A MODEL FOR CORPORATE E-LEARNING: LEARNOMOTIVE

RESMİYE ECE CANSUN

M.S., Computer Engineering, Işık University, 2008

Submitted to the Graduate School of Science and Engineering
in partial fulfillment of the requirements for the degree of
Master of Science
in
Computer Engineering

IŞIK UNIVERSITY
2008

IŞIK UNIVERSITY

GRADUATE SCHOOL OF SCIENCE AND ENGINEERING

A MODEL FOR CORPORATE E-LEARNING: LEARNOMOTIVE

RESMİYE ECE CANSUN

APPROVED BY:

Prof. Selahattin KURU (Bahçeşehir University) _____

Assist. Prof. Taner ESKİL (Işık University) _____

Assoc.Prof. Seyhun ALTUNBAY (Işık University) _____

APPROVAL DATE: 17 September 2008

A MODEL FOR CORPORATE E-LEARNING: LEARNOMOTIVE

Abstract

Enterprises with dynamic business processes have training needs that should be addressed innovatively. Depending on the business process, new tasks may be constructed. The competence level differences between workers may cause losing time for finishing a project/task. These tasks should be completed by the personnel who have enough competence level in time. The learning process should be in an innovative manner that will increase the performance of the learner and therefore the enterprise where it has the possibility of individualizing the learning.

In this thesis, a model for corporate e-learning has been developed and a prototype of that model has been implemented, which is called Learnomotive. Learnomotive is a competence development model that enables learners to choose the desired task with the desired available learning method of their own and plan their competence development process. Therefore; learners may be able to determine the tasks they want to have competence with and personalize Learnomotive depending on their usage. Learnomotive may be used for competence development purposes whereas it may also be used for human resources departments to determine the overall efficiency of the enterprise and the personnel

.

KURUMSAL E-ÖĞRENME İÇİN BİR MODEL: LEARNOMOTIVE

Özet

Dinamik iş süreçlerine sahip firmaların eğitim ihtiyaçlarının, yenilikçi bir bakış açısı ile değerlendirilmesi gerekmektedir. Yeni iş süreçlerine bağlı olarak, göre yeni görev tanımları oluşabilmektedir. Çalışanlar arasındaki yeterlilik seviyesinin farklı olması, görev ve projelerin bitirilme sürelerinde zaman kayıplarına neden olabilmektedir. Görevlerin yeterli yeterlilik seviyesine sahip çalışanlar tarafından zamanında bitirilmesi gerekmektedir. Öğrenme sürecinin de, öğrenen kişinin ve buna bağlı olarak firmanın verimini arttıracak yenilikçi bir bakışa sahip olması ve kişiselleştirmeye olanak tanıması gerekmektedir.

Bu tezde, kurumsal e-öğrenim için bir model geliştirilmiş ve bu modelin bir prototipi oluşturulmuştur. Learnomotive, bir yeterlilik geliştirme modeli olarak kişilerin kendi istekleri doğrultusunda yeterlilik geliştirme sürecini planlamalarına, öğrenilecek konuların uygun olan öğrenme metodları ile seçilmelerine olanak tanır. Böylelikle kullanıcılar, yeterlilik seviyelerini arttırmak istedikleri öğrenilecek konuları seçebilir ve Learnomotive'i kullanım şekillerine gore kişiselleştirebilirler. Yeterlilik geliştirme modeli olmasının yanısıra Learnomotive, firmaların insan kaynakları departmanları tarafından firma genelinde ve kişisel performans ölçümü amacı ile de kullanılabilir.

Acknowledgements

I would like to thank my supervisor Prof. Selahattin KURU for guiding me throughout the idea of Learnomotive.

I would like to thank my family and to my very special friends for helping me in every phase of my study.

Table of Contents

Abstract ..... **ii**

Özet ..... **iii**

Acknowledgements ..... **iv**

Table of Contents ..... **v**

List of Tables ..... **xi**

List of Figures ..... **xiii**

List of Figures ..... **xiii**

List of Abbreviations ..... **xv**

The Learning and E-learning Concepts **1**

1.1. The Learning Concept and Transformation of E-Learning 1

1.1.1. What is Learning? 1

1.1.2. Training 1

1.1.3. Transformation of Learning Process 1

1.2. The Evolution of E-Learning 3

1.2.1. History of Technological Learning 3

1.2.2. Rise of Web-Based Learning Industry 4

1.3. The Role of E-Learning 4

1.4. Needs of Learner and Organizations 5

1.4.1. Learner Needs 5

1.5. Advantages of E-Learning 6

1.5.1. Benefits of E-Learning 6

1.6. The E-Learning Strategy 7
1.6.1. Why Have an E-Learning Strategy? 7
1.7. Foundations of E-Learning Environments 8
1.7.1. Having a Strategic Foundation 8
1.7.2. Psychological Foundations 8
1.7.3. Pedagogical Foundations 8
1.7.4. Technological Foundations. 8
1.7.5. Cultural Foundations 8
1.7.6. Pragmatic Foundations 9
1.8. Knowledge Management 9
1.8.1. What is Knowledge Management? 9
1.8.2. Types of Knowledge 10
1.8.3. The Knowledge Management Pyramid 11

Information for Building an E-Learning Infrastructure 12

2.1 E-Learning Environments 12
2.1.1 Basic Components of E-Learning Environments 12
2.2 E-Learning Methodologies 13
2.2.1 Asynchronous Learning 13
2.2.2 Synchronous E-Learning 13
2.3 E-learning Models 14
2.4 Interoperability 14
2.5 E-Learning Standards and Standards Organizations 14
2.5.1 AICC (Aviation Industry Computer-Based Training Committee) 14
2.5.2 IMS GLC (IMS Global Learning Consortium) 14
2.5.3 SCORM (Sharable Content Object Reference Model) 15
2.5.4 IEEE-LTSC (Institute of Electrical and Electronics Engineers; Learning Technology Standards Committee) 15
2.5.5 ARIADNE (Alliance of Remote Instructional Authoring and Distribution Networks for Europe) 15

An E-learning Model: Learnomotive **16**

3.1 The Concept of Learnomotive 16

3.1.1 Introduction 16

3.1.2 Model Definition 16

3.1.3 Challenges and Objectives 16

3.2 A Theoretical Approach to Learnomotive 23

3.2.1 The Competence Development Environment: A Preview 23

3.2.2 Main Components of the Learning Model 26

3.2.3 Relationships Between Components 29

3.2.4 Reporting System 29

3.2.5 Registration System 29

3.3 Scenarios: What is Happening When 30

3.3.1 Integrating Business Processes to Learning Processes 30

3.3.2 Giving the Management Roles to Related Personnel 31

3.3.3 Making the Database and Loading Files to the System 33

3.3.4 Registering to the System 33

3.3.5 Assigning Task to a Learner 34

3.3.6 Learner Makes the Competence Development Plan 35

3.3.7 CDM Determining Initial Competence Level of a Learner 35

3.3.8 CDM Mapping Learning Tasks to Learning Modules 35

3.3.9 Learner Chooses Problem-Based Method 35

3.3.10 Learner Chooses Work-Based Method 36

3.3.11 Learner Chooses Collaborative Method 36

3.3.12 CDM Determination of the Competence Level 37

3.3.13 Learner Uses Learning Portal 38

3.3.14 Learner Registers with Courses in Learning Portal 38

3.3.15 Learner Being a Trainer 39

3.3.16 System Suggestions to Learner 39

3.3.17 Learner Suggests New Training Titles and Areas 39

3.3.18 Guide for Learner 40

3.4 Expected Impacts of the Learning Model 40

Development of the Model **42**

4.1. Development of Learnomotive 42
4.1.1. Technical Information 42
4.1.2. PHP 42
4.1.3. MySQL 42
4.2. Users of Learnomotive 43
4.3. Database of Learnomotive 43
4.3.1. Information 43
4.4. Database Structures 46
4.4.1. Departments 46
4.4.2. Dep_news 46
4.4.3. Users 48
4.4.4. Tasks 49
4.4.5. Learning Modules 50
4.4.6. Exams 51
4.4.7. Exam_Questions 52
4.4.8. Exam_Statistics 53
4.4.9. Total_Exam Statistics 54
4.4.10. Forum_Answer 55
4.4.11. Forum_Question 56
4.4.12. Guides 57
4.4.13. Lm_Assets 57
4.4.14. Lm_Entry_Count 58
4.4.15. Portalnews 59
4.4.16. Task_approvals 60
4.4.17. Task_News 60
4.5. Screenshots from Prototype 61
4.5.1. Administrator Adds Facilitator Accounts 61
4.5.2. Administrator Creating Departments 62
4.5.3. Administrator Assigning Facilitator to a Department 62
4.5.4. Facilitator Menu 63
4.5.5. Administrator Menu 63
4.5.6. Learner Menu 64

4.5.7. Facilitator Adds New Task 64
4.5.8. Facilitator Adds New Learning Modules 65
4.5.9. Facilitator Views All the Tasks 65
4.5.11. Learning Module Detail 66
4.5.12. Login to the System 66
4.5.13. Login Failed 67
4.5.14. Registration 67
4.5.15. Facilitator Adds Department News 68
4.5.16. Facilitator Adds Task News 69
4.5.17. Administrator Adds Portal News 69
4.5.18. Facilitator Learning Module Menu 70
4.5.19. Facilitator Task Menu 70
4.5.20. Facilitator Approves Department Request 71
4.5.21. Facilitator Approves Task Request 71
4.5.22. Facilitator Edits Guide 72
4.5.23. Facilitator Adds Test 72
4.5.24. Facilitator Adds Questions to Test 73
4.5.25. Facilitator Edits Test 74
4.5.26. Facilitator Adds Text Asset 75
4.5.27. Facilitator Adds File Asset 75
4.5.28. Facilitator Takes Report 76
4.5.29. Facilitator Report Detail 77
4.5.30. Learner Attends for a Task 77
4.5.31. Learner Task Menu and LM Menu 78
4.5.32. Learner Views Waiting Tasks 78
4.5.33. Learner Views Guide 79
4.5.34. Learner Selects Test to Attend 79
4.5.35. Learner Taking the Test 80
4.5.36. Learner Taking the Time Limited Test 80
4.5.37. Learner Passes the Test 81
4.5.38. Learner Views Statistics for the Test 81

Evaluation and Conclusions **82**

5.1. Evaluation 82

5.2. Conclusion 83

References 85

Appendix A CD Containing the Application and Tools 88

Appendix B An Example Scenario 89

B1. An Example Organizational Structure 89

B2. An Example Task and Learning Module Structure 89

List of Tables

Table 4.1 Structure of departments table 46
Table 4.2 Example data for departments table 46
Table 4.3 Structure of dep_news 47
Table 4.4 Example data for dep_news table 47
Table 4.6 Example data for users table 49
Table 4.7 Structure of tasks table 49
Table 4.8 Example data for tasks table 50
Table 4.9 Structure of learning modules table 50
Table 4.10 Example data for learning modules table 51
Table 4.11 Structure of exams table 51
Table 4.12 Structure of exams table 52
Table 4.13 Structure of exam_questions table 52
Table 4.14 Structure of exam_questions table 53
Table 4.15 Structure of exam_statistics table 54
Table 4.16 Structure of exam_statistics table 54
Table 4.17 Structure of total_exam_statistics table 54
Table 4.18 Structure of total_exam_statistics table 55
Table 4.19 Structure of forum_answer table 55
Table 4.20 Structure of forum_answer table 55
Table 4.21 Structure of forum_question table 56
Table 4.22 Structure of forum_question table 56
Table 4.23 Structure of guides table 57
Table 4.24 Structure of guides table 57
Table 4.25 Structure of lm_assets table 57
Table 4.26 Structure of lm_assets table 58
Table 4.27 Structure of lm_entry_count table 58
Table 4.28 Structure of lm_entry_count table 59

Table 4.29 Structure of portal_news table 59
Table 4.30 Structure of portal_news table 59
Table 4.31 Structure of task_approvals table 60
Table 4.32 Structure of task_approvals table 60
Table 4.33 Structure of task_news table 61
Table 4.34 Structure of task_news table 61

List of Figures

Figure 1.1 The knowledge cycle 10
Figure 3.1 Learnomotive platform 19
Figure 3.2 Learner 26
Figure 3.3 Task components 27
Figure 3.4 Task and learning methods components in detail 29
Figure 4.1 Database of Learnomotive 45
Figure 4.2 Administrator adds facilitator accounts 61
Figure 4.3 Administrator creating departments 62
Figure 4.4 Administrator assigning facilitator to a department 62
Figure 4.5 Facilitator menu 63
Figure 4.6 Administrator menu 63
Figure 4.7 Learner menu 64
Figure 4.8 Facilitator adds new task 64
Figure 4.9 Facilitator adds new learning modules 65
Figure 4.10 Facilitator views all the tasks 65
Figure 4.11 Facilitator views his/her tasks 66
Figure 4.12 Learning module detail 66
Figure 4.13 Login to the system 67
Figure 4.14 Login failed 67
Figure 4.15 Registration 68
Figure 4.16 Facilitator adds department news 68
Figure 4.17 Facilitator adds task news 69
Figure 4.18 Administrator adds portal news 70
Figure 4.19 Facilitator learning module menu 70
Figure 4.20 Facilitator task menu 71
Figure 4.21 Facilitator approves department request 71

Figure 4.22 Facilitator approves task request 72
Figure 4.23 Facilitator edits guide 72
Figure 4.24 Facilitator adds test 73
Figure 4.25 Facilitator adds questions to test 74
Figure 4.26 Facilitator edits test 74
Figure 4.27 Facilitator adds text asset 75
Figure 4.28 Facilitator adds file asset 76
Figure 4.29 Facilitator takes report 76
Figure 4.30 Facilitator report detail 77
Figure 4.31 Learner attends for a task 77
Figure 4.32 Learner task menu and LM menu 78
Figure 4.33 Learner views waiting tasks 78
Figure 4.34 Learner views guide 79
Figure 4.35 Learner selects test to attend 79
Figure 4.36 Learner taking the test 80
Figure 4.37 Learner taking the time limited test 80
Figure 4.38 Learner passes the test 81
Figure 4.39 Learner views statistics for the test 81

List of Abbreviations

AICC	Aviation Industry Computer-Based Training Committee
ARIADNE	Alliance of Remote Instructional Authoring and Distribution Networks for Europe
CBT	Computer based-training
CDM	Competence Development Model
IBT	Internet based training
IEEE -LTSC	Institute of Electrical and Electronics Engineers-Learning Technology Standards Committee
IMS GLC	IMS Global Learning Consortium
KM	Knowledge Management
LMS	Learning Management System
LO	Learning Object
OLS	Online Learning System
SCORM	Sharable Content Object Reference Model
WBT	Web based training

Chapter 1
The Learning and E-learning Concepts

1.1. The Learning Concept and Transformation of E-Learning

1.1.1. What is Learning?

There are different kinds of learning definitions that change depending on the field it is related with. The general definition; “Learning is the internal way of processing information into knowledge” [1].

In the business context, learning is the process that helps workers to gain skills in order to increase the overall performance of the company. So, when achieved accurately, learning enables people to add value to the processes they are realizing both in professional and daily life while acquiring skills and wisdom.

1.1.2. Training

“Training is used when it is necessary to shape learning in a specific direction to support learners in acquiring new skill or to utilize new knowledge in a specific way or to a specific level of proficiency, and perhaps within a specified time frame” [1].

1.1.3. Transformation of Learning Process

The development of various technologies has affected the information in several aspects. With the new data storage capabilities, more information can be stored and therefore can be produced on demand. With the growth of communication technologies, information exchange has been accelerated and information can now be reached more easily. As a result of these advances, the process of getting the right

information in a reasonable time, transforming this information into knowledge and improving it by gaining new skills has become a milestone for development. This development process may be necessary for individuals, businesses and for educational institutions in different aspects. Therefore, in addition to our traditional learning methods, new ways of learning and processing information is required. Some of the main reasons for the necessity of transformations are;

Human performance technology: While learning is a major instance, in order to have a complete benefit from the learning process, other aspects of learning should be considered such as, having the right tools, feedback, motivation and an appropriate learning environment.

Reachable sources independent from time and place: Learning should be available in a 24/7 manner that is independent from any place. In the new century, time is one of the most important assets for everyone. That importance causes the need of scheduling to be made by learners themselves, not by trainers or facilitators.

Sources independent from paper: As the sources are getting digital, it is critical to use the benefits of it. As the information has a tendency to get old and outdated, one of the most important advantages of the digital source is to update the content in an immediate and continuous manner. As a result of this, the revisions of a course may be done within a short period of time.

Getting more connected and networked: As the technology develops, the connection methods become independent of physical facilities to online networked facilities. So different people from different countries may have an ability to have a connection with each other and share information without the need of physical attendance. This feature also affects the transformation of learning.

The speed of change: The information we are learning can easily become old and the needs of organizations and people are rapidly changing. In order to stay current, new techniques for instruction and new learning methods should be developed to improve the performance and effect of learning.

The Definition of E-Learning

E-learning is the use of internet technologies to deliver a various solutions in a large extend that enhance knowledge and performance. It has three fundamental criteria:

1) Networked: It is capable of instant updating, storage/retrieval, distribution and sharing of instruction or information

2) Delivered to the end-user via a computer using standard internet technology.

3) Focuses on broadest view of learning; learning solutions that go beyond the traditional paradigms of training. This includes the following features;

- Not limited to the delivery of instruction as in Computer–based training (CBT).
- E-learning also aims to increase performance so Web-based training (WBT) and Internet-based training (IBT) which are the up-to-date descriptions of CBT are too limiting in scope to be a description of e-learning.
- E-learning spans distance but distance learning includes approaches that do not fit the e-learning's description. Therefore e-learning is a form of distance learning but distance learning is not e-learning.

1.2. The Evolution of E-Learning

1.2.1. History of Technological Learning

In history different kinds of technological teaching methods are used but for some reasons they could not be used or was not as effective as thought. For instance, when TV was used as a training tool it did not become so widespread for this purpose because it was missing a very essential quality of teaching; it did not have an interaction with the learner neither did it provide any feedback or could not be customized.

The early CBT programs were not sufficient because of compatibility problems, limited storage, slow computer speeds, poor graphical features. And because the knowledge was changing so quickly it was hard to have the content stability. So some trainers only used CBT for a short-time in trainings with many people or for a

long time with content stability situations with many people. In nineties CBT came out with the limitations;

1. different kinds of platforms could not all be supported by one learning platform because of the rapid changes in technology.

2. because of the limitations in hardware and software capabilities, (such as graphical features and capabilities of graphic cards) the content was not entertaining or realistic.

3. the information was not stable so developing a complete and contemporary system was costly both in time and for money.

4. the knowledge level in computers and its technologies was in beginning level and because of the lack of awareness of instruction design approaches; the advanced learning approaches could not be developed.

1.2.2. Rise of Web-Based Learning Industry

E-learning industry is rapidly growing and now being noticed by investors. Different types of practices, job definitions, application areas exist for e-learning. As a university example of distance learning, Florida's Nova University was the first university that applied distance-learning. Now many universities have online courses, access to electronic books, research libraries etc. Also another concept named as "for-profit eUniversity" such as University of Phoenix, International University are also available. In private sector, many companies help in building learning infrastructures and networks for higher education institutions as well as corporations and some companies have the job definition of online learning.

1.3. The Role of E-Learning

E-learning has an advantage to have the capability of serving as either a training source or a knowledge management structure depending on different learning needs. These two compose the two components of e-learning. For businesses, it is a positive issue being able to provide access to information which is especially selected and

analyzed for a specific training purpose. “The real challenge of e-learning is to distinguish the need for information (knowledge management) and the need for instruction (online training) and to understand how they work in tandem” [1].

Another important issue of e-learning is the difference between information and instruction. The two instances may be used both for the e-learning process, but their purpose, contents, foundations and technical requirements all differ.

1.4. Needs of Learner and Organizations

1.4.1. Learner Needs

In order to benefit from e-learning the learner side will have some fundamental needs. These are named as; access, comprehensive approach and balance of information and instruction.

- *Access:* It has four dimensions;
  - *Technical:* Having the necessary infrastructure to get the information,
  - *Empowerment:* Having the necessary rights to get or use the information.
  - *Flexibility:* Reaching the information by self-scheduling.
  - *Time:* having time for learning the information. (For learning process)
- *Comprehensive Approach:* The learner needs a comprehensive approach which is robust, continuous, having the right information within a scheduled manner, being easily reached.
- *Balance:* The balance between training and information. (When people need the information only to obtain the related knowledge, the time and resources are used in an unnecessary manner, if the learning need is only information but the method has chosen as online training or oppositely when the learning should be with training, but the method has chosen as knowledge management.)

Organizational Needs

There are some requirements that are expected from organizations for being a "learning organization."

- *Information:* The information that is given to learners through various channels should be up-to-date and should be accurate. When people choose to learn through training, the material should be carefully selected without wasting additional time for giving unnecessary information. In order to achieve these, a specialized learning plan should be constructed for each person.
- *Open Culture:* Information sharing is a key for learning. Therefore, every organization that wants to be a learning organization should have a culture of information sharing. That culture may be constructed by encouraging people to do so.
- *Effective Technology:* In order to have a good learning and training mechanism in any organization, technology should be used as a building stone. Technical difficulties such as delays, connection breaks, non-accessible infrastructures etc. are non-motivating instances that cause loosing interests of learning.

1.5. Advantages of E-Learning

1.5.1. Benefits of E-Learning

As the use of new technologies getting widespread, combining new learning strategies with technology is easier. Thus having more benefit from e-learning is the state-of-the-art. Some of the many benefits of e-learning may be listed as follows;

- *Low Cost:* With e-learning the usual training expenses can be minimized. There are savings opportunities especially in the instructor costs, classroom need, travel expenses and time expenses.
- *Business Responsiveness:* With e-learning networked simultaneous training is possible. In many dynamic companies the need for training people in short time may be achieved.
- *Customization:* The presentation of learning may be customized depending on the learner's needs although the content remains the same.

- *Contemporary:* Because the ability to update the content easily and disseminate it among learners quickly, information remains up-to-date and accurate.
- *Time and Location Independent:* E-learning can be accessed anywhere in anytime independent from time and location.
- *No User Ramp-up Time:* Web technologies are used widely around the world; so it is not a problem to use the browser technologies to have access to e-learning interface.
- *Universality:* Because e-learning is mostly constructed on web, it uses the standardized internet protocols and browsers. So it is universal and independent from platforms that may cause interoperability problems.
- *Builds Community:* With the web technologies, many people are connected through via many communication programs, forums etc. by taking this advantage, people may share their ideas of what they've learnt from e-learning lessons and thus create a community for organizational learning.
- *Scalability:* Depending on the system e-learning environment has installed, it is possible to serve many people changing from less to many. (Broad range of people)
- *Leverages the Corporate Investment in the Web:* E-learning is a good chance to evaluate the investments on training in businesses.

1.6. The E-Learning Strategy

1.6.1. Why Have an E-Learning Strategy?

With the introduction of e-learning, not only a technological aspect of learning is presented but also a new way of learning is introduced. There are different ways of learning and everyone learns in different ways; from other people, by experience, by instruction, by having details, by using technological tools etc.

"A true e-learning strategy certainly addresses issues of technology and learning effectiveness, but it also addresses issues of culture, leadership, justification, organization, talent and change" [1].

1.7. Foundations of E-Learning Environments

1.7.1. Having a Strategic Foundation

In order to have a complete e-learning environment it is needed to have a strategy of achieving it. That strategy may be evaluated from many different aspects. Examples are; approaches to e-learning environment (having an online training and knowledge management), technological aspects that include the infrastructure, learning architectures which include the way of integrating business processes to learning processes, cultural issues, change management and ownership of the learning processes by supportive management and reorganizing the training organization in order to professionalize the training and learning function of the enterprise. Some other important issues that should be considered in detail are below;

1.7.2. Psychological Foundations

Psychological foundations reflect and observe how individuals acquire, organize, and use knowledge and skill. Various design frameworks are prepared and various activities are tried to understand how people learn better to form an effective strategy.

1.7.3. Pedagogical Foundations

Pedagogical foundations arrange how the content is organized using the psychological model for strategies and methods to be used in efficient way.

1.7.4. Technological Foundations.

A good e-learning environment should support the necessary technologies in order to benefit from the latest opportunities.

1.7.5. Cultural Foundations

Cultural foundations reflect beliefs about education, depending on the values of a culture, and the roles of individuals in society.

1.7.6. Pragmatic Foundations

Pragmatic foundations have a role to fill the gap between theory and reality. They are used to decide whether a specific approach can be used in a certain learning environment.

1.8. Knowledge Management

1.8.1. What is Knowledge Management?

Knowledge management (KM) is the process of creating, archiving and sharing of valued information –the knowledge- within certain people having the similar interest. That valued information may be the expertise, insight or any necessary information that is related to the subject.

In addition to its technological aspect, KM requires a strategy to create, share, publish and update the information. KM depends on people, relationships and communication. Different learning methods can regulate the balance between information and the actions of people. The business processes about creating know-how in a company, the procedures of accessing knowledge all determine the knowledge management strategy.

KM is the purposeful information management in order to improve the performance using the organizational learning methods. It is different than just storing the knowledge, KM aims to manage the information so that the information is flexible, easy to understand, created and improved by people and have a broad aspect of knowledge culture.

If a company uses an intranet for sharing the information, it can be said that the company has a knowledge management with the strategy of centralizing the information. But it is different from collecting information in a way that the information should also be managed.

1.8.2. Types of Knowledge

Knowledge has a big extent of sources. Different factors may form the knowledge. It can be an individual's knowledge, an organization's knowledge and a community's knowledge which has collected throughout years.
Knowledge can be explicit (easily described and specific enough to be explained in documents, with practices and training) or tacit (harder to store as a record to teach others).

The knowledge of organizations and individuals are not separated from each other. They have an interaction with each other. Explicit and tacit knowledge together form the business performance. Different types of knowledge require different approaches to knowledge management. Each represents unique challenges and opportunities. The types of knowledge and their interaction with each other are depicted at the Figure 1.1 [1] below;

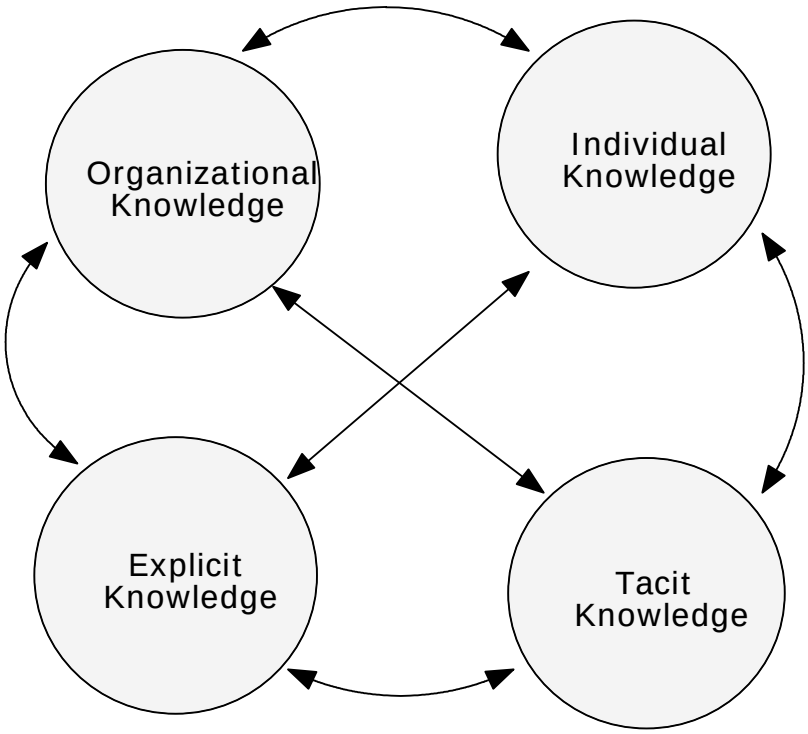


Figure 1.1 The knowledge cycle

1.8.3. The Knowledge Management Pyramid

Knowledge management can be divided into three categories named as; document management, information creation, sharing and management and enterprise intelligence. As these three instances collected one on the top of the other, the consistency of the Knowledge Management is gathered.

Chapter 2
Information for Building an E-Learning Infrastructure

2.1 E-Learning Environments

2.1.1 Basic Components of E-Learning Environments

In e-learning environments there exist learning portals, learning management systems and learning assets. Learning objects are also a component of e-learning environments. E-learning environments can also be called as online learning systems (OLS), Learning platforms or virtual learning environments.

Learning Portals

Learning portals can be named as the gateways to information. They have a single point of access to information. A learning portal may be used to arrange the information and centralize the access of information easing the navigation of information and resources. Portals should be compatible with learning management systems in order to have a consistent e-learning system.
From learning portals, individuals may share information, collaborate with each other and create knowledge.

Learning Management Systems (LMS)

Learning management systems are the functional parts of the learning environments. It is the component where the all courses (asynchronous/ synchronous) are available, management of the users is handled, and grading or evaluation is done. It is also the component that contains a database that stores all the related records of a user or learning objects where all the queries of the system are done from. The query may be either about a user or about a course. It may be anything that is stored in database.

Learning Assets

Learning assets are all the document and multimedia resources that are used by learning environments. It is the raw data that may be used for learning purposes. A learning asset may be anything which helps learner to understand the subject. It may be any multimedia file like a video, a picture, a graphic or an audio file or any document such as a web page, a slideshow, a text document. Learning assets can be used to form LOs and they do not have a learning objective.

Learning/Knowledge Objects (LO)

Learning object is any resource that can be used more than once by technology supported learning. It may be reusable, digital or non-digital. Materials that may be reused during e-learning are called as learning objects. A LO is an instructional module that may be used with e-learning. With learning objects, the used material in some course may be used anytime. A LO can be a video file, a graphic, an animation, simulation or a text page that has a learning objective. There is no need to re-construct course documents every time a course is opened. A LO has at least one learning objective.

2.2 E-Learning Methodologies

2.2.1 Asynchronous Learning

In asynchronous learning, the instruction part is somehow recorded or prepared before and learners may reach it anywhere from anytime; therefore there is no need to be in the same location or interactively online with instructor. Actually the benefits of e-learning are also the benefits of asynchronous learning.

2.2.2 Synchronous E-Learning

In synchronous learning, although the learner and the instructor may be in different geographical areas, a synchronous meeting happens. That is, an instructor guides the learning and students follow the instruction on time but they may be in the same geographical area or they may be in different locations.

2.3 E-learning Models

There are many e-learning models developed by different organizations. Some of them developed and funded by European Union's framework programs, some of them developed as a virtual university, and many learning models are still in the progress of development for achieving more interoperable, more reliable and personalized systems depending on the need.

2.4 Interoperability

Interoperability is the ability of compatibility of the e-learning system and components with each other. It is an important issue that different e-learning products may be developed using different tools. In order to integrate these tools with the existing system, they should be interoperable with each other. At this point, the effect of standardization in e-learning systems comes as an issue. The main goal of standards is to make the major parts of e-learning products universal so they can operate with each other.

2.5 E-Learning Standards and Standards Organizations

2.5.1 AICC (Aviation Industry Computer-Based Training Committee)

Aviation Industry Computer-Based Training Committee is an international association that develops guidelines for aviation industry about the development, and delivery and evaluation CBT and relating technologies. The objectives of this association include developing guidelines for increasing the usage of interoperability, providing an open forum for the discussion of CBT technologies, assisting airplane operators in development of guidelines that will help as an instructing material to develop effective computer based training solutions.

2.5.2 IMS GLC (IMS Global Learning Consortium)

The IMS Global Learning Consortium (IMS GLC) is a global, nonprofit, member organization that works to enable the growth and impact of learning technology in the education and corporate learning sectors worldwide. IMS GLC has approved and published some 20 standards that are the most widely used learning technology

standards in the world. Some standards cover the topics of meta-data, content packaging, sequencing, enterprise services, and tools interoperability.

2.5.3 SCORM (Sharable Content Object Reference Model)

SCORM is a collection of standards and some specifications from multiple sources that may be used in Web-based learning content to enable the interoperability, accessibility and reusability.

2.5.4 IEEE-LTSC (Institute of Electrical and Electronics Engineers; Learning Technology Standards Committee)

The IEEE Learning Technology Standards Committee (LTSC) is chartered by the IEEE Computer Society Standards Activity Board to develop technical standards, guides and best practices for the technology that is used for learning purposes.

2.5.5 ARIADNE (Alliance of Remote Instructional Authoring and Distribution Networks for Europe)

ARIADNE project helps academic education to enable the open and distance learning by defining the implementation and applications by addressing four aspects of learning; producing computer based teaching material, managing this material, assembling courses, and delivering courses to students.

Chapter 3
An E-learning Model: Learnomotive

3.1 The Concept of Learnomotive

3.1.1 Introduction

Learnomotive is a competence development platform for enterprises integrated with business processes. Specific objectives include developing a learning and competence development model for business-integrated mass-individualized learning in a networked enterprise together with associated learning methods and business processes therefore developing a technical solution to validate this model.

3.1.2 Model Definition

The main goal of Learnomotive is to create a competence development platform for enterprises with business processes. The model will support different learning methods, personalization, skills/competence development.

3.1.3 Challenges and Objectives

Training needs of enterprises and learning needs of employees in the enterprises need to be addressed in an innovative way. Consider a business enterprise. Tasks definitions are defined in terms of competences necessary to perform the tasks. In other words a task can be assigned to an employee only if the employee has the competences required for the task (and at the required level). Therefore; task assignment requires identifying and appointing the most suitable employee in terms of the competences required for the task. In other words, the HRM (Human Resources Management) system of the enterprise is able to identify the most suitable employee for a task. Positions are defined in terms of the set of tasks relevant to positions.

Consider an enterprise that has a competence development system at the disposal of its employees. Employees can determine their competence areas and their competence levels with the help of the competence development system. Managers can see competence levels of their employees. Employees and managers can see the list and the descriptions of competences required for tasks. The competence development system has available learning modules and learning activities for employees to acquire competences. The competence development system can tell which learning modules and learning activities are relevant for a particular position and task. The competence development system is rich in terms of learning modules and supports different learning methods and activities. Employees can personalize learning modules according to their personal preferences, learning behavior, and exact competence level. The system is intelligent in the sense that learners can do semantic search (that is, they do not have to memorize the exact vocabulary of the system), that the system is context-aware, and that it can learn about the learner behavior of a particular learner. The system is interoperable with other similar systems in the sense that it can access to learning modules to these system through a common (interfacing) language. The system offers a planning facility for the learners to make their own competence development planning. The business environment is very dynamic. New projects require new competences and employees must acquire new competences continually.

Now consider networked enterprise as a new dimension for the above situation. Real organizations form virtual enterprises on a project basis, that is several real organizations come together temporarily as a virtual organization to accomplish a project jointly. Differences in the competence levels of the employees of the members of the networked enterprise create a barrier for the performance of the networked enterprise. Furthermore these networked enterprises are dynamic enterprises, in the sense that the member enterprises change and the employees of the member enterprises change. Such a dynamic networked enterprise should be supported with a dynamic competence development environment to harmonize incompatibilities in competences. Learnomotive has been developed for validating such a competence development system.

Learnomotive has many innovative aspects. Therefore Learnomotive supports the use of innovative learning models. Integration of the learning processes with the business processes is a must in the Learnomotive environment. The learning processes and the learning machine that has been used in Learnomotive allow personalization and mass-individualization.

The specific objectives of Learnomotive are the following:

- Identify, adopt and develop a learning and competence development model for business-integrated mass-individualized learning in a networked enterprise environment
- Identify, adopt and develop learning methods that suit well to business-integrated mass-individualized learning in a networked enterprise environment
- Identify, adopt and develop business processes that integrate well with learning processes (including promotion models and procedures)
- Identify, adopt and develop tools for business-integrated mass-individualized learning in a networked enterprise environment
- Design and develop a technical solution (that is, a prototype platform) to facilitate business-integrated mass-individualized learning in a networked enterprise environment
- Validate the approach and the models (learning model, business process model) developed for business-integrated mass-individualized learning in a networked enterprise environment
- Address technical challenges such as flexibility, interoperability and scalability
- Study learner behavior in a business-integrated mass-individualized competence development environment within a networked enterprise
- Study effectiveness of relevant learning methods in a business-integrated mass-individualized competence development environment within a networked enterprise
- Investigate exploitation possibilities of the technical solution developed

The objectives of *Learnomotive* are driven by pedagogical, business and organizational, technical, and social challenges in a business-integrated mass-individualized competence development environment within a networked enterprise. These objectives and the driving challenges are further discussed below.

Pedagogical Challenges and Objectives

The main challenge of *Learnomotive* in the pedagogical area is to put forward a learning and competence development model for business-integrated mass-individualized learning in a networked enterprise environment and the learning methods that suits well to this environment.

The *Learnomotive* platform is based a learning and competence development model integrated with business processes and organizational context. The learning and competence development model comprises three main elements, as given in the Figure 3.1 below:

- Skills/competences (types and levels) of the learner,
- Skills/competences required for business tasks, and
- Learning modules.

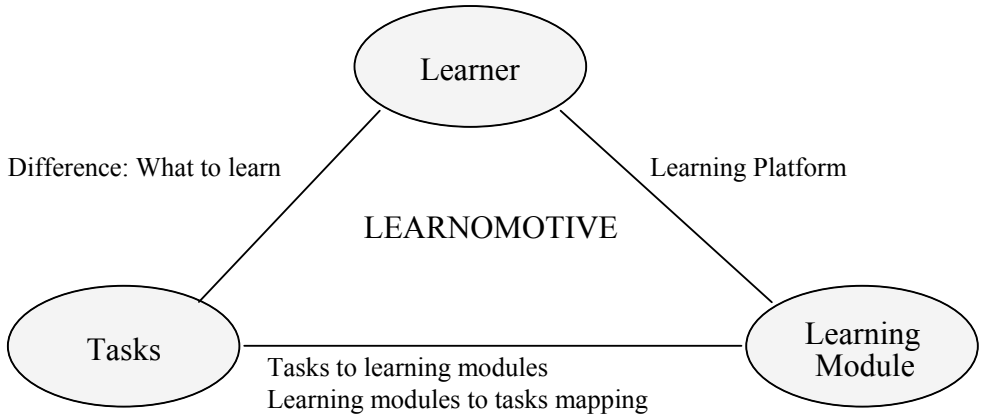


Figure 3.1 Learnomotive platform

Learner represents a learner behavior and an initial starting competence level. Learners are able to determine their skill/competence levels, identify skills/competences needed for certain tasks, and identify learning modules and learning activities they need to be engaged in order to acquire certain learning outcomes. Business tasks indirectly represent learning outcomes. Learning outcomes

for a given task can be identified. Learning modules are organized in terms of learning methods and learning outcomes. Learning modules have associated with them learning content and learning activities. Issues to be addressed include (but not limited to):

- Determining competence level of a specific learner with respect to a given skill
- Determining learner characteristics for a given learner (at a given competence level) for a given learning outcome under a given learning method
- Mapping tasks to learning outcomes through learning modules
- Mapping learning objectives to learning outcomes
- Design and development of learning modules (for different situations of specific learner, a specific learning outcome, and a specific learning method)
- Mapping learning outcomes to learning methods for a specific learner
- Measuring learning performance of a specific learner for a specific learning outcome under a specific learning method
- Determining personalization options (i.e. what personalization is possible) relevant to a specific situation (i.e. a specific learner for a specific learning outcome under a specific learning method)
- Design of learning modules and learning activities integrated with business processes

Learnomotive will not suggest or compose a new learning method. The competence development model of *Learnomotive* is based on current learning methods. Different learning methods will be supported including work-based, collaborative learning and problem-based learning. Adoption of these methods to the environment under consideration, i.e. business-integrated mass-individualized learning in a networked enterprise environment is another pedagogical challenge of *Learnomotive*. These methods will be investigated from the point of learning performance, i.e. learning efficiency and learning quality. Learning quality refers to the level of success in the learning process in terms of achieving learning objectives and learning outcomes. Learning efficiency refers to the resources used (e.g. time of learner, time of facilitators, physical resources) for a given learning quality level and a starting point (i.e. learner characteristics, learner's initial competence level).

Business and Organizational Challenges

The main challenge in *Learnomotive* in business and organizational area is integrating learning processes and business processes for business-integrated mass-individualized learning in a networked enterprise environment.

Issues to be addressed include (but not limited to);

- Adoption (redesigning) of learning modules and learning activities to existing business processes (i.e. work-based learning)
- Adoption (redesigning) of existing business processes to learning modules and learning activities
- Integration of learning modules and learning activities to existing business processes
- Design of a promotion model integrating the competence development model and the business needs
- Investigating the parameters and the effect of dynamic enterprise model (i.e. virtual networked enterprise, dynamically changing tasks, dynamically changing employees, dynamically changing competence levels of employees)

Social and Economical Challenges and Objectives

Life long learning is becoming more and more important because of the need for new skills and competences for the work force. In other words, the work force must continually upgrade its skills and competences and acquire new skills and competences. *Learnomotive* provides a solution for work-based life-long learning.

Issues to be addressed include (but not limited to):

- Generalizing the business-integrated competence development model to a more unstructured and more flexible life-long learning model
- Promoting the competence development model for its use by a large number of organizations
- Developing business based on the platform developed

Another economical (and technical to some extend) challenge is to rely on open source tools and open content to the highest extend possible. This is a policy issue in this thesis, which brings together certain challenges.

Technical Challenges and Objectives

The project has to provide solutions to technical issues related to the development of a mass-individualized competence development platform integrating business processes and learning methods and processes. The following are the technical challenges of *Learnomotive*:

- Interoperability,
- Flexibility and scalability,
- Personalization and mass-individualization,
- Semantics and context-awareness.

Interoperability refers to *Learnomotive*'s ability to communicate with other systems, to exchange data with other systems, and to work with other systems. This is important for two reasons. First, *Learnomotive* should be able to co-exist and work together with existing systems. Second, *Learnomotive* should be able to make use of the services and content available at other system.

Interoperability is a hard problem in this case. This is because, unlike other learning systems, *Learnomotive* integrates with business processes. This brings with it interoperability issues not only at physical level (communication protocols, etc) and semantic level (using a common ontology) but also at organizational level (i.e. incompatibilities between business processes). Organizational interoperability makes possible to overcome the differences between business structures and business processes. Semantic interoperability makes possible to overcome the differences in understanding the meaning of exchanged information.

Flexibility is the ability for a system or a component to be easily modified to be used in environments or for other needs, different than the original design purpose. It is addressed in Learnomotive by having a flexible structure of choosing tasks independent from departments. It is expected from a learner to know the

specifications about his/her department but by having a flexible structure, Learnomotive let learner to choose tasks from other departments. Hence learner may use the system depending on his/her needs other than company's needs.

The content of the Learning portal is managed by the facilitators of each department. Every time the business structure changes, depending on the type of change, new learning modules can be added or some learning modules can be removed with their related facilitator and assets. With a suitable database structure, Learnomotive model can be extended and integrated with the growing organizational structure. Addition of new departments and new learners does not effect the operation of the company. This feature of Learnomotive is to address the scalability.

3.2 A Theoretical Approach to Learnomotive

3.2.1 The Competence Development Environment: A Preview

Learnomotive supports new learning methods such as collaborative learning, social learning, problem-based learning, work-based learning, etc. which are more effective for the acquisition of knowledge, competences and skills. This is especially true for the acquisition of skills as these methods are categorized as learning by doing. The competence development environment supports personalization and mass-individualization. These properties will help increase effectiveness of learning and competence and skill building. This is because these properties exploit the learning behavior and other characteristics of the learner for more effective learning delivery. Integration of learning processes and business process is another characteristic of the system that will increase effectiveness of knowledge, competence and skill acquisition. This is because many of the business activities will be at the same time learning activities. This is true learning by doing.

The competence development environment that has been developed helps increasing knowledge worker productivity. This is by increasing knowledge, skill levels and therefore the competence of the worker as explained above.

Learnomotive integrates business processes and learning processes. This means that business processes will serve to a large extend the purpose of learning processes.

This will result in a learning organization. The organization will learn while performing its usual functionalities. With the effect of this integration, the hierarchical structure of the company can be used in the model and the competence levels, skills and performance of the workers can be followed.

Learnomotive let learners to store their completed tasks in their profile; therefore for every user a personal database of task materials is constructed.

Competence Development Model

The competence development model in Learnomotive is a whole system that contains all the phases of learning through planning a task to finishing a task. The model let learner improve his/ her skills depending on his/her choices and progress. Learner may be able to choose the tasks of his/ her desire, finish the necessary learning modules thus improving himself / herself.

The model contains all the components in itself. Once a user becomes a learner the initial competence level is determined and in every phase (every time a user finishes a task) the competence level is updated.

The competence level is determined by the tasks that are completed. Hence, all the task descriptions are actually the competence descriptions.

Because the tasks are built depending on business processes and finished tasks determine the competence level, the model is integrated with the organizational context.

The skill types and competence levels of learners can be determined. The skill types include the information category that the task is in and the competence level includes which tasks are satisfied by the user under that category.

Registering with a task may happen by personal choice or with a direction. As a personal choice, individuals may choose what to learn. In other words, learners can do their own competence development planning to go forward on their careers which

is beneficial for self-development and personalization. For a direction, the facilitator of the department that the worker is registered with may assign a task. This is beneficial for the company that the workers may be directed for being aware on certain topics therefore; the knowledge level of the company is increased.

Because there is a chance to determine the competence level of every learner, the workers that have specific skills may be listed and they can be candidates for specific businesses. Thus, the competence levels of the learners are mapped with business tasks.

The competence development method may suggest for a specific learning method to a specific learner.

Personalization is an important aspect of the model. As it is specified above, every learner has a chance to arrange his/ her own competence development plan. Learner may benefit from the learning portal as he/ she desires. Every learner may choose the method of learning for a task. Therefore; it is possible to measure the development of a specific learner under a specific learning method for a specific task.

Integration of Learning Processes and Business Processes

In Learnomotive, business processes determine the required tasks. These tasks are used for constructing learning processes. Every company has a different hierarchical structure, different departments, job descriptions, job titles etc. The area of profession of a company determines the area of business processes. These business processes are composed of business tasks. These tasks are also exists in learning processes and learners choose these tasks as a learning object. Therefore the content of tasks is determined by the business processes.

The actors of the learning model are also determined with respect to the responsible people in the company. Therefore; constructing the department, specifying facilitator processes are easily handled.

3.2.2 Main Components of the Learning Model

Learner

Anyone who wants to be included in the learning process may register and after the approval of the related facilitator becomes a learner and may request for a task. Every learner may choose any task of interest. If that request is approved by the task's facilitator, learner may begin to use the task's learning portal.

Any learner who wants to be registered with the system should fill the profile information.

Every learner has a chance to arrange his/ her own competence development plan. Therefore; every learner has a chance to personalize the planning for tasks by viewing either the registered and the waiting to be registered tasks.

Any learner, who has some suggestions about the tasks or for any improvement in the system, may send a message to the related facilitator containing the related task name and the message itself. Or every learner may discuss the topics of certain learning modules in the related forum. Also learner may view the task news and portal news.

Every learner has a report that shows the tasks/ learning modules that are completed by the learner and department information that shows which department that the learner works in. The figure of an example learner is depicted in Figure 3.2 below;

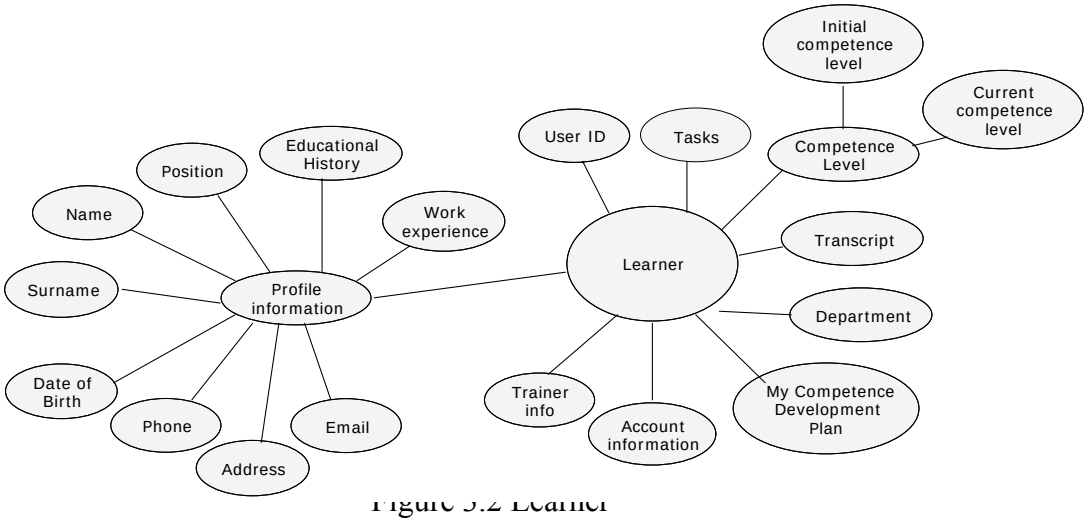


Figure 3.2 Learner

Tasks

Tasks are the learning objects that indirectly represent the learning outcomes. Every department has its own tasks. Tasks are composed of learning modules. Tasks are the components of the learning model that determines the competence level of a learner.

Every task may be either chosen by the learner or assigned by the facilitator to a learner. At the time of choosing a task, the learning method should be also specified. That learning method determines some extra functionality in the learning portal. After a task is completed, the task is seen as passed in learner's related report.

Tasks are separated by subject in each department and for a learner to complete a task; every learning module that is under that task should be completed. The separation of the tasks and choosing a learning method helps to choose and personalize the learning.

Tasks determine the required knowledge for a specific job (for instance in a company for being a senior software developer the requirements may consist of having knowledge of certain topics (programming languages, optimization etc.) and a certain time of working experience. For a junior software developer in order to be a senior, except the working experience necessity, the knowledge threshold should be completed. Therefore; the junior developer should complete all the tasks for being a candidate of senior developer) Relation between tasks and learning modules is depicted in Figure 3.3 below;

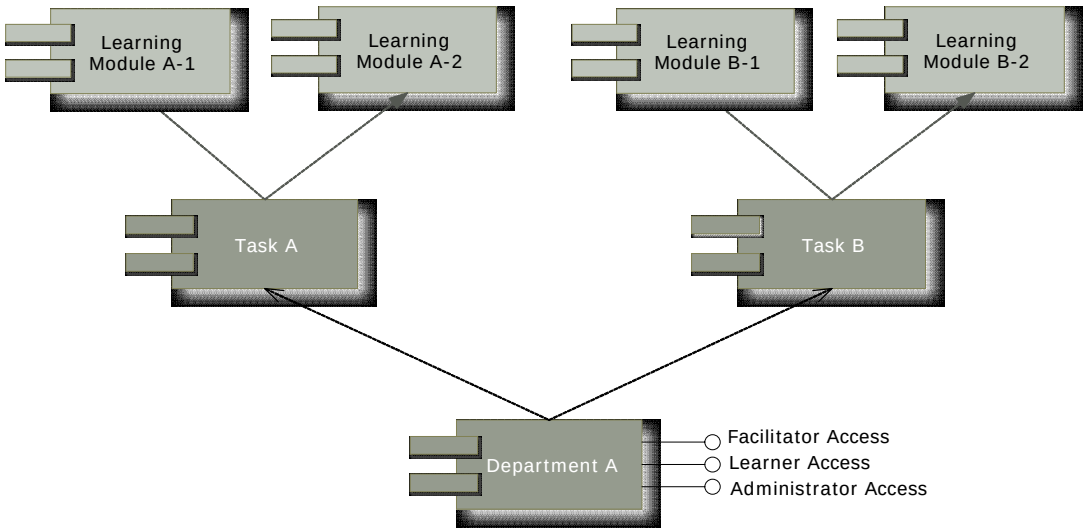


Figure 3.3 Task components

Learning Module

Learning modules are the learning objects that exist under tasks. Together, they constitute the tasks. Learning modules are actually the sub topics that should be learned in order to have sufficient information and competence level about a specific task.

When a task and its related learning method have chosen that learning method becomes valid for all learning modules under that task.

Learning module is one of the main components of Learnomotive that the learning process occurs in. Learner may;

- Reach to the assets (documents, pictures, videos etc.),
- Open a topic under the related forum,
- Chat with other learners,
- Ask questions to the trainers,
- Participate in either a class- based or online course,
- Play games about the related topic,
- Give suggestions about tasks or learning modules to trainer.
- Take the tests that is necessary to pass the learning module

Learning modules also form the list of topics that is available in the learning portal. They are designed to be integrated with business processes and help to obtain personalization and mass- individualization in Learnomotive. The figure of Task and Learning Methods components is depicted in Figure 3.4 below;

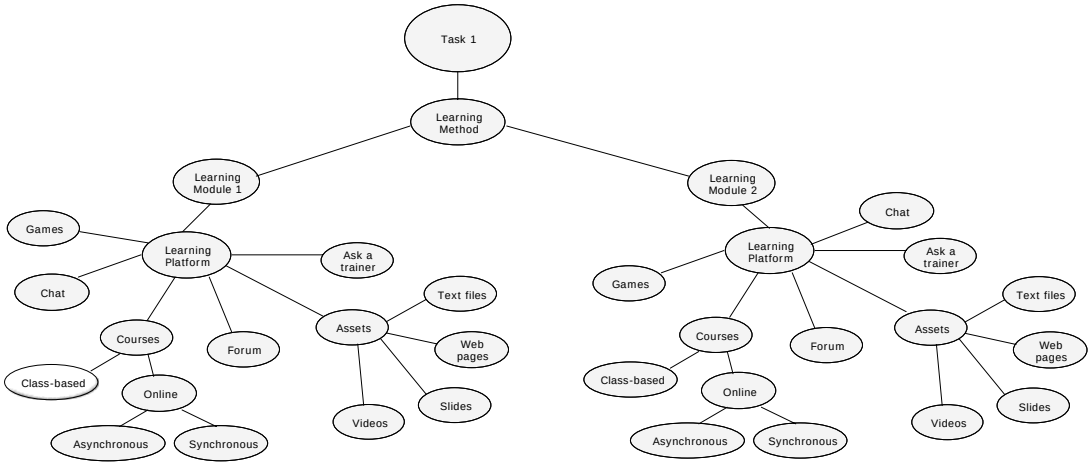


Figure 3.4 Task and learning methods components in detail

3.2.3 Relationships Between Components

All the components of Learnomotive have a relationship with each other. Once a user is registered as a learner to the system, he/ she should choose a task in order to reach to the learning module. And every time a learner finishes a learning module or choosing a new task, he/ she communicates with the task component. After choosing a task, learner deals with the related learning modules that are under that task therefore; a learner always has an interaction with the learning module component.

3.2.4 Reporting System

In Learnomotive, every learner has a transcript. These transcripts include all the tasks and their related methods that are completed by the users and all the learning modules that are taken by the users, the works that are completed by the users.
Every facilitator may take a report of a specific learner under his/ her department or may list the learners with specific competence level.

3.2.5 Registration System

All users should register in order to create an account. Facilitators are registered by the administrator and learners are registered by themselves and approved by their department's facilitators in order to create an account. After having an account, all learners that will apply for a task, should be approved by the related facilitator.

3.3 Scenarios: What is Happening When

3.3.1 Integrating Business Processes to Learning Processes

This feature includes the following operations:

1) The structures of the company is specified
    - Hierarchical structure
    - Department names/ departmental structure
    - Business processes of each department is listed
    - The tasks that are necessary for these business processes are determined
2) The tasks of each business process are stored in database separated as departments and updated regularly.
    - The task names of necessary knowledge are listed(i.e. if the department is an IT department that develops software in Java, C++ and Web-based applications, the business process will require having knowledge of software development. Than the tasks will include programming concept, programming languages c++, java and web programming)
    - In the same example in the same department, if there exist another business process that requires a person that has knowledge about project management and being responsible for developing projects than as addition to the software developer's tasks it will include the task named as project management
    - Because each task has its own learning modules that contain courses, forums etc., the subtopics of each task are assigned as learning module names which should be taken.
    - The tasks, the learning modules of each task, the learning portal information for each module are created. And for each learning module, the learning methods are evaluated and if necessary, assigned to that learning module. Therefore, the learning processes are determined.

3.3.2 Giving the Management Roles to Related Personnel

This feature includes the following operations:

1) According to the company structure that is listed before, current actively working positions with job titles is determined and listed.

2) Administrator of the system is determined from the personnel who is related with it processes in the company according to the authority level.

   - Administrator of the system will manage and maintain the technical problems that may occur in the system
   - Administrator has the authority to reach to the database
   - The administrator account which has all the authority (which may delete a user, add a user, add /delete a task, learning module or any component of the system) that is created in system.

3) Facilitators of the system are determined from managers who are responsible from a department.

   - Every department has its own facilitator
   - Facilitators are the people who may guide learners to specific positions
   - They determine and arrange the learning modules that are necessary for their department
   - They evaluate the suggestions and demands for new learning modules, new tasks that is coming from learners
   - They may assign a task for a learner
   - They may determine the topics that will be listed in the learning modules
   - They may arrange the assets, facilitate the games, organize the trainers for giving the courses
   - Facilitators arrange(upload) the necessary documents that should be used by specific learning methods for any learning module under a certain task

- For the system, each facilitator has a department attribute. And the facilitator may assign a task to a learner only if the learner has the same department attribute (only if they are in the same department)
- Facilitator is the person who does not need to take a test of any task for his/her department
- Facilitator may be a learner of another department's tasks
- Only in his/her department's learning module a facilitator may add/ delete assets
- Learners may send a message to the facilitator
- Facilitator approves the learners' registration requests for the tasks in his/her department
- Facilitator of a department is also the trainer of that department
- Facilitators of the departments arranges the guide that will be used by learners
- Facilitators prepare and edit the tests
- Facilitators take the report of learners of their departments
- Facilitators create forum topics for every learning module
- Facilitators approve the department registration requests and task requests of their department

4) Candidate trainers of the system are determined

- A person who wants to be a trainer of a specific topic should complete the related task or should have the competence level of that task
- Facilitators who would like to be a trainer of another department may apply as a learner if all the required learning modules are completed

3.3.3 Making the Database and Loading Files to the System

This feature includes the following operations:

1) According to the information that is gathered as task list and related learning module list the database is prepared.

2) All the tasks, related learning modules, assets are created.

   - Facilitators determine the task names and learning modules that are related with their department, create the tasks, learning modules and upload all the necessary assets and test modules
   - Tests are uploaded in learning model basis which means every learning module has its own test
   - Tests includes the pool of questions and every time a learner tries to take a test, the questions are selected from that pool in a random manner and in specified number
   - Tests are prepared by facilitators and it may be password protected or time-limited, facilitators may specify the specifications of tests
   - Forum topics may be constructed after learners are registered to the system.

3.3.4 Registering to the System

This feature includes the following operations:

1) All the personnel that will use the learning system of the company should register to the system.

2) Administrator creates the departments

3) Administrator creates the facilitator accounts

4) Administrator connects the departments with related facilitators

5) After the facilitator accounts are created, they are sent to facilitators to login to the system and update their profile

6) Learner creates an account using the registration system. Unless specified before, a default user is registered as a learner.

- A user (not registered person) enters the interface of the system.
- User creates a username and a password
- The system opens a database record for the user
- The user enters the necessary profile information (Name, Surname, address details, department, educational history, work experience as year, email address etc.)

    a. The system creates an account for the user
    b. And sends a message to the facilitator for approval

7) After the facilitator approves the request, the user info part is turned into active and added to the system.

3.3.5 Assigning Task to a Learner

This feature includes the following operations

1) A task may be assigned either from the demand of the learner or a facilitator may assign a task to a learner

2) Learner requests for a task

- Learner lists the tasks and views the necessary learning modules to complete the task.

3) If the learner wants to complete the task he/she selects the task and sends a request

- The system send this request to the related facilitator
- After facilitator approves the request, the task is assigned to learner
- The system adds the task name to the tasks record of that user

4) Facilitator assigns a task to learner

- Facilitator lists tasks of his/her department and chooses a task to assign
- Facilitator lists the users of his/her department
- Facilitator selects the user and assigns the task to the user

3.3.6 Learner Makes the Competence Development Plan

This feature includes the following operations:

1) Learner lists the tasks and views the related learning modules that are necessary
2) Learner chooses the tasks and add them to my competence plan
3) If learner decides to select the tasks, he/ she selects the related task and send a request to related facilitator

3.3.7 CDM Determining Initial Competence Level of a Learner

This feature includes the following operations:

1) After a task is assigned to a learner(after the task is approved by the related facilitator) for each learning module learner takes all the initial tests
2) For each learning module, the result is stored in a initial competence level table
3) Every user has a competence level table related with his/ her assigned tasks

3.3.8 CDM Mapping Learning Tasks to Learning Modules

1) Every task has its own learning module when a user completed all the required learning modules (when all the required learning modules are mapped with that learning task) the task is assumed as completed

3.3.9 Learner Chooses Problem-Based Method

This feature includes the following operations:

1) When a learner chooses a task to finish, he/she also chooses the preferred

method to finish that task

2) If the learner chooses problem-based method for a task, in his/her interface there appears a link called problems

3) The link problems includes all the learning module names and under them it includes the problems that is assigned by the facilitator

4) The learner may choose to solve the problems

3.3.10 Learner Chooses Work-Based Method

This feature includes the following operations:

1) When a learner chooses a task to finish, he/she also chooses the preferred method to finish that task

2) If learner chooses work-based method for a task, in his/her interface a link

3) appears called work-to-do

4) The link work-to-do includes all the learning module names and under them it includes the works and its deadlines that are assigned by the related facilitator.

5) The work-to-do links has deadline times and answer-deadline times so if a learner wants to work on it, he/she should answer in the period of answer-deadline time

6) The works that is finished by a learner is stored in the learner's transcript

3.3.11 Learner Chooses Collaborative Method

This feature includes the following operations:

1) When a learner chooses a task to finish, he/she also chooses the preferred method to finish that task

2) If learner chooses collaborative method for a task, in his/her interface there appears a link named as group and when clicked, for every learning method a group appears

3) If the learner wants to join the group he/she simply joins the group

4) When the learner joins the group he/she can see the mailing information and messaging information of other people

5) For every learning method, a group is opened. Every facilitator determines at least how many people should exist for a certain group

6) After the minimum value of a group is completed, every facilitator may assign a work to be done or a problem to be solved to a group with a deadline

7) If the work has completed or the problem solved it is stored in each learner that the work has been completed or a problem has been solved with a collaborative method

3.3.12 CDM Determination of the Competence Level

This feature includes the following operations:

1) After the learner completes the learning modules that are necessary and passed each test of learning modules (which means reached to the satisfied level of knowledge) the related task assigned to the learner

2) A learner may take the tests at the time he/ she registers with that task or he/ she can take the test after studying in learning portal

3) In order to find the competence level of a learner, a detailed report can be taken by the facilitators

3.3.13 Learner Uses Learning Portal

This feature includes the following operations:

1) When the account of the learner is accepted by the related facilitator, learner chooses the desired task/tasks

2) When the learner chooses a task the related learning modules are assigned to the learner

3) The learner sees all the tasks link in his/her menu and when the task are clicked, a task menu appears on the right

4) When the learner lists the learning modules, the learning module menu (LM Menu) appears on the right

5) In the learning portal, a learner may write on a forum, may chat with other learners, may be registered to a course, ask the related questions to trainers, play games that are related with the learning modules, reach to the documents(web pages, slides, videos) that are available for the chosen tasks and learning modules

3.3.14 Learner Registers with Courses in Learning Portal

1) When a learner is assigned with a task, he/she may want to register with a course. If the learning modules has the course availability with them, then when the learner clicks on the courses section and list the tasks and related learning modules that have course availability

2) Learner chooses one learning module and choose whether the course is online or class-based

3) If the course is an online course learner chooses whether the course is asynchronous or synchronous

4) If the learner chooses synchronous course he/she lists the timeline of the courses and pick a timeline to be registered with

5) If the learner chooses asynchronous course he/she downloads the course that has been stored from the database

3.3.15 Learner Being a Trainer

This feature includes the following operations:

1) After the task is completed(After the learner completed all the learning modules that is necessary for that task) the system asks user to be a trainer for that task or not if the user accepts the trainer record for that task is turned into yes and the user is added to the trainer database for that task.

2) Their information may be used by facilitator- Communication information, also their email is assigned to ask a trainer part. That means facilitator may ask them to give online course and he/she accept getting mails from learners.

3.3.16 System Suggestions to Learner

This feature includes the following operations:

1) After learner completed some tasks if the learning modules may be combined

into new tasks -except being targeted- the new tasks are automatically assigned to user. And if there exist some tasks that may be gained by taking up to two tasks, the system sends a notification to user and suggests those learning modules in order to be assigned to those tasks.

3.3.17 Learner Suggests New Training Titles and Areas

This feature includes the following operations:

1) Learner may suggest for new training titles and areas to his/her facilitator.

2) The suggestion form will include the;

- Department
- Suggestion type (Multiple choice, may be a task, learning module, course)
- User ID

- Suggestion description

3) Facilitator evaluates the suggestion

3.3.18 Guide for Learner

This feature includes the following operations:

1) After learner adds the tasks, learning modules are automatically assigned

2) When learner views the learning modules, an LM menu appears on the right side

3) LM Menu includes a link named as Guide which indicates the learner's interest of the learning module

4) Every time a learner views the assets of the learning module, a star is appears on the guide part

5) Up to three stars, learner may follow the interest of his/her to the learning module. Learning modules that are not visited are indicated by a line.

6) After three visits the learning module is deleted from the guide

7) Guides can be edited by the related facilitators

3.4 Expected Impacts of the Learning Model

The expected impacts of the model are as follows:
Faster and more effective acquisition of knowledge, competences and skills: The competence development environment supports new learning methods such as collaborative learning, problem-based learning, work-based learning, etc. These methods are more effective for the acquisition of knowledge, competences and skills. This is especially true for the acquisition of skills as these methods are categorized as learning by doing. The competence development environment will support personalization and mass-individualization. These properties will help increase effectiveness of learning and competence and skill building. This is because these properties exploit the learning behavior and other characteristics of the learner for more effective learning delivery. Integration of learning processes and business process is another characteristic of the system that will increase effectiveness of

knowledge, competence and skill acquisition. This is because many of the business activities will be at the same time learning activities. This is true learning by doing.

Increased knowledge worker productivity: The competence development environment is expected to increase knowledge worker productivity. This is by increasing knowledge, competence and skill levels of the knowledge worker as explained above.

More efficient organizational learning processes: This is one of the main focus areas of the environment. The model addresses directly integrating business processes and learning processes. This means that business processes will serve to a large extend the purpose of learning processes. This will result in a learning organization. The organization will learn while performing its usual functionalities.

Chapter 4
Development of the Model

4.1. Development of Learnomotive

4.1.1. Technical Information

A prototype of Learnomotive environment is implemented by PHP 4 over MySQL database structure. For implementation platform, Zend Studio Enterprise Edition is used.

In the developed prototype, only some part of the conceptual system are validated which are the registration part with having different user accounts, all the admin duties, many of the facilitator duties and many of the learner duties of those user accounts are implemented.

The developed prototype also includes the big part of the conceptual learning portal (adding assets, forum, ask a trainer, guide, task and department news, testing etc.) big part of the reporting system.

4.1.2. PHP

PHP stands for Hypertext Preprocessor and it is a scripting language that is usually used with HTML of a web page. The PHP code is embedded in HTML and when requested, the related web server executes that script and gives back the result.

4.1.3. MySQL

MySQL command interpreter is used for creating databases in web applications. All the SQL commands can be used with and interpreted by MySQL.

4.2. Users of Learnomotive

In the developed prototype of Learnomotive, there are three types of user accounts exist. They are; administrator, learner and facilitator accounts.

Administrator account has admin privileges that can create departments, add facilitator accounts, add portal news and assign facilitator accounts to the related departments.

Learner accounts may only see the waiting tasks and the approved tasks with related learning modules, use learning portal, create a forum topic, write an answer for a forum topic, request for a task, follow the guide to have information about the interest, take the tests of each learning module, follow his/her competence level from the test results.

Facilitator accounts may approve requested task assignments of learners, can edit and prepare the guides of tasks, can create a forum topic and answer a topic, can create reports for their department's learners, can add and edit tests, arrange the assets for each task, can add task and add learning module to their departments, can add department and task news can request for tasks from other departments.

4.3. Database of Learnomotive

4.3.1. Information

The implemented part of Learnomotive prototype has seventeen database tables in it. All tables are related with each other either through a table or directly.

Different account types are stored in users table with some attributes. The user types may be admin, facilitator or learner. Since every user should be in a department, users table has a direct connection with departments table through dep_id tuples. The birthday attribute of every user is a derived number of a fix UNIX clock time and the values can be calculated through that number. The creation time of tasks and learning modules use the same method to calculate the creation time.

When a user chooses a task, he/she request for this task and the request is recorded into task_approvals table to approved tuple with value of No. After a person with a

facilitator account approves that request, the value turned into Yes and that task is assigned to a learner.

Every task is composed of different learning modules. When a user with enough privileges adds a new learning module, that record is added to learningmodules table. Every learning module is connected to a task with a task_id value. Every learning module and task has a description attribute. The assets of each learning module are stored in lm_assets table and the number of entry of the user to each learning module is stored in lm_entry_count table to be used for guide which is stored in guides table.

Exams table is used to create exams. It is directly connected to the exam_questions table where the questions are stored for each exam. In exam_statistics, the exam result of the learner is stored. If the learner tries the test more than once, the greatest pointed exam is considered. Exams are based on learning modules that each learning module may have its own exam. Total_exam_statistics table is used to calculate the exam results for each task.

Forum_question and forum_answer tables are used for the forum that can be created by every user.

News tables (portal_news, depnews and tasknews) are used to store the news that can be created by admin and facilitator.

The implemented part of Learnomotive's database schema is depicted in Figure 4.1 below;

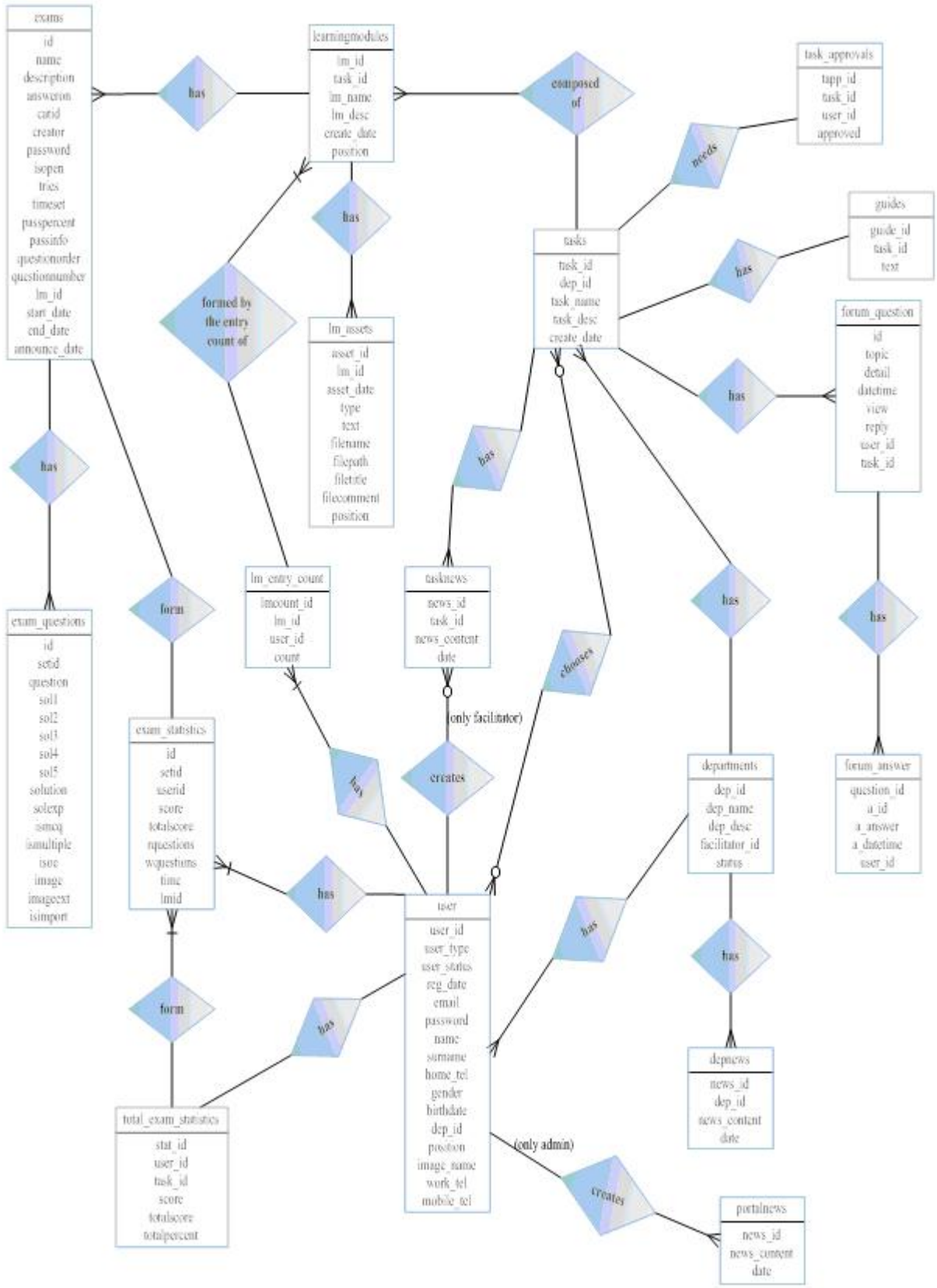


Figure 4.1 Database of Learnomotive

4.4. Database Structures

The database structure of Learnomotive is explained in tables from Table 4.1 through Table 4.34 below;

4.4.1. Departments

The structure of each tuple in departments table and example data for the related tuples are depicted in Table 4.1 and Table 4.2 respectively below**;**

Table 4.1 Structure of departments table

Field	Type	Null	Default
dep_id	smallint(6)	Yes	NULL
dep_name	tinytext	Yes	NULL
dep_desc	tinytext	Yes	NULL
facilitator_id	smallint(6)	Yes	NULL
status	enum('Open', 'Closed')	Yes	Open

Table 4.2 Example data for departments table

dep_id	dep_name	dep_desc	facilitator_id	status
1	Research&Development	New work ideas about e-learning and new development strategies are researched in this department	2	Open
2	Sales&Marketing	Department where the goods are sold and advertisements of those goods are done	3	Open
3	IT&Support	Department where local technical support of company are given	4	Open
4	Accounting	Department where financial transactions are done	5	Open
5	Software Development	Department where software development is done	6	Open

4.4.2. Dep_news

The structure of each tuple in dep_newstable and example data for the related tuples are depicted in Table 4.3 and Table 4.4 respectively below**;**

Table 4.3 Structure of dep_news

Field	Type	Null	Default
news_id	smallint(6)	Yes	NULL
dep_id	smallint(6)	Yes	NULL
news_content	mediumtext	Yes	NULL
date	int(11)	Yes	0

Table 4.4 Example data for dep_news table

news_id	dep_id	news_content	date
1	4	Suggestions for the department are encouraged	1221320916
2	1	A departmental meeting will be done in next weekend	1221321278
3	2	There will be a marketing seminar in our seminar room in the next tuesday	1221332736
4	3	An introductory lab course will be given on the next monday about computer components	1221332885
5	4	Fundamental regulating laws about accounting can be found in the library, please ask for it.	1221333277
6	5	Programming lab course will be done in developing center at 4:00 pm on next tuesday, please mail me your names if you'll attend.	1221333414

4.4.3. Users

The structure of each tuple in users table and example data for the related tuples are depicted in Table 4.5 and Table 4.6 respectively below**;**

Table 4.5 Structure of users table

Field	Type	Null	Default
user_id	smallint(6)	Yes	NULL
user_type	enum('Admin', 'Facilitator', 'Learner')	Yes	Admin
user_status	enum('Active', 'Deactive')	Yes	Active
reg_date	int(11)	Yes	0
email	tinytext	Yes	NULL
password	tinytext	Yes	NULL
name	tinytext	Yes	NULL
surname	tinytext	Yes	NULL
home_tel	tinytext	Yes	NULL
gender	enum('Male', 'Female')	Yes	Male
birthdate	int(11)	Yes	0
dep_id	tinyint(4)	Yes	0
position	tinytext	Yes	NULL
image_name	tinytext	Yes	NULL
work_tel	tinytext	Yes	NULL
mobile_tel	tinytext	Yes	NULL

Table 4.6 Example data for users table

user_id	user_type	user_status	reg_date	email	password	name	surname	home_tel	gender	birthdate	dep_id	position	image_name	work_tel	mobile_tel
1	Admin	Active	0	ececansun@gmail.com	1234	Admin	Ece	02125467865	Female	0	0	Admin	NULL		
2	Facilitator	Active	1221311220	dwright@learnomotive.com	1234	Denise	Wright	536327353	Male	-141703200	1	Senior	NULL	342343423	32443434455
3	Facilitator	Active	1221311365	ktimber@learnomotive.com	1234	Kim	Timber	3765237543	Female	180133200	2	Senior	NULL	4532453454	53443245533
4	Facilitator	Active	1221311670	mjacobson@learnomotive.com	1234	Mark	Jacobson	343434132134	Male	76971600	3	Senior	NULL	342352524524	435324532454
5	Facilitator	Active	1221311933	tjacksonville@learnomotive.com	1234	Timber	Jacksonville	73674474548	Male	-137037600	4	Manager	NULL	21346184761	34763487634
6	Facilitator	Active	1221312340	etincar@learnomotive.com	1234	Emily	Tincar	673536344	Female	116802000	5	Senior Developer	NULL	234234826	234234232
7	Learner	Active	1221327933	r&dlearner1@learnomotive.com	1234	R&D	Learner1	34234234	Male	333489600	1	junior researcher	NULL	234234234	2342343
8	Learner	Active	1221335236	s&mlearner1@learnomotive.com	1234	s&m	learner1	231413434	Female	271976400	2	junior sales worker	NULL	634134344	645645645
9	Learner	Active	1221339976	it&slearner1@learnomotive.com	1234	IT&S	Learner1	34234232	Female	407019600	3	junior support worker	NULL	23434224	24556744
10	Learner	Active	1221341938	alearner1@learnomotive.com	1234	A	learner1	2342552452	Male	394747200	4	junior accounting worker	NULL	2454545678	8686877477
11	Learner	Active	1221342038	s&dlearner1@learnomotive.com	1234	SD	Learner1	884327892	Female	344552400	5	junior developer	NULL	435356363	356365342
12	Learner	Active	1221424842	r&dlearner2@learnomotive.com	1234	r&d	Learner2	586749654	Female	385851600	1	junior	NULL	634647373	252426578
13	Learner	Active	1221555587	s&mlearner2@learnomotive.com	1234	s&m	learner2	45346326	Male	331675200	2	junior	NULL	25656565	78676787
14	Learner	Active	1221557683	it&slearner2@learnomotive.com	1234	it&s	learner2	8345445532	Female	469918800	3	junior	NULL	5685685685	658545345
16	Learner	Active	1221569252	alearner2@learnomotive.com	1234	A	learner2	453465365	Female	338932800	0	junior	NULL	546565465456	456456456456
17	Learner	Active	1221569252	s&dlearner2@learnomotive.com	1234	SD	Learner2	3874623874	Male	338932800	5	junior	NULL	3242345645	8989546536

4.4.4. Tasks

The structure of each tuple in tasks table and example data for the related tuples are depicted in Table 4.7 and Table 4.8 respectively below**;**

Table 4.7 Structure of tasks table

Field	Type	Null	Default
task_id	smallint(6)	Yes	NULL
dep_id	smallint(6)	Yes	0
task_name	tinytext	Yes	NULL
task_desc	tinytext	Yes	NULL
create_date	int(11)	Yes	0

Table 4.8 Example data for tasks table

task_id	dep_id	task_name	task_desc	create_date
1	5	C++	This task covers all C++ subjects	1217169637
2	5	Java Programming	This task covers all subjects of Java Programming	1217169744
3	5	Visual Studio .NET	.NET usage	1217180039
4	5	Programming Theory	Programming Theory	1217185589
5	2	Introduction to goods	An introductory task to get familiar with the goods	1217816650
6	2	Introduction to Marketing	An introduction to marketing concepts	1217816899
8	1	Literature Search	An introduction to literature search.	1221320170
9	1	Researching methodologies	Different methodologies for researching	1221320313
10	2	Selling Tips	Tips for better selling	1221320452
11	3	Common User Problems	Problems that users are frequently facing with	1221320535
12	3	Introduction to hardware	An introductory task for computer hardware	1221320590
13	4	Accounting Essentials	An introductory task for accounting	1221320750
14	4	Preparing Inventory	How to prepare an inventory	1221320786

4.4.5. Learning Modules

The structure of each tuple in learning modules table and example data for the related tuples are depicted in Table 4.9 and Table 4.10 respectively below**;**

Table 4.9 Structure of learning modules table

Field	Type	Null	Default
lm_id	smallint(6)	Yes	NULL
task_id	smallint(6)	Yes	0
lm_name	tinytext	Yes	NULL
lm_desc	tinytext	Yes	NULL
create_date	int(11)	Yes	0
position	smallint(6)	Yes	0

Table 4.10 Example data for learning modules table

lm_id	task_id	lm_name	lm_desc	create_date	position
2	8	Life-cycle of scientific information and types of literature	A chart that describes the life-cycle	1221415000	1
3	8	OBJECTIVES	OBJECTIVES OF A LITERATURE SEARCH	1221415172	2
4	8	INITIAL SEARCH	Where to begin your literature search ?	1221415618	3
5	6	What is Marketing?	An introductory document for marketing	1221552675	0
6	11	Mail Problems	Problems about mail program used inside company	1221556737	0
7	1	Functions	Functions	1221575273	3
8	1	Arrays	Arrays	1221575282	2
9	1	Basics of C++	Introductory information	1221575320	1

4.4.6. Exams

The structure of each tuple in exams table and example data for the related tuples are depicted in Table 4.11 and Table 4.12 respectively below**;**

Table 4.11 Structure of exams table

Field	Type	Null	Default
id	int(10)	Yes	NULL
name	text	Yes	NULL
description	text	Yes	NULL
answeron	int(3)	Yes	1
catid	int(10)	Yes	0
creator	text	Yes	NULL
password	text	Yes	NULL
isopen	tinyint(3)	Yes	1
tries	tinyint(3)	Yes	0
timeset	int(10)	Yes	0
passpercent	int(10)	Yes	0

passinfo	text	Yes	NULL
questionorder	tinyint(3)	Yes	1
questionnumber	int(10)	Yes	0
lm_id	smallint(6)	Yes	0
start_date	int(11)	Yes	0
end_date	int(11)	Yes	0
announce_date	int(11)	Yes	0

Table 4.12 Structure of exams table

id	name	description	answeron	catid	creator	password	isopen	tries	timeset	passpercent	passinfo	questionorder	questionnumber	lm_id	start_date	end_date	announce_date
1	Literature Search	A small test to measure the knowledge level	1	0		1234	1	3	0	50		1	3	4	1221375900	1221721500	1221417644
2	Marketing Test	Introduction to marketing 1 question test	1	0			1	5	120	70		1	1	5	1221512400	1221685200	1221554948
3	Mail problems	One question test	1	0		1234	1	0	60	80		1	1	6	1221512400	1221685200	1221557201

4.4.7. Exam_Questions

The structure of each tuple in exam_questions table and example data for the related tuples are depicted in Table 4.13 and Table 4.14 respectively below**;**

Table 4.13 Structure of exam_questions table

Field	Type	Null	Default
id	int(10)	Yes	NULL
setid	int(10)	Yes	0
question	text	Yes	NULL
sol1	text	Yes	NULL
sol2	text	Yes	NULL
sol3	text	Yes	NULL
sol4	text	Yes	NULL
sol5	text	Yes	NULL
solution	text	Yes	NULL
solexp	text	Yes	NULL
ismcq	tinyint(3)	Yes	1

ismultiple	tinyint(3)	Yes	0
isoe	tinyint(3)	Yes	0
image	mediumblob	Yes	NULL
imageext	text	Yes	NULL
isimport	tinyint(1)	Yes	0

Table 4.14 Structure of exam_questions table

id	setid	question	sol1	sol2	sol3	sol4	sol5	solution	solexp	ismcq	ismultiple	isoe	image	imageext	isimport
1	1	What is the first stage of the life cycle of scientific information?	Informal Communication	Primary Literature	Secondary Literature	Tertiary Literature		4	Tertiary Literature is the first stage for the life cycle of information	1	0	0			0
2	1	Please choose 4 informal communication instances	CONFERENCE	PREPRINTS	IDEA	RESEARCH	JOURNAL ARTICLES	1234		1	1	0			0
3	1	Which of the following does not exist in secondary literature?	Abstracts	Subject Indexes	Table of Contents	Preprints	Review Articles	4	Preprints belongs to informal communication stage	1	0	0			0
4	2	Is this explanation true? To which extend? "Marketing is a philosophy in which the Customer, with his needs and wishes, is in the centre of all business activities of the company "	Yes, exactly true.	Yes, but if the market situations do not affect	No, completely false			1	It is exactly true. You don't need to consider market situation.	1	0	0			0
5	3	Does user priviledges affect the mail usage in our company?	Yes, users with no sufficient authority cannot reach to mail	No, only IP may affect as a privilediged instance	No, user priviledges only affect installing programs and limits some windows capabilities.			23		1	1	0			0

4.4.8. Exam_Statistics

The structure of each tuple in exam_statistics table and example data for the related tuples are depicted in Table 4.15 and Table 4.16 respectively below**;**

Table 4.15 Structure of exam_statistics table

Field	Type	Null	Default
id	int(10)	Yes	NULL
setid	int(10)	Yes	0
userid	int(10)	Yes	0
score	tinyint(4)	Yes	0
totalscore	tinyint(4)	Yes	0
rquestions	text	Yes	NULL
wquestions	text	Yes	NULL
time	timestamp	Yes	CURRENT_TIMESTAMP
lmid	smallint(6)	Yes	0

Table 4.16 Structure of exam_statistics table

id	setid	userid	score	totalscore	rquestions	wquestions	time	lmid
1	1	7	3	3	3 2 1		2008-09-14 14:01:03	4
2	1	12	2	3	1 2	3	2008-09-14 15:45:52	4
3	2	8	1	1	4		2008-09-16 03:57:56	5
4	2	13	0	1		4	2008-09-16 04:01:39	5
5	2	13	1	1	4		2008-09-16 04:02:03	5
6	3	9	1	1	5		2008-09-16 04:33:07	6

4.4.9. Total_Exam Statistics

The structure of each tuple in total_exam_statistics table and example data for the related tuples are depicted in Table 4.17 and Table 4.18 respectively below**;**

Table 4.17 Structure of total_exam_statistics table

Field	Type	Null	Default
stat_id	smallint(6)	Yes	NULL
user_id	smallint(6)	Yes	NULL
task_id	smallint(6)	Yes	NULL
score	smallint(6)	Yes	NULL
totalscore	smallint(6)	Yes	NULL
totalpercent	float	Yes	NULL

Table 4.18 Structure of total_exam_statistics table

stat_id	user_id	task_id	score	totalscore	totalpercent
1	7	8	3	3	100
2	12	8	2	3	66.6667
3	8	6	1	1	100
4	13	6	1	1	100
5	9	11	1	1	100

4.4.10. Forum_Answer

The structure of each tuple in forum_answer table and example data for the related tuples are depicted in Table 4.19 and Table 4.20 respectively below**;**

Table 4.19 Structure of forum_answer table

Field	Type	Null	Default
question_id	int(4)	Yes	0
a_id	int(4)	Yes	0
a_answer	longtext	Yes	NULL
a_datetime	int(11)	Yes	0
user_id	smallint(6)	Yes	NULL

Table 4.20 Structure of forum_answer table

question_id	a_id	a_answer	a_datetime	user_id
1	1	http://www.literature.org/	1221386934	2
1	2	scholar.google.com Some good papers can be found in that site	1221387025	2
2	1	First answer from me, 1- Software programs	1221387548	3
5	1	http://www.marketingteacher.com/Lessonstore.htm#marketing_environment	1221554351	3
6	1	I have a question about arrays. In a double array, how can we traverse the whole array? How many loops should we use?	1221577980	6
6	2	As far as i know, you should use two loops one for the row and the other for the column.	1221578044	6

4.4.11. Forum_Question

The structure of each tuple in forum_question table and example data for the related tuples are depicted in Table 4.21 and Table 4.22 respectively below**;**

Table 4.21 Structure of forum_question table

Field	Type	Null	Default
id	int(4)	Yes	NULL
topic	varchar(255)	Yes	
detail	longtext	Yes	NULL
datetime	int(11)	Yes	0
view	int(4)	Yes	0
reply	int(4)	Yes	0
user_id	smallint(6)	Yes	NULL
task_id	smallint(6)	Yes	NULL

Table 4.22 Structure of forum_question table

id	**topic**	**detail**	**datetime**	**view**	**reply**	**user_id**	**task_id**
1	Literature Search Essentials	Do you have any suggestions for good literature search sites?	1221386900	6	2	2	8
2	Categorization of goods	Let's categorize the goods we're selling	1221387515	6	1	3	5
3	Research methodologies	Some links containing research methodologies' information are: http://www.ptc.nsw.edu.au/scansw/method.html http://www.gartner.com/it/products/research/methodologies/index.jsp Do you have any other??	1221395501	2	0	2	9
4	Sales rates	Can you post your sales rates for this month?	1221397699	2	0	8	6
5	Marketing Links	You may share the websites that have information about marketing under this topic	1221554342	3	1	3	6
6	C++ Forum	You may ask questions, make discussions about c++ in this forum.	1221577623	5	2	6	1

4.4.12. Guides

The structure of each tuple in guides table and example data for the related tuples are depicted in Table 4.23 and Table 4.24 respectively below**;**

Table 4.23 Structure of guides table

Field	Type	Null	Default
guide_id	smallint(6)	Yes	NULL
task_id	smallint(6)	Yes	0
text	longtext	Yes	NULL

Table 4.24 Structure of guides table

guide_id	task_id	text
1	8	Please study the literature search task as indicated by subjects
2	11	
3	1	It will be beneficial to study in the order of ; 1- Basics 2- Arrays 3- Functions and than take the test, Good Luck,

4.4.13. Lm_Assets

The structure of each tuple in lm_assets table and example data for the related tuples are depicted in Table 4.25 and Table 4.26 respectively below**;**

Table 4.25 Structure of lm_assets table

Field	Type	Null	Default
asset_id	smallint(6)	Yes	NULL
lm_id	smallint(6)	Yes	0
asset_date	int(11)	Yes	0
type	enum('Text', 'File')	Yes	Text
text	longtext	Yes	NULL
filename	tinytext	Yes	NULL
filepath	tinytext	Yes	NULL
filetitle	tinytext	Yes	NULL
filecomment	tinytext	Yes	NULL
position	tinyint(4)	Yes	0

Table 4.26 Structure of lm_assets table

asset_id	lm_id	asset_date	type	text	filename	filepath	filetitle	filecomment	position
1	2	1221415052	File	NULL	Literature Type Chart.gif	uploads/	The chart	literature search	1
2	4	1221416270	File	NULL	initial search.doc	uploads/	Initial Search	Initial search detail	3
4	4	1221424397	Text	Some steps for initial search;	NULL	NULL	NULL	NULL	2
10	3	1221470896	Text	<big>Understand the value of literature reviews</big> <p class="MsoNormal" style="text-indent: -36pt; margin-top: 0px; margin-…	NULL	NULL	NULL	NULL	1
11	5	1221552771	Text	What is Marketing? <h2 style="padding-right: 0px; padding-left: 0px; font-size: 0.9em; margin-top: 0px; margin-right: 30px; ….	NULL	NULL	NULL	NULL	2
14	6	1221556995	Text	Users may have some problems about sending and receiving mail. For that condition, please	NULL	NULL	NULL	NULL	1
13	5	1221554731	File	NULL	Picture2.jpg	uploads/	Marketing Concept	Taken from; http://www.wsmarketing.ch/Bilder/Picture2.JPG	1
15	9	1221575488	Text	<pre style="margin-top: 0px; margin-right: 0px; margin-bottom: 0px; margin-left: 0px; padding-top: 0px; padding-right: ….	NULL	NULL	NULL	NULL	1
16	9	1221575579	Text	The first panel shows the source code for our first program. The second one shows the result of the program once compiled and executed. The way to edit and compile a …	NULL	NULL	NULL	NULL	2
17	9	1221575880	Text	The program has been structured in different lines in order to be more readable, but in C++, we do not have strict rules on how to separate ….	NULL	NULL	NULL	NULL	3
18	8	1221576277	File	NULL	ARRAYS.doc	uploads/	Arrays	Introductory text	1
19	8	1221576729	File	NULL	ARRAYS.doc	uploads/	Arrays	Introductory text	1
20	7	1221576841	File	NULL	Functions.doc	uploads/	Functions	Functions	1

4.4.14. Lm_Entry_Count

The structure of each tuple in lm_entry_count table and example data for the related tuples are depicted in Table 4.27 and Table 4.28 respectively below**;**

Table 4.27 Structure of lm_entry_count table

Field	Type	Null	Default
lmcount_id	smallint(6)	Yes	NULL
lm_id	smallint(6)	Yes	0
user_id	smallint(6)	Yes	0
count	smallint(6)	Yes	0

Table 4.28 Structure of lm_entry_count table

lmcount_id	lm_id	user_id	count
1	2	7	6
2	4	7	10
3	4	12	3
4	2	12	2
5	3	7	2
6	5	8	1
7	5	13	1
8	4	9	2
9	6	9	1
10	6	14	1

4.4.15. Portalnews

The structure of each tuple in portalnews table and example data for the related tuples are depicted in Table 4.29 and Table 4.30 respectively below**;**

Table 4.29 Structure of portal_news table

Field	Type	Null	Default
news_id	smallint(6)	Yes	NULL
news_content	mediumtext	Yes	NULL
date	int(11)	Yes	0

Table 4.30 Structure of portal_news table

news_id	news_content	date
5	Our company will soon construct a new department that is called as "Software Security" John Wilkar will be the manager of that new department John Wilkar is working in security area as a security analyst since 1995	1221313426
6	You may suggest new tasks for departments to the related facilitators	1221313661

4.4.16. Task_approvals

The structure of each tuple in task_approvals table and example data for the related tuples are depicted in Table 4.31 and Table 4.32 respectively below**;**

Table 4.31 Structure of task_approvals table

Field	Type	Null	Default
tapp_id	smallint(6)	Yes	NULL
task_id	smallint(6)	Yes	0
user_id	smallint(6)	Yes	0
approved	enum('Yes', 'No', 'Rejected')	Yes	Yes

Table 4.32 Structure of task_approvals table

tapp_id	task_id	user_id	approved
1	8	7	Yes
2	5	8	Yes
3	6	8	Yes
4	10	8	Yes
5	11	9	Yes
6	12	9	Yes
7	8	9	Yes
8	9	9	Yes
9	5	3	Yes
10	6	3	Yes
11	10	3	Yes
12	8	12	Yes

4.4.17. Task_News

The structure of each tuple in task_news table and example data for the related tuples are depicted in Table 4.33 and Table 4.34 respectively below**;**

Table 4.33 Structure of task_news table

Field	Type	Null	Default
news_id	smallint(6)	Yes	NULL
task_id	smallint(6)	Yes	NULL
news_content	mediumtext	Yes	NULL
date	int(11)	Yes	0

Table 4.34 Structure of task_news table

news_id	task_id	news_content	date
1	8	Literature search seminar will be done in next tuesday	1221400926

4.5. Screenshots from Prototype

Screenshots of different transactions that are done in prototype Learnomotive is depicted and explained through Figure 4.2 to Figure 4.39 below;

4.5.1. Administrator Adds Facilitator Accounts

When a person with administrator account tries to add a facilitator, he/ she fills a form of certain information. The screen of the add facilitator is depicted in Figure 4.2 below;

Figure 4.2 Administrator adds facilitator accounts

4.5.2. Administrator Creating Departments

When a person with administrator account creates a department, he/she fills the form that includes department name and description. The screen of the add department is depicted in Figure 4.3 below;

Figure 4.3 Administrator creating departments

4.5.3. Administrator Assigning Facilitator to a Department

When a person with administrator account created a department, he/she should assign a facilitator for that department. The screen of the assign facilitator is depicted in Figure 4.4 below;

Figure 4.4 Administrator assigning facilitator to a department

4.5.4. Facilitator Menu

When a person with facilitator account logs in to the system, the menu appears that includes add task, add learning module and add department news sections. The screen of the facilitator menu is depicted in Figure 4.5 below;

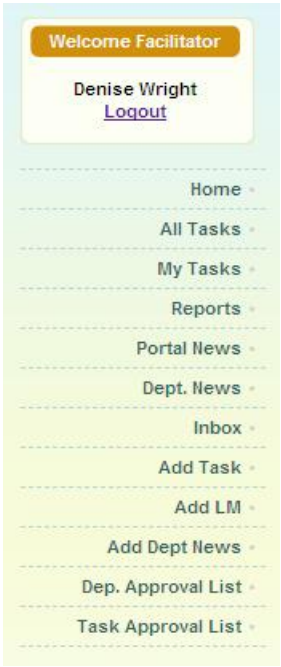


Figure 4.5 Facilitator menu

4.5.5. Administrator Menu

When a person with administrator account logs in to the system, the menu appears that includes add department, add facilitator and assign facilitator sections. The screen of the administrator menu is depicted in Figure 4.6 below;

Figure 4.6 Administrator menu

4.5.6. Learner Menu

When a person with learner account logs in to the system, before he/she registers with a task, on the left menu he/she can only view all the tasks, his/her waiting tasks under my tasks link and portal news. The screen of the learner menu is depicted in Figure 4.7 below;

Figure 4.7 Learner menu

4.5.7. Facilitator Adds New Task

When a person with facilitator account wants to create a task, he/she fills a form that includes the task name and description information. The screen of add task menu is depicted in Figure 4.8 below;

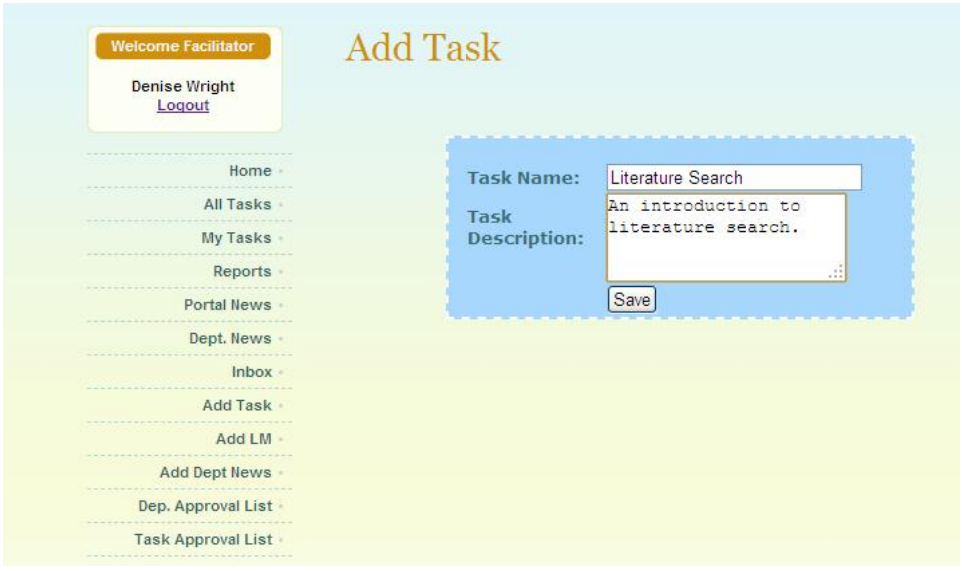


Figure 4.8 Facilitator adds new task

4.5.8. Facilitator Adds New Learning Modules

When a person with facilitator account wants to add a learning module, he/she fills a form that includes the learning module name, description and the task that the learning module is. The screen of add learning module menu is depicted in Figure 4.9 below;

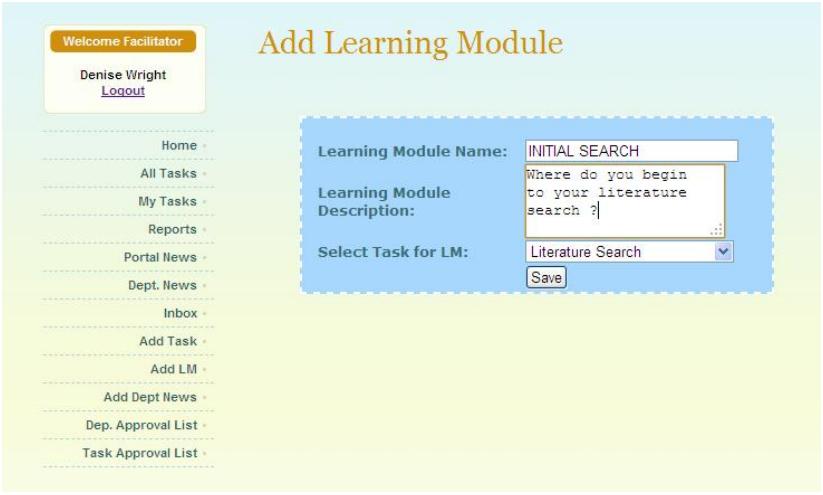


Figure 4.9 Facilitator adds new learning modules

4.5.9. Facilitator Views All the Tasks

When a person with facilitator account chooses to view all the tasks, the tasks and related departments are listed. The screen of list all tasks is depicted in Figure 4.10 below;

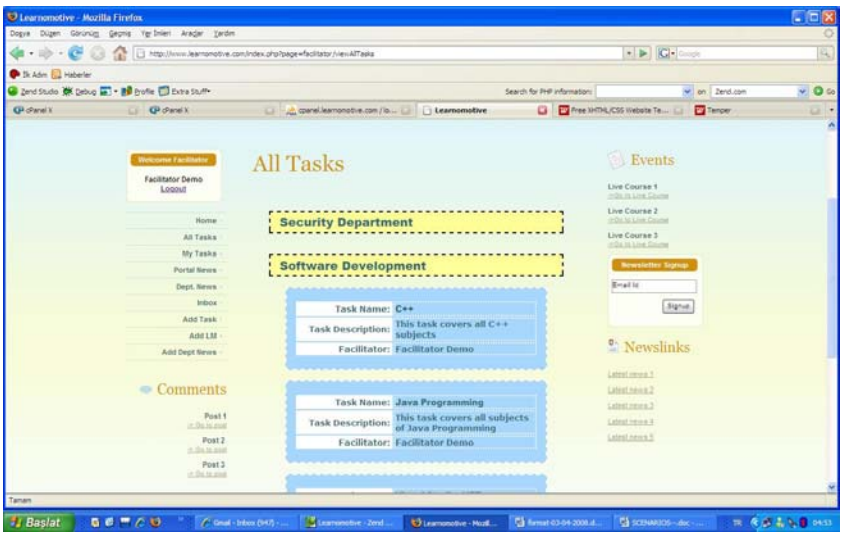


Figure 4.10 Facilitator views all the tasks

4.5.10. Facilitator Views His/Her Tasks

When a person with facilitator account views his/her tasks, the tasks and related learning modules are listed. The screen of list all tasks is depicted in Figure 4.11 below;

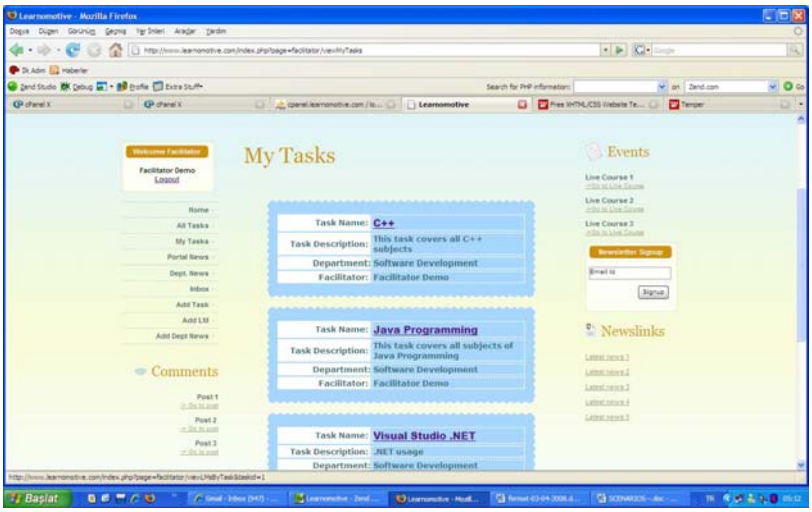


Figure 4.11 Facilitator views his/her tasks

4.5.11. Learning Module Detail

Learning module details may be seen on the mid-page. The screen of a learning module detail is depicted in Figure 4.12 below;

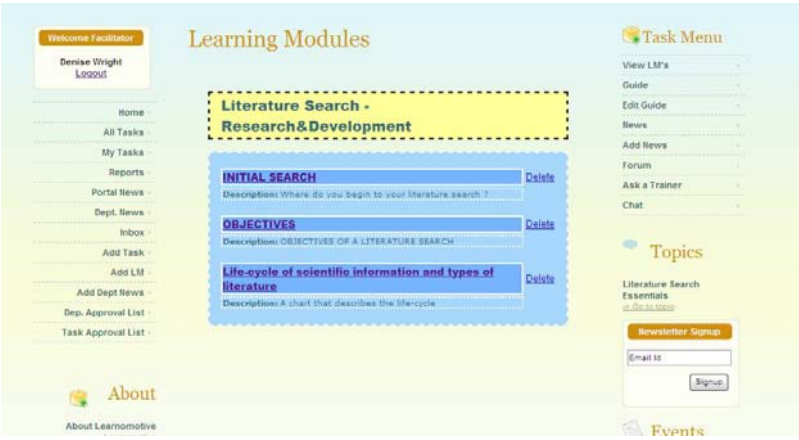


Figure 4.12 Learning module detail

4.5.12. Login to the System

When any user wants to login to the system, he/she enters the account information. The related screen is depicted in Figure 4.13 below;

Figure 4.13 Login to the system

4.5.13. Login Failed

When a user enters wrong account information the failed screen appears. The screen of failed login is depicted in Figure 4.14 below;

Figure 4.14 Login failed

4.5.14. Registration

When a user wants to register with the system, he/she clicks the registration link that can be seen on the main page and fill a form of certain information. The related screen is depicted in Figure 4.15 below;

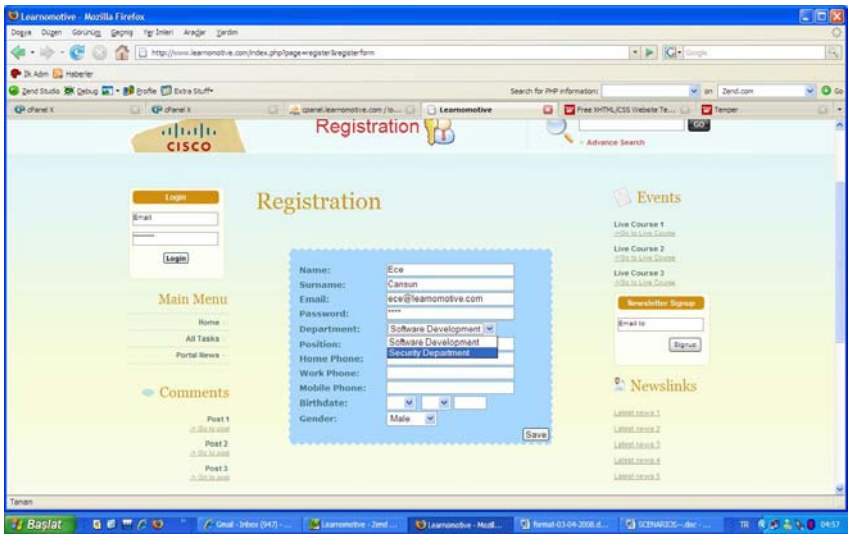


Figure 4.15 Registration

4.5.15. Facilitator Adds Department News

When a user with facilitator account wants to add news to his/ her department, from the left menu he/she selects the add dept news link and type the news. The related screen is depicted in Figure 4.16 below;

Figure 4.16 Facilitator adds department news

4.5.16. Facilitator Adds Task News

When a user with facilitator account wants to add news to a certain task, from the task menu he/she selects the add news link and type the news. Task news may be used for publishing certain announcements of a specific task. The related screen is depicted in Figure 4.17 below;

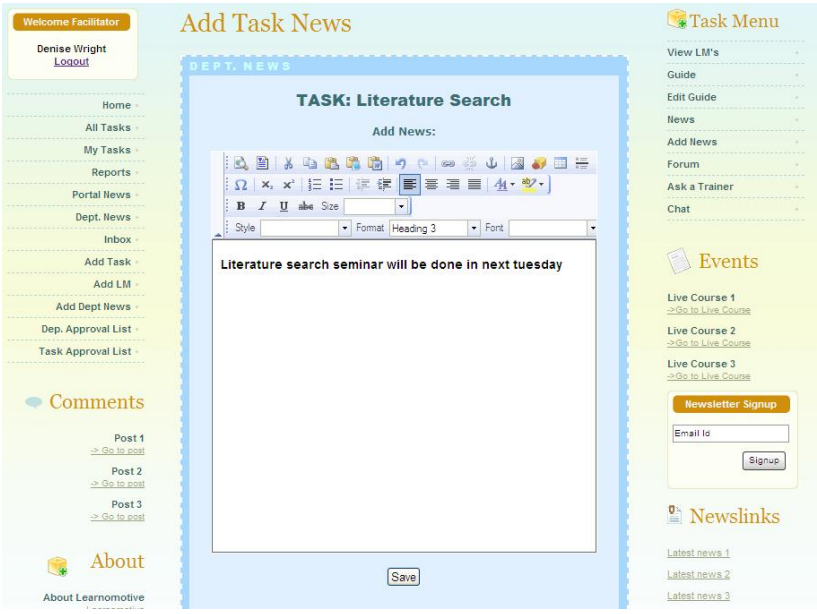


Figure 4.17 Facilitator adds task news

4.5.17. Administrator Adds Portal News

When a user with administrator account wants to add news to the portal, from the left menu he/she selects the portal news link and type the news. Portal news may be used for general announcements. The related screen is depicted in Figure 4.18 below;

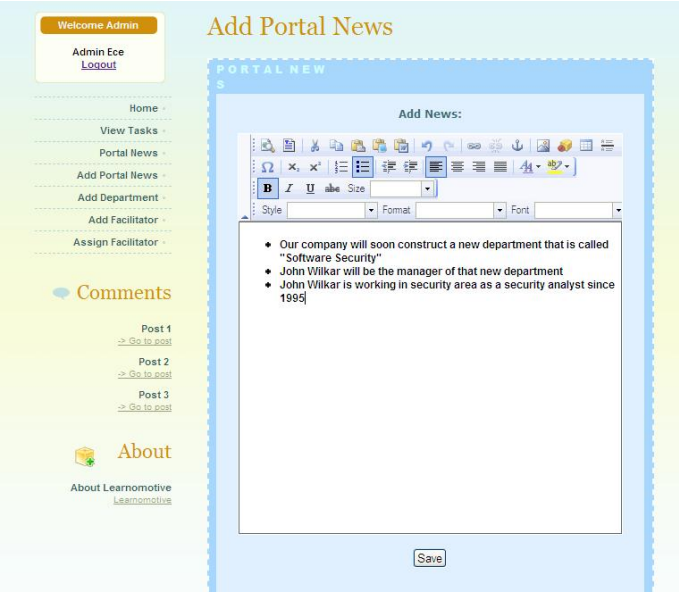


Figure 4.18 Administrator adds portal news

4.5.18. Facilitator Learning Module Menu

The LM Menu appears on the right for a facilitator which includes the features that facilitator can do for a specific learning module is depicted in Figure 4.19 below;

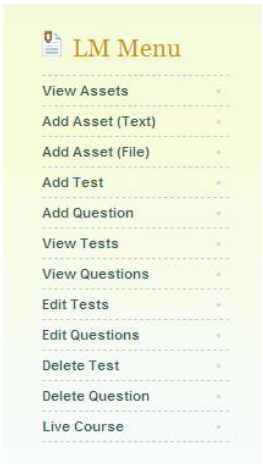


Figure 4.19 Facilitator learning module menu

4.5.19. Facilitator Task Menu

The Task Menu appears on the right for a facilitator which includes the features that facilitator can do for a specific task (editing guide, adding task news etc.) is depicted in Figure 4.20 below;

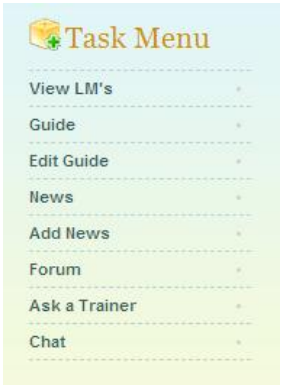


Figure 4.20 Facilitator task menu

4.5.20. Facilitator Approves Department Request

When a user wants to attend to a department he/she sends a request to the facilitator. Then the facilitator can approve that request by choosing the dep. approval list from the left menu. The related screen is depicted in Figure 4.21 below;

Figure 4.21 Facilitator approves department request

4.5.21. Facilitator Approves Task Request

When a user wants to attend to a task he/she sends a request to the facilitator. Then the facilitator can approve that request by choosing the task approval list from the left menu. The related screen is depicted in Figure 4.22 below;

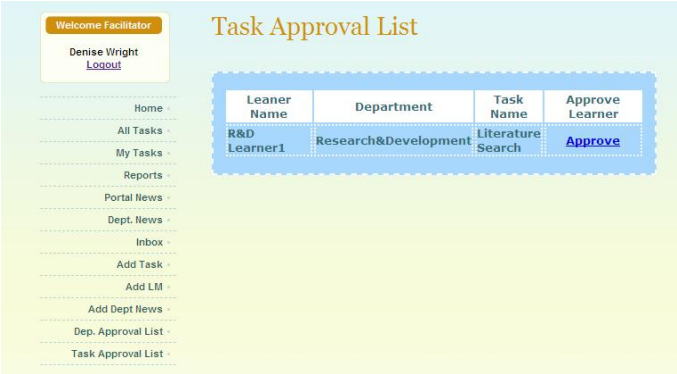


Figure 4.22 Facilitator approves task request

4.5.22. Facilitator Edits Guide

Guides are for instructing learners to specific tasks. These guides are edited by related facilitators. Facilitators may write a note above the guide for studying the tasks in a certain order. To do so, facilitators can specify the position numbers of the learning modules. The related screen is depicted in Figure 4.23 below;

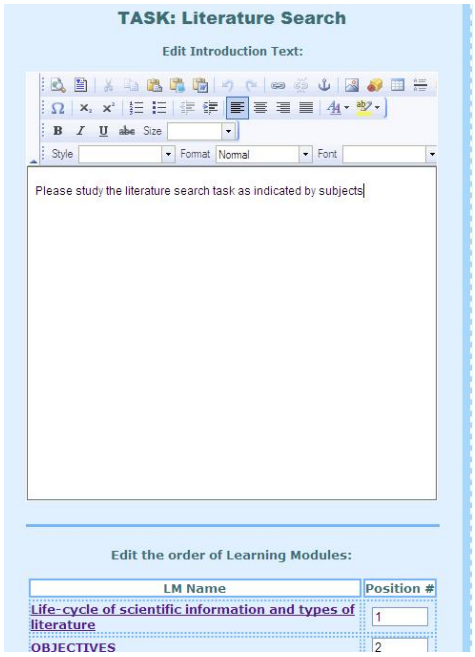


Figure 4.23 Facilitator edits guide

4.5.23. Facilitator Adds Test

User with facilitator account may add test for the learning modules of a task in his/her department. He/she can describe the test; specify the features of the test

(password-protected, time-limited, max. number of tries, activating the test, showing the answers, pass percentage etc.) The related screen is depicted in Figure 4.24 below;

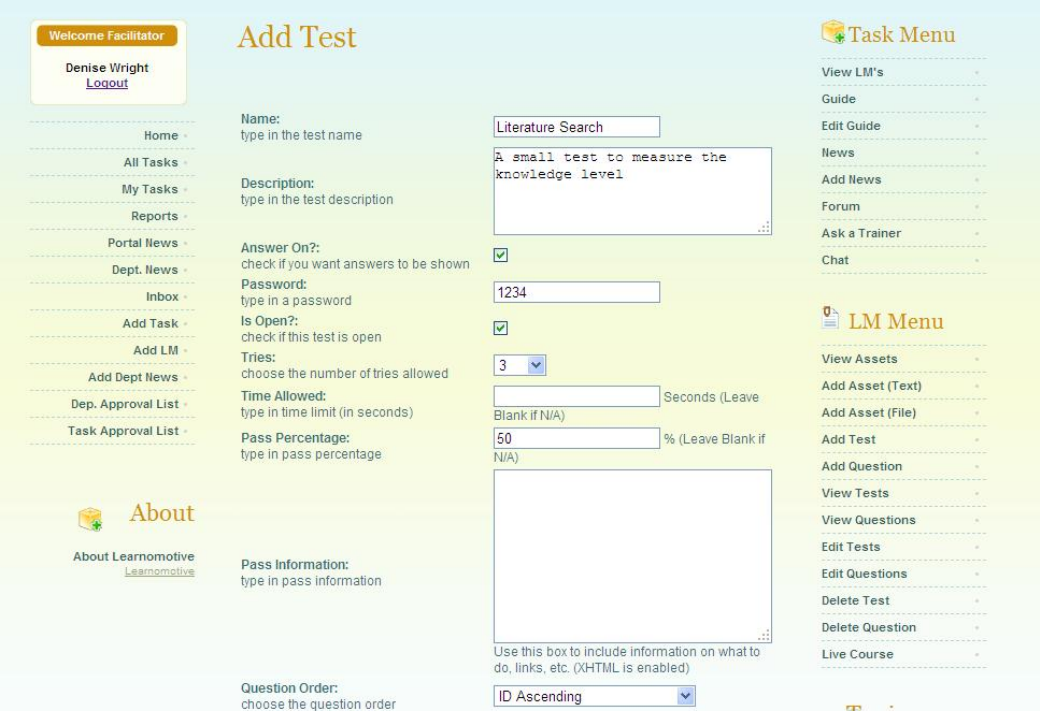


Figure 4.24 Facilitator adds test

4.5.24. Facilitator Adds Questions to Test

After the facilitator added the test, he/she can add questions to the test. From the LM Menu, add question link is selected and the questions are entered by the facilitator. The number of questions can be specified and if the entered question number is more than the test question number than the questions are randomly selected. The related screen is depicted in Figure 4.25 below;

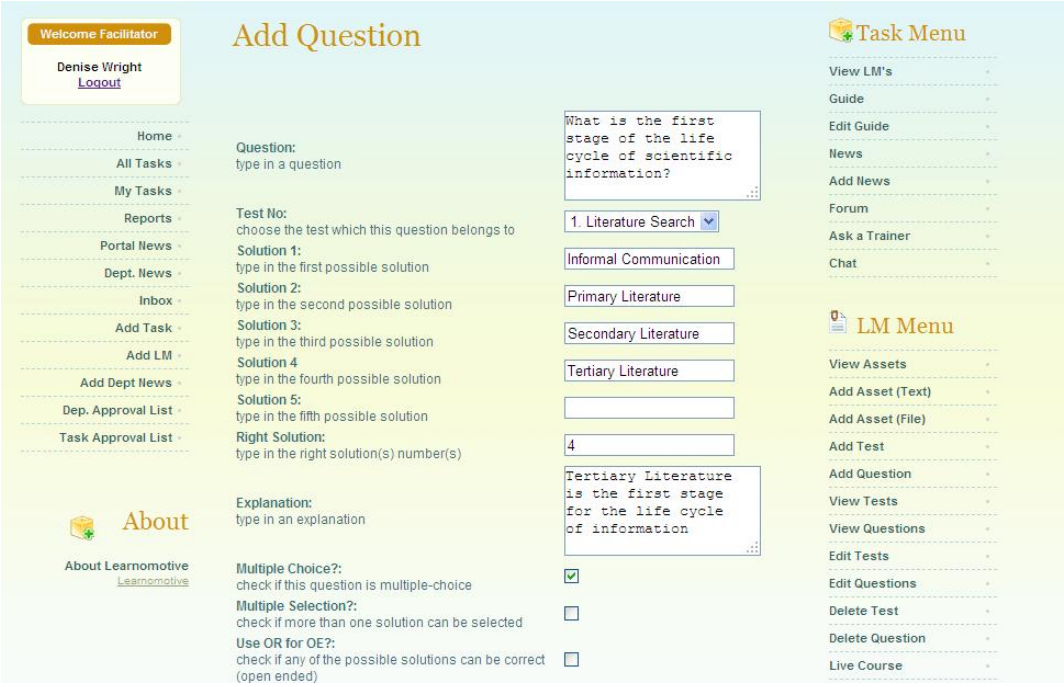


Figure 4.25 Facilitator adds questions to test

4.5.25. Facilitator Edits Test

When a facilitator wants to edit the test, he/she can choose the link edit test from the LM Menu. And then choose the related test of the learning module and edit. The related screen is depicted in Figure 4.26 below;

Figure 4.26 Facilitator edits test

4.5.26. Facilitator Adds Text Asset

Facilitator can add assets to the learning modules. The assets can be any of the type. The assets that is prepared by the facilitator (typed by) can be added from the LM Menu on the left by choosing Add Asset (Text) link. The related screen is depicted in Figure 4.27 below;

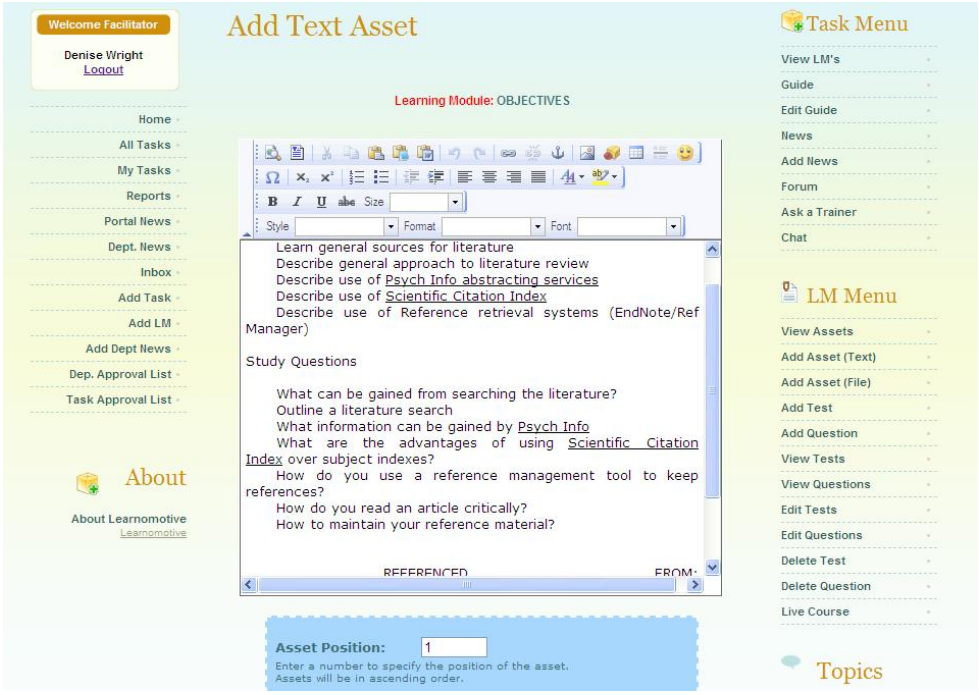


Figure 4.27 Facilitator adds text asset

4.5.27. Facilitator Adds File Asset

Facilitator can add assets to the learning modules. The assets can be any of the type. The assets of files can be added from the LM Menu on the left by choosing Add Asset (File) link. The related screen is depicted in Figure 4.28 below;

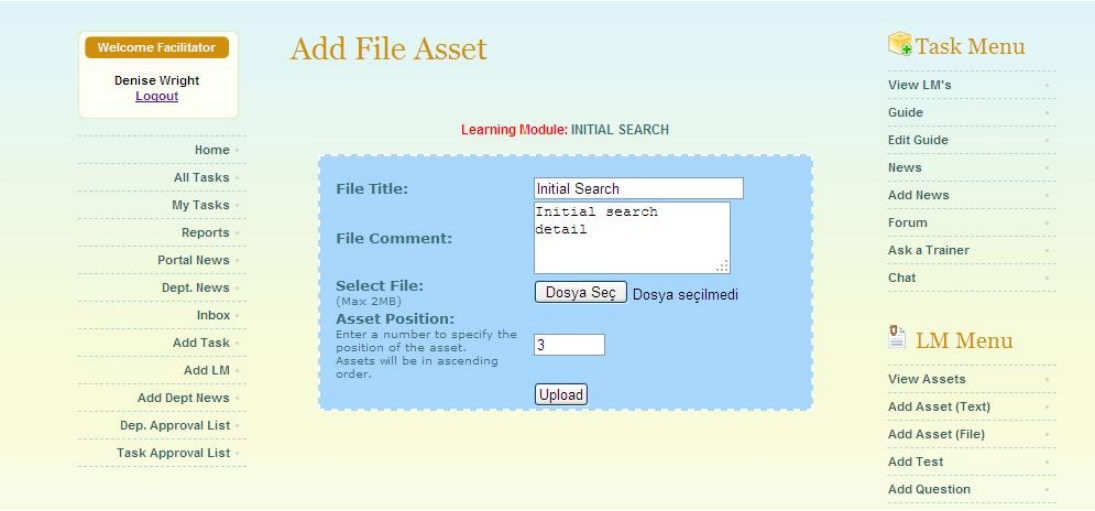


Figure 4.28 Facilitator adds file asset

4.5.28. Facilitator Takes Report

When a facilitator wants to see the test results of his/ her department, he/she can take a report from the left menu from the report link. Choosing report screen is depicted in Figure 4.29 below;

Figure 4.29 Facilitator takes report

4.5.29. Facilitator Report Detail

When a facilitator chooses the criteria and took a detailed report, he/she can see all the learners' related test results. The related screen is depicted in Figure 4.30 below;

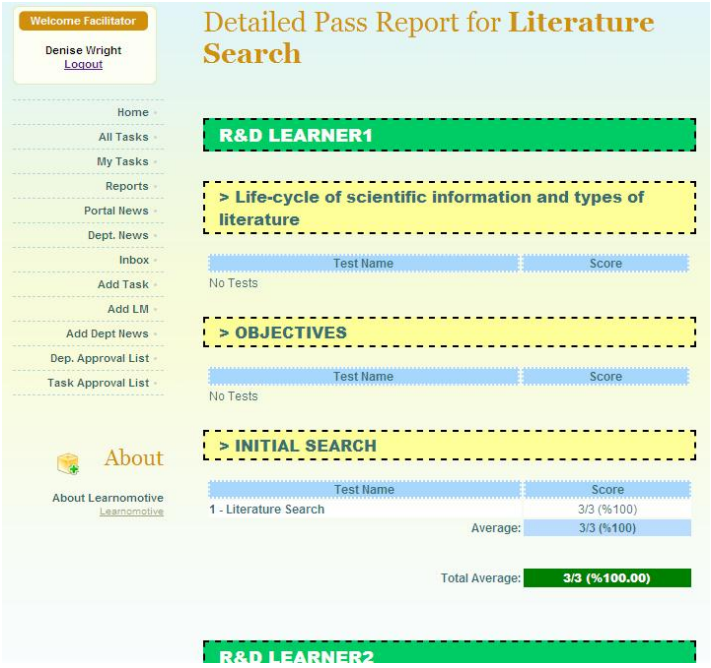


Figure 4.30 Facilitator report detail

4.5.30. Learner Attends for a Task

When a user with learner account wants to attends a task, he/she can list the tasks and choose attend task links. The related screen is depicted in Figure 4.31 below;

Figure 4.31 Learner attends for a task

4.5.31. Learner Task Menu and LM Menu

The Task menu and LM menu of a learner is depicted in in Figure 4.32 below;

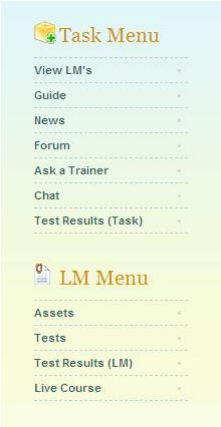


Figure 4.32 Learner task menu and LM menu

4.5.32. Learner Views Waiting Tasks

When a learner sends a request to attend to a task but not approved by the facilitator, he/she can see the unapproved tasks from my tasks link. Unapproved tasks are specified by waiting approval title. The related screen is depicted in Figure 4.33 below;

Figure 4.33 Learner views waiting tasks

4.5.33. Learner Views Guide

Guide is to instruct the learner by the facilitator in order to learn the tasks more appropriately and easily. When a learner chooses the guide link, he/she can see the related learning modules of a specific task. If the learner did not visit a task than a line appears near of the learning module. When the learner visits the learning module, a star to indicate that visit appears on the right side of the learning module. Until three visits, these stars are increased to indicate that the learner is visiting the learning modules and not missing any detail. After three visits, the learning module disappears from the guide. The related screen is depicted in Figure 4.34 below;

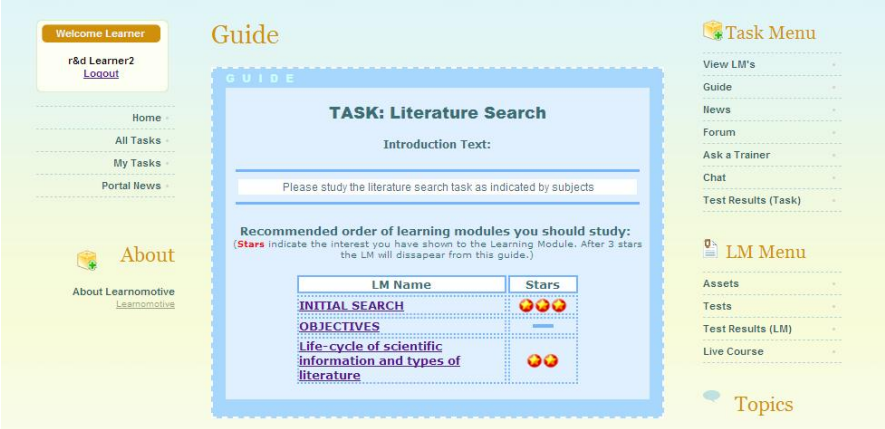


Figure 4.34 Learner views guide

4.5.34. Learner Selects Test to Attend

When a learner wants to attend to a test he/she can list the tests of learning modules for a specific task. The related screen is depicted in Figure 4.35 below;

Figure 4.35 Learner selects test to attend

4.5.35. Learner Taking the Test

Learner can take the test. The test questions can be multi selected or multiple choice. The related screen is depicted in Figure 4.36 below;

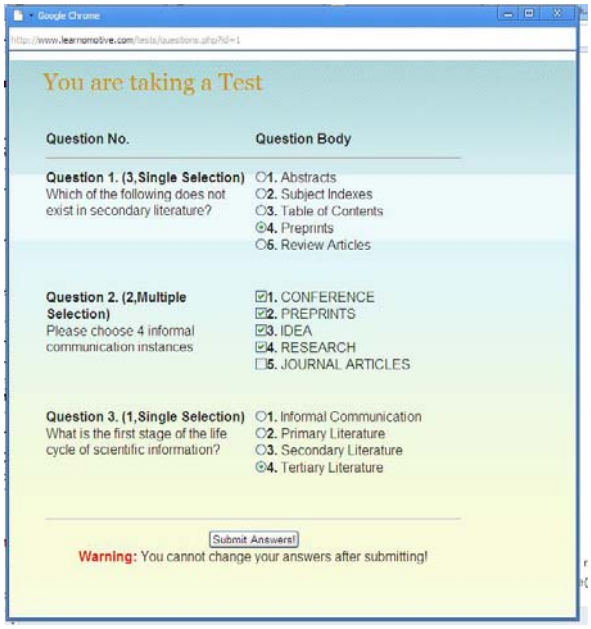


Figure 4.36 Learner taking the test

4.5.36. Learner Taking the Time Limited Test

The test can be specified as time-limited. In order not to close the session of the test, the learner should submit the answers before the time limit ends. The related screen is depicted in Figure 4.37 below;

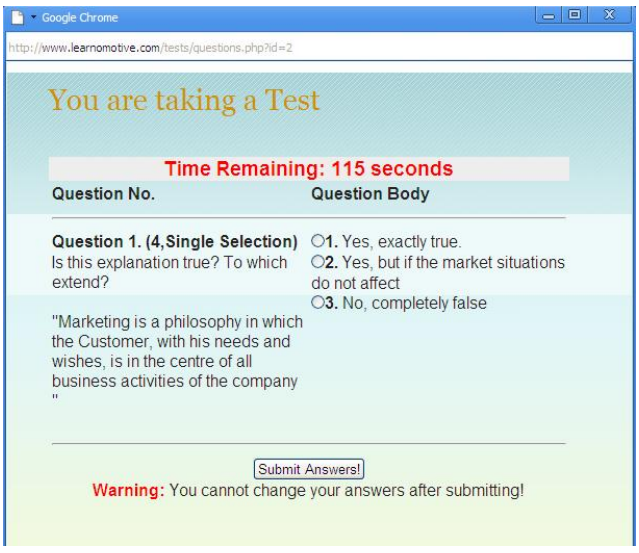


Figure 4.37 Learner taking the time limited test

4.5.37. Learner Passes the Test

After the learner finishes the test, he/she can see the results. The related screen is depicted in Figure 4.38 below;

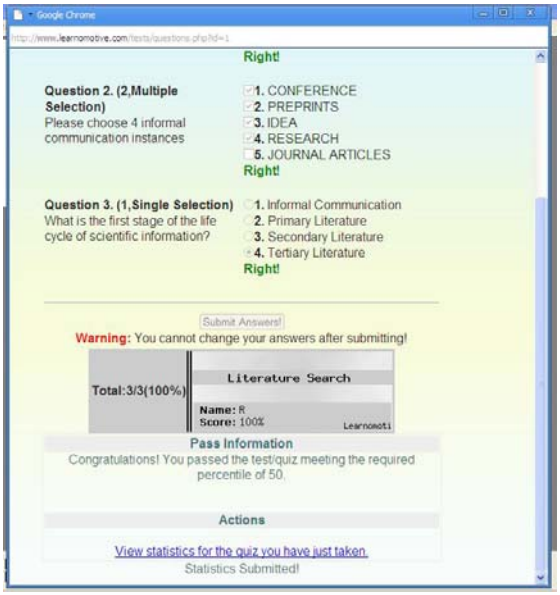


Figure 4.38 Learner passes the test

4.5.38. Learner Views Statistics for the Test

After the learner takes the test, he/she can see the statistics of the related test. The screen of the situation is depicted in Figure 4.39 below;

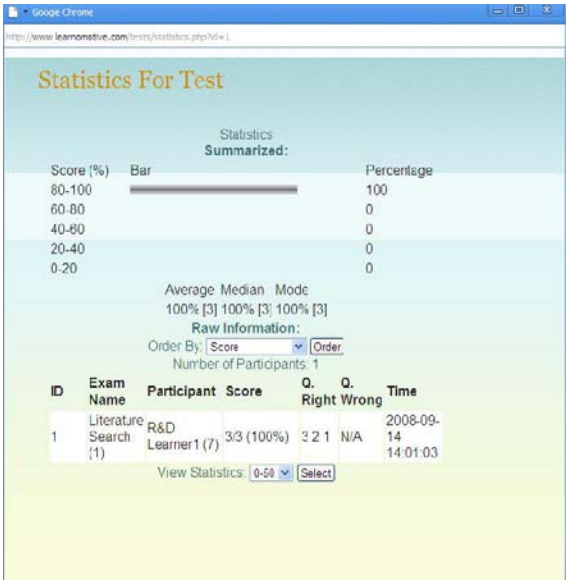


Figure 4.39 Learner views statistics for the test

Chapter 5
Evaluation and Conclusions

5.1. Evaluation

The idea behind Learnomotive model is to develop a competence development model that can be used in business environments to increase the know-how of the company while enhancing worker productivity by personalizing learning.

The technical issues that are addressed by learning model of Learnomotive are; flexibility, scalability, personalization, semantic search, context awareness and mass-individualization. The developed prototype supports flexibility, scalability and personalization.

Interoperability, semantic-search and context awareness are other important issues that should also be implemented into Learnomotive prototype. All these concepts are deeply related with each other in the context of personalization. Especially semantic-search and context awareness concepts directly address personalization.

Although it is considered in theoretical model, as an application, Learnomotive should be extended into a context-aware environment that supports semantic-search and therefore learn the behavior of a learner and respond regarding the needs of the learner. That may ease obtaining a personalized environment.

In Learnomotive, any learner may choose which tasks to be learned and may take tests until the level of knowledge is satisfied. Because the aim of the environment is not grading the knowledge-level but to determine the competence level, every learner may use the learning portal as comfortable as they feel and take the tests until the satisfied level is reached. That flexibility helps to use the environment in comfort and increases the motivation of learning.

In business context, challenge that is addressed by Learnomotive is the integration of business processes to learning processes. As new business processes constructed, the

learning processes of Learnomotive will be extended to cover all these processes. Learnomotive is an environment that grows as learners joined, new business processes attached and new tasks composed. As new tasks are attached to the learning platform in any department, the database and the diversity of information grow. Therefore; the variation of information which learners may benefit from increases.

From the pedagogical perspective, the concept of Learnomotive makes use of different learning methods such as collaborative learning, work-based learning and problem-based learning.

Learnomotive may be used in businesses which have dynamic business processes that require supplying fast and efficient learning platform for their workers. It may also be used by Human Resources department for skills and competency management.

5.2. Conclusion

In this thesis, a model of e-learning named as Learnomotive has been composed and a prototype of that model has been implemented. The main usage area of this model is business enterprises which have dynamic and networked business processes.

In the process of constructing a model, some challenges which come from different contexts of learning concept have been addressed. These challenges may be named as learning methods, integration of business processes to learning processes, technical issues such as interoperability, personalization and more.

The developed prototype only shows a big picture of the model. In that prototype, the main concepts of the model are developed such as specifying the tasks of an enterprise with business processes as the department-level, specifying the related learning modules that are related with these tasks, making the relationship of a facilitator and a department, a testing system which forms the main component of the competence development system, some personalization features such as; the ability to choose a learning task of interest.

The expected impact of the model is having a greater knowledge-level in the enterprise by improving the skills and competence level of the workers and therefore having a much better overall working efficiency and performance.

References

[1] Rosenberg, M. J., *E-Learning: Strategies for Delivering Knowledge in the Digital Age,* McGraw-Hill Companies, 2000

[2] Hannafin, M. J.& Land, S. M. "The Foundations and Assumptions of Technology-Enhanced Student-Centered Learning Environments", *Instructional Science* 25: 167-202, Kluwer Academic Publishers, 1997

[3] Latchman, H.A.& Salzmann, Ch.& Gillet, D. & Bouzekri, H., Information Technology Enhanced Learning in Distance and Conventional Education, IEEE *Transactions on Education*, Vol. 42, No. 4 ,November, 1999

[4] Allen, M., *Michael Allen's Guide to e-learning,* John Wiley & Sons, Inc, 2003

[5] Carliner, S., *Designing E-Learning ,* ASTD, 2002

[6] Horton, W.& Horton K., *E-learning Tools and Technologies,* John Wiley & Sons, Inc, 2003

[7] TechKnowLogia*, International Journal of Technologies for the Advancement of Knowledge and Learning*, May/June 2001

[8] ERCIM News, *European Research Consortium for Informatics and Mathematics,* Number 71, October 2007

[9] Chen, A., Mashhadi, A. and Harkrider, N., Cultural Issues in the design of technology-enhanced learning systems, *British Journal of Educational Technology,* Vol 30 No 3, 1999

[10] "Advanced Distributed Learning-SCORM", http://www.adlnet.gov/scorm, 2008

[11] “CORDIS”, http://cordis.europa.eu/fp7/home_en.html, 2008

[12] “Learning Technology Standards Committee”, http://ieeeltsc.org/about, 2008

[13] “IMS Global Learning Consortium”, http://www.imsglobal.org/backround.html, 2008

[14] “E-Learn Magazine”, http://www.elearnmag.org/index.cfm, 2008

[15] “Academee news and articles”, http://www2.academee.com/html/news-case/articles/article-2.html, 2008

[16] “Saul Carliner’s personal website”, http://saulcarliner.home.att.net/resources.htm, 2008

[17] “WINDS (Web-based Intelligent Design tutoring System)”, http://raft-app.fit.fraunhofer.de/cgi-bin/WebObjects/ale-ng#, 2008

[18] “Personalized Adaptive Web Systems Lab”, http://www.sis.pitt.edu/~paws/index.html, 2008

[19] “Journal of Technology Education”, http://scholar.lib.vt.edu/ejournals/JTE/, 2008

[20] “European Conference on Technology Enhanced Learning”, http://www.ectel06.org/index.html, 2008

[21] “PROLEARN”, http://www.prolearn-project.org/, 2008

[22] “E-learning Europa, initiative of the European Commision”, http://www.elearningeuropa.info/main/index.php?page=home, 2008

[23] “ICAMP Project”, http://www.icamp-project.org/, 2008

[24] “Teaching and Learning Research Programme”, http://www.tlrp.org/, 2008

[25] Singh, H. “Developing an e-learning Model for an Industrial Enterprise” (Under the guidance of Dr. Laurie Ann Williams)

[26] “CETIS”, http://jisc.cetis.ac.uk/, 2008

[27] http://www.aicc.org/pages/aicc_faq.htm, 2008

[28] http://www.ercim.org/publication/Ercim_News/enw33/forte.html, 2008

[29] David L., Hugh E. W., *Web Database Application with PHP and MySQL, 2nd Edition*, O'Reilly, May 2004

[30] "Learnomotive's Hosting Service", http://www.hostgator.com/, 2008

[31] "Learnomotive's Quiz Template", http://www.wireplastik.com/, 2008

[32] "Learnomotive's Theme Template", http://www.templateworld.com/free_templates.html, 2008

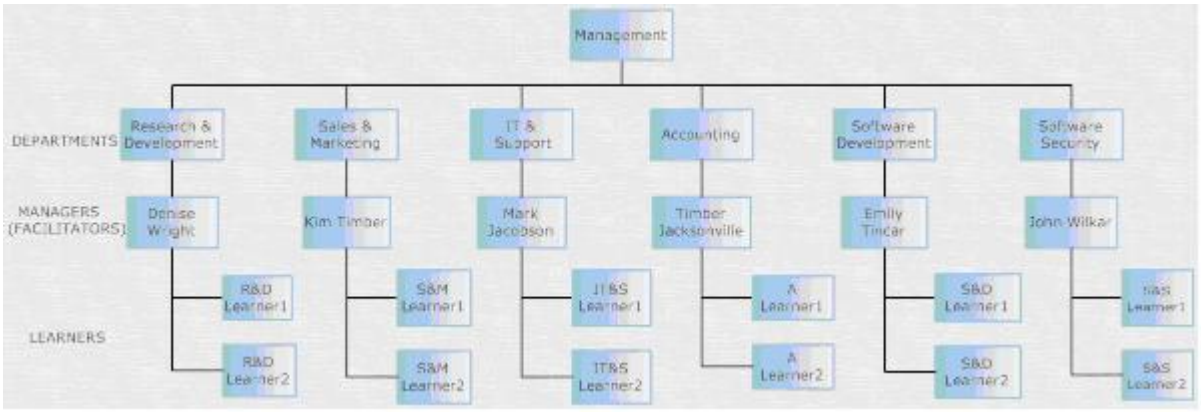
[33] "Developed Prototype's Website Address", www.learnomotive.com, 2008

Appendix A CD Containing the Application and Tools

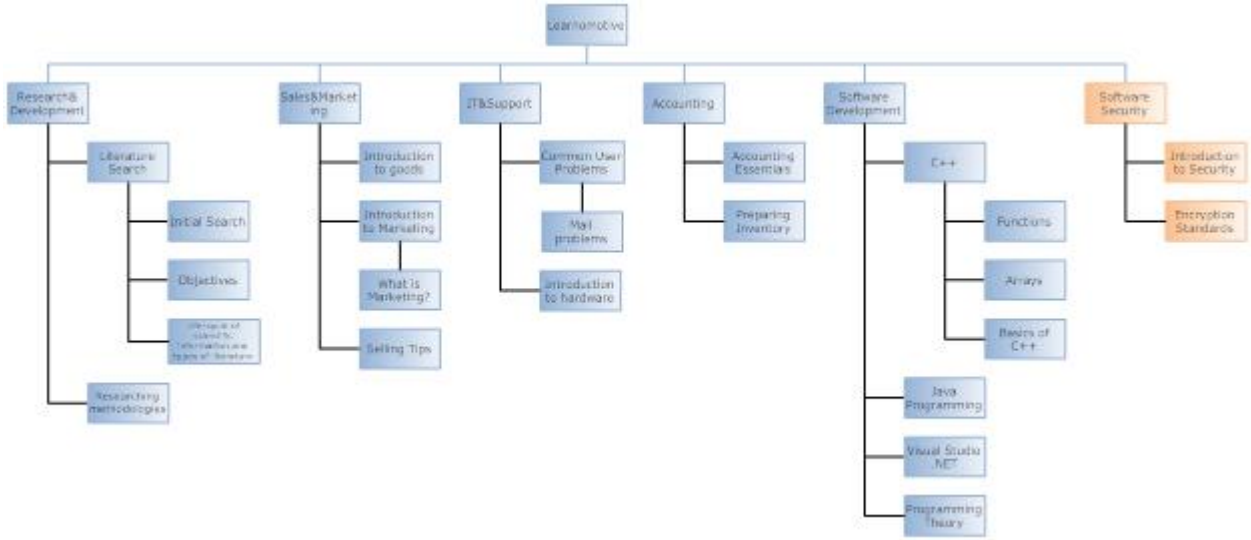
A1. CD includes the source code of the application, soft copy of the thesis in .pdf type.

Appendix B An Example Scenario

B1. An Example Organizational Structure



B2. An Example Task and Learning Module Structure



Curriculum Vitae

Resmiye Ece Cansun was born on 9 February 1984, in İstanbul. She received her BS degree in Computer Engineering in 2006 from Işık University. She has registered with the MS program in 2006. She has been working in the IT department of a private company since 2003. She has received multiple honor and high-honor degrees in BS and MS programs. Her research interests include computer networks, computer security and technology enhanced learning.