova and Mark P. Wachowiak, 2009, used web accessibility in the development of an e-Learning system for individuals with cognitive and learning disabilities (CLDs). This paper describes current human-computer interaction research for cognitive and/or learning disabled individuals, and outlines several human-computer interaction challenges that arise when designing web-based systems for them.

The prototype e-Learning system presented in this paper can potentially benefit users with CLDs by reducing their memory burden, and by allowing them to focus on their tasks. The interface to the e-Learning system can also be used in conjunction with existing online content and programs, and may also be developed with other tools, such as Adobe Flash.

The result from research indicated that online course system is intended to give people with cognitive and learning disabilities, the opportunity to learn, unimpaired by the system that they must use. The goal is to enhance their learning experience, thereby allowing them to increase their knowledge, and to become more productive. [20]

(3) Hui-Chuan Chu, Tsung-Yi Chen and et al., 2008, studied using a problem-based e-Learning (PBeL) model which incorporates the problem-based learning (PBL) theory, social constructivism, and situated learning theories to assist regular and special education teachers in effectively developing knowledge for mathematic teaching for students with mild disabilities. This research also developed an adaptive case recommendation approach which identifies the most suitable authentic earning cases based on the characteristics of learners (teachers), the strengths, weaknesses, and types of disabilities of their students, the teaching problems of various mathematical topics, and the teaching context in order to facilitate adaptive case-based learning in the context of problem-based e-Learning for regular and special education teachers' knowledge development.

The result found the adaptive recommendation approach not only enables the realization of adaptive PBeL, but also enhances teachers' practical knowledge and assists them to solve students' learning problems. [21]

(4) Norfarhana Abdollah and et al., 2010, studied in topic Multimedia Design and Development in 'Komputer Saya Courseware for Slow Learners'. In this paper, the design and development part of the multimedia courseware for slow learners is discussed. The courseware is developed based on ADDIE methodology and used Macromedia Flash as the main platform, as well as Adobe Illustrator and Adobe Photoshop for interfaces and graphics design.

The instructional design model, courseware components and courseware modules have been designed according to the early analysis results combined with the studies on suitable learning theories principles and characteristics aswell as appropriate instructional design for the slow learners. The courseware which is still in the development phase implements various learning approach and incorporated multiple media elements. As exploitation of multimedia technology empowers learners to move at their comfortable speed, this courseware is hoped to increase their confidence and independent learning skills thus raise slow learner's motivation for continuous learning. [22]

(5) You-Jin Seo and Diane Pedrotty Bryant, 2009, studied to conduct a meta-study of computer-assisted instruction (CAI) studies in mathematics for students with learning disabilities (LD) focusing on examining the effects of CAI on the mathematics performance of students with LD. This study examined a total of 11 mathematics CAI studies, which met the study selection criterion, for students with LD at the elementary and secondary levels and analyzed them in terms of their comparability and effect sizes.

This study found that those CAI studies did not show conclusive effectiveness with relatively large effect sizes. The methodological problems in the CAI studies limit an accurate validation of the CAI's effectiveness. Implications for future mathematics CAI studies were discussed. [23]

(6) Wan Fatimah Wan Ahmad, Emelia Akashah P. Akhir, and Sarah Azmee, 2010, developed a multimedia courseware that can be used to educate children with Learning Disabilities (LD). The use of game-based courseware could help those with LD to explore their capabilities without having to pressure them to catch up with other friend but to let them learn in their own pace of time. This courseware might encourage the teachers and parents to improvise their ICT skills and hands-on learning as a learning tool.

The courseware is known as Play time Learning consists of Play games and Fun activities. The user acceptance test shows that teachers and students could adapt well with this kind of learning tool and they have shown positive sign of interest in utilizing it in the future.

The paper has described the game-based learning for children with learning disabilities. It can be concluded that this Game-based learning courseware will be able to portray how the future of learning for the children with disabilities. Using these materials, can have fun learning while building their basic skills. [24]

CHAPTER III
METHODOLOGY

This chapter describes the research methods and materials used in the development of Learning Disabilities Management System (LMS)for students with learning disabilities (LD) which is designed step by step as waterfall model in Figure 3.1.
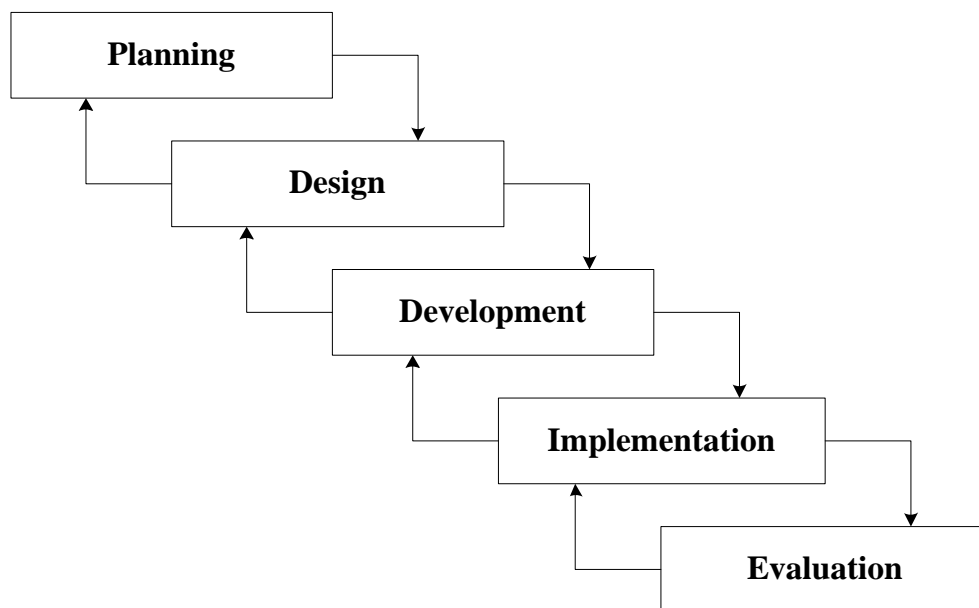
Figure 3.1 Research Steps

3.1 Planning and Gathering Related Data

In this step, researcher plans the construction of web application as in figure 3.2
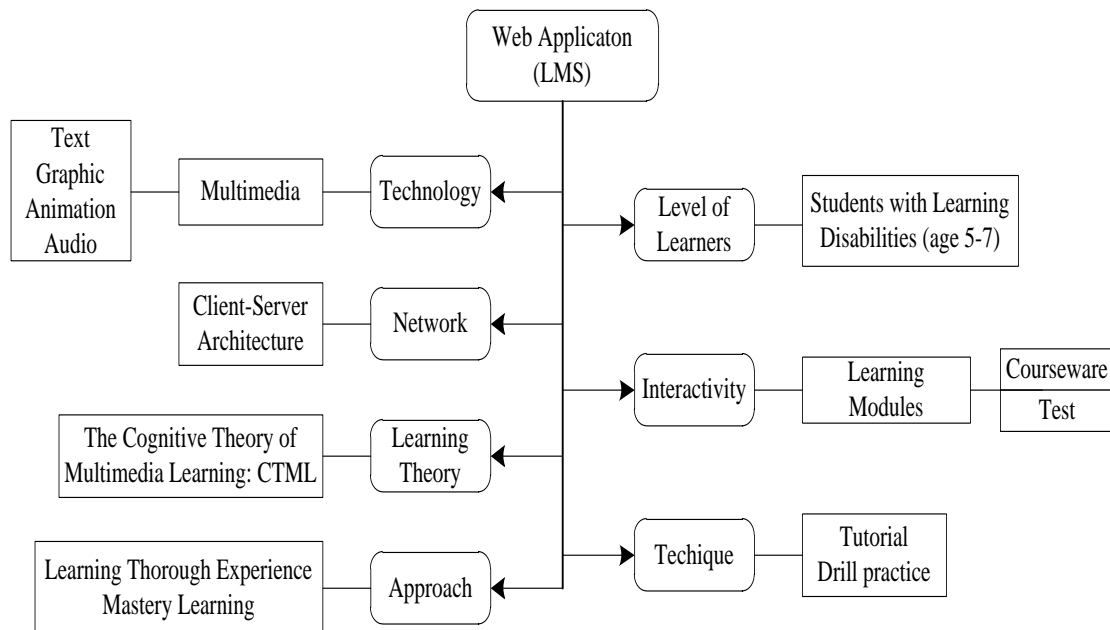
Figure 3.2 Construction of web application

3.2   Analysis and Design LMS

3.2.1 User Analysis

1) Administrator Requirement

- To delete member
- To manage web board
- To view real time summary user report
- To re-user name and password
- To view and edit own history

2) Teacher Requirement

- To create lesson and test
- To view and edit own history
- To use web board
- To view real time the summary report
- To re-user name and password

3) Student Requirement

- To learnlesson and do test
- To view and edit own history
- To view real time school-record report
- To use web board
- To re-user name and password

3.2.2 Three Sub-systems of LMS

1) Member System

Thissub-system manages all members which stores their data consists of administration, teacher and student. There are six parts as follow:

- Enrollment
- Log in and log out
- Forget password
- Change password
- Edit private data
- Manage user (delete user)

2) Webboard System

This sub-system is the part of opinion exchanging, commentary and presentation news. It is only available for members.

3) Learning System

This sub-system for members access to do schooling consists of two parts as follow:

- *Schooling management*
- Teacher can insert, update, delete lesson and test.
- Teacher creates lesson and test by themselves.
- *Usability*
- Students can choose to learn any lesson or any test that they want, also view their school-record reports.
- Teacher can view their school-record reports.
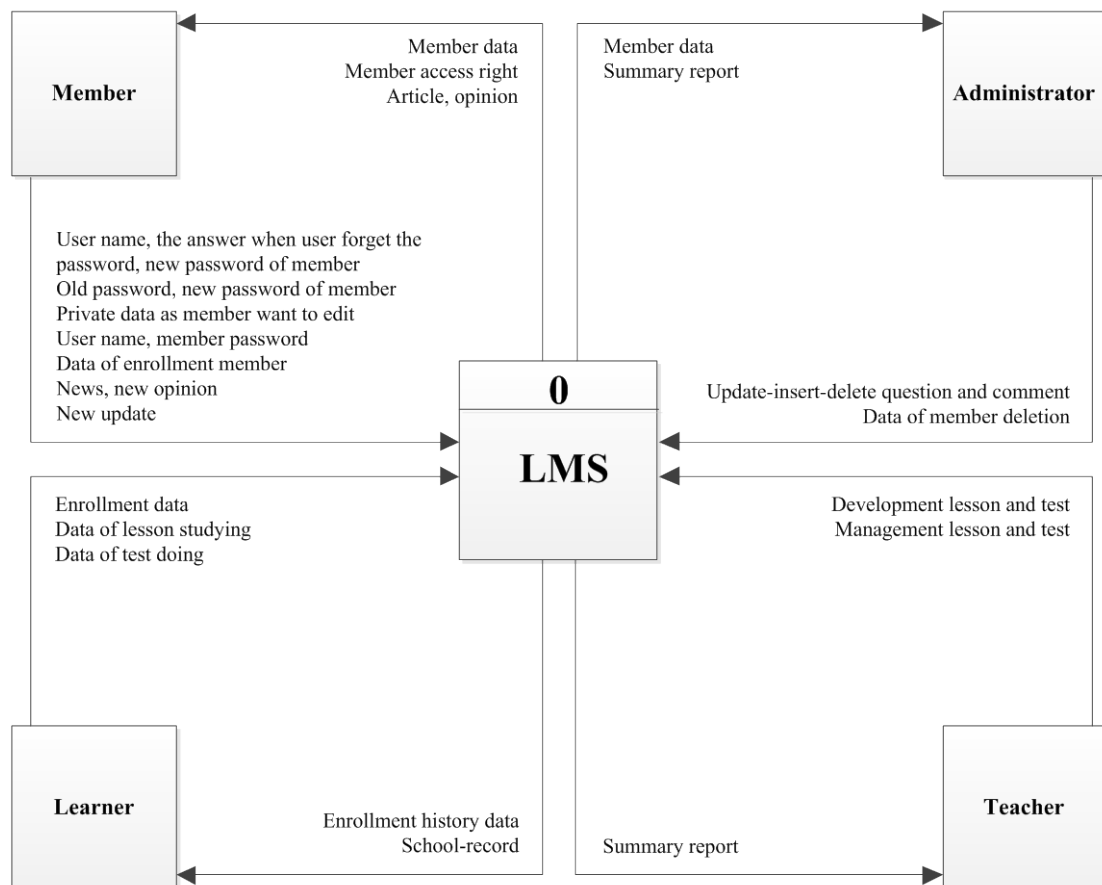
Figure 3.3 Context diagram of LMS
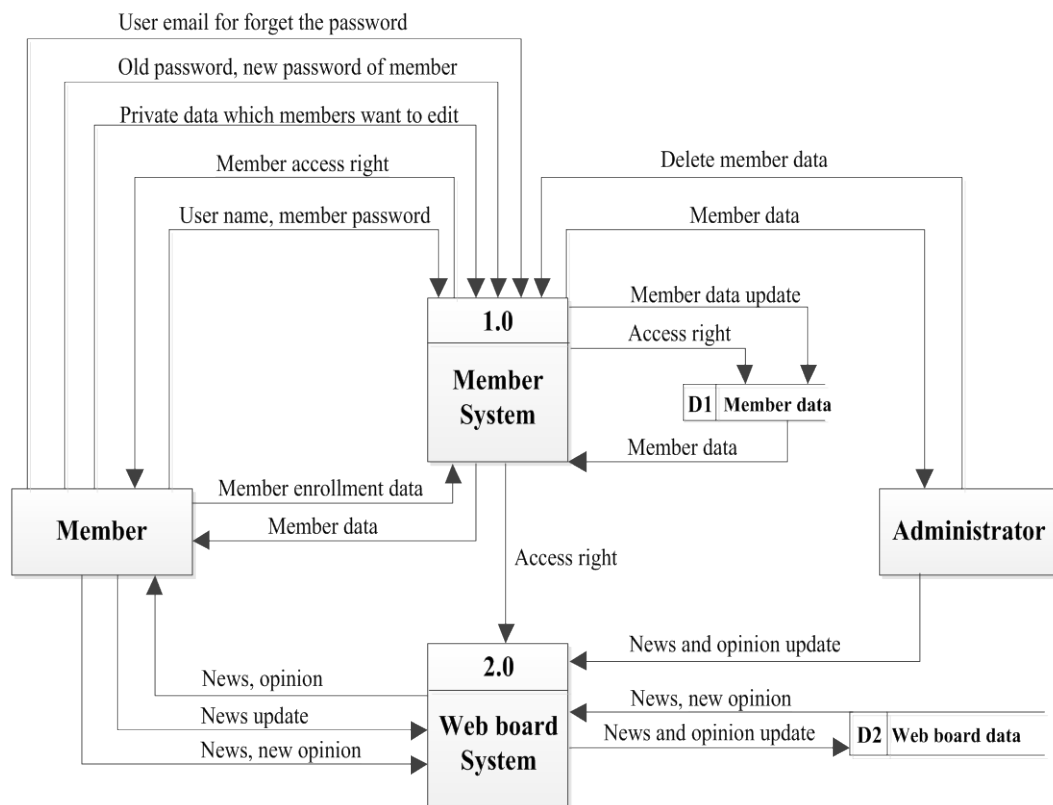
Figure 3.4 Data Flow Diagram Level 0
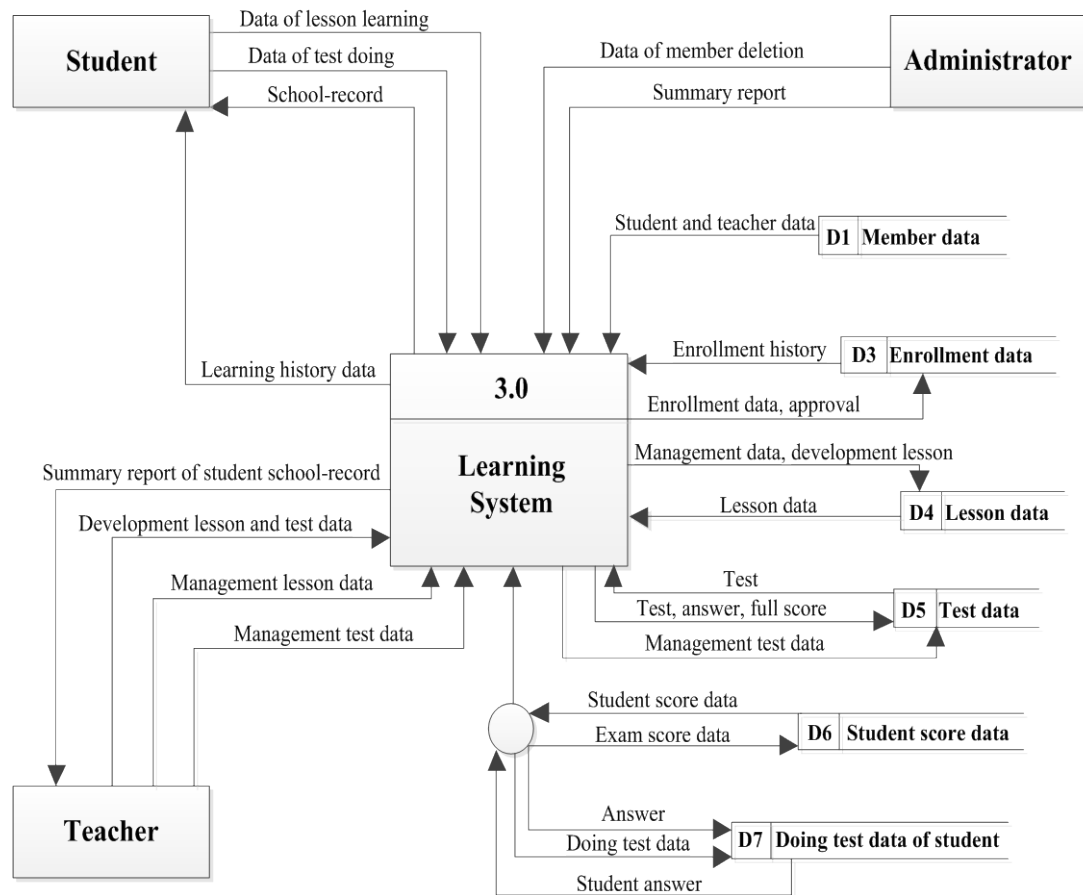
Figure 3.5 Data Flow Diagram Level 0 (Cont.)

LMS analysis requires knowing which data have to be stored into which storage entities of the database. Figure 3.6 shows this relationship between data and storage entities.
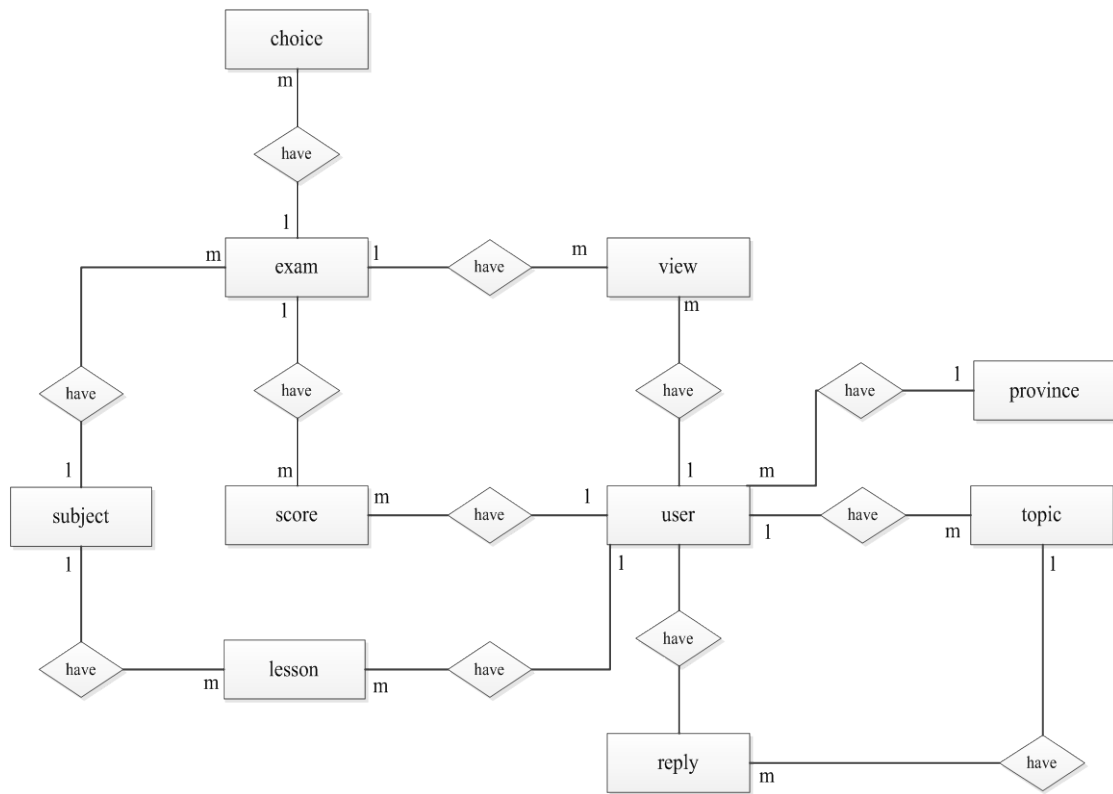
Figure 3.6 E-R Diagram
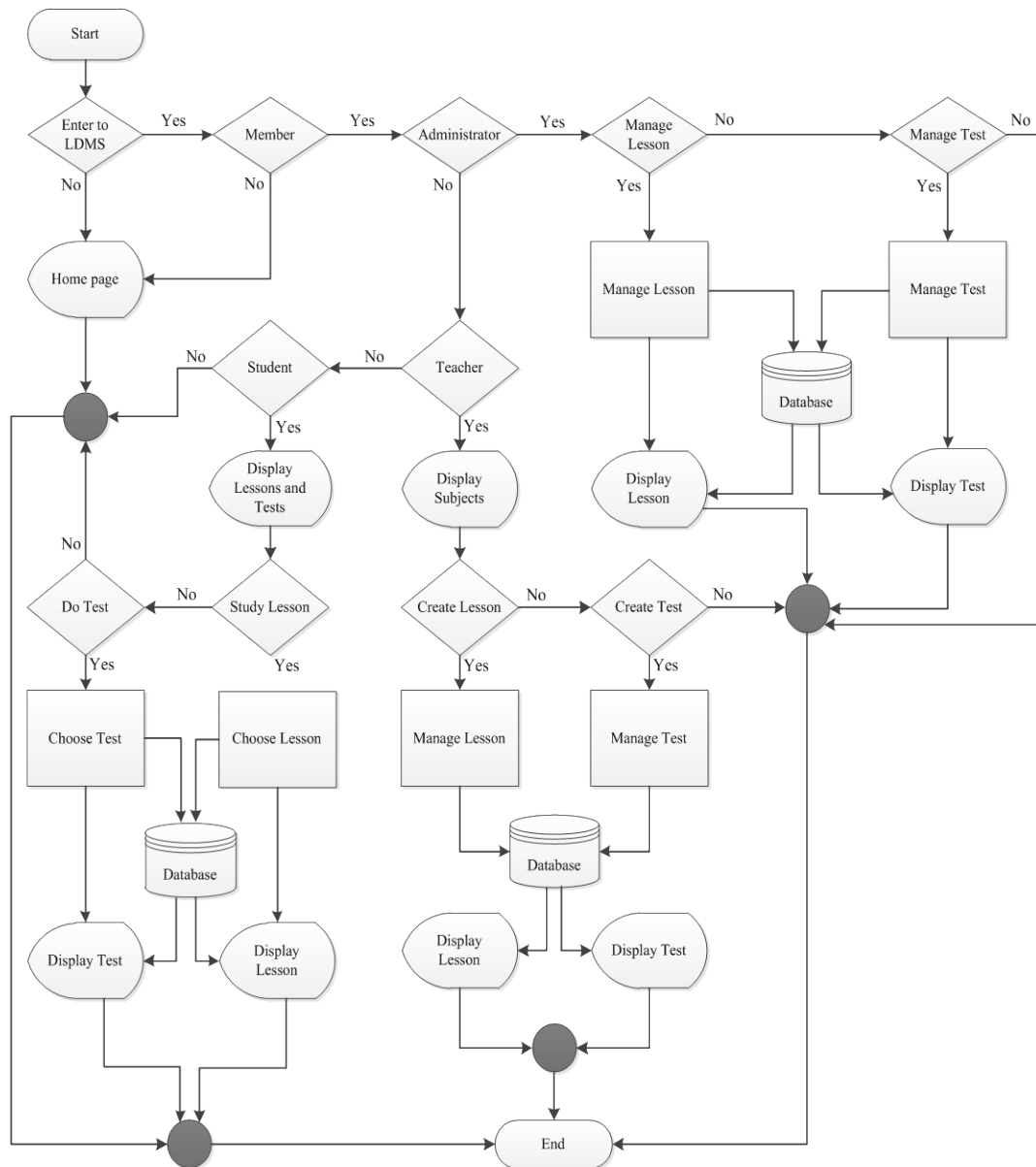
Figure 3.7 System Flowchart of LMS
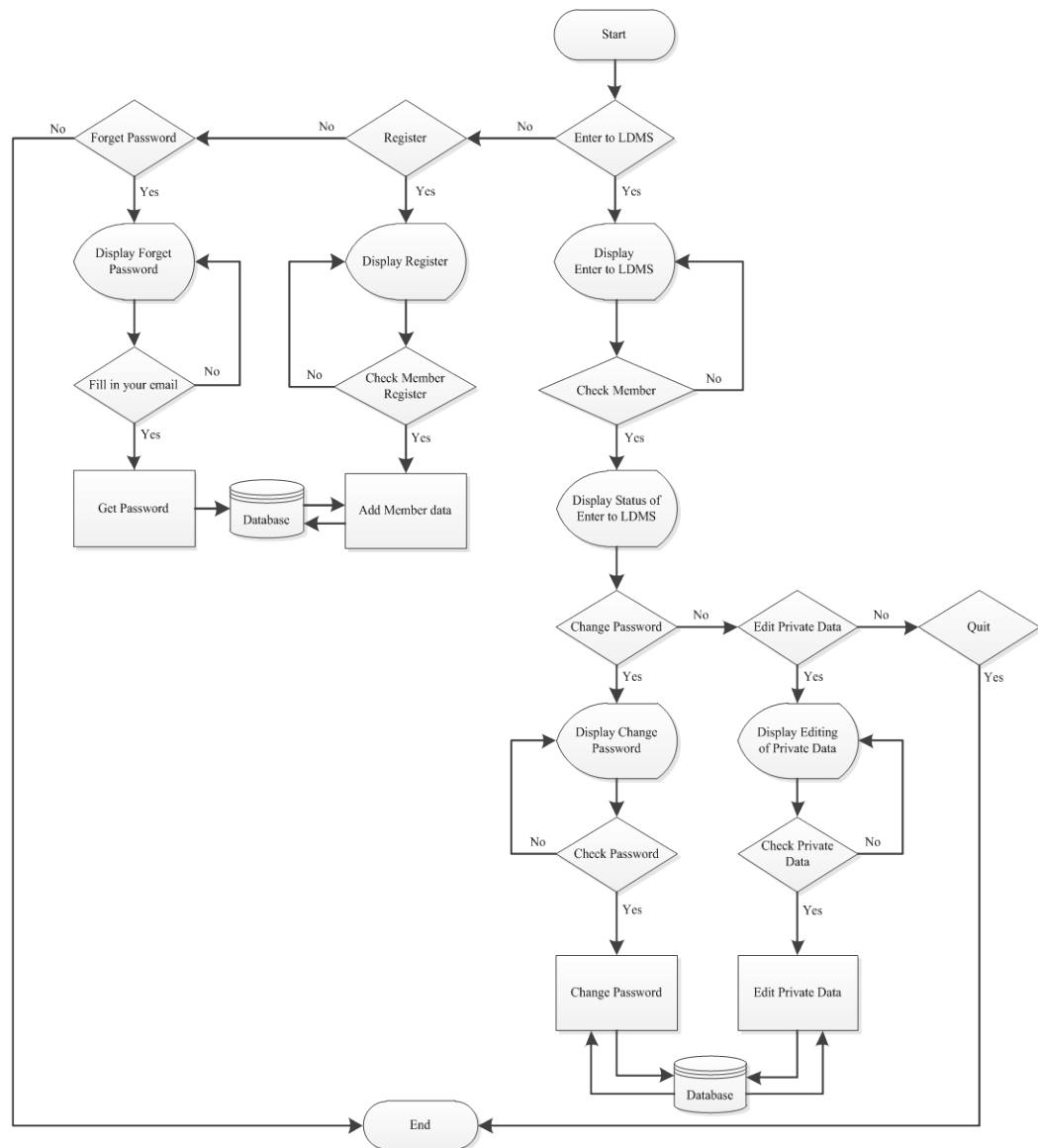
Figure 3.8 Front End: System Flowchart of Member Register
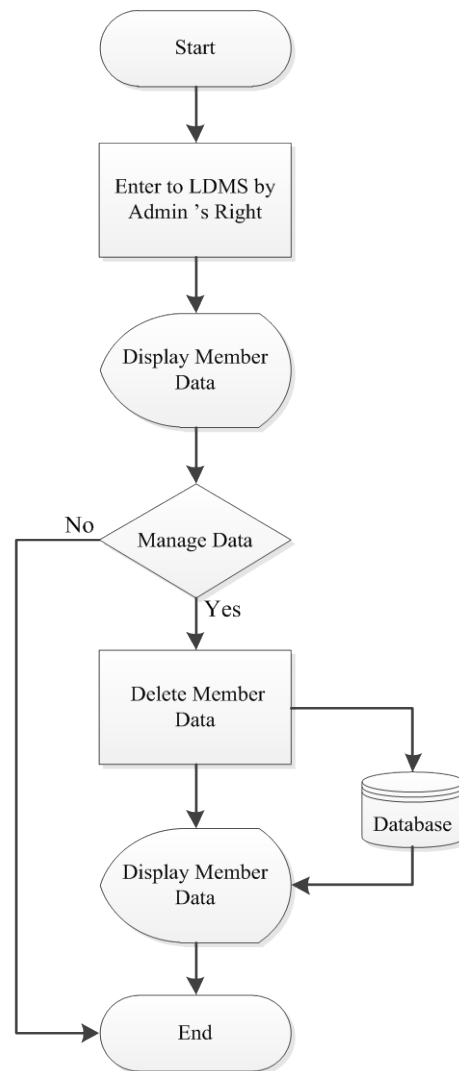
Figure 3.9 Back End: System Flowchart of Member Register
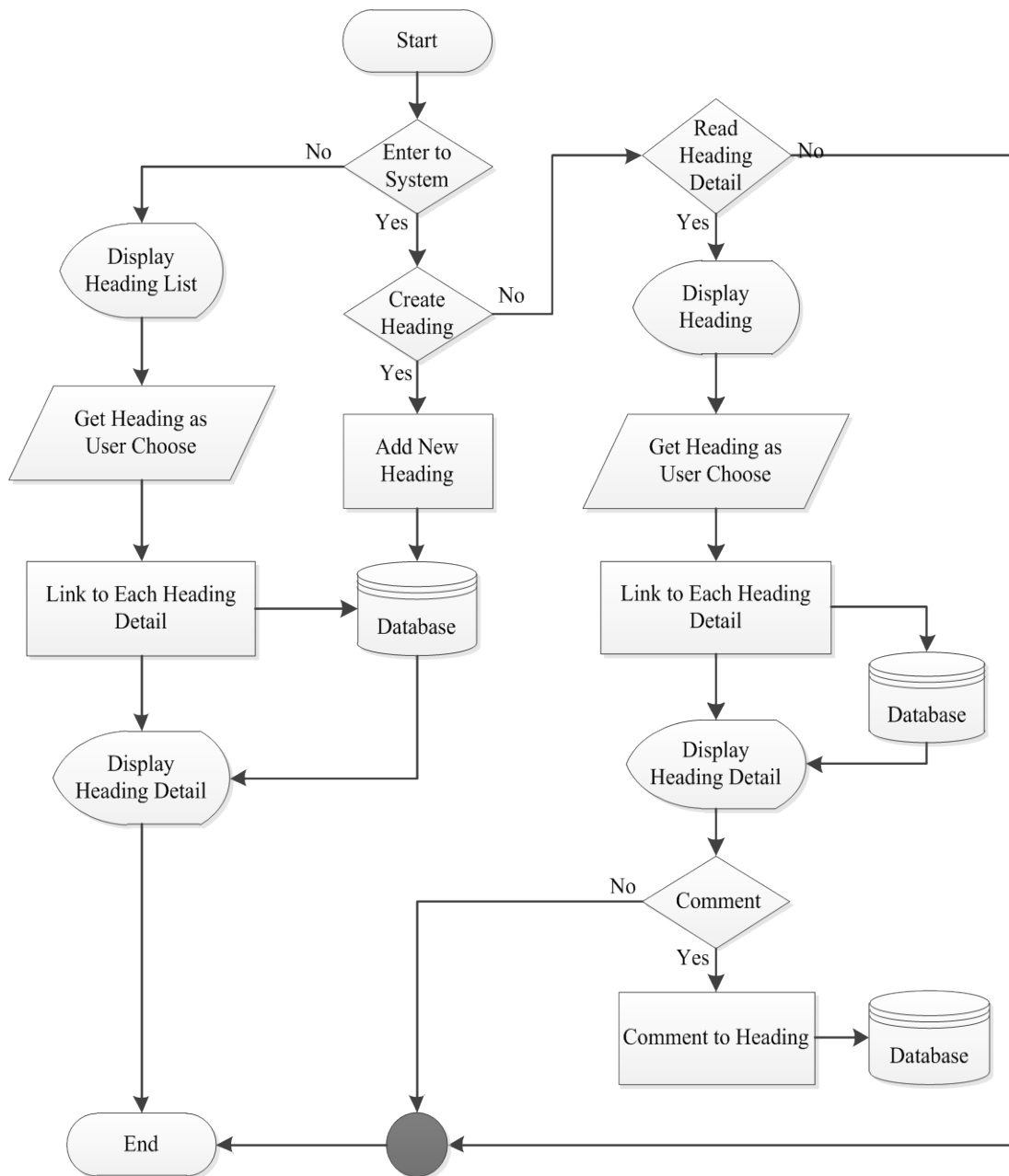
Figure 3.10 Front End: System Flowchart of Web board
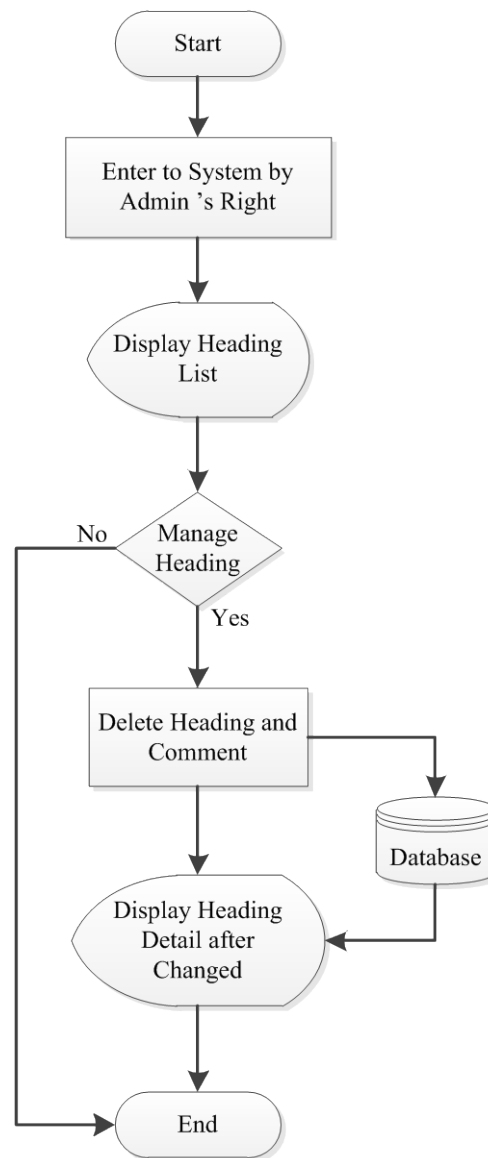
Figure 3.11 Back End: System Flowchart of Web board

Table 3.1 Entities of LMS

Entity 's name		Explanation
1.	Choice	To store choices of answer and questions
2.	Exam	To store test data
3.	Lesson	To store lesson data
4.	Province	To store province data
5.	Reply	To store opinion data
6.	Score	To store test score
7.	Subject	To store subject data
8.	Topic	To store question of web board
9.	User	To store user data
10.	View	To link User and Lesson entities

3.3   Development

3.3.1 To create media to present content and web page

Media in the web application contains text, graphic image, audio and animation. These are designed to create the usable web application. The first step, which creates web pages one at a time, belongs to the outline and graphic components. All contents are put in the web pages and format them correctly. Second step, create menu link and navigation bar and format components properly. According to figure 3.7 displays step by step of task detail classification of web application development process and figure 3.8 displays course component which consists of lesson and test. These development steps are shown below:
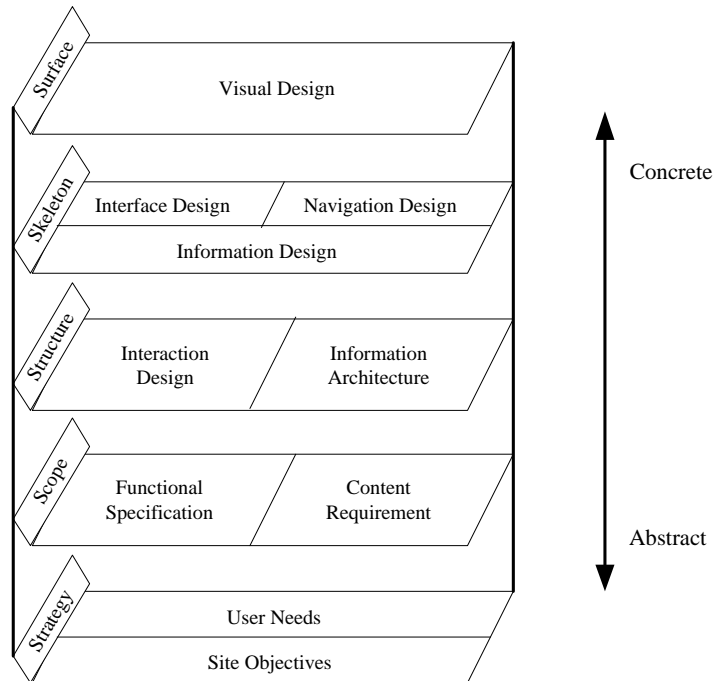
Figure 3.12 Development process of web application (Jesse James Garrett)
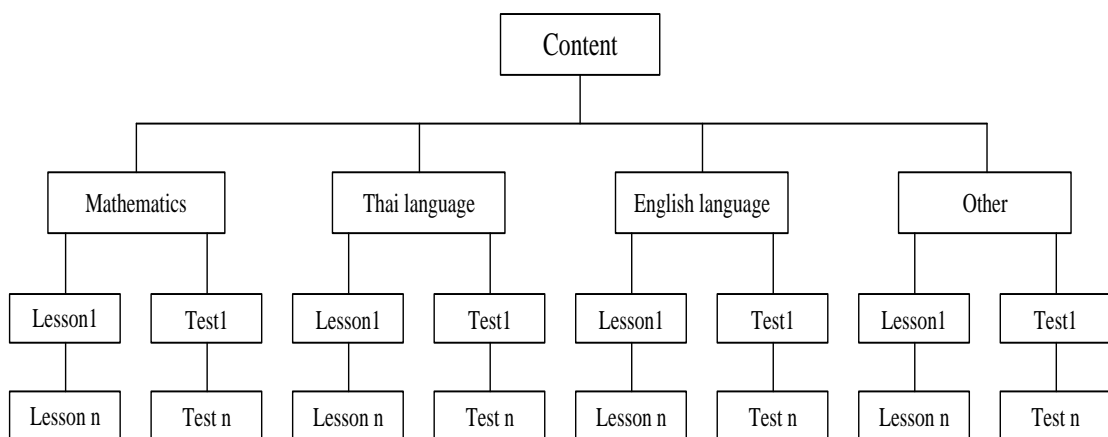
Figure 3.13 The component of content

3.3.2 To create form of web page

The purpose of this step is to send data which users fill their data into the form. These data are used with PHP script language that is important basic of bringing to create web application. Therefore, good form should be designed easy to fill in and can protect any error from unsatisfied data. There are five forms shown below:

1. Comment form
2. Add lesson form
3. Add test and choices form
4. Enrollment form
5. Log in form

3.3.3 To create database

This research incorporates the MySQL database in the web application. First step is to install AppServ 2.5.9 then, open phpMyAdmin to create MySQL database which name database after that, create entity's table from E-R diagram. LMS includes three sub systems as follow:

1. Enrollment sub system
2. Instruction sub system
3. Web board sub system

3.4   Implement and Test

This step installs and tests LMS to detect bugs (program error) in the script language and the database. User functions such as browser version, screen resolution, and Internet speed. These functions displayed correctly when users enter the system to view the web application.The network system in this research use Client-Server architecture that rents hosting from the service provider named http://www.appservhosting.com and domain named www.ldkids.com
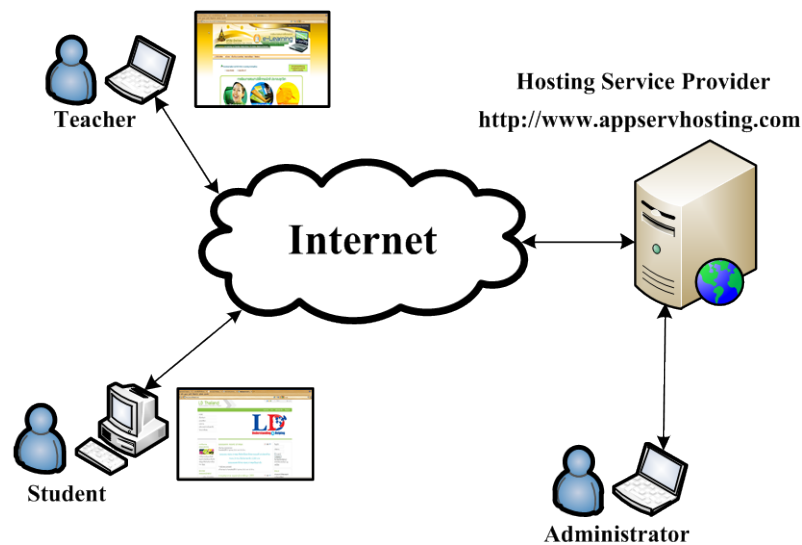
Figure 3.14 Client-Server architecture

3.5 Evaluation

3.5.1 Expert Evaluation

Six experts from the Technology Information System Management, Faculty of Engineering, Mahidol University evaluated the LMS. They are listed in appendix B.

The criterion of acceptance LMS is the experts consider average score of example group as representation of the real learner group. The criterion of average score has to be good level and would be accepted an efficiency of LMS as well as an usable real condition. There are four parts of evaluation as follow:

1) Content

The experts evaluate to cover many points consists of correctness, up to date of content, content quantity, language using, suitability for students with LD and appropriate question – answer in test.

2) Graphic Images Text and Multimedia

The experts evaluate the proper presentation of graphic image, text and audio for users who acknowledge them. GUI will support in step usability supervision of the user who is using programming through keyboard or mouse.

3) Web Page

The experts evaluated the web page design including the logo, banner, frame, colors and graphic images that suitable for students with learning disabilities as well as clear navigation for user.

4) Learning Management System: LMS

The experts consider LMS depend on response time of user's task. The factors affect the operation consists of hardware, software, and data. They evaluate three systems including member system, web board system and LMS.

3.5.2 Experiment

In this step, researcher tests the LMS or web application by letting a sample group, which represents real users, use LMS via a web browser. The aim is to evaluate an efficient LMS that researcher try to provide the situation nearest real usability. Before the experiment, researcher will explain objectives and introduce usability steps of LMS, after that let the sample group start to use LMS with under control of researcher. Researchers will closely observe and note sample group's behavior for usability of LMS.

3.5.3 Questionnaire

The characteristic tool used in this research is questionnaire which divide into three parts as follow:

1) Questionnaire relates individual status of user in check-list format.

2) Questionnaire relates satisfied of user using LMS. It is rating scale which has standard to define weight of evaluation. There are five levels by Likert. [25]

Table 3.2 To display satisfied weight

Satisfied level	Score weight of choices
Should improve	1
Poor	2
Medium	3
Good	4
Very good	5

Translation meaning standard is to manage average score level of satisfaction. It is defined into interval as follow:

Table 3.3 To display average score meaning

Average Score	Meaning
1.10-1.49	To have satisfaction is supposed to improve.
1.50-2.49	To have satisfaction is poor.
2.50-3.49	To have satisfaction is medium.
3.50-4.49	To have satisfaction is good.
4.50-5.50	To have satisfaction is very good.

3) Questionnaire relates about opinion and suggestion which is in open ended format.

3.5.4 Statistic Data Analysis

The statistic which use for finding efficiency of LMS are as follow:

1) *Arithmetic mean (Mean)*

  Formula:

$$\bar{X} = \frac{\sum X}{N}$$

  $\bar{X}$ = mean

  $\sum X$ = sum

  N = all amount

2) *Standard Deviation*

  Formula:

$$SD = \sqrt{\frac{\sum(X-\bar{X})^2}{n-1}}$$

  $\bar{X}$ = mean

  $\sum X$ = sum

  n = all amount

3.6   Materials

3.6.1 Hardware

- **Server**

1) CPU Intel Quad Core Xeon 3250 2.66Ghz

2) Memory ECC-RAM Bus 800Mhz 8GB

3) Hard Disk Drive SATA2 500GB

- **Client**

1) CPU Core 2 Duo 2.40 GHz

2) RAM4 GB

3) HDD 250 GB

4) Graphic Chip Intel GMA Graphics 1024MB

5) Monitor 14 inches

6) Peripherals: Mouse, Pen Mouse

3.6.2 Software

- **Server**

1) Operating System: Linux 6.0 Squeeze

2) Apache

3) Database: MySQL

4) Database Management tool: phpMyAdmin

5) Script language: PHP 5.2

- **Client**

1) Operating System: Microsoft Window 7 32bit

2) Web Browser: Microsoft Internet Explorer 8.0

- **System Development Tool**

1) Adobe CS5 (Flash, Illustrator, Photoshop, Dreamweaver)

2) Microsoft Office 2010 (Word, Excel, Visio)

3) Markup Language(DHTML, HTML, CSS)

3.7 Research Schedule

Table 3.4 Time Frames

Tasks	Nov 2011	Dec 2011	Jan 2012	Feb 2012	March 2012	April 2012	May 2012	June 2012	July 2012
1.Data and Information Gathering	▓								
2.Requirement Analysis		▓							
3.LMS Design and Analysis			▓	▓					
4.LMS Development				▓	▓	▓			
5.LMS Implementation and Testing					▓	▓			
6.LMS Evaluation							▓	▓	
7.Documentation								▓	▓

CHAPTER IV
RESULTS

4.1 The result of LMS development

Home Page of web application (www.ldkids.com) includes logo, banner, footer, menu bar, links, number of viewer and register.

Figure 4.1 Home page of www.ldkids.com

4.1.1 Administrator Part

Administrator can view user list, search user by section or name and has right to cancel user as well as change password and edit history information.

Figure 4.2 Web page of administrator part

Figure 4.3 Web page of name searching

4.1.2 Teacher Part

Figure 4.4 Web page of teacher part

In this part, when user registered and select to be teacher which can develop lesson and test.
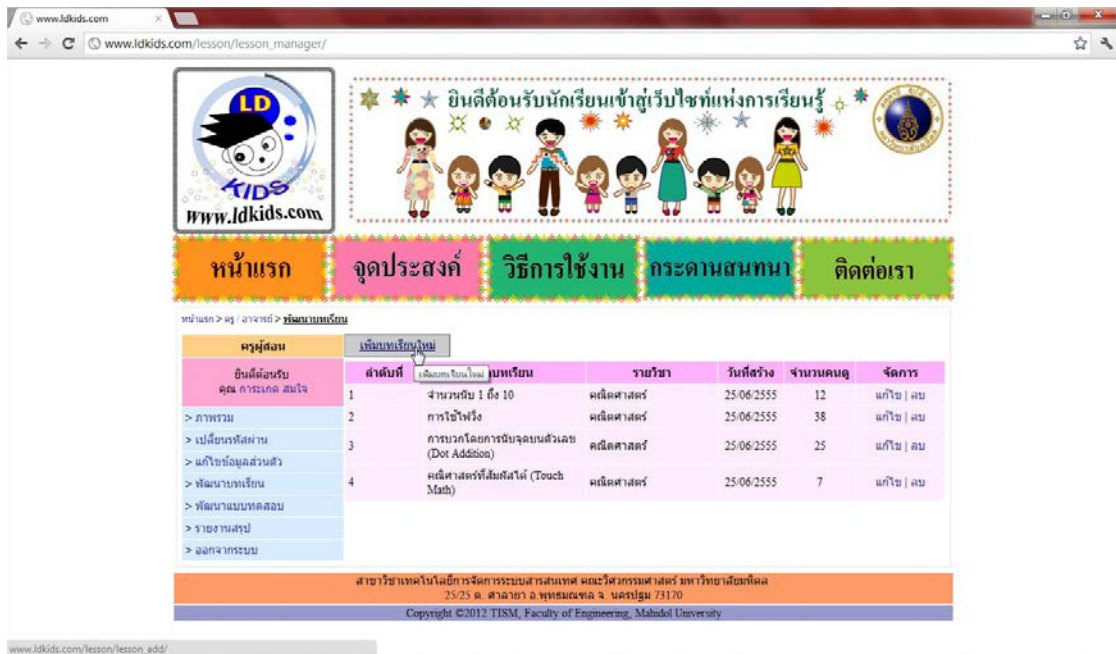
Figure 4.5 Web page of add new lesson

The step of add lesson, it begins to name lesson then select subject and type objectives, after that select file to upload.

Figure 4.6 Detail of add lesson

This is a create test part that teacher names test into course correctly and type the order of test detail and decide question number of test.

Figure 4.7 Detail of test creation

The teacher decides question number of test then create question and answer choices. The teacher can upload illustration into each question and decide the correct answer by clicking the radio button.
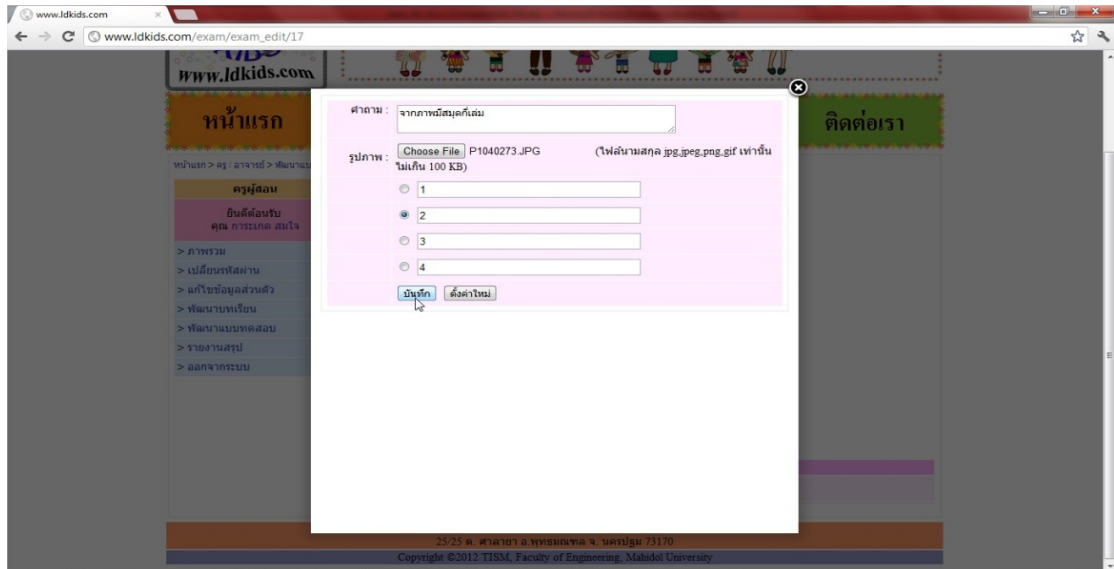
Figure 4.8 Detail of each test creation
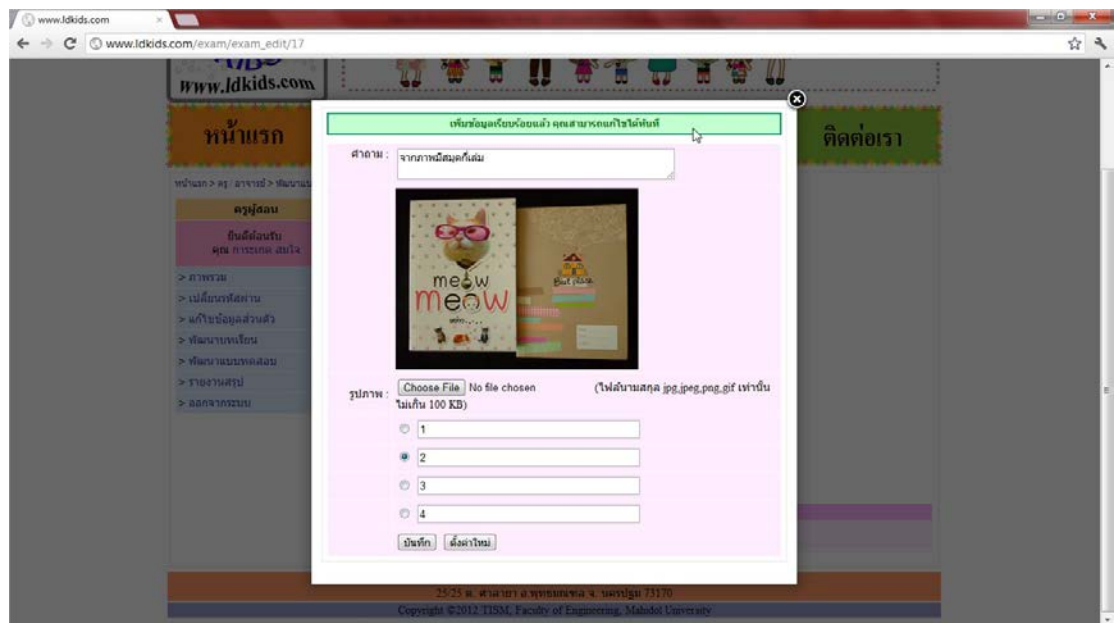
Figure 4.9 Display the screen while test finished

First create the first number of the test then click the Reload button to add the next question.
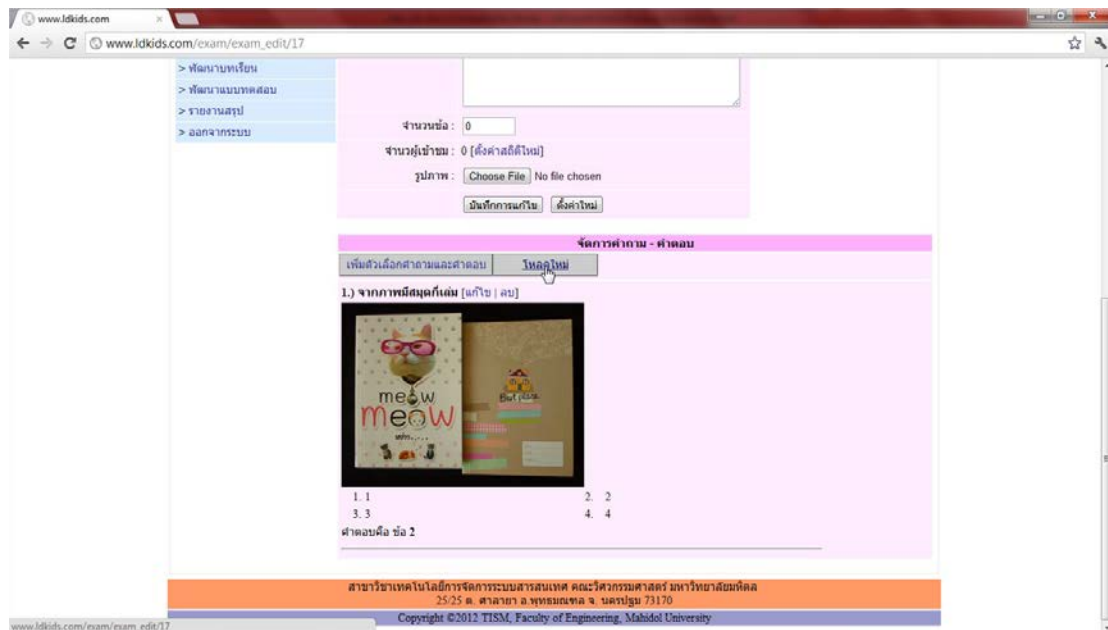
Figure 4.10 Display screen when teacher will create the next question

4.1.3 Student Part

In this part, students can enter to study lesson, do test, view their summary report and view lesson that read already.

Figure 4.11 Display screen of student part

There are 4 sections of subject consists of Mathematics, Thai language, English language and others.

Figure 4.12 Display screen of subjects

Figure 4.13 Display screen of lessons in Mathematics
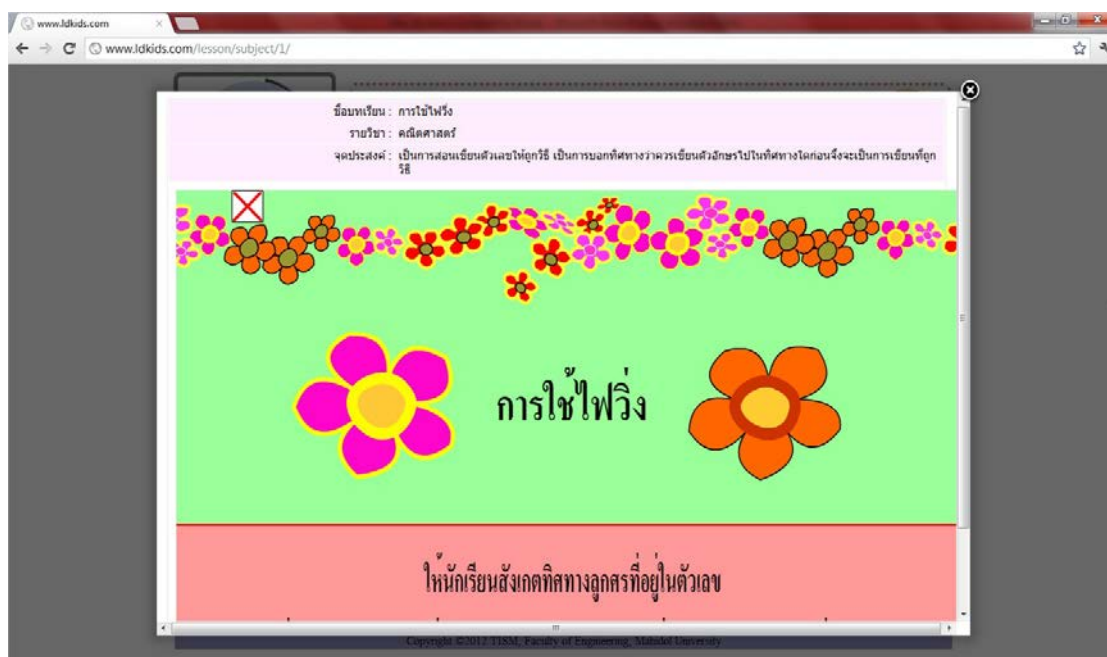
Figure 4.14 Display content

Figure 4.15 Display screen of lesson which read already

Figure 4.16 Display screen of tests in Mathematics

Figure 4.17 Display screen of test
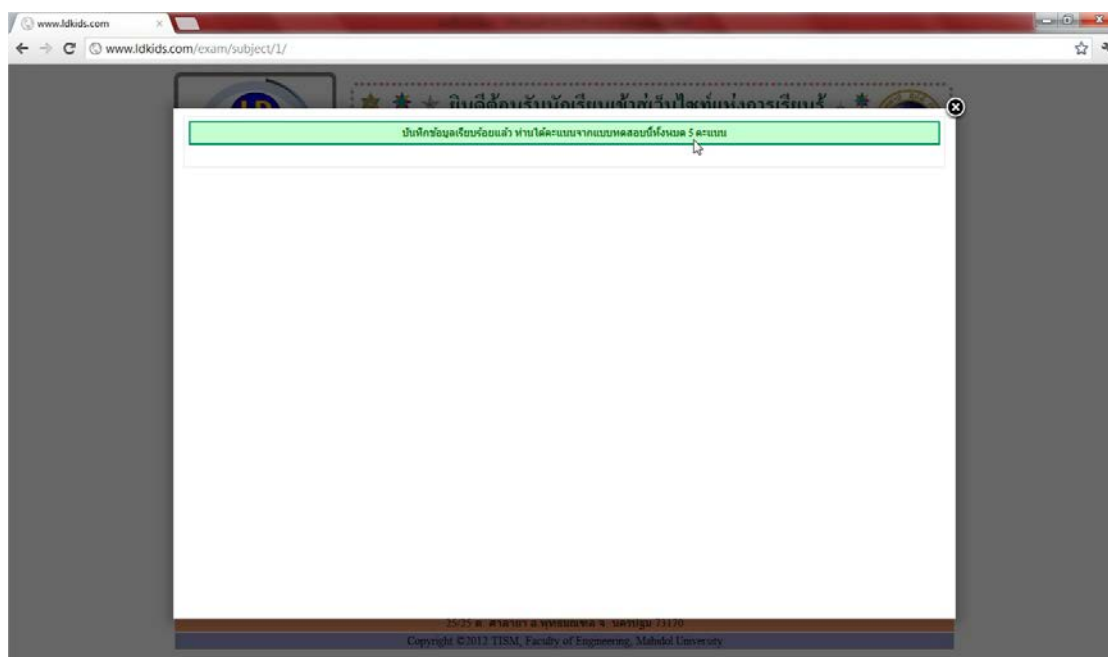
Figure 4.18 Display screen of each test score

Figure 4.19 Display screen of summary report of test which student did them

4.1.4 Web board Part

In this part, user who was a member can use web board which start question heading and answer any questions. For administrator, who can delete question heading is only one person in this system.

Figure 4.20 Display screen of web board

Figure 4.21 Display screen of administrator want to delete the question heading

4.1.5 Register Part

When user enter to home page. User have to register first for define their right to be either teacher or student. Users fill their emails in the blank when forgot password and can change new password too.

Figure 4.22 Display screen of register

Figure 4.23 Display screen of change new password

Figure 4.24 Display screen of user forgot password

4.2 The result of LMS efficiency for students with LD

The researcher design evaluation form of LMS which is Rating Scale 5 levels. The evaluation form was evaluated by six experts from Faculty of Engineering, Mahidol University and nine teachers who have a teaching experience of students with learning disabilities teaching at Klongtaweewattana School, Bangkok. The result as table 4.1

Table 4.1 Summary result of content efficiency evaluation

Statements	Efficiency		
	$\bar{X}$	SD	Efficient Level
1. Content			
1.1 Content was relevant to objectives	4.17	0.75	Good
1.2 Exposition was clear	3.67	0.82	Good
1.3 Test was relevant to content	3.83	0.41	Good
1.4 Test was easy to understand	3.83	0.41	Good
1.5 Lesson level was appropriate	3.83	0.75	Good
1.6 Test level was appropriate	4.17	0.75	Good
1.7 Language was correct	3.83	0.75	Good
1.8 Multimedia supported the content	3.83	0.41	Good
1.9 Presentation format was effective	3.83	0.98	Good
1.10 Content was suitable to distribute for education	3.83	0.75	Good
Total	**3.88**	**0.68**	**Good**

From table 4.1 found that overview of summary result of content efficiency evaluation was at a satisfactory level. Mean was 3.88 and Standard Deviation was 0.68.

Table 4.2 Summary result of graphic and text efficiency evaluation

Statements	Efficiency		
	$\overline{X}$	SD	Efficient Level
2. Graphic Images and Text			
2.1 Alphabet format was appropriate	3.83	0.41	Good
2.2 Alphabet size was appropriate	3.67	0.52	Good
2.3 Alphabet color was appropriate	4.33	0.82	Good
2.4 Background color was appropriate	3.67	0.52	Good
2.5 Graphic User Interface (GUI) was easy to use	3.83	0.41	Good
2.6 Graphic Images are beautiful and convey meaning	3.83	0.41	Good
Total	**3.86**	**0.51**	**Good**

From table 4.2 found that overview of summary result of content efficiency evaluation was at a satisfactory level. Mean was 3.86 and Standard Deviation was 0.51.

Table 4.3 Summary result of multimedia efficiency evaluation

Statements	Efficiency		
	$\overline{x}$	SD	Efficient Level
3. Multimedia			
3.1 Multimedia display continuously	3.67	0.52	Good
3.2 Multimedia was interesting	4.00	0.89	Good
3.3 Multimedia was appropriate for student with LD	3.38	0.75	Good
3.4 The period of time in showing was appropriate	4.17	0.75	Good
3.5 Multimedia was easy to understand	4.00	0.63	Good
3.6 Sound of multimedia was appropriate and clear	3.50	1.38	Good
Total	**3.86**	**0.82**	**Good**

From table 4.3 found that overview of summary result of content efficiency evaluation was at a satisfactory level. Mean was 3.86 and Standard Deviation was 0.82.

Table 4.4 Summary result of web page efficiency evaluation

Statements	Efficiency		
	$\bar{x}$	SD	Efficient Level
4. Web page			
4.1 All of web pages were appropriate	4.00	0.63	Good
4.2 All of web pages were easy to use and continued	4.33	0.82	Good
4.3 Web page was beautiful	3.67	0.52	Good
4.4 Element of web page was balance	3.67	0.52	Good
4.5 All URL can link to their website	3.83	0.75	Good
4.6 Webpage convey the education for children	3.67	0.52	Good
4.7 GUI was easy to understand	3.83	0.75	Good
4.8 Logo was unique and suitable for children with Learning Disabilities	4.33	0.52	Good
4.9 Menu bar was appropriate	4.33	0.82	Good
4.10 Users were aware of themselves where they are in the web page	4.17	0.75	Good
Total	**3.98**	**0.66**	**Good**

From table 4.4 found that overview of summary result of content efficiency evaluation was at a satisfactory level. Mean was 3.98 and Standard Deviation was 0.66.

Table 4.5 Summary result of LMS efficiency evaluation

Statements	Efficiency		
	$\bar{x}$	SD	Efficient Level
5. Learning Management System (LMS)			
5.1 LMS was easy to use	4.33	0.82	Good
5.2 LMS reported up to date	4.17	0.75	Good
5.3 Score summary of test was correct	3.67	0.52	Good
5.4 Register system was easy to use	3.17	0.75	Medium
5.5 LMS was appropriate for teacher and student	3.83	1.17	Good
5.6 Lesson functions (update-insert-delete) were effective	3.83	0.41	Good
5.7 Test functions (update-insert-delete) were effective	3.67	0.82	Good
5.8 Web board was appropriate and easy to use	4.00	0.63	Good
5.9 Satisfaction to over view of LMS	3.67	0.52	Good
Total	**3.81**	**0.71**	**Good**

From table 4.5 found that overview of summary result of content efficiency evaluation was at a satisfactory level. Mean was 3.81 and Standard Deviation was 0.71.

Table 4.6 Summary result of content satisfaction evaluation by teachers

Statements	Efficiency		
	$\bar{x}$	SD	Efficient Level
1. Content			
1.1 Content was relevant to objectives	4.33	0.50	Good
1.2 Exposition was clear	4.00	0.87	Good
1.3 Test was relevant to content	4.33	0.50	Good
1.4 Test was easy to understand	4.44	0.53	Good
1.5 Lesson level was appropriate	4.56	0.53	Very good
1.6 Test level was appropriate	4.44	0.53	Good
1.7 Language was correct	4.56	0.53	Very good
1.8 Multimedia supported the content	4.44	0.73	Good
1.9 Presentation format was effective	4.22	0.44	Good
1.10 Content was suitable to distribute for education	4.44	0.53	Good
Total	**4.38**	**0.57**	**Good**

From table 4.6 found that overview of summary result of content satisfaction evaluation was at a satisfactory level. Mean was 4.38 and Standard Deviation was 0.57.

Table 4.7 Summary result of graphic images and text satisfaction evaluation by teachers

Statements	Efficiency		
	$\bar{x}$	SD	Efficient Level
2. Graphic Images and Text			
2.1 Alphabet format was appropriate	4.44	0.53	Good
2.2 Alphabet size was appropriate	4.33	0.71	Good
2.3 Alphabet color was appropriate	4.33	0.50	Good
2.4 Background color was appropriate	4.33	0.50	Good
2.5 Graphic User Interface (GUI) was easy to use	4.22	0.67	Good
2.6 Graphic Images are beautiful and convey meaning	4.11	0.60	Good
Total	**4.30**	**0.58**	**Good**

From table 4.7 found that overview of summary result of graphic images and text satisfaction evaluation was at a satisfactory level. Mean was 4.30 and Standard Deviation was 0.58.

Table 4.8 Summary result of multimedia satisfaction evaluation by teachers

Statements	Efficiency		
	$\bar{x}$	SD	Efficient Level
3. Multimedia			
3.1 Multimedia display continuously	4.44	0.53	Good
3.2 Multimedia was interesting	4.11	0.78	Good
3.3 Multimedia was appropriate for student with LD	4.11	0.78	Good
3.4 The period of time in showing was appropriate	4.22	0.67	Good
3.5 Multimedia was easy to understand	4.44	0.73	Good
3.6 Sound of multimedia was appropriate and clear	4.11	0.78	Good
Total	**4.24**	**0.71**	Good

From table 4.8 found that overview of summary result of multimedia satisfaction evaluation was at a satisfactory level. Mean was 4.24 and Standard Deviation was 0.71.

Table 4.9 Summary result of web page satisfaction evaluation by teachers

Statements	Efficiency		
	$\bar{x}$	SD	Efficient Level
4. Web page			
4.1 All of web pages were appropriate	4.33	0.50	Good
4.2 All of web pages were easy to use and continued	4.22	0.67	Good
4.3 Web page was beautiful	4.22	0.83	Good
4.4 Element of web page was balance	4.11	0.60	Good
4.5 All URL can link to their website	4.00	0.50	Good
4.6 Webpage convey the education for children	4.11	0.78	Good
4.7 GUI was easy to understand	4.33	0.71	Good
4.8 Logo was unique and suitable for children with Learning Disabilities	4.67	0.50	Very good
4.9 Menu bar was appropriate	4.33	0.50	Good
4.10 Users were aware of themselves where they are in the web page	4.22	0.44	Good
Total	**4.26**	**0.60**	**Good**

From table 4.9 found that overview of summary result of web page satisfaction evaluation was at a satisfactory level. Mean was 4.26 and Standard Deviation was 0.60.

Table 4.10 Summary result of LMS satisfaction evaluation by teachers

Statements	Efficiency		
	$\bar{x}$	SD	Efficient Level
5. Learning Management System (LMS)			
5.1 LMS was easy to use	3.78	0.97	Good
5.2 LMS reported up to date	4.78	0.44	Good
5.3 Score summary of test was correct	4.33	0.87	Good
5.4 Register system was easy to use	3.56	0.88	Medium
5.5 LMS was appropriate for teacher and student	4.22	0.67	Good
5.6 Lesson functions (update-insert-delete) were effective	4.33	0.71	Good
5.7 Test functions (update-insert-delete) were effective	4.33	0.71	Good
5.8 Web board was appropriate and easy to use	4.22	0.67	Good
5.9 Satisfaction to over view of LMS	4.00	0.71	Good
Total	**4.17**	**0.74**	**Good**

From table 4.10 found that overview of summary result of LMS satisfaction evaluation was at a satisfactory level. Mean was 4.17 and Standard Deviation was 0.74.

CHAPTER V
DISCUSSIONS

5.1 LMS versus other related researches

(1) You-Jin Seo and Honguk Woo, 2010 studied in topic The identification, implemation, and evaluation of critical user interface design features of computer-assisted instruction programs in mathematics for students with learning disabilities. In this research is based on the identified features and guidelines, a multimedia computer-assisted instruction program, 'Math Explorer' which delivers addition and subtraction word problem-solving instruction for students with learning disabilities at the early elementary level, was design and developed.

Nevertheless, this LMS can online and collect data user via Internet network. Students review their lessons and tests at virtually any time or location. Home page was designed appropriate and attractive for them and different from that CAI that is only offline system.

(2) Grant D. Fryia, Renatawachowiak-Smolikova and Mark P. Wachowiak, 2009, used web accessibility in the development of an e-Learning system for individuals with cognitive and learning disabilities (CLDs). This paper describes current human-computer interaction research for cognitive and/or learning disabled individuals, and outlines several human-computer interaction challenges that arise when designing web-based systems for them. The result from research indicated that online course system is intended to give people with cognitive and learning disabilities, the opportunity to learn, unimpaired by the system that they must use.

However, LMS aimed to support their learning as supplementary media to review their lessons and tests. There is function of summary learning result.

(3) NorfarhanaAbdollah and et al., 2010, studied in topic Multimedia Design and Development in 'Komputer Saya Courseware for Slow Learners'. The instructional design model, courseware components and courseware modules have been designed according to the early analysis results combined with the studies on suitable learning theories principles and characteristics as well as appropriate instructional design for the slow learners.

However, Researcher designed and developed multimedia lesson from book: *The improvement of disabilities in mathematics series 2: Number* [7]. The multimedia perform 2-dimentional animation using Adobe Flash program.

(4) Wan Fatimah Wan Ahmad, Emelia Akashah P. Akhir, and Sarah Azmee, 2010, developed a multimedia courseware that can be used to educate children with Learning Disabilities (LD). The use of game-based courseware could help those with LD to explore their capabilities without having to pressure them to catch up with other friend but to let them learn in their own pace of time.

Nevertheless, Students review their lessons and tests at virtually any time or location without pressure as well.

5.2 Expert evaluation and teacher satisfaction to LMS

5.2.1 Content Evaluation

The efficiency is satisfied. Content was accepted correctly, easy to understand and appropriate to distribute for kindergarten and early elementary with and without Learning Disabilities (LD).

5.2.2 Graphic and Text Evaluation

The efficiency is satisfied. There are suitable format, size and color text including beautiful graphic images convey their learning.

5.2.3 Multimedia Evaluation

The efficiency is satisfied. Multimedia lessons perform continuously. They are attractive, easy to understand and appropriate for them.

5.2.4 Web page Evaluation

The efficiency is satisfied. All web pages are easy to use and continuously. They convey education for students with Learning Disabilities. Graphic User Interface (GUI) is easy to understand and accuratethe website objectives.

5.2.5 LMS Evaluation

The efficiency is satisfied. LMS is easy to use, real time summary report, appropriate for users and functions accurate the website objectives.

5.3 The limitation of this study

LMS was evaluated by expert group and teacher group only without various opinions as expected. Therefore, LMS should be evaluated by other expert or teacher next time. Researcher may set online evaluation into LMS.

Moreover, LMS should test for kindergarten and early elementary students with and without Learning Disabilities (LD) that design test as pre-test and post-test.

CHAPTER VI
CONCLUSION

6.1 Developing Learning Management System (LMS)

This LMS is a supplementary media online and collecting user data via Internet network. Students with LD review their lessons and tests better. LMS applies the theory and related technology such as web application technology connect database, multimedia technology and Internet network technology to support the developing LMS continuously and smoothly. Experts and teachers accepted the efficiency and satisfaction of LMS was at a satisfactory level. The summary of LMS abilities are as follow:

1) Administrator Function:
- To delete member
- To manage web board
- To view the real time summary user report
- To re-user name and password
- To view and edit own history

2) Teacher Requirement
- To create lesson and test
- To view and edit own history
- To use web board
- To view the real time summary report
- To re-user name and password

3) Student Requirement

- To learn lesson and do test
- To view and edit own history
- To view real time school-record report
- To use web board
- To re-user name and password

6.2 Multimedia lesson base on the Cognitive Theory of Multimedia Learning (CTML)

Multimedia lessons were designed by related their characteristic and requirements based on the Cognitive Theory of Multimedia Learning: CTML. CTML supported 2-dimentional learning which perform colorful animation and easy to understand. The content was created from two books consists of The instructional method of mathematics for children with learning disabilities and The improvement of disabilities in mathematics series 2: Number. [7,8]

6.3 The Standard Deviation (SD) and Mean ($\overline{X}$)

Statistic result came from evaluation form which researcher created. The experts evaluated efficient LMS and teachers evaluated satisfied LMS. Results revealed that the efficiency and satisfaction to LMS was at a satisfactory level.

6.4 The outcomes of the evaluation

1) LMS is the supplementary e-Learning to support education of students with LD at virtually any time or location with Internet connectivity.

2) LMS is appropriate and attractive for kindergarten and early elementary students with and without Learning Disabilities (LD).

3) Students with LD will increase their knowledge depend on teachers design and create the content appropriately to appear highest effect.

4) Teachers is satisfied to use LMS as supplementary media. It is easy to use and perform efficient result report and various designs such text, graphic images and animated multimedia (2-dimention) on Internet more than book that only perform paper format.

6.5 Recommendations

1) Teachers who design and create the lessons and tests should have an experience creation of Flash Animation: (2-Dimention).

2) The function of test creation in LMS should have an ability to create various formats by user such as matching test or write-up test.

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APPENDICES

APPENDIX A
DATA DICTIONARY

LMS consists of ten entities as follow;

1) Entity: Choice

Column	Type	Null	Definition
ChoiceId	Int(11)	No	ID of answer
ExamId	Int(11)	No	ID of test
ChoiceName	Text	No	Question
Choice1	Varchar(225)	No	Choice of answer number one
Choice2	Varchar(225)	No	Choice of answer number two
Choice3	Varchar(225)	No	Choice of answer number three
Choice4	Varchar(225)	No	Choice of answer number four
Ans	TinyInt(1)	No	Correct answer
ChoiceCreateDate	Datetime	No	Date of create
ChoiceUpdate	Datetime	No	Date of up to date

2) Entity: Province

Column	Type	Null	Definition
ProvinceId	TinyInt(2)	No	ID of province
PrevinceName	Varchar(150)	No	Province name

3) Entity: Exam

Colume	Type	Null	Definition
ExamId	Int(11)	No	ID of test
SubjectId	Int(11)	No	ID of subject
ExamName	Varchar(225)	No	Test name
ExamDetail	Text	No	Test detail
ExamChoice	Tinyint(2)	No	All number of each test
ExamView	Int(11)	No	Amount of viewer
ExamCreateDate	Datetime	No	Date of create
ExamUpdate	Datetime	No	Date of up to date
UserId	Int(11)	No	User who creates or edit

4) Entity: Lesson

Column	Type	Null	Definition
LessonId	Int(11)	No	ID of lesson
SubjectId	Int(11)	No	ID of subject
LessonName	Varchar(255)	No	Lesson name
LessonObjective	Text	No	Lesson objective
LessonFile	Varchar(255)	No	Lesson file
LessonView	Int(11)	No	Amount of view
LessonCreateData	Datetime	No	Date and time which create
LessonUpdate	Datetime	No	Date and time which edit
UserId	Int(11)	No	User who creates or edit

5) Entity: Reply

Column	Type	Null	Definition
ReplyId	Int(11)	No	ID of comment
TopicId	Int(11)	No	ID of question
ReplyDetail	Text	No	Comment detail
ReplyFile	Varchar(255)	No	Picture
ReplyIP	Varchar(20)	No	IP address
ReplyDateTime	Datetime	No	Date of comment giving
UserId	Int(11)	No	User who gives a comment

6) Entity: Score

Column	Type	Null	Definition
ScoreId	Int(11)	No	ID of score
ExamId	Int(11)	No	ID of test
UserId	Int(11)	No	Score of user
ScoreNum	Int(11)	No	Score
Scoredatetime	Datetime	No	Date and time which get score

7) Entity: Subject

Column	Type	Null	Definition
SubjectId	Int(11)	No	ID of subject
SubjectName	Varchar(255)	No	Subject name
SubjectNameEn	Varchar(255)	No	English subject name

8) Entity: Topic

Column	Type	Null	Definition
TopicId	Int(11)	No	ID of web board question
TopicName	Text	No	Question name
TopicDetail	Text	No	Detail
TopicFile	Varchar(255)	No	Picture
TopicDateTime	Datetime	No	Date of question starting
TopicIP	Varchar(20)	No	IP address
TopicStatus	TinyInt(1)	No	On or off status
TopicView	Int(11)	No	Amount of viewer
TopicNumAns	Int(11)	No	Amount of user that reply the question
UserId	Int(11)	No	User who set the question

9) Entity: User

Column	Type	Null	Definition
UserId	Int(11)	No	ID of user
Username	Varchar(255)	No	Name for enter LMS
Password	Varchar(255)	No	Password
Email	Varchar(255)	No	Email address
UserType	TinyInt(1)	No	Type of user
Title	TinyInt(1)	No	Title of user
FirstName	Varchar(255)	No	First name
LastName	Varchar(255)	No	Last name
BirthDate	Date	No	Date of birth
MaritalStatus	Tiny(1)	No	Status
Education	Tiny(1)	No	Education
SchoolName	Varchar(255)	No	Academy name
Address	Varchar(255)	No	Address
District	Varchar(255)	No	District
ProvinceId	Tiny(2)	No	Id of province
ZipCode	Int(5)	No	Post code

Tel	Varchar(255)	No	Telephone number
LDStatus	TinyInt(1)	No	Status of Learning Disabilities (LD)
LD1	TinyInt(1)	No	Dyslexia
LD2	TinyInt(1)	No	Dysgraphia
LD3	TinyInt(1)	No	Listen Disabilities
LD4	TinyInt(1)	No	Dyscalculia
LD5	TinyInt(1)	No	Oral Disabilities
LD6	TinyInt(1)	No	Spell Disabilities
TeacherEdu	Text	No	Teacher education
TeacherWork	Text	No	Work place of teacher
TeacherMajor	Text	No	Education major of teacher
TeacherPosition	Text	No	Teacher position
RegisterDate	Datetime	No	Date of enrollment

10) Entity: View

Column	Type	Null	Definition
UserId	Int(11)	No	ID of user
LessonId	Int(11)	No	ID of lesson
ViewDateTime	datetime	No	Date and time which user enter to view

APPENDIX B
THE PANEL OF EXPERT AND TEACHER LIST

❖ **Six experts of Technology Information System Management, Faculty of Engineering, Mahidol University, Salaya Campus**

     1. Dr. Songpol Ongwattanakul

     2. Asst. Prof. Dr. Warakorn Charoensuk

     3. Asst. Prof. Dr. Rangsipan Marukatat

     4. Asst. Prof. Dr. Adisorn Leelasantitham

     5. Dr. Supaporn Kiattisin

     6. Dr. Wanyoo Wongsaeree

❖ **Nine teachers who have an experience teaching or are teaching students with Learning Disabilities at Klongtaweewattana School belong to Department of Education Bangkok Metropolitan Administration.**

     1. Ms. Kanchana Khodwongsa

     2. Ms. Nuchcharee Kerdmak

     3. Ms. Fongnuan Jindatham

     4. Ms. Patcharin Ruenrapha

     5. Ms. Patlapa Thaodee

     6. Ms. Namphueng Koonsuwan

     7. Ms. Yannapat Nakam

     8. Mr. Patiwat Kampakdee

     9. Mr. Atthapong Chumworathayee

APPENDIX C
EVALUATION FORM

<u>**แบบประเมินความพึงพอใจของผู้ใช้งานต่อระบบจัดการเรียนการสอน (LMS)**</u>

❖ **ส่วนที่1: ข้อมูลทั่วไป**

1. ชื่อ-สกุล………………………………………...……………………………………..

2. เพศ ☐ชาย   ☐หญิง

3. อายุ…………………….…………ปี

4. สถานภาพ……………………....……………………………………………………

5. ระดับการศึกษา

   สูงสุด…………………………………………………………….....................

   สาขา…………………….…....………………………………………………

   คณะ……………………….…………....……………………………………

   มหาวิทยาลัย…………………………………………....…..………………

6. อาชีพ…………………………………………………………………………..…..

7. ตำแหน่ง/ยศ…………………………………………………………………………

8. สถานที่ทำงาน…………………………………………………………..……………

9. ที่อยู่………………………………………………………...………………….....

10. ท่านรู้จักเด็กที่มีความบกพร่องทางการเรียนรู้ในฐานะ

    ☐ ผู้ปกครอง   โดยเป็น………………….จำนวนที่รู้จัก……………คน

    ☐ ครู   จำนวนที่รู้จัก……………….คน

    ☐ อื่นๆ   โดยเป็น………………….จำนวนที่รู้จัก…………คน

    ☐ ไม่รู้จัก

11. ท่านมีประสบการณ์ในการมีปฏิสัมพันธ์กับเด็กที่มีความบกพร่องทางการเรียนรู้กี่ปี

   ☐ มี   จำนวน..........ปี.............เดือน

          เป็นเด็กที่มีความบกพร่องทางการเรียนรู้ด้าน……………………..

   ☐ ไม่มีประสบการณ์

   ☐ ไม่แน่ใจ

12. ท่านรู้จักอาการหรือลักษณะของเด็กที่มีความบกพร่องทางการเรียนรู้หรือไม่

   ☐ รู้จัก จากหนังสือ หรือสื่อต่างๆ

   ☐ รู้จัก จากการบอกเล่าจากผู้อื่น

   ☐ รู้จัก จาก……………………..

   ☐ ไม่รู้จัก

****

❖ **ส่วนที่ 2: จงกากบาท X ลงในช่องที่เห็นด้วย**

  1. การประเมินผลด้านเนื้อหา

รายการประเมิน	ดีมาก	ดี	ปานกลาง	น้อย	ควรปรับปรุง
	5	4	3	2	1
1. เนื้อหามีความเกี่ยวข้องกับวัตถุประสงค์					
2. มีการอธิบายเนื้อหาอย่างละเอียดและชัดเจน					
3. แบบทดสอบมีความเกี่ยวข้องกับเนื้อหา					
4. แบบทดสอบมีความเข้าใจง่าย					
5. บทเรียนมีความเหมาะสมต่อระดับชั้นของผู้เรียน					
6. แบบทดสอบมีความเหมาะสมต่อระดับชั้นของผู้เรียน					
7. ภาษาที่ใช้มีความถูกต้อง					
8. การสนับสนุนทางด้านมัลติมีเดียต่อเนื้อหา					
9. รูปแบบการนำเสนอมีประสิทธิภาพ					
10. บทเรียนนี้มีความเหมาะสมในการนำไปเผยแพร่เพื่อการเรียนรู้ได้					

2.   การประเมินผลด้านภาพกราฟฟิก และตัวอักษร

รายการประเมิน	ดีมาก	ดี	ปานกลาง	น้อย	ควรปรับปรุง
	5	**4**	**3**	**2**	**1**
1. รูปแบบตัวอักษรมีความเหมาะสม					
2. ขนาดตัวอักษรมีความเหมาะสม					
3. สีตัวอักษรมีความเหมาะสม					
4. สีพื้นหลังมีความเหมาะสม					
5. ส่วนต่อประสานกราฟฟิกกับผู้ใช้ใช้งานง่าย					
6. ภาพกราฟฟิกสื่อความหมายและสวยงาม					

3.   การประเมินผลด้านมัลติมีเดีย

รายการประเมิน	ดีมาก	ดี	ปานกลาง	น้อย	ควรปรับปรุง
	5	**4**	**3**	**2**	**1**
1. บทเรียนมัลติมีเดียมีการแสดงผลอย่างต่อเนื่อง					
2. บทเรียนมัลติมีเดียมีความน่าสนใจเรียนรู้					
3. บทเรียนมัลติมีเดียมีความเหมาะสมสำหรับเด็กแอลดี					
4. ระยะเวลาที่ใช้ในการแสดงผลของบทเรียนมัลติมีเดียมีความเหมาะสม					
5. บทเรียนมัลติมีเดียดูแล้วเข้าใจง่าย					
6. เสียงบรรยายมีความชัดเจนและเหมาะสม					

4. การประเมินผลด้านเว็บเพจ (Web Page)

รายการประเมิน	ดีมาก	ดี	ปานกลาง	น้อย	ควรปรับปรุง
	5	4	3	2	1
1. จำนวนหน้าของเว็บเพจในการเข้าถึงมีความเหมาะสม					
2. เว็บเพจทุกหน้าใช้งานง่ายและมีความต่อเนื่อง					
3. เว็บเพจมีความสวยงาม					
4. องค์ประกอบของเว็บเพจมีความสมดุล					
5. ลิงค์ (Link) ที่ปรากฏในหน้าโฮมเพจ สามารถเชื่อมโยงไปยังเว็บไซต์นั้นๆได้					
6. หน้าตาเว็บเพจสื่อถึงการเรียนรู้สำหรับเด็ก					
7. ส่วนต่อประสานกราฟฟิกกับผู้ใช้สามารถเข้าใจได้ง่าย					
8. โลโก้มีความเป็นเอกลักษณ์และบ่งบอกถึงความเป็นเว็บไซต์แห่งการเรียนรู้สำหรับเด็ก					
9. เมนูบาร์(Menu Bar) มีความเหมาะสม					
10. ผู้ใช้งานรู้ตัวอยู่เสมอว่าตนเองใช้งานเว็บเพจอยู่หน้าไหน					

5. การประเมินผลด้านระบบจัดการเรียนการสอน(LMS)

รายการประเมิน	ดีมาก	ดี	ปานกลาง	น้อย	ควรปรับปรุง
	5	4	3	2	1
1. ระบบจัดการเรียนการสอนใช้งานง่าย					
2. ระบบมีการรายงานผลที่เป็นปัจจุบัน					
3. การสรุปผลคะแนนในแบบทดสอบมีความถูกต้อง					
4. ระบบลงทะเบียนสมัครสมาชิกง่ายต่อการใช้งาน					
5. ระบบจัดการเรียนการสอนเหมาะสมสำหรับครูและนักเรียน					
6. ส่วนการทำงาน (Function) ของการเพิ่มลบ และแก้ไข บทเรียน มีประสิทธิผล					
7. ส่วนการทำงาน (Function) ของการเพิ่มลบ และแก้ไข แบบฝึกหัด มีประสิทธิผล					
8.ระบบกระดานสนทนามีความเหมาะสมและง่ายต่อการใช้งาน					
9.ความพึงพอใจต่อภาพรวมในการใช้งานLMS					

ข้อเสนอแนะเพิ่มเติม

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