A **M**odel for **E**-Learning **C**ontent **D**esign

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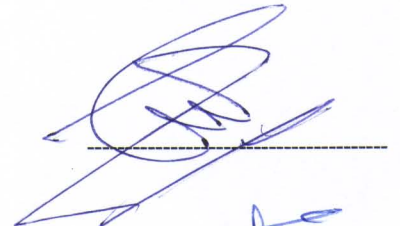Computer Information Systems Department

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COMMITTEE DECISION

This Thesis **(A Model for E-Learning Content Design)** Was successfully defended and approved on 31 May 2009.

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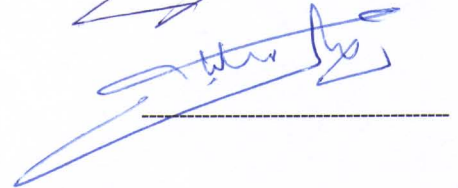
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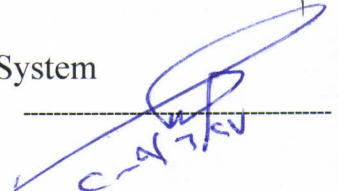**Dr. Ghazy Raho**
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DEDICATION

This is dedicated to my family, for their love and encouragement.

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ABSTRACT

With the evolvement of internet and maturation of e-learning method; attention is ever increasing towards development of e-content that achieves the required educational goals set by tutors. The importance of e-content development is now recognized as a major factor of e-learning design. To create a proper electronic learning content to various social strata (especially tutors); the e-content should be designed in a manner that is centrally focused on learners; effective; easily accessible; flexible; and in "user-friendly" electronic content. This thesis are going to solve a significant problem, which is designing and adapting the e-learning content to solve educational content design Inability in attract the attention of students to the educational material, that makes a lack of desire to learn, fully comprehend of educational content is not be as expected, also not taking into account the individual variability of student, finally, student is recipient not participant. In order to attack the main problem, we discussed some of the important factors that spread over the various dimensions of e-learning environment. We have also explored those factors that significantly render the e-content fruitful; accessible and flexible. Those factors fall into four categories: Management-related factors, Technological factors, Pedagogical factors, User interface. Based on that, we have introduced a detailed approach to design the learning content and proposed design model that can be applied to effectively design the content, Where presents the e-content in a flexible; accessible and meaningful manner. This model was applied, assessed and the results were recorded and matched to the educational goals intended as well as, we have successfully design a model to adapt the learning content in education by a questionnaire applied on a group of students that was both concerned and involved in the e-learning process. The group was assembled as a representative sample that resembled students of Artificial intelligence course in the 2nd semester 2009 in the Hashemite universities in Jordan.

Key words: E-content design, E-learning content.

الملخص باللغة العربية:

مـع ظهـور شـبكة الانترنت ومنهجيـات التعليم الالكترونـي والتكنولوجيـا الحديثـة أصـبحت هنـاك توجهـات مـن قبـل المهتمين بالتعليم والتدريب لخلق محتوى تعليمـي الكترونـي لتحقيق المتطلبات المنشودة من قبلهم حيث ان تطوير المحتوى التعليمي يلعب دورا مهما في التعليم الالكترونـي.

يمثل المتعلم عنصرا اساسيا من عناصر العملية التعليمية وعندما يكون له دور في المشاركة فيها سوف يحقق ذلك نجاحا كبيرا وتحقيقا سريعا وكبيرا لغايات واهداف التعليم المطلوبة ذلك اذا توفرت له الخدمات الداعمة دون انقطاع وبشكل موثوق فيه ٫ عندئذ يصبح التعليم ذو فائدة ومعنى بالنسبة لكلا الطرفين (المتعلم ٫ المعلم).

مـن هذا المنطلق ناقشنا في هذه الاطروحة بعض المشاكل التي تواجه التعليم الالكترونـي وهـي عـدم مقدرة المحتوى التعليمـي على جلب اهتمـام وانتبـاه الطـلاب ايضا عـدم مراعـاة الفروق الفرديـة بين الطـلاب فـي التعليم واستيعاب المحتوى التعليمي بالطريقة الصحيحة ومن حيث دور الطالب كمتلقي للمعلومة فقط ولا يكون لـه دور فـي المشاركة في العملية التعليمية. وقمنا باستكشاف حقل التعليم الالكترونـي وبالاخص تصميم المحتوى الالكترونـي التعليمـي بما فيها العوامل المساهمة في جعل التعليم ذو معنى ومرن وسهل الحصول والوصول اليه ٫ حيث تمت مناقشة وتقديم العديد من العوامل والتي تساعد في تحقيق الغايات السابقة الذكر وجعل المحتوى التعليمي ذو معنى ٫ هذه العوامل ترتبط مع بعضها بشكل منتظم ومتكامل يساعدنا في خلق ذلك المحتوى الالكتروني المطلوب.

وقد اندرجت هذه العوامل تحت مجموعـة مـن الفئـات وهـي: الادارة ٫ التكنولوجيـا ٫ اصـول التربيـة والتعليم ٫و واجهـة المستخدم.

وكترجمة لهذه الغايات قمنا بتصميم نموذج تطوير المحتوى التعليمـي الالكترونـي وتطبيقـة وتقييمـه وتسجيل النتائج ومطابقتها بالاهداف والغايات التعليمية. ٫ ايضا تم تقديم اسلوب وارشادات لتصميم المحتوى التعليمـي والتوجهـات المتعلقة بذلك لتقديم محتوى بالمواصفات المذكورة .

وقد نجح النموذج عن طريق عمل استبيان ياخد اراء الطلاب المهتمين ذوي العلاقـة حرصـا منـا كمـا ذكرنـا علـى ان يكون المتعلم جزءا لا يتجزأ من العملية التعليمية.

CHAPTER 1: INTRODUCTION

1.1. PREFACE

Learning is an activity that lasts as long as the humans will ever last. It is undoubtedly and rightly considered a vital issue that contributes to the development of any society ever found.

Two factors are important to the learning process: one is the learning style; the other is the applied technology. Styles can vary but the educational goal is always the same. Some students prefer "the visual style" like diagrams and pictures whereas some others prefer "The Aural Style" like sounds and music.

Technology is merely that collection of tools that help to deliver the educational content in an effective manner. An example of these tools is the internet and computers. Technology has had a major effect in increasing the spread of learning and in improving the educational level. Learners are now able to engage in the learning process whenever and wherever he/she wants. Learners can now also interact freely with the other learners and with tutors too.

This does not completely undermine or delete the traditional method of learning at all. Despite the restraints and needed commitments required by the classroom environment it still has an integral part complementary to e-learning.

E-learning appeared in the early 1990's and has had a deep impact on the evolution of the learning process. This is due to the above mentioned benefits of immobilization and time-limit free characteristic of e-learning as an inherent nature. The effect of exchange of ideas and knowledge between all the involved members of the process is extremely significant (see figure1.1).
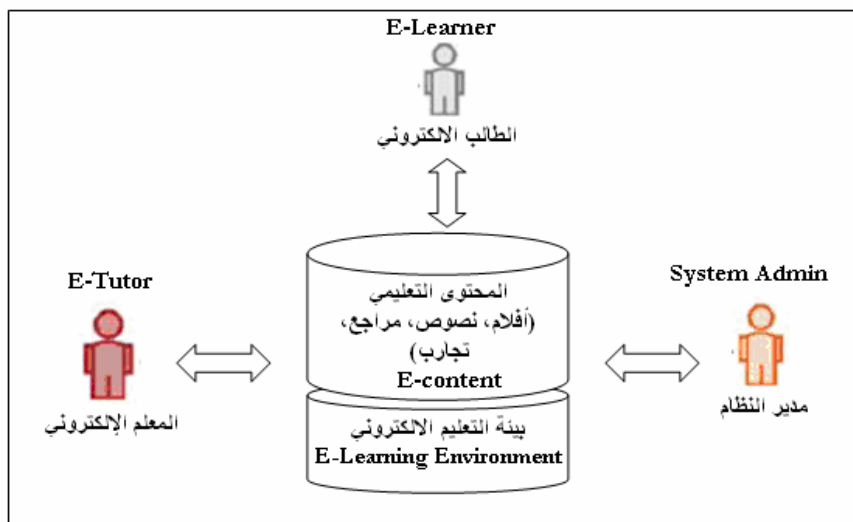
Figure 1.1: Components of E-Learning System

E-learning facilitates the introduction of an e-content. The E-content is used by tutors to offer the learning material to students. It also facilitates the implementation of "re-use" of learning material. These activities led to the eruption of a new term: the learning object. The learning object is defined according to LOM IEEE as "any entity digital or non-digital which can be reused or referenced during technology support learning" **[17].**

Learning content is passed through various phases before it is conducted to the learner for interaction. Each phase has its own goal that strengthens the e-content **[10].**

These phases are:
1. Analysis phase: is the foundation that helps in understanding the learning content, building the logical model and preparing the content to be designed.
2. Design phase: is one of the most critical phases in creating content which includes applying some instructional design model or guidelines and identifying the technologies and tools that will be used to deliver the content.
3. Authoring phase: in this phase the content is created and written from the scratch.
4. Assembly phase: this phase includes joining the existing contents into rational presentation. It may also include methods for personalizing the learning content; identify content for different learners, so different learners can view different versions of the content.
5. Transport phase: is responsible for transporting the learning content from one system to another. Beside, it is also responsible of storing and retrieving the content through a search engine.
6. Delivery phase: finally the learning content is ready to be delivered to the learner. The way in which the learner uses the content can be monitored to gain a history of interactions between the learner and the system.

Another approach for models of design education, the majority of models of design education depends on the model established ADDIE **[29]**, this is due to the brevity of using the first letters which constitute the five stages that make up the model are:

1. (Analyze): an analysis of the needs, such as work tasks and goals of students and the community needs, place and time, materials, budget and capabilities of the regulations.
2. (Design): The problem is determining whether the exercises were related to work or education, and then setting goals, strategies, and different teaching methods necessary to achieve goals.
3. (Develop): The development of plans available to the sources, and preparing educational material.
4. (Implement): The delivery and implementation of the distribution of educational materials and tools.
5. (Evaluate): The formative evaluation of educational materials, and inadequate regulation canals (decision), and also evaluate the usefulness of such a decision for society, and then final evaluate.

In this thesis we will consider ADDIE approach.

Over the next chapters the research will focus on the design phase of e-content as it resembles the most important phase and it is intended to focus on the creation and design of e-content. Research will also tackle the various factors attributed to that.

1.2. STATEMENT OF PROBLEM

The strongest challenges which face e-learning are: how can students fully comprehend the educational e-content? How to attract the attention of students to e-content's educational material? How to demonstrate mastery of the learnt e-content? How to apply learnt e-content to solve a problem and use it in critical thinking exercises? and most importantly, how to design e-content educational material in a way that allows for, and compensates the individual variability of students.

When answering the previous questions, it will contribute to solving the problems of education, especially e-learning.

As a first step in achieving that, emerging the importance of electronic content to improve the level of education and the achievement of the objective and purpose of the educational process.

Despite the availability of all elements of the educational process (students, tutor and educational content), There are weaknesses in the design of electronic educational content, also, weaknesses in the adaptation between these elements and the meaningful design of electronic educational content.

The problem lies in the educational content design Inability in attract the attention of students to the educational material, that makes a lack of desire to learn, Achieve fully comprehend of educational content not be as expected, also not taking into account the individual variability of student, finally, student is recipient not participant.

1.3. OBJECTIVES OF THIS STUDY

- ❖ Create a model for designing learning material contributing to the migration from classroom learning to e-learning and solve the previous problems.
- ❖ Improve the quality of graduates, by utilizing modern instructional materials and methods, including increased use of text, video, animation, audio, and graphics in learning, that will contribute in enhance the understanding of learners and engaging them, as well as, attract the attention of learners.
- ❖ Facilitate the process of designing meaningful e-content in all subjects.
- ❖ Distribution of the e-content to teachers and students from formal and non-formal educational modes, for supplementing and complementing the process of e-learning in education.
- ❖ Activation of partnerships and interactive between tutors and learners, that make the learning process to be Participatory between them and convert learner from recipient to participant.
- ❖ The content helps learners in resolving critical thinking exercises.

1.4. MOTIVATIONS BEHIND THE STUDY

❖ Educational e-content is a bridge between scientific theory (behavioral and cognitive sciences) and applied sciences (use of technology in the learning process). In this technical era where the gap is widening between various theories of education; comes the need to improve educational e-content design to transform the educational process from one that relies solely on "teaching" that is "teacher-dependent" into another one that is purely "learning" that is "student-dependent" and is fully interactive and more efficient both in learning and in assessing mastery of learnt material.

❖ Conduction of knowledge in a more effective method. i.e. the transfer of knowledge, skills, attitude and quality as effectively as possible.

❖ The use of e-Contents and other new technologies, can promote positive attitudes towards learning and higher achievements among learners.

❖ E-learning is more compatible to this era of digital revolution and cyber space.

1.5. SIGNIFICANCE OF THIS STUDY

Many educational institutions publish books, research reports, lecture modules, theses and other information for academic purposes. All these publications are usually in-print form and stored in the libraries of academic institutions for other lecturers, and researchers and students.

Are there compelling reasons why these in-print publications cannot be in electronic form? To answer this it is necessary to identify the advantages and disadvantages of printed content (p-Content) and e-Content. According to Bonime and Pohlmann, (1998) [21] e-Contents benefit from:

❖ Hyperlinking - contents can be linked to other pages inside and outside the book;
❖ Non-linearity - i.e. the order of access can be determined by users.
❖ Addition of multimedia - i.e. content presentation is enhanced by mixing information type (i.e. sound, video ...etc.).
❖ Data density - storage capacity is decreased while at the same time increasing portability.
❖ Searching - the usefulness of the content is enhanced by the ability of the users to locate any piece of information, or to access any section instantly.

A comparison of paper book and electronic book features (see Table 1.1) provided by Bonime and Pohlmann (1998) and Rawlins (1991) [21] can be used as a guideline when considering the possibility of converting printed information to e-Content.:

Features	pContent	eContent
Tactile	Yes	No
Portable	Yes	Yes & No
Access without devices	Yes	No
Easy random access*	No	Yes
Multiple access at one time	Yes	Yes
Customisable (font size, annotations etc.)	No	Yes
Hyperlinks	No	Yes
Text	Yes	Yes
Pictures	Yes	Yes
Audio	No	Yes
Animation/video	No	Yes
Instant search facility	No	Yes
Easily and conveniently read	Yes	No
Easily damaged (i.e. tear)	Yes	No
Content updated easily	No	Yes
Go out of print	Yes	No
Highly interactive	No	Yes
Good legibility	Yes	No
Easily reproduced with the same quality	No	Yes

Table (1.1) .A comparison of paper book and electronic book features **[21]**

The target group for this study is the students, so, they can take advantage of this new type of content presentation as follow:

- ❖ Adjustment in accordance with the needs of student
- ❖ Increase the skills to access information, evaluation and use
- ❖ Students develop the capacity to solve complex problems
- ❖ Increase public awareness of students
- ❖ Nurturing creativity of students
- ❖ Create opportunities for creative extracurricular student
- ❖ Compatibility with digital age

1.6. METHODOLOGIES USED IN THIS STUDY

The E-design process is a description and analysis operations are being conducted to study the requirements of dealing with learning, the necessary measures to regulate and development the education, implementation and evaluation in line with the characteristics of cognitive learner.

The designers of education depend on a "technology education", as a base for launching their theory for the development of education**.**

Upon deciding, to produce e-Content, authors should consider several things:

- ❖ Taking a representative sample of the university students of different ages and from both gender.

❖ Distribution survey containing various questions about the methods and the means by which the representative sample of students desired to receive information through it to be received this information in understandable and clear form, and also about the difficulties faced during the receipt of information using the computer, whether online or otherwise, and whether the students desired to receive information especially in the education process as electronically or printed on paper, and how would prefer to receive information through the (video, voice, images, charts, printing on screen), and so on.

❖ When designing e-content several things must be considered:

- The stability of educational content, updated, and revised from time to time.
- The extent to which the educational content for change and keep pace with reality
- Define goals, educational, media presentations of scientific, practical, training, and educational activities by learners
- Authors should then select the file format from various alternatives, one of the common format is SCORM [16], SCORM is Stands for Shareable Content Object Reference Model and is designed by Advanced Distributed Learning (ADL), SCORM is a mixture of technical standards that give web-based learning systems the possibility of looking up, importing, sharing, re-using and exporting learning content, Learning object compliance with the SCORM standard ensures that learning objects can easily be shared between systems.
- It is essential that the media should be used in such a manner so that it helps the learner in understanding the content in more effective manner, It will also be essential that the format used in various purposes in e-content development, speed of download, the text, audio/video will also make lot of difference, The aesthetic use of medium in the presentation will attracts the learner and also help in understanding the subject matter

❖ Designing a holistic manner by analyzing various learner, institution, and content needs.
❖ Meet international instructional design principles and has integrated some of the best practices of instructional design.
❖ Compliant to the inherent characteristics of learning objects.
❖ Use a holistic model that has been tested to plan and identify areas of subject content that will need learning objects
❖ Use the proposed Instructional Design Principles to design their learning objects
❖ Evaluate sample learning objects to identify strengths and weaknesses of the learning objects, especially the quality of learning.
❖ Design and present a learning object.

1.7. RELATED WORKS

The use of digital learning material in education has increased considerably in recent years. Now that digital learning environments are becoming increasingly popular, the demand for content or for digital learning content is also increasing. We believe that E-Content can help promote academics work worldwide, assist students to immediate access to lecture notes, modules, and textbooks, the researcher also believe that in order to achieve these quite ambitious goals, good design is needed, E-content design is fairly new topic admitted to the human knowledge of education only after the recent advanced in computing and telecommunication, these tow factors are the backbone of E-content design without which E-content design would never be there.

Review of the literature on this issue will be in two parts: the first one discusses the historic evolution of the concept and the various attempts made at modifying it; and the second part will discuss the detailed representative models proposed in recent years.

1- The historic evolution of e-content design:

Only in the past very few years that scholars could see some journals and specialized articles discussing the importance and techniques of these topics. It was not until late 1999 that articles specifically targeted the concept of E-content design were widely published. Reviewing the published materials on the www, the oldest publication on this topic appeared in 1992, which was merely an attempt to establish a new type of learning different from the classroom environment: according to Ayot, H.O. & Patel M. M. [3] stated that The teaching methods present themselves in a continuum: from expository to heuristic. Starting with the lecture method on the expository end, the next in the continuum is the demonstration method then the history method, followed by discussion or questioning. Others include the assignment and supervised study method and finally discovery or inquiry, in that order. As one moves from the lecture method through to the discovery method, the learners' participation increases as the teacher's diminishes. Quite often a teacher may combine these methods during a teaching session.

In the same year according to Hayes and Maurice (1992) [12] defined good instructional design from the point of view of the learner in their article which presents instructional design that Instruction should build on what has gone before, in a logical, sequential manner, and should be broken down into small learning units or modules. Then the sequence in the features of good instructional design is outlined as follows: occupational analysis and training needs analysis; establish modules; write objectives; prepare test items; design the instruction. And the importance of evaluation and validation as part of the instructional design process is stressed.

In 1996 according to Priscilla G. [5] clearly stressed the importance of the content of educational material and considered it to be the core of the relationship between students and teachers and she stated that Instructional materials are the very core of distance education (DE). This is because the learning context of DE is essentially self-instructional. There is no direct contact between teacher and learner, so that in a very real sense, the materials are what bring the remote teacher and learner together.

To be effective therefore, the materials have to be well designed so that the intended teaching and learning outcomes can be achieved**.**

1996 is an important year in the history of e-content design. It has seen the emergence of the report of Willis and Marilynn **[13]** Their work is significant because it discussed clearly the issue of a specific model design of knowledge; the format of presentation; and the outcome of that model in actual practice.

In 2001 Reeves, Barry have contributed to the evolving identification of good practice in instructional design for online learning environments through the discussion of the role of the instructional designer, and instructional design challenges that were met during the development of online courseware for vocational education and training (VET) by the Open Training and Education Network - Distance Education (OTEN-DE).**[20]**.

The concept of e-content design started to be more defined and more attention was paid to design details such as accessibility, reusability, flexibility…etc.

Later published articles agreed to utilize computers and interactive software to conduct knowledge ever since, attempt of producing various models were made, but none of them claimed absolute success in all various field of learning. The cutting edge of research is now directed towards the production and design of new interactive frameworks that reconsiders the specific issues of individual differences between learners and attempts to deliver the content in the best method that s suitable to the learners in the shortest possible timeframe.

The internet also presented a huge pace forward in this area where it is possible now to utilize an interactive website instead of a mere software to conduct knowledge to learners. The most dazzling difference is that the website is a cumulative field where addition and correction can be easily made and updating is a common practice .another huge advantage is the possibility of linking of two or more website to deliver the same content in more than one type of presentation to interested learners.

2-Review of models targeted at delivering e-content:

In 2004, Trevor Doerksen, Anastasia Cheetham, Laurie Harrison, and King Chung Huang from universities of Toronto and Calgary presented "Flexible E-content Guidelines" **[8],** the question that their research has considered is: what can be done to design and develop e-content? Some factors were considered and discussed to answer this question.

They started with issues that prevented the realization of e-content and thus prevented the implementation of learning objects principles, they concluded- due to the argument they made-that the need for a flexible e-content model increased where context is present. Intellectual property rights, access-articulated factors, and technical barriers were removed (or controlled) through the use of tools, standards and specifications that support learning objective principles including repurposing .

They concluded that –based on the above mentioned argument- the need for modular e-content that can be shared among and between different end-users is being driven by the ubiquity of digital content.

To achieve this purpose, the principle of "re-use" of the e-content or learning object, there are three types of "re-use":

- Sharing which assumes e-content requires no changes to technology, content, or appearance.
- Multipurposing: an automatic or manual transcoding of e-content from medium to another.
- Repurposing: customize, add, delete, edit, change, and enhance content.

These types of "re-use" provide cost-saving and opportunities to enhance, sustain, and extend the e-content and the associated infrastructure.

According to Trevor Doerksen, Anastasia Cheetham, Laurie Harrison, and King Chung Huang from universities of Toronto and Calgary the Flexible E-Content Model uses layers, or composite approaches (see figure 1.2) to the design and development of flexible e-content **[8]**:
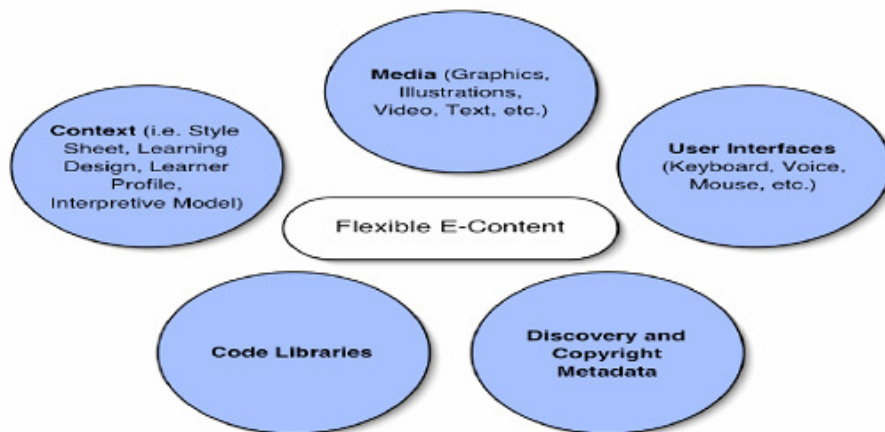
Figure 1.2: Flexible E-content Model

Specific criteria were discussed to support multipurposing and repurposing that represented the requirements for flexible e-content and include considerations contained within the scope of the flexible e-content research project includes:

- Media production techniques supporting multipurposing and repurposing, Exemplars (Adobe Photoshop).
- Metadata, Exemplars (Adobe Photoshop, The Inclusive Learning Exchange (TILE)).
- Externally Controlled Navigation, Exemplars (Synchronized Multimedia Integration Language (SMIL)).
- Intellectual Property license.

- Externally Controlled User Interface/Presentation, Exemplars (QuickTime and Windows Media Player).
- Externally "Articulated" Context, Exemplars (The IMS Learner Information Package Accessibility for LIP (ACCLIP) provides means to specify accessibility preferences and support for people with disabilities).
- Reusable code libraries, Exemplars (Concurrent Version System (CVS) allows: sharing of code; code libraries; version controls; and checks in and out functionality).
- Support for Standards and Specifications.

Finally, to answer on the question on the beginning a designer should:

1. Separate context, media, user interfaces, code, and metadata.
2. Develop media with "reuse" in mind and use sound media production techniques (e.g. save source files).
3. Articulate the Intellectual Property clearly and reasonably.
4. Use and purchase tools that support for standards and specification.

In 2005, Omwenga, E.I. from University of Nairobi (Kenya), Waema, T.M., Eisendrath, G.P.C. and Libotton, A., from Vrije Universiteit Brussels (Belgium) discusses A "Structured E-content Development Framework" **[18]** Using a "Stratified Objectives-Driven Methodology", this study proved that although there is no silver-bullet to process e-content development, the use of the "objective-driven structuring technique" proved to be an effective method that enables logical braking-up and sequencing of the e-content.

The proposed model supports a hierarchical approach of knowledge presentation starting from the most broader and abstract at a higher level to the most specific through chunks of content in to modules and subheadings, and intuitively determine the content for each subheading, in other words, the proposed model enforces good structuring techniques using stratified hierarchical layers that are attached to strata objects, this structuring is made possible by creating specific objectives at each level and "braking-up" each level into components that help to attain the objectives.

The results indicate that objectives and "collaborative efforts" among groups play a central role in providing an effective e-content validation mechanism and efficient approach on training in e-content development.

Depending on using patterns to develop e-content as described in (Jegan, 2004) **[18]**, the "objective-driven" e-content structuring and deployment model was developed (ODC-SDM).

The methodology used starts from recognizing the pattern within a course on how the content is structured. This process goes through a 5-layered strata, each level having a number of component that should be created, the program is the highest stratum followed by course then module (like chapter), unite (like section), and finally topic. In each level the objectives are developed and these objectives are broken up in to the level that followed. Activity and links to other resources are developed if need be in each level (see figure1.3).
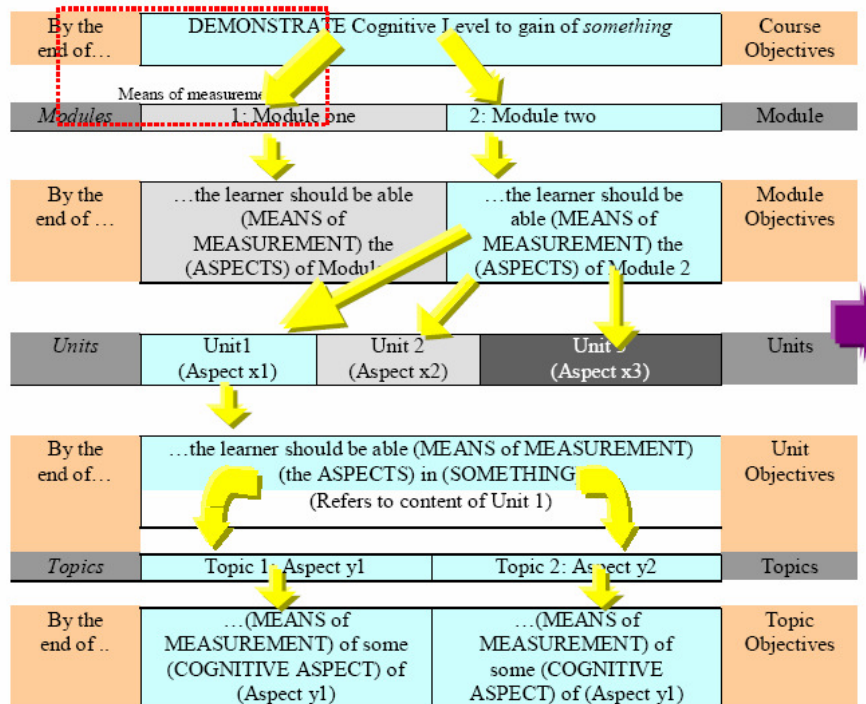
Figure 1.3: A Model For E-Content Structuring Using
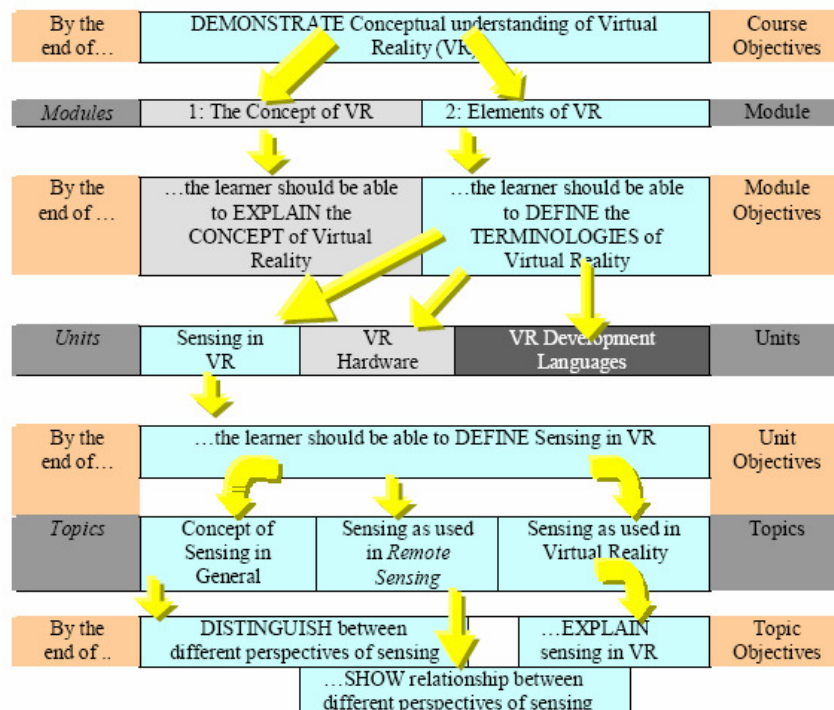The Objective-Driven Methodology

Figure 1.4: An example of an Objective-Driven Model
For course on virtual reality

Besides objectives an important attribute of "unite" is the "End of Unite" Test which can serve as self assessment and way of enforcing conditions of progressive to the next "unite".

As a part of the study, the behavioral terms was considered through the content that is presented should be able to bring about this behavioral change.

Through applying this model between two universities, a "pilot training" on e-content development was initiated, initially after the first training it was realized that e-content development is a complex issue, later in, with more training and progressive approaches with varying conditions; the desired results started to appear.

Finally, there was a need to ensure that their staff was competent in computer skills to attain easy accessibility to training; this can be done by giving the necessary scaffolding support. Important issues that are pertinent in this training include a selection of participants, which will ensure that staff members are grouped in to homogenous cells. This grouping fosters team work. A work-group assembled on common interest performed better than a work-group of similar disciplines. applying support" scaffolding" to the "common-interest-group" produced better results than applying the same "scaffolding" to amorphous groups. Group support produced better results than individual effort subjects.

In 2007, Ana Dias (Minho, Braga), José Bidarra (Aberta, Lisbon) presented a model in a published paper that they called "Design E-content A Challenge for Open Educational Resources" [7], this project aimed at creating advanced technological and learning resources necessary to support and guide the author/trainer in the process of designing learning material; Integrating new pedagogies in a technology-supported environment. They were attempting to shift from classroom environment to e-learning environment in their model.

Within the project two issues were discussed, the first one was the technologies and software application that developed to support e-learning and adaptable to the learning requirements of each curricular unit of different courses available with stable and user-friendly interface, these technologies include:

- "Learning Authoring Tools" (software application to help teachers create e-learning content in easy way without adaptation in the various thematic areas based on flexible open source interface).
- "Repository of Educational content" like open educational resources tools (software application to make possible the trouble-free upload of learning content in a standard format).

The second issue is how to design and deploy an e-course to provide teachers with knowledge and practice of learning design and e-content design by using the previous technology? This issue based on two assumptions:

1. They should be based on criteria of utility, portability and scalability.
2. They should be practical tools, easy to use by the teachers themselves and by training organizations.

The content developed with learning authoring tool (LAT) can be further assembled as e-courses; packaged according to specific norms (SCORM and IMS) and integrated into learning management system (LMS) (Blackboard).

A typical lifecycle in the development of learning e-content was presented (see figure 1.5) to be used by students in a specific learning context under the monitoring and orientation of teacher. This lifecycle represents a process starts with design of learning e-content by author (trainer or teacher), by using LAT the author create the e-content and organize the pedagogical path the student have to follow, after building the e-content in the Authoring tool environment by upload process carried out directly, e-content already available in the repository of educational content in preset formats namely SCORM or web HTML specification to "re-use" and export the content to a directory, the author can fill in the corresponding metadata .
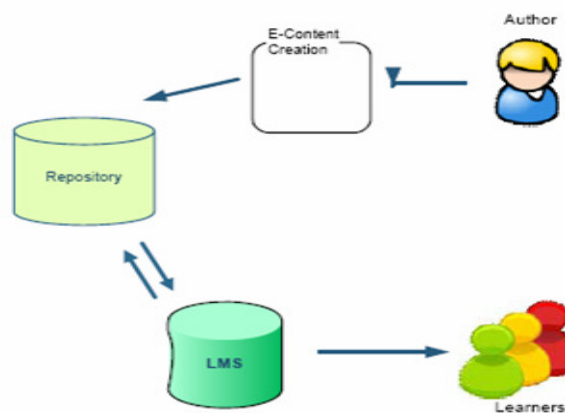
Figure 1.5: E-Content Life Cycle

Once the learning content is made available on the repository, it can be accessed from anywhere through the Repository Portal or by using the single address system (handle) that allows the "content objects" to be accessed from any other internet based system. In this way, the system will provide the link between the repository and the e-learning platform (LMS). Thus, the trainer does not need to transport/upload his/her content onto each e-learning platform, but rather indicate the address of the content (handle) on the platform and the content will be automatically included.

Within this project the specialized course on e-content design was developed and implemented based on class training and online learning.

The learning design of the course follows a Project Based Learning model, where the students must develop their own e-content project through having an area on the e-learning platform where they will be able to upload their project; carryout learning activities and present online the resulting projects.

Designer should be capable to design e-content for a certain learning context; planning the e-content to be developed; producing e-content according to international standards and make e-content activity in the LMS.

The technologies developed within this project were tested by different groups of teachers/trainers from various Higher Education Institutions, namely the University of Porto, the Open University (Universidade Aberta), the Polytechnic Institute of Porto and the University of Minho.

1.8. COMPARING AMONG THE MODELS AND THE PROPOSED MODEL:

When comparing between the previous models found a group of similarities and differences, one of the most prominent similarities is focusing on "re-use" and compelling it in the learning process through make the e-content more easily in transition, sharing, and using among the learners, also the main goal was how to develop and design the e-content? Regardless about methods or tools that used to achieve that.

The first model "Flexible E-content Model", this model talks about the general frame work for e-content, also determine the main component and the environment that e-content passed through it to develop and deliver e-content, as well as this model defined extensively the tools, software, standards and specifications that make controlling to the Intellectual property rights, access-articulated factors, and technical barriers, also achieve "re-use" factor.

Flexible E-content Model also argued shallowly the need for modular e-content that can be shared among and between different end-users which is the "Stratified Objectives-Driven Model" argued extensively to achieve "re-use" factor. Both previous models use layers approach with almost similar objectives, and different content and functions. Flexible E-Content Model uses layers, or composite approaches to the design and development of flexible e-content, the layers include Context, Metadata, Media, User interface, and Code libraries, these layers determine the e-content general framework for design process. This model also discussed the criteria that support the "re-use" factor, these criteria represent the e-content design requirements that needs to achieve flexible and reusable design.

"Flexible E-content Model" shared with Ana Dias and José Bidarra [7] model through Interest with tools that used to support the "re-use" factor.
This model lacks how the dividing of e-content process can be achieved through the previous tools?

To manipulate this lacking, Omwenga, Waema, Eisendrath, and Libotton [18] developed model that explains how to separate the course based on criteria that ensure the achievement of the desired goal? Their model was focus on Objectives-Driven Methodology for each level the content passed through the dividing process, as well as, their model was argue the strong and important impact for the "collaborative efforts" among groups in playing a central role in providing an effective e-content validation mechanism and efficient approach on training in e-content development that the first model didn't give attention..

As we mentioned in the previous model, the design process based on layer approach, depends on hierarchal order with different style, every layer represent a part of one phase from the dividing phases. Objectives were assigned to each phase.

The behavioral interests had a major role in the e-content design development process, it was noted that through "pilot training" that record positive result, where the work team group with the same interest get the best result.

The model was successful but there was a lack in the arguing of tools, technologies and software, which used in the development process that will achieve "re-use" factor. As well as, didn't explain the phases that the content passed through after and before dividing.

"Stratified Objectives-Driven Methodology" was covers these lacks through focusing on the tools, software and technologies that used in the E-content development and present it to learners. That was through suggesting E-content life cycle from the content composer to learners.

By use the proper tools, software and technology based on international standards ensures "re-use" factor achievements.

The Proposed model supposed integration of previous model with achieve "re-use", flexibility, and ease of use, where assumed four Assumptions:

Assumptions Used For Group Categorization

1- User interface Assumptions

The user interface assumptions are mainly focused on the visual presentation of the material. The following elements need to be accounted for in order to produce a successful interface:

- User interface should accommodate visually impaired users
- Ability to access the educational content in less than 3 clicks
- Interface should be also enhanced with proper audio and video add-ons that would provide users with wider range of selection methods to utilize the software.
- Navigation should also be optimum and user friendly.
- Font characteristics in the proposed user interface should be standardized in terms of: size, color and type. i.e.: in my design, I only proposed the following font characteristics: font sizes=14 and 16. Font Colors: Black and Dark Blue. Font types: Times New Roman and Arial.
- Icons display in the proposed user interface should be visually displayed to become self explanatory that would reduce software learning and get around time. The icons should also make a homogenous environment with the overall design.

2- Content Management Assumptions

Management Assumptions are those assumptions that particularly concentrate on the educational content. In addition, Management assumptions should include the following elements:

- The educational content should be presented in a hierarchical structure.
- Modules present the major divisions that are then subdivided into sections that are subdivided into smaller lessons.
- Educational content should also provide the necessary tools that would help the user utilize the different functions and services that module provides. "i.e.: number of pages, date, time ...etc".

3- Pedagogical Assumptions

Pedagogical assumptions are primarily contained in the educational content design. They can safely be referred to as the meat of the educational content and need to include the following:

- Idea transition should be smooth and sequential.
- Educational material should be presented and designed in a hierarchal structure format. The hierarchy of the design chain should be in the following order: the Title, Facts, Concepts and Terminology, Procedure, Real Life Examples, summary and a Short Exercise.
- Educational objectives and educational content should always coincide.
- User interactive should attract the student to get more involved in the software.
- Utilizing the one thought for one page in the educational material.
- Educational material should also contain means and tools for translation and other functions to achieve user's full understanding of the subject.
- Language accuracy has to be adequate including: spell checks, grammar structure and syntax structure.
- Educational material should contain key words that would ease reaching the desired objective.

4- Technological Assumptions

Technological assumptions are related to the technology offered and utilized by the design of the module. Those assumptions should include the following:

- Electronic links should be working properly
- Learning objects should be re-usable
- Student's interaction and communication mechanisms should be provided and encouraged.
- The software should be able compatible with as much internet explorer software as possible.

All of these assumptions used under the terms of achieve "reusable" and flexible factors.

1.9. E-LEARNING ENVIRONMENT:

E-learning is a term describes the e-learning systems. Many definitions define e-learning as a system used internet to offer the learning material to student supported by activities, assessments, and guidance.

According to Hall, B.; Snider, A **[11]** define e-learning as "the process of learning via computers over the Internet and intranets". Other definitions, such as according to Urdan, T. A.; Weggen C. C **[25]**, tend to view e-learning as a system that deliver the learning content via any electronic media including satellite broadcast and interactive TV, Internet, intranet and CD-ROMS.

However, the e-learning is to take advantage of distributed systems, networks and devices and communications technologies for the implementation of, at most, and all the activities provided by the traditional Learning environment including the provision of learning content, examinations, and teacher guidance, Assessment and communication to facilitate the learning and teaching process.

The emergence of e-learning began in the middle of the eighties, where universities benefit from a www technology and provide the best educational content, where e-learning continued development and progress because of the large number of Internet users and technology. Both of students and teachers participated in the development process. But in the Arab world, it seems it was a little late, but has since started to grow some of the projects support e-learning and establishment of electronic virtual universities and we believe it will be great progress in the field of e-learning in the Arab world.

E-learning has many categories classified in to three types:

- On-line and blended learning, where blended learning is a combination between traditional learning and online learning.
- Synchronous (real- time) and Asynchronous (on-demand).
- Self-pace (controlled by the learner himself), instructor-led (controlled and supervised by tutor), and a combination between them.

E-learning provides many services classified by Trifonova, A.; Ronchetti, M [24] to four categories:

- E-learning resources, includes manage and control the e-learning process by e-learning tools with ensuring the authentication issues, as well as, learning management system and learning content management system which have ability to provide exams, assessment, and learning content on-line. In addition, offering Metadata repository that indicate to data dictionary.

- Specific e-learning services, these specific services related with learning content management system that responsible about manage, control, and organize the e-learning content usually organized as a component such as courses, lectures and classes and subcomponents such as course syllabus, Lecture presentation

section, exercise section and additional material section, as well as, self-assessment that automatically checks the results of the online tests.

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- Common services, which represented by e-learning actors (Admin, tutor, and Learner) as well as, additional services that the e-learning needs such as online calendar and schedules.

- Content presentation, this is the most important services that are provided by e-learning to meet learners needs. Where e-learning should be available and easy access by any browser.

There are many technologies used in e-learning that aid to deliver the e-learning content to learner in the proper form and proper environment, Therefore, we need to a regulatory environment to create and organize the objects of this course such as audio, video, text, and image, these are through the Web tools or the advanced tools have enough flexibility to enable the learner to create the course by himself, some tools can automatic convert the content from traditional to electronic format.

E-learning also offers a delivery and communication environment for e-learning content as a type of collaborative process between e-learning actors.

E-learning offers synchronous and asynchronous collaboration tools that make it Possible for learners to communicate with each other and with the tutor. Where Synchronous technologies are like virtual classroom, chat, audio and video conference, shared white board, application shared, and on-line meeting tool. Asynchronous technologies are like e-mail, weblog (public website where users can post their thoughts ideas and comments), and Electronic Bulletin Boards (Discussion Forums).

CHAPTER 2: A PROPOSED MODEL FOR E-CONTENT DESIGN

E-learning is concerned with tow aspects, services, and content.

In this thesis I will discuss the e-content, which is an important part of the learning process. E-content includes materials, activities, objective, and assessment.

One of the best trends in the design of e-content is the content combination of multimedia learning content and three dimension technology (3D) to improve the effectiveness of learning process. It also includes a combination of multimedia learning object with technologies that interest will stimulate learners to participate in the exchange and transfer the knowledge and experience.

E-learning content is fully visible, this feature makes the content clear and unambiguous, but the visibility has a negative side. That is any error in the learning material will be easily detected and can be seen by the learner **[9].**

2.1. LEARNING OBJECT

Learning object is defined by IEEE as "any entity digital or non-digital which can be used, re-used, or referenced during technology supported learning" **[17].**

These objects are self-contained which means that each learning object can be taken independently and it has its own learning objectives, can be aggregated to larger sets, can be decomposed to chunks, and can be re-used when the same learning objective comes in other learning circumstances.

Three learning objects will be considered throughout this thesis. These are:

- The "Text-based" Learning Object.
- The "Multimedia" Learning Object.
- The "Graphics" Learning Object.

These types will be discussed in the 2.5 section in this chapter.

2.2. STRUCTURE OF LEARNING OBJECT

Each learning object must contain a learning objective which provides the level of understanding that must be achieved after completing the learning object.

As an Initiative may be the best in the classification of Learning objects, a division of the objectives to sub-objectives, as will be seen in later, where each sub-objective will be serve a group of ideas, each idea could be related and assigned to specific learning objects -one or more- that will contribute to the strengthening of the absorption of the objectives for student.

Each learning object can be related with metadata such as the author of learning content and other descriptions, this process is available now through applying that automatically by specific algorithms.

2.3. LEVELS OF LEARNING OBJECT

IEEE learning objects metadata (LOM) **[17]** used a term "Aggregation Level" to describe the levels of learning objects as following:
- The smallest level of aggregation, e.g., raw media data or fragments.
- A collection of learning objects, e.g., a lesson.
- A larger collection of learning objects, e.g., a course.
- The largest level of granularity, e.g., a set of courses that lead to a certificate

2.4. DESIGNING E-CONTENT

As mentioned before, e-learning content is passed though six phases which are: analysis, design, authoring, assembly, transport, and delivery, as well as ADDIE phases.

Each of these phases plays an important role in transforming the learning object to meaningful and acceptable form used in e-learning process.
According to Brown, A.; Voltz, B **[4]** "The design of e-learning content requires understandings in education, multimedia content, resource publication, and electronic technologies" , that claims to divide the process of designing e-learning content into four sequence events as follows :

1. **Define the learning objectives and e-learners:**
    Determine the learners that will use the content, their age, their knowledge level, and find out the learning objectives for each learning object level that will assist on design effective e-learning content. For example, defining the main concepts that will be demonstrated in the lesson, the tasks that should be achieved at the end of lesson, and the how to evaluate it, that will be in the lesson level.

2. **Adopt a convenient learning design model**
    Designers must choose one or hybrid learning design model that is appropriate with content type. According to Institute for Interactive Technologies **[15]** instructional design model is a systematic process that instructional designer must follow in order to achieve the creation of efficient and effective instruction. One of the most applied models in instructional design is "Robert Gagné's" which is serves as "a major vehicle for incorporating the conditions of learning into an instructional situation, and as a framework for the design of lessons"; Gagné model has nine events of instruction **[23]:**

    i. Gain Attention: in e-learning, you can gain the attention of the learners in many ways such as: displaying images, introducing an interesting video or scenario that is related to the subject or asking a puzzling question.
    ii. Inform learners of objectives: You have to inform e-learners, specially self-paced learners, of the learning objectives that should be achieved after completing the learning content. Of course, the learning objectives

will depend on the learning object level that will be displayed for the learner.

iii. Stimulate recall of prior learning: Recall some previous related learning materials or objects to make it easy for the e-learners to understand the new learning materials.

iv. Present the content: The e-learning content should be presented in one of the learning styles that fit the learner's preferences.

v. Provide learning guidance: In instructor-led e-learning, the tutor can provide guidance for the e-learners while in self-paced e-learning the system can alert the learner if he selects an incorrect path of learning objects to guide him to the correct path.

vi. Elicit performance: Present the procedural content, which focuses on the procedures, practical application and processes, to enable the learners to practice what they have studied by using some tools such as application sharing tool.

vii. Provide feedback: The tutor will send individualized feedback to answer the e-learners' questions. E-learning can offer different types of feedback, as mentioned by Chyung, Y **[6]**. The first type of e-learning feedback is answer-specific feedback which means that the learner submits an answer to a question, and the tutor provides feedback specific to the chosen answer. The second type is question-level feedback which means that the learner submits an answer to a question, and the tutor provides generic feedback on that question. the third type is test-level feedback, after a learner completes a test, the tutor can presents a summary report of the test results, test score, a review of chosen answers, feedback on the answers and a pass or fail result. The last type can be semi-automated response to students' work.

viii. Assess performance: Many e-learning tools such as LMS and LCMS can create assessments and quizzes to measure the learners' performance.

ix. Enhance retention and transfer to the job: Finally e-learning should provide parallel applications of the content, give the learners opportunities to try it out and finally summarize the content that was presented **[9].**

3. Resorting some of design guidelines to the content

To address the design process of e-learning content guidelines were proposed: Sharable Content Object Reference Model (SCORM) is designed by Advanced Distributed Learning (ADL), SCORM is a mixture of technical standard that give web-based learning systems the possibility of looking-up; importing; sharing; re-using; and exporting learning object **[16].**

According to Advanced Distributed Learning Initiative, Sharable Content Object Reference Model **[1]** the most important standards for SCORM are:

i. Accessibility: learning content can be identified and accessed when it is needed.

ii. Interoperability: learning content should function in multiple applications, environment and software/hardware configurations regardless of the tools and platform used to create it.

iii. Reusability: content is independent of learning context

    iv. Durability: no modification required for the learning content to operate even if the software systems are changed.

    v. Affordability: it should not cost very much.

There were guidelines based on visualization of learning content such as type, color and font. The choice of proper and different colors for learning material and by choice appropriate font style and size can attract the learner attention and effect on effectiveness of design (Design Guidelines for Effective E-learning Materials Website Retrieved from:http://www.paulburt.co.uk/e-learning/index.htm).

Designing the learning content requires keeping the visual style of material consistent and it is not preferred to create a new design for every screen or page, this will lead to confusion **[26]**, as well as, learning object should cover the traditional learning that the teacher can managed, for that learning object should be rich with diagrams; flowcharts; and other explanation.

Designers should select one or more from these guidelines that fit the type and style of e-learning content.

4. Define the context of learning object

By defining the type of learning environment; technical environment; e-learning strategies; and content accessibility, the context for e-learning content can be determined **[4].** The learning context is limited although it is wider than the traditional learner context.

2.5. THE PROPOSED MODEL

To put the design in its proper perspective and to effectively design an e-learning content, an approach that is convenient to learner and tutor was applied. That approach was based on decomposition and objective-orientation for e-content.

Artificial intelligence (AI) course will be adopted in the illustrator examples.

This approach includes the following practical steps:

1. Determine the objectives for the course as a whole:

In specific courses that are provided to learners there were a number of elements of content. Therefore, designers need this step to determine the main objectives, see figure (2.1) that should be achieved and completed at the end of the course. These objectives describe the prime elements of content. For example, Knowledge Base system course, the main objectives are:
- Explain the major components of AI.
- Discuss the theoretical foundation of knowledge representation.

And so on……
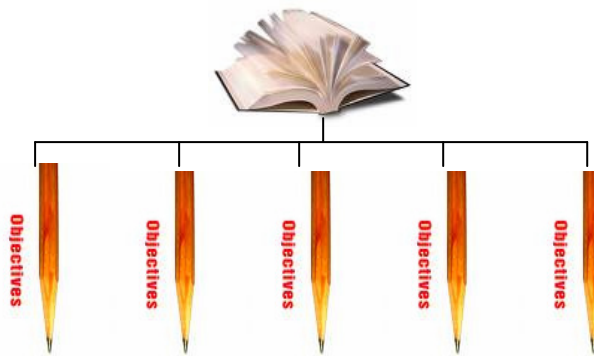
Figure 2.1: Assigned objectives to course

2. Determine the modules in each course, see figure (2.2):
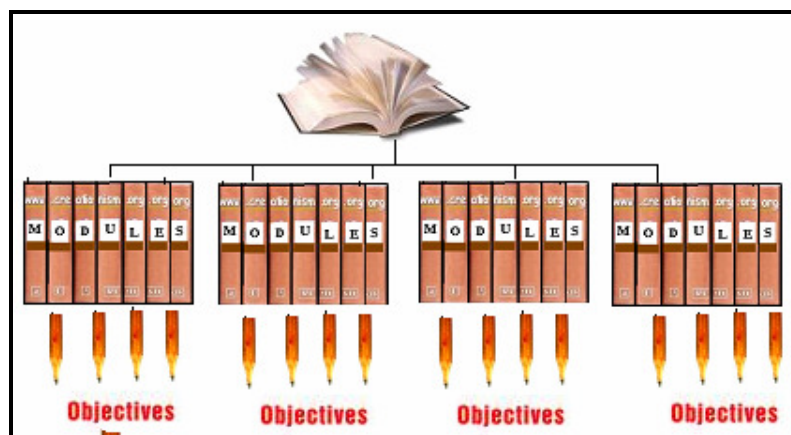
Figure 2.2: Decomposition Course to modules

Once the main objectives of the whole course are determined the next step is to assign specific objectives to individual modules. Each module is intended to achieve one or more course objective, foe example, there area several objectives in the "search technique" module in the AI course like: Identify these concepts: Search, Graph, Tree, Path, and Node, Learn the advantages and disadvantages for search techniques, and so on see figure (2.3).

Figure 2.3: Individual module objectives

Modules for any specific course should be easily navigated by learners. An example is in the form of a "menu of hyper linking". The graphical content in the interface should be reduced to the least possible minimum. Failing to do so will delay downloading and occupies a considerable portion of memory, see figure (2.4).
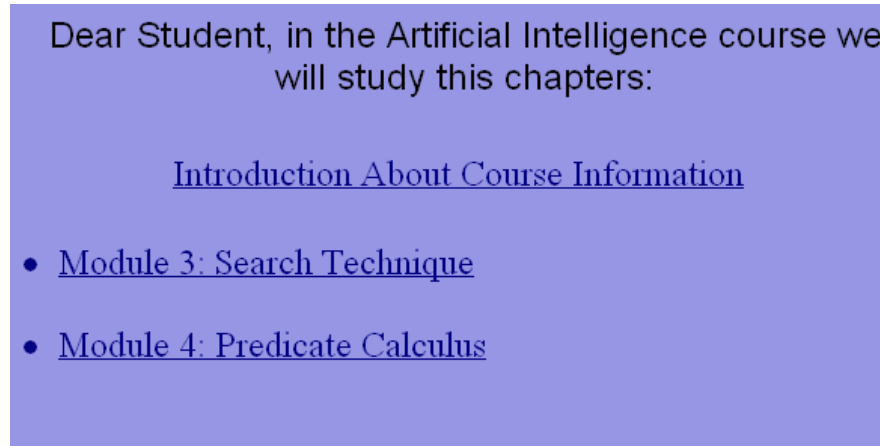
Figure 2.4: Menu of hyper linking

3. **Dividing each module into a number of lectures or lessons:**

Each module should contain a specific number of lessons or lectures that fulfill the training objectives of the module. Each lesson or lecture is assigned to a specific objective. And has a specific structure, For example:
- Defining the "Title".
- Defining "Facts".
- Defining "Concepts".
- Presenting and demonstrating "facts" and "concepts".
- Explanation of procedures.
- Providing examples.
- Summary (.in case of need)
- Quizzes.(in case of need)

In AI course, for example, "search technique" module has a number of lessons like "Breadth First Search", this lesson has objective, title, concepts and facts , procedures, examples, summary, and quiz. See figure (2.5).
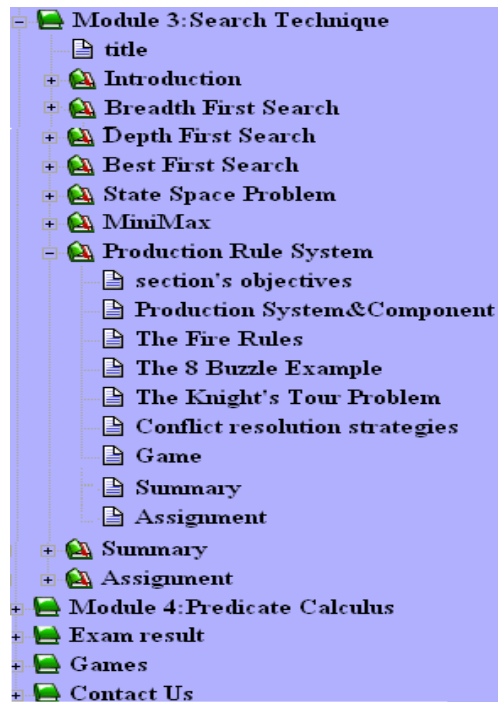
Figure 2.5: Structure of modules

As mentioned earlier in the discussion of modules; lessons and lectures are presented in the form of a "menu of hyperlinks" or dropdown list see figure (2.6). Lessons and lectures should not be extensively long in time so that the attention of learners is always attracted.
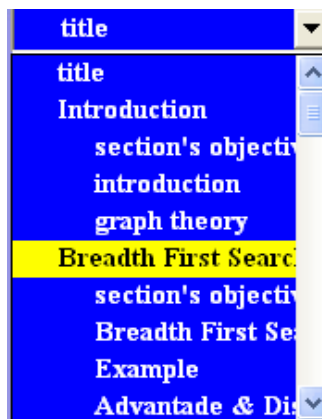
Figure 2.6: lesson's dropdown list

4. Dividing each lecture objective to "sub-objective", see figure (2.7) :
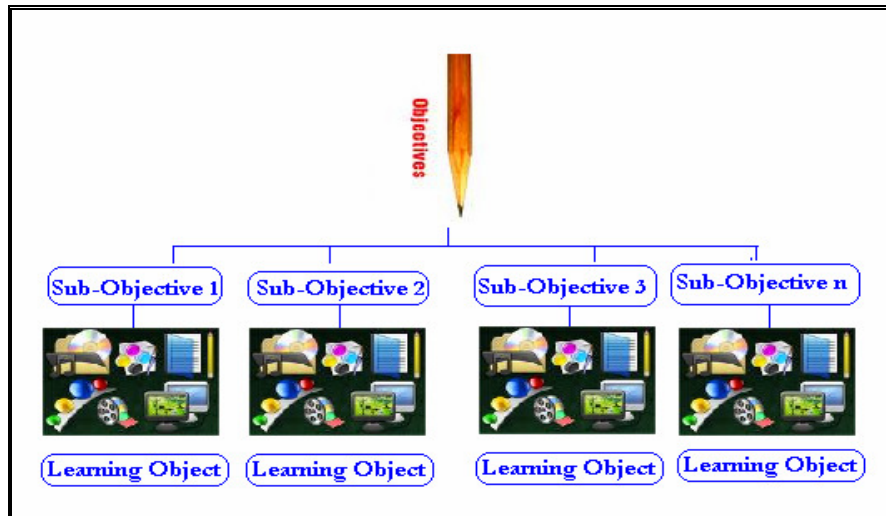
Figure 2.7: Decomposition of the Lecture Objectives into Sub Objectives

In this step the concepts and facts of the lesson are emphasized. Each procedure discussed earlier is assigned a "sub-objective". Obviously this may not always be applicable or necessary as in the case of "Defining the Concept" where the division is both meaningless and unnecessary.

This process can be done through a specific learning objects, the student can understand the desired goal of a lesson or a specific educational paragraph, for example, in the "state space problem" lesson, student needs to understand the require steps to solve this problem, on of the most popular example for state space problem is "two cups", see figure (2.8), when importing the two cups animation as example the student can play and understand the procedure and steps to solve this problem
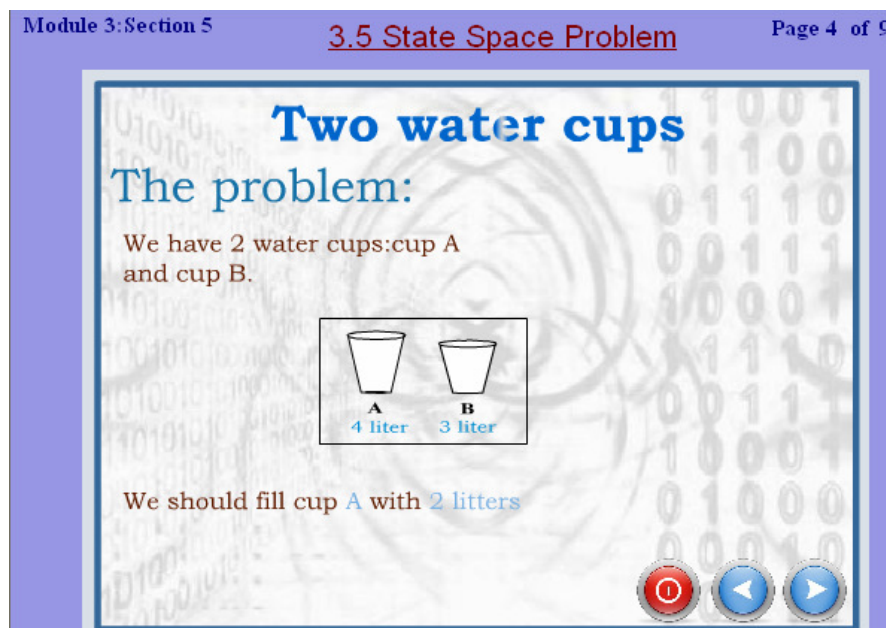
Figure 2.8: Two cups example

This was the intent when pointed out that one of the objectives of this study is to make students resolving critical thinking exercise.

5. Categorization "learning objects":

As an Initiative may be the best in the better understanding and delivery for educational objectives, categorization of Learning objects that will be the best way through divide the objectives to sub-objectives, where each sub-objective will be serve a group of ideas, each idea could be related and assigned to specific learning objects -one or more- that will contribute to the strengthening of the absorption of the objectives for student.

Sometimes the student needs to a different way to understand a certain idea that the educational content seeking to achieve, may be no best way we can deliver educational objectives, but we can obtain a good results through the process of classification the educational objectives, where the delivery of educational content will become easier, since the objective can be identified and then divided into several targets or sub-objectives and thus assign a set of ideas that will serve to achieve this objectives or sub-objectives, it is the best way to interact with these ideas by student who can better absorb the educational objective , we will not find better than the learning objects to deliver these ideas cause have the ability to easily, comprehensible, and accurately express of the ideas through the interaction between student and the educational content which is make the learning process more fun, fruitful, and useful , which are required.

6. Creation of "Learning objects" for each "Idea" :

Three learning objects will be considered throughout this thesis. These are:

- The "Text-based" Learning Object.
- The "Multimedia" Learning Object.
- The "Graphics" Learning Object.

The "Text-Based" Learning Object:

Learning object should be small and meaningful. The content in each learning object should preferably be assembled in the following manner:

- Small clusters of information objects.
- Summary of learning object contents.
- Multiple choice questions.

This assembly makes it easier for learners to assess the extent of comprehension achieved by him/her of that learning object.

The "Multimedia" Learning Object:

This learning object contains two main sets of learning objects:

- The Audio Learning Object:

Audio learning object supports the text-based learning object. Audio learning objects are presented by different speakers. For example: one speaker will announce the titles; the other will tell the texts; and another one will recite the summary...Etc.
Some "non-human" sound may be used in some parts of the content. For example: the sound of a bell ringing or the sound of a police siren or explosion sounds…etc.
The size of audio should be easily uploaded and downloaded and the quality should be carefully assessed as regards the frequency of audio.

- The Animation Learning Object:

This is mainly used to transcribe some text-based learning objects. It is a principal participant in achieving the objectives of the lecture or lesson. It is presented in the form of Cartoons and paintings that can be static or dynamic. The size and quality should be observed as regards resolution.

The Graphics Learning Object:

In this form the text-based learning object is presented as graphics. For example some of the models may not be easily explained in plain text whereas these same models can be easily explained if presented in the graphical manner.

Some important issues must be observed in designing all of the above-mentioned learning objects:
- Size: It should not be large and should not take long to download or upload.
- Quality: It should be carefully observed as regards resolution and frequency.
- Each learning object should ideally contain one single objective.
- Each learning object should be related to metadata that describes it.
- Each learning object should contain data that describes its nature and uses; for example date of issue and requirements for usage…etc. This will be of great significance in search processes.

7. Defining the e-learning design model:

This is defined as an organized process that should be followed by designers to achieve effectiveness and efficiency in creating instructions.
Based on that definition a model should be adapted and applied in each lesson or lecture.

Six instructional events used to structure the e- learning design model adopted in this thesis run in the following sequence:

1) Defining the learning content that attracts the attention of learners such as interesting facts.
2) Defining the main objective of the lesson or lecture. This is preferably done in the form of audio or text-based.
3) Presentation of the learning content in a manner that is compatible to the main objective.
4) A "Feed back" mechanism should be offered to learners in the form of an evaluation or questionnaire. This will ensure that the concepts are properly delivered and the objective is achieved. This is the "user-experiences" concept in designing models.
5) A key point should be made that resembles the main aim around which the content revolves.
6) Once the lesson or lecture is completed the learners are given a choice between quizzes and engagement in certain interactive activities among learners and tutors. This will ensure that creativity can be achieved. These "interactive activities" should better be in the form of audios or text-based.

8. Apply e-learning design model for each learning object:

The previous instructional event already created after creating learning objects for each objective or sub-objective, but some of these events need learning object without any type of evaluation and summary and prefer to be text-based or audio LO. These events are: defining the learning content that attracts the attention of learners, defining the main objective of the lesson or lecture, and a choice between quizzes and engagement in certain interactive activities, see figure (2.9).
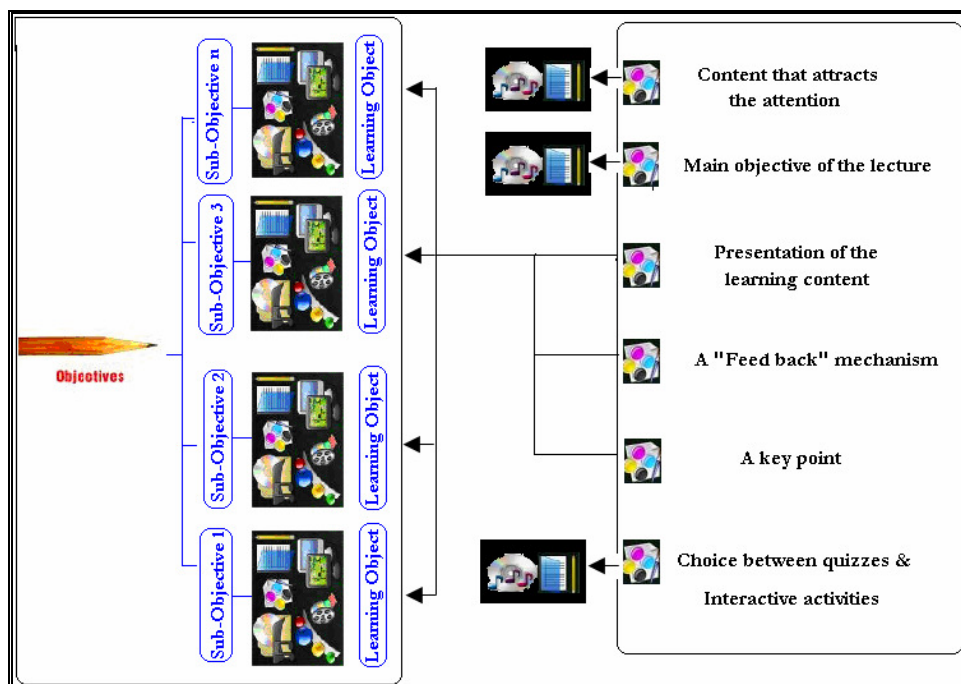
Figure 2.9: Applying Learning Objects for Both Sub Objectives
and Instructional Events

The following procedure explain the steps clearly, tutor collect the facts, main concepts and all content that attract the attention of student and design these content as voice or text, after that assigned objectives for each lecture by using learning objects, then presentation the content as objectives or sub-objectives and learning objects that assigned to the lectures, when complete the presentation there was need to return feed back about the student comprehensive that presented by questionnaire's or assessment's results, after that there is a key point helps to resemble the main aim around which the content revolves, once the lesson or lecture is completed the learners are given a choice between quizzes and engagement in certain interactive activities among learners and tutors. This will ensure that creativity can be achieved. These "interactive activities" should better be in the form of audios or text-based.

9. Optimize the learning object

Learning objects should be organized in a specific sequence structure that ensures the relation between learning objects and achieving the objectives or sub-objectives after completing each level, each line in the following figure represent a learning objective.
As we argue before, each learning object serves specific objective or sub-objective, these sub-objectives can be: Defining the "Title", Defining "Facts", Defining "Concepts", Presenting and demonstrating "facts" and "concepts", Explanation of procedures, providing examples, Summary, Quizzes, see figure (2.10).

Figure 2.10: Learning Objects Structure

10. Coordinate the learning content according to usability factors:

According to ISO 9241- 11, "usability" may be defined as "the extent to which a product (such as software) can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" **[14]**.

The word "usability" is also used to improve the ease-of-use methods during the design process.

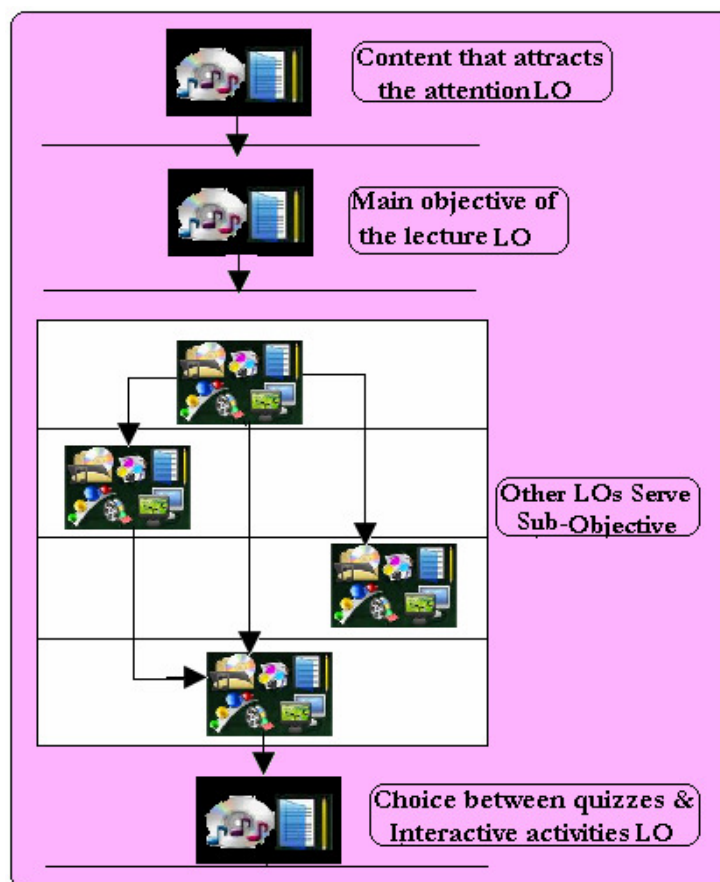The need for usability has been defined in content design literature as a vital quality when considering user satisfaction in such systems. Therefore the usability of e-learning applications can drastically affect learning.

Issues of usability take on an added dimension in an educational environment. It is not sufficient to ensure that the e-learning system is simply usable; it must also be effective in meeting the pedagogical objectives **[2].**

Considering the ISO 9241- 11 definition of usability, the main factors of "usability" are effectiveness (The accuracy and completeness with which users achieve specified goals), efficiency (The accuracy and completeness of goals achieved in relation to resources) and user satisfaction (Freedom from discomfort, and positive attitudes towards the use of the system) where effective is achieving a desired result. In the context of e-learning contents, learning objectives could consider the desired results. Therefore, the learning objectives should be considered in studies of the usability of e-learning content.

Every time a course or e-content needs to be updated, to avoid that, besides the usability, imperative factor should consider that is Interoperability. Interoperability refers to the aim of having content from multiple sources working equally well with different learning systems.

Another important factor impact on the usability, which is interface design,
Shneiderman and his associates propose a number of guiding principles for design of user interfaces that will help improve the usability of the underlying information access systems **[22]:**

1. Strive for consistency in terminology, layout, instructions, fonts and color.
2. Provide shortcuts for skilled users.
3. Provide appropriate and informative feedback about the sources and what is being searched for.
4. Design for closure so that users know when they have completed searching the entire collection or have viewed every item in a browse list.
5. Permit reversal of actions so that users can undo or modify actions; for example, they should be able to modify their queries or go back to the previous state in a search session.
6. Support user control, allowing users to monitor the progress of a search and be able to specify the parameters to control a search.
7. Reduce short-term memory load; the system should keep track of some important actions performed by the users and allow them to jump easily to a

formerly performed action, for example, to a former query or to a specific result set.

8. Simple error-handling facilities to allow users to rectify errors easily; all error messages should be clear and specific.
9. Provide plenty of space for entering text in search boxes.
10. Provide alternative interfaces for expert and novice users.

In addition to the previous factors, other factors should be concerned, these are quality and findability, which precede usability- if the learner cannot find the content or the content doesn't present in a desired form, he or she will never have a chance to use it.

The learner is the most important part of the learning process. Therefore, the learner behavior should be considered. There are specific factors related to learner behavior, these include how they navigate to content? How they select content for viewing? And which content they actually view? these issues directly related to the correctness of linking, searching procedures, helping guidelines, and learnability. In other words, how much the learner enjoy working and user-friendly with the design?

2.6. USER CENTERED DESIGN

On of the important issues in the design process should be considered is "User-Centered Design" (UCD), UCD is the term which describes the design process, which affects the learner in how to design content and how the design takes a shape so that appropriate and comfortable in dealing. Ideas and principles may vary from one learner to another to give several shapes and designs. UCD may differ according the role of learner in a specific time during the design process, for example, during the gathering requirements process and usability testing there was a need to consult the learner about their needs, sometimes learners have a deep role impact on the design process as a whole through involve the learner in the design process as partners with designers.

Donald Norman's research laboratory at the University of California San Diego (UCSD) in the 1980s, Norman recognizes the important role and the great impact of the learner or user, and focus on the usability of the design **[19]**. He provides four suggestions for the design how should be done, these suggestion places the learner at the center of design, these are:

- Make it easy to determine what actions are possible at any moment.
- Make things visible, including the conceptual model of the system, the alternative actions, and the results of actions.
- Make it easy to evaluate the current state of the system.
- Follow natural mappings between intentions and the required actions; between actions and the resulting effect; and between the information that is visible and the interpretation of the system state. **[19]**

These suggestions were made after Norman noted that the long efforts and cumbersome, unintelligible manuals that accompany products are not user-centered. So he suggested that should be have a guidelines such a small pamphlet contains some design principles are needed to guide the design.

Now, how to involve the learner in the design process?

Questionnaires, structured interviews and focus groups are methods used to employ UCD through understand and identify user requirements.

CHAPTER-3: E-CONTENT DEVELOPMENT

There are more than 100 different (Instructional System Development) ISD models, but almost all are based on the generic "ADDIE" model, which stands for Analysis, Design, Development, Implementation, and Evaluation, as illustrated below. Each step has an outcome that feeds the subsequent step.

Analysis --> Design --> Development --> Implementation --> Evaluation

During analysis, the designer develops a clear understanding of the "gaps" between the desired outcomes or behaviors, and the audience's existing knowledge and skills. The design phase documents specific learning objectives, assessment instruments, exercises, and content. The actual creation of learning materials is completed in the development phase. During implementation, these materials are delivered or distributed to the student group. After delivery, the effectiveness of the training materials is evaluated.

In the next sections we will explain theses steps with focusing on the design phase.

3.1 ANALYSIS PHASE

The results that will emerge from this phase are work tasks and goals of students and the community needs, place and time, materials, budget and capabilities of the regulations.

In this thesis we want to achieve the following goals:

- Create advanced technological and learning resources necessary to support and guide the trainer/author in the process of designing learning material, integrating new pedagogies in a technology-supported environment, thus contributing to the migration from classroom training to e-learning.
- Improve the quality of graduates, by utilizing modern instructional materials and methods, including increased use of text, video, animation and graphics in teaching.
- Promote generation of e-content, in all subjects.
- Development of teachers and experts resources in e-content creation.
- Distribution of the e-content to teachers and students from formal and non-formal educational modes, for supplementing and complementing the process of e-learning in education.
- Development of partnerships between educational institutions and the IT industry for the continuous development of new e-content and methodology considered contemporary technology.
- Engaging learners and gauging their understanding.
- Demonstrate mastery of the e-content.
- Apply learned e-content to solve a problem and use the content in critical thinking exercises.

These goals affect the student positively in the learning process through many factors such as:

- Adjustment in accordance with the needs of student
- Increase the skills to access information, evaluation and use
- Students develop the capacity to solve complex problems
- Increase public awareness of students
- Nurturing creativity of students
- Create opportunities for creative extracurricular student
- Compatibility with digital age

During analysis we identify the target audience of e-course who are student's access Artificial intelligence (AI) course in the second semester 2009/2010 in the Hashemite University. But we need to clearly identify the skill deficiencies in AI students so we can focus on our design on areas that help close the gaps. We use proper methodologies and tools such as surveys and focus groups to determine existing gaps.

Through the surveys and focus groups, the results show that there are several factors which affect on the student and attract their attention With respect to design e-content, as well as, cover the gaps such as:

With respect to user interface:
- Access the information through animations, graphics, sound, text and video with the resolution and clear for all these media.
- The font properties and the resolution which relieve the eye while reading such as dark colors (black and dark blue), font types, appropriate types of font for any operating system or browser (Times New Roman, Arial), the font size clear, suitable and convenient to read such as 16 and 14, all the colors used in the various screens of the course clearly distinguishable by the visually impaired.
- Access and navigate the educational content easily and rapidly, learners can easily get to a specific piece of content (in no more than 3 clicks).
- Using all objects (Buttons and Icons) without guessing.
- Build interactive user interface.
- Course provides structural aids (i.e., unit, lesson, activities, etc.) to help learners navigate the course.
- The course provides a site map (i.e., big picture of the course) to help learners navigate the course?

With respect to Pedagogical factors:
- Proffering accuracy of the e-content.
- Compatibility between the content and syllabus that approved by the curriculum committee.
- Clarify objectives before starting the study of electronic content.
- Compatibility of the examinations with the educational material.
- Using media presentation mode (Graphics, Audio, Video, and Animation).
- Sequencing in presentation of ideas.
- The course follows the "one idea per paragraph" rule.
- Using real world examples.

- Existing summary and exercises for each chapter.
- Using keywords for easy access to the objective.

With respect to management factors:
- The course has page counters? (Note: Page counters are useful for students to keep track of where they are in relation to the lesson. For example, 1 of 5 pages.)
- The course content updated dynamically.
- Content progression and transition is accumulative in the form of Modules then sections and lessons.
- Using tool to know the time and date.

With respect to technological factors:
- All learning objects available in the course reusable.
- Provide any of interaction or communication mechanisms for students (by Black Board).
- The content is viewed by any browser.

Now after achieving these requirements by designing e-course, how can we convey it to the learner?

It will be online by "Black Board"; we need for keep in mind such factors as loading speed, flexibility, accessibility, and helping procedure.

Through designing the e-course, we must consider the previous requirement as much as possible. So Trivantis Lectora is a software that aid to achieve that with a proper design for e-course.

Trivantis Lectora is a software package that allows an individual or group to easily create interactive instructional courses, which can be deployed as Internet Web sites, and/or standalone CD-ROM applications. Lectora supports a wide variety of common media types including text, images, audio, video, animation, etc., and even popular Internet technologies such as Shockwave, HTML, Java, and JavaScript.

Trivantis also offers a service called Course Mill. Course Mill is a location on the Internet where you can post a finished Lectora-generated course and have students utilize it. The site also stores test results of any students who may have taken the course, and allows your instructors to administrate the course by adding and deleting students, and to review any grades that have been submitted.

Students who sign up for and take courses can enter course-specific chat rooms which allow them to interface with other students who are taking the same class whether they are across the room or on the other side of the world.

Because of the limited budget we can not post a finished Lectora-generated course, we instead that by other learning management system that is "Black Board".

3.2 DESIGN PHASE:

The results that will emerge from this phase are setting goals, strategies, and different teaching methods necessary to achieve goals, as well as, documents specific learning objectives, assessment instruments, exercises, and content.

The over all system contains four elements: that's Administrator, Student, Black board and Course.

The E-course displays at university web site on the Black Board, students, Instructor, and Administrator choice the courses in this semester and register in it to have an account.

They can view the E-course from any where at any time; also view a sample of the course and instruction information, choice of the time for lecture and instructor. Check the attendance of the student through registration information, and know the student in this course. Updating and validation of course is enabling to do in this system.

Each element has an ID and Password to be able to access to the system and course, this account information could be processed by administrator and instructor through operations such as create, delete, and update.

About assessment: can emplace assessment and get a mark, also update and create it when it need by instructor, then students can log the system to take the assessment and get mark as feed back of the assessment process.

About the course, both of instructor and admin can control the course that is loaded to the system by many operations such as load or create, update, and delete.

Students and instructors can display the course and pages of course, then navigate the over all objects what and when they need, so they can play both video and sound, show animations, go to next and back page, and go to home page and other functions.

The communications also has allocation; the system allows communication between the Instructor and student through the procedure of question and answer.

In this system not any body can log in and enter to the system but there is an ID and a password that is given from admin to Student and instructor so it is security system.

The system can do what user wants and needs and its enable to use from any actor at any time, so it's availability and flexibility system, This system can view all components of system that user need it. This system is user-friendly.

More characteristics, activities, and features the learner and tutor can benefit from it will be illustrated in the implementation phase section when talking about the Moodle learning management system and what offers of possibilities to achieve the desired goal.

3.3. DEVELOPMENT PHASE:

The result that will emerge from these phases is complete the actual creation of learning materials.

In the design phase the developer created an outline that identified the tasks, strategies and sequencing of the project or instruction. In the development phase this outline will turn into specific step-by-step details and support documentation which are important during development and testing and far into the future, long after everyone who originally worked on the project or instruction has gone.

Design structure:

The design contains two parts, the first one is information about the course, and the second is course chapters/modules.
The first part contains these items: course information, tutor information, syllabus, and references.

The second one contains tow chapters/modules form the Artificial Intelligence course.

Each module divided as follows:
- Introduction (contains the module objectives).
- Module's sections.
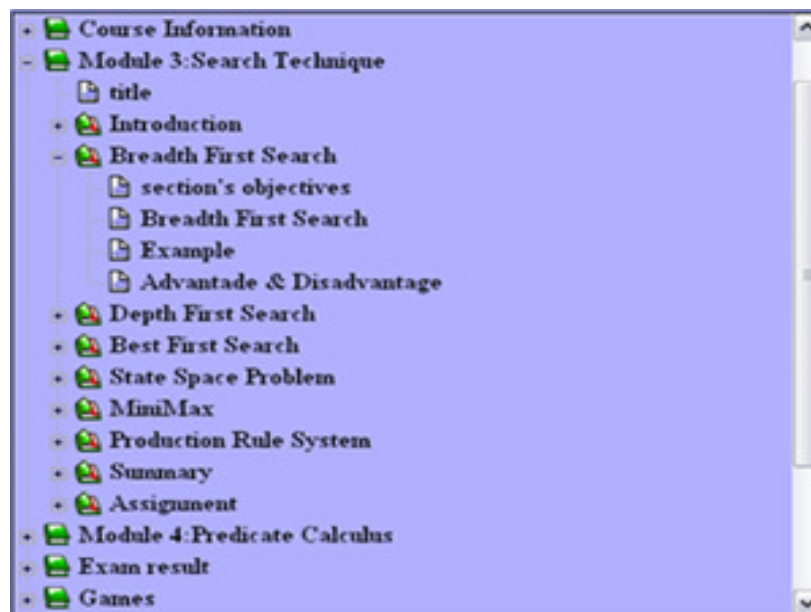- Summary.
- Exercises (practice if any).

Figure 3.1: Hierarchal structure for the course

This figure (3.1) shows the hierarchal structure for the course.

<u>Designing the graphical user interface:</u>

Based on the golden rules the design should be as follows:

1. Strive for consistency:

- Information, the names and arrangement of menus, the size, shape, font and color of icons are consistent throughout the design; also make a homogenous environment with the overall design.

2. Offer informative feedback

- Each action that the user performs will get result in some type of feedback from the computer
    - Ex. When the user takes an exam and finishes it the result will be displayed

3. Design dialogs to yield closure

- Users need to feel that they can explore options and take actions that can be canceled easily
- If they make an error, they can cancel the action
- Should include cancel buttons on all dialog boxes
    - Ex. When the user takes an exam he/she can cancel it, the exam contains cancel button.

4. Reduce short-term memory load

- People have short-term memory limitations
- People remember only about little chunks of information at a time.
    Ex. doesn't need to ask the learner to remember every thing.

Also the design contains Header, menus, and content area.

We will start from home page; home page contains several functions which will be explained to each object alone.

Figure 3.2: Graphical User Interface for Design

You will see at the top of site banner that represent the title of course -AI- and on the right side you will see the time and date

Figure 3.3: Date and Time at the banner

At the bottom of site there is a pane which represent the copy right of the course and design.

Figure 3.4: Copy Right bar

You will see under the banner a panel which contains a group of buttons that perform a particular function.

Figure 3.5: Main Menu

- The **Home** button linked to the first page in the course.
- The **Dictionary** button linked to the Dictionary page that translates the word from several languages to several languages by Google translation.
- The **Games** button linked to games page and contains several games to support some of AI concepts.
- The **Help** button linked to help wizard.
- The **contact us** button linked to contact information about designers.
- The **Exit** button closes the application.
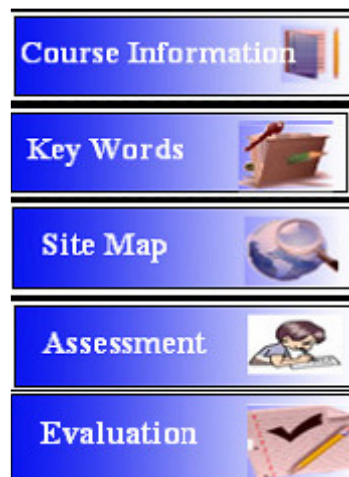
Figure 3.6: Right Menu

In the right side we have a menu which represents a group of buttons each one has a particular function:

- Course Information button linked to the page and contains information about the course, we will explain it later.
- Key words button linked to pages and contain the key words in the whole course sorted by alphabetic, we will explain it later.
- Site map button linked to the page and contains a table of content for a whole course (modules, sections, and pages), we will explain it later.
- Assessment button linked to the pages and contains an exam after complete the course in the multiple choice and true/false form.
- Evaluation button linked to the pages and contains questions about the usability in the course design in the multiple choice form.

There are some of buttons in the top menus which need explanation:

Dictionary button linked to page that represent the translation method which you can click to perform the process.

Figure 3.7: Dictionaries page

Games button linked to page contains a group of games designed to support the AI concepts, you can start playing by clicking any link (note: you should be online).

Figure 3.8: Games Links

The **right menu** again contains buttons which need explanation:

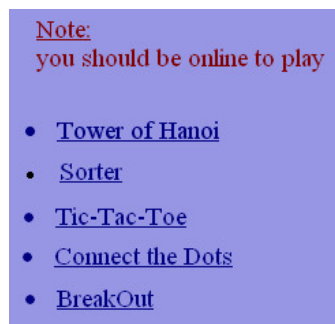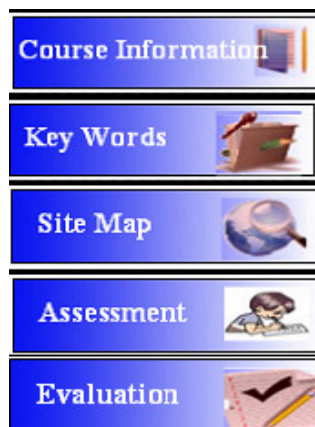The **Course Information** button linked to the pages and contains information about the course, as well as, these pages which have a menu representing the course information parts

Figure 3.9: Course Information Menu

- Course Information button linked to the page and contains the course name, pre-request, department, course description, aims, and learning outcomes.
- Syllabus button linked to the page contains contents outline.
- Tutor Information button linked to the page contains information about the tutor's name, phone, fax, mail, and office number and hours.
- References button linked to the page and contain the recourses and references (Text book and support material) that the content referred to it.

The **key words** button linked to the pages contain key words sorted by alphabetical order for the whole course to help student access easily the particular subject that he is interested in.

Letter	Words	Module #	Section #	Page #
	Data base standard form	4	4	3
	Deep	3	3	1, 4
	Demonstrating the equivalence	4	2	13
	Depth	3	6	4,5,8,10
	Depth first search	3	4	1
		3	3	1, 3
	Descendant	3	3	1
D	Deterministic	3	6	3
	Directed graph	3	1	4
	Disadvantage	3	1	2
		3	3	4
		3	2	5
	Disjunction	4	2	5,6,10
		4	3	11
		4	4	4
	Domain knowledge	3	6	10

Figure 3.10: Key Word Page of Course

Site map button linked to the page contains a content table shows the course partition (modules, sections, and lessons) and you can also access any of them just by clicking.
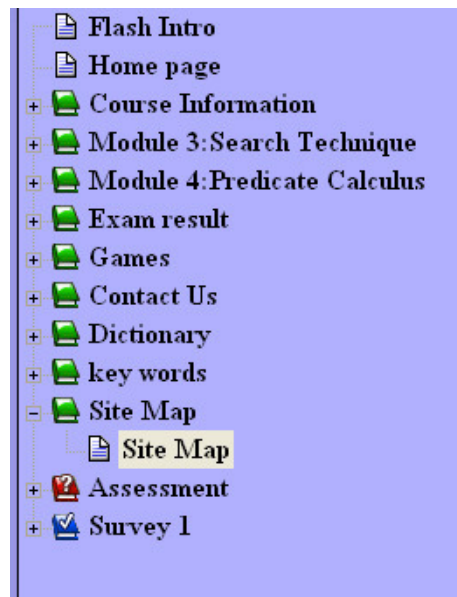
Figure 3.11: Site Map of Course

Assessment button linked to the pages and contain an exam at the end of course to assessment and test the student to absorb the educational content in the end of course, these questions are represented in the form of multiple-choice and true/false.
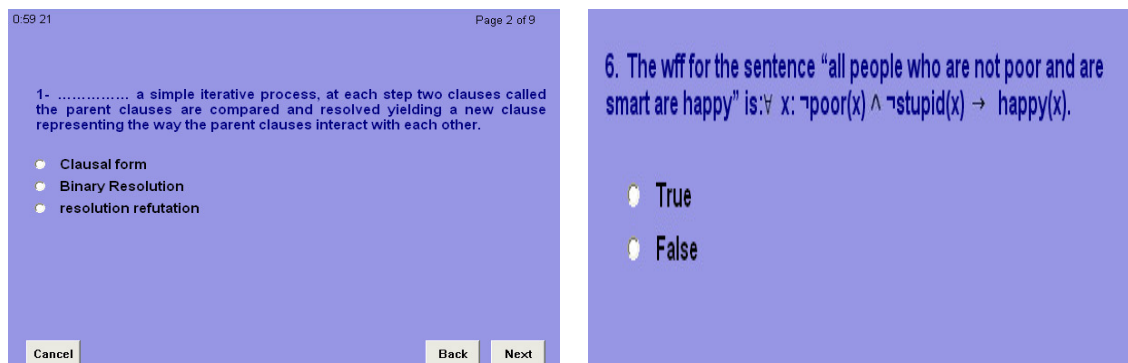
Figure 3.12: Assessment Forms

Assessment pages contain the time of test and the page you are already in

Figure 3.13: Time and page counter in the assessment page

Evaluation button linked to the pages that contain the questions about the course design at the end of course, the type of this question is multiple-choice.

Figure 3.14: Evaluation Page

Each page in this course contains

- **Two buttons** to move between pages- **Next** and **Back**- Except the last page in the module; you will see the Back button alone.

Figure 3.15: Next and Back buttons

- **Progress Bar** to show where you are and how many pages are still remaining from the hall chapter

Figure 3.16: Progress Bar

- **Content table** in the form of **drop-down list** in each module to move between pages in less than 3 clicks.
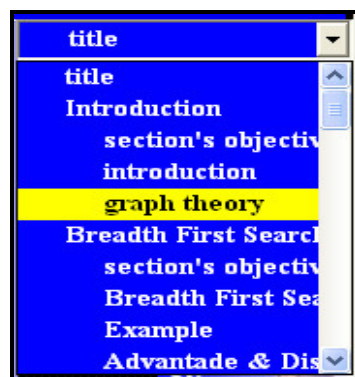
Figure 3.17: Content Table drop down list

- **Listen** button allows you to hear the lesson instead of reading by clicking.

Figure 3.18: Listen Button

- **Print** button allows you to print the current page by clicking.

Figure 3.19: Print Button

- In each section we display the path in the top of page you already in, such as:

Figure 3.20: Section Path

That is referring you already in chapter 3 and section 4.

Figure 3.21: Lesson Page Path

This means you are already on page 3 and this section have 7 pages

Our course has been divided as follows: **Module – Sections – Lessons**, so each module has sections and each section has lessons.

In each section we have the **objectives** form this **section**, then**, introduction**, after that **lessons**, then **summary**, and **exercises**.

In the home page we display the links for the modules which allow students to move to the module that they want by clicking.

Dear Student, in the Artificial Intelligence course we will study this chapters:

Intoduction About Course Informatoin

- Module 3: Search Technique

- Module 4: Predicate Calculus

Figure 3.22: Links of the Modules in the Course

Each lesson contains **text area, pictures, flashes, and animation**, in addition to hearing function.

Some flashes are auto run, and others need some action such as:

This is an animated flash that run automatically, in this site we have a lot of them

Figure 3.23: Automatically Playing Animation

Another type of flashes is needed to some action from the user.
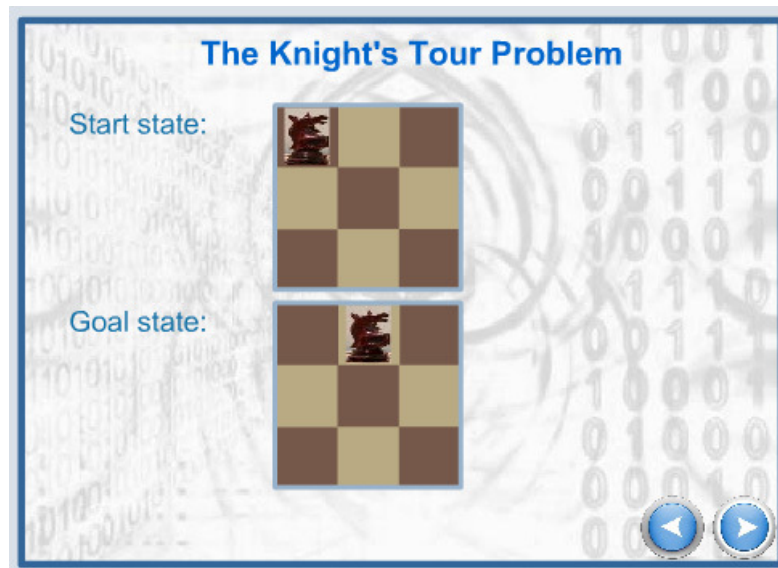
Figure 3.24: Action Animation from user

Another flash needs an action:
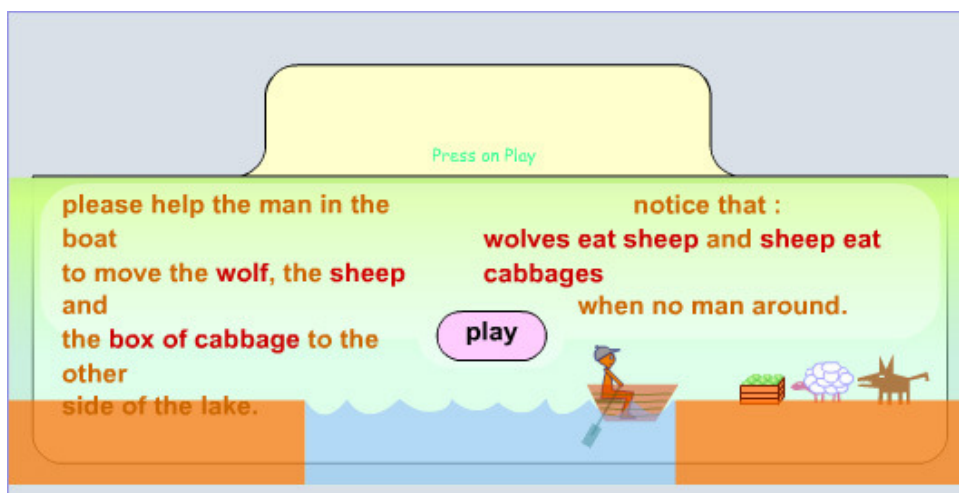
Figure 3.25: Action Animation before user play

We refer to user that may press play button to start play the game, when the user presses the play button:
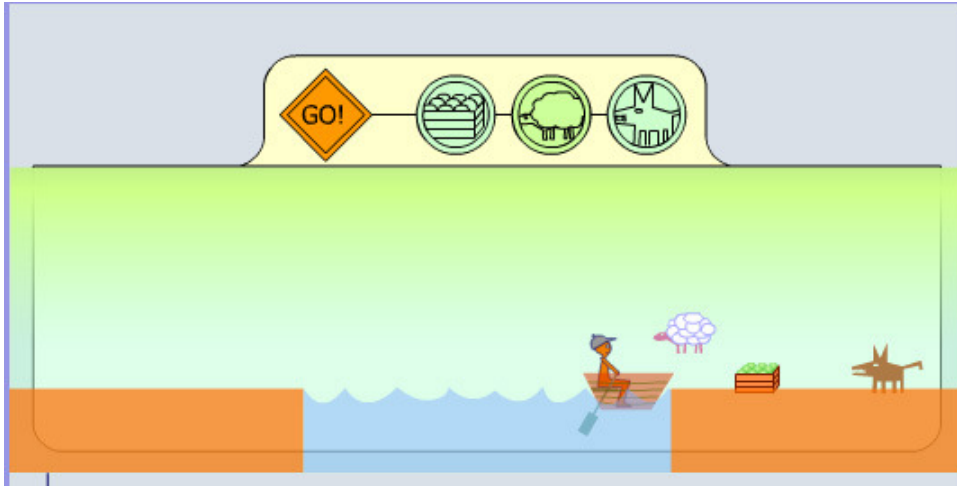
Figure 3.26: Action Animation after user play
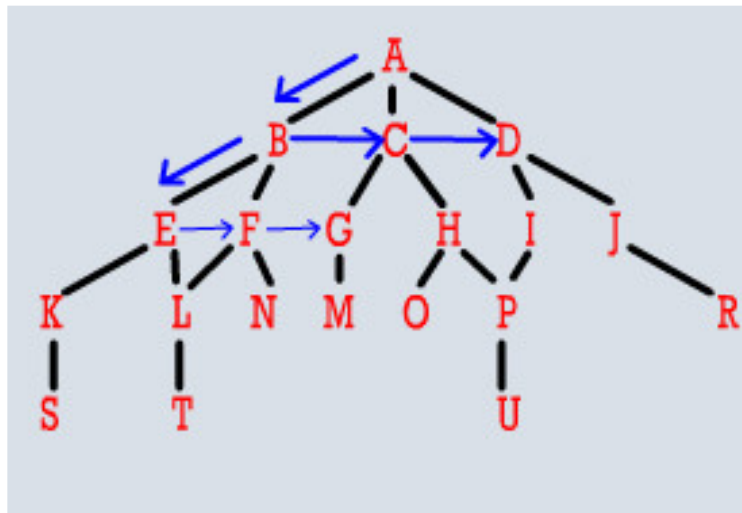
About the content area it contains text, animations, pictures, and video.
The design is completed then we begin entering the content.

In the text content we consider the font size, color, and type, where suggested Times New Roman and Arial as a font type also dark blue and black as a color then 14 and 16 as a size.

The text has been entered by Lectora software.

About the images, we choose JPEG images because they are small and fast during loading the course on Blackboard.
If the image extension isn't JPEG we use Photoshop program to edit it.

Each image is related with the text that the image followed it.

About the animations, we use the Macromedia Flash to make animations; we divide the flash file into sub files (SWF file) to reduce the size of the flash file. The animations are easy to understand and they are attractive.

3.4. IMPLEMENTATION PHASE:

The phase of the designed course is delivered or distributed to the students group.

Also, ensure the devices have the appropriate access to the design and that users are provided with logins and passwords to access if necessary. Check that there is enough seating and comfortable temperature, proper lighting etc. also, ensure there is plenty of technical support. Also, provide teacher users manuals guides for trouble-shooting.

Lectora program can publish the course to HTML, Lectora exe file, and to CDRom or to CorseMill.

After we publish the html course or as Lectora exe file, we load it to Blackboard which is the delivery environment or learning management system to our course.

After we publish the course, then any authenticated student can use this course.
Student can navigate our course easily by the help document which is found in the header menu.
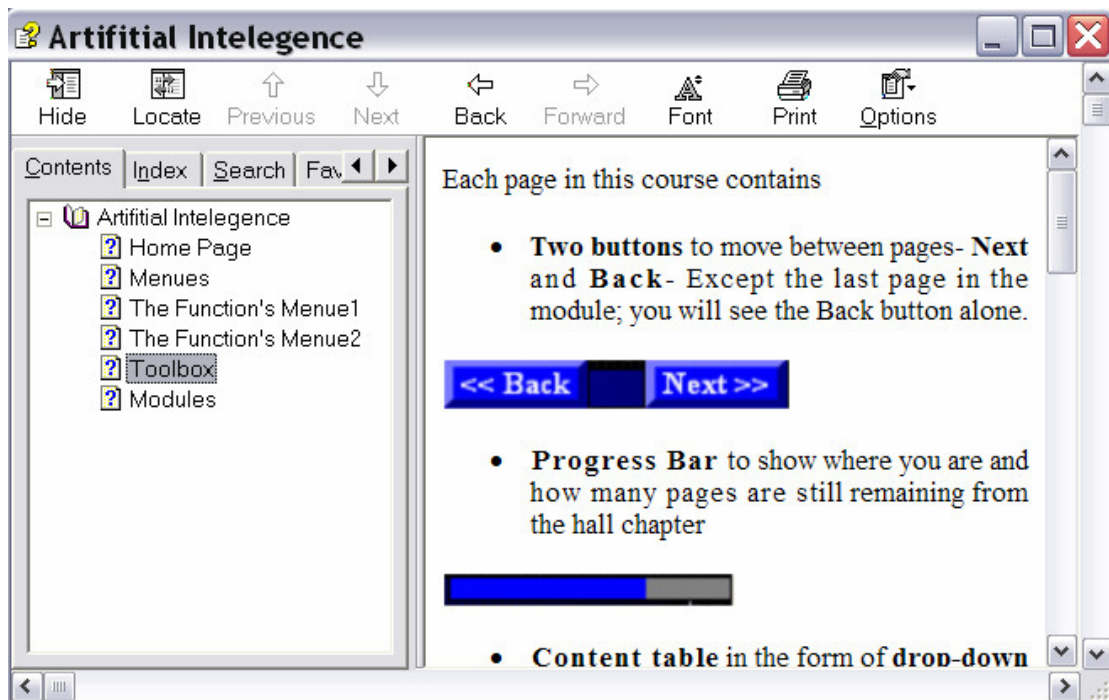
Figure 3.27: Help document

There is another way we can deliver the content design that is through other learning management system (LMS), which is Moodle, Moodle is a package of programs for produced courses on the Internet and web sites.

Moodle is acronym for Modular Object-Oriented Dynamic Learning Environment.

Moodle is a package of programs for produced course on the internet; it considers an open source course management system, as well as, learning management system and can be used on any computer and any operating system.

Moodle website provides features for Moodle's users such as central point of information, discussion, and collaboration among them, and always evolving to meet user's needs.

During the design on the Moodle can provide many services: promote the collaboration through blogs, messaging, participant lists, …etc, and activities like forum, glossaries, wikis, assignment, quizzes,…etc, suitable for supplementing face-to-face learning, provide full database abstraction, also have strong securities throughout, as well as, the ability for categorized and searched the course.

With respect to management side, Moodle interest with the site management, User management, and Course management as follows:

Site management: Moodle's site is managed by an administrator who has the authority to modify the site, customize the themes (color, font, layout …etc) to be appropriate for local use and needs.
Site is also distinguish oneself with possibility to add additional tools, such as adding activity modules to Moodle, as well as, Possibility of adding and editing the languages packs which contains more than 70 languages.

User management: to reduce the role of admin were taken the user (tutor and learner) into account where some of authentication assigned to user like create and manage his/her account, build an on-line profile, specify own time-zone, choose the language used for the Moodle interface, as well as, the enrolment process …etc, all of these roles with keep the security.

Course management: each course has coordinator or full tutor has a full control over all setting of a course with restricting other tutor, as well as, each course contains different activities placed on a flexible array that contribute to enrich the educational process. Theses activities are:

Forums: discussion area contains author's files attached, contribute to increase the communication between the learner's themselves and between the learner and tutor.

Glossaries: allows participant to create and maintain a list of definitions, like a dictionary and can be searched, imported, and exported. Where this process is carry out under the control of instructor before publishing.

Wikis: consider as a web page that anyone can modify, add to or delete, also, supports the collaborative learning and restoring the old version from the authored collectively documents.

Assignment: allow the students to enhance their understanding and examine their comprehended, as well as, provide feedback to tutor for learner's results, assignment that uploaded by learners specified with due date and maximum grade and show the amount of learner to tutor. Multiple files can be uploaded for assignment.

Quizzes: it is questions bank placed by tutor for re-using in quizzes, it is easy to categorization access and can provide auto-grading for questions. Types of question are: multiple choice, true/false, short answer, matching, random, numerical, embedded answer and descriptive text, graphics and passage of text. And can accept any file format and type.

Survey: on-line built-in survey with feedback provided to students.

Resources: supporting the display of all types and format of e-content and managed them.

Lessons: series of pages presented in more than style to students who can navigate these pages easily and doing some activities.

Also, Moodle enables the communication between tutor and learners and full user tracking.

3.5 : EVALUATION PHASE:

After delivery, the effectiveness of the training materials is evaluated. Researcher used in this thesis the questionnaire type of evaluation; Artificial intelligence's students make the evaluation after use the design. This questioner consists from 27 items distributed for 80 student and get good results.

This chapter aims to show the results of the statistical analysis of the practical part (Design). Note that the researcher and through the identification and preparation of statistical analysis, has consulted with a number of specialists in field who helped me in the analysis of data.

The study is based on a descriptive analytical method used and the method of field study.

This chapter will analyze and investigate the respondent results that analyzed by SPSS program.

COMMUNITY STUDY AND STUDY SAMPLE:

We distributed 80 questionnaires which include study questions about the representative sample of AI student in the Hashemite University in the second semester 2009/2010.

TRUTH AND STABILITY TOOL:

1. Truth tools:

The researcher developed a survey with the guidance and assistance of the supervisor, and was presented during the arbitration of a number of specialists those interested in scientific research, and known for their excellent experience in their field, have been taken around the observations, which have been modified survey based on these observations.

2. Stability of the tool:

To verify the stability of the tool was calculated using the equation tool Cronbach alpha, with alpha coefficient of stability for members of the sample as one survey in general (00 ,8492), which is indicative of a high level of stability of the measurement tool.

STATISTICAL METHODS USED:

The SPSS statistical package was used for analysis and testing of hypotheses and use statistical means the following:

- Arithmetic averages and standard deviations.
- Tested a sample of T. One (One Sample T-Test). In order to test hypotheses.

- Test (T) (Independent Sample T - Test)

CHOICE OF SCALE QUESTIONNAIRE:

We used the likert 5-point scale to answer the questionnaires items. The degree of the answers is as follows:

- high: 1.
- Above average: 2.
- average: 3.
- Below average: 4.
- bad: 5.

TESTING FOR HYPOTHESIS USED:

H0: There is no relationship between the supported characteristics of the user interface, and the presentation of the visual content of the educational

H1: There is a relationship between the supported characteristics of the user interface, and the presentation of the visual content of the educational

Table (3.1):

Test results (T) for the supported characteristics of the user interface

One - Sample Statistic

	N	Mean	Std. Deviation	Std. Error Mean
The supported characteristics of the user interface	80	4.696	0.3086	

One - Sample Test

	Test Value = 3					
	T	Df	Sig	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
The supported characteristics of the user interface	49.162	79	0.00	1.696	1.6277	1.7651

55

This is illustrated by the data in Table (3.1) that the supported features in the user interface have a strong relationship with the designed model based on the calculated value of (T) that is (49,162) at the level of significance (0.01 = α). The hypothesis is rejected if the value of (T) greater than the calculated value in the level of spreadsheet at the moral significance that is (0.05) for this study. This suggests rejection of the null hypothesis (H0), which states that "there is no relationship between the supported characteristics of the user interface, and the visual presentation of the educational content" and accept the alternative hypothesis (H1), which states that "there is a relationship between the support characteristics of the user interface, and supply the visual content of education."

Second Hypothesis:

H0: There is no relationship between the design of educational content, and the degree of ease of use of the educational content by the learner.

H1: There is relationship between the design of educational content, and the degree of ease of use of the educational content by the learner.

Table (3.2):
Test results (T) to the user-friendliness of the educational content by the learner

One - Sample Statistic

	N	Mean	Std. Deviation	Std. Error Mean
User-friendliness of the educational content by the learner	80	4.71	0.30	

One - Sample Test

	Test Value = 3					
	T	Df	Sig	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
User-friendliness of the educational content by the learner	51.65	79	0.00	1.713	1.647	1.779

This is illustrated by the data in Table (3.2) that the supported features in the user interface have a strong relationship with the designed model based on the calculated value of (T) that is (52.65) at the level of significance (0.01 = α). The hypothesis is rejected if the value of (T) greater than the calculated value in the level of spreadsheet at the moral significance that is (0.05) for this study. This suggests rejection of the null

hypothesis (H0), which states that " There is no relationship between the design of educational content, and the degree of ease of use of the educational content by the learner " and accept the alternative hypothesis (H1), which states that " There is relationship between the design of educational content, and the degree of ease of use of the educational content by the learner."

Third Hypothesis:

H0: There is no relationship between the design of educational content, and the extent of the learner to take advantage of this educational content.

H1: There is relationship between the design of educational content, and the extent of the learner to take advantage of this educational content.

Table (3.3):
Test results (T) to extent of the learner to take advantage of educational content.

One - Sample Statistic

	N	Mean	Std. Deviation	Std. Error Mean
Extent of the learner to take advantage of educational content	80	4.685	0.251	

One - Sample Test

	Test Value = 3					
	T	Df	Sig	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Extent of the learner to take advantage of educational content	60.135	79	0.00	1.685	1.6292	1.741

This is illustrated by the data in Table (3.3) that the supported features in the user interface have a strong relationship with the designed model based on the calculated value of (T) that is (60.135) at the level of significance (0.01 = α). The hypothesis is rejected if the value of (T) greater than the calculated value in the level of spreadsheet at the moral significance that is (0.05) for this study. This suggests rejection of the null hypothesis (H0), which states that " There is no relationship between the design of educational content, and the extent of the learner to take advantage of this educational content " and accept the alternative hypothesis (H1), which states that " There is relationship between the design of educational content, and the extent of the learner to take advantage of this educational content."

Fourth Hypothesis:

H0: There is no relationship between the technology used, and the validity of the models designed.

H1: There is a relationship between the technology used, and the validity of the models designed.

Table (3.4):
Test results (T) to the technology used

One - Sample Statistic

	N	Mean	Std. Deviation	Std. Error Mean
The technology used	80	4.5292	0.3993	

One - Sample Test

	Test Value = 3					
	T	df	Sig	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
The technology used	34.249	79	0.00	1.5292	1.4404	1.6180

This is illustrated by the data in Table (3.4) that the supported features in the user interface have a strong relationship with the designed model based on the calculated value of (T) that is (34.249) at the level of significance (0.01 = α). The hypothesis is rejected if the value of (T) greater than the calculated value in the level of spreadsheet at the moral significance that is (0.05) for this study. This suggests rejection of the null hypothesis (H0), which states that "There is no relationship between the technology used, and the validity of the models designed" and accept the alternative hypothesis (H1), which states that "There is relationship between the technology used, and the validity of the models designed."

CHAPTER 4: CONCLUSION AND FUTURE WORK

4.1. CONCLUSION:

Although e- content design reaches to advance stages, it can improve and support the learning process if we effectively handle the e- content design and adaptation issues. In our thesis, we have introduced a top-down content design approach that guarantees an effective displaying and downloading of the learning content. The approach focuses on splitting the learning content into small learning objects each with objectives or sub-objectives. Each learning object must be available in several forms which are: text, audio, video, animation, and image. We found these learning objects assist the learner in attract their attention to the educational material, that makes a lack of desire to learn, Achieve fully comprehend of educational content as expected, also taking into account the individual variability of learner, and learner is participant not recipient .

In our work, we interest in design learning objects in a way that ensure achieving the previous objectives Taking into account all the characteristics of learning objects in terms of size and clarity .

Finally, the learning objects organized according to an instructional design model, they should be related to each other in a tree hierarchy structure and they must be adapted to achieve the learner satisfaction and learning objectives.

Furthermore, while implementing the model, we found that the desire of students to follow the model some of the important factors that spread over the various dimensions of e-learning content.

We have also explored those factors that significantly render the e-content fruitful; accessible and flexible. Those factors fall into four categories and based on these factor we generate four assumption, These assumptions have been adopted in the design of the model cause capture these elements of the reasons that contribute to solving the educational problems in the case were taken into consideration and taken into account :
1- Management-related assumption.
2- Technological assumption.
3- Pedagogical assumption.
4- User interface assumption.

The proposed model was tested through the design of artificial intelligence course based on this model and questionnaire was applied on a group of students that was both concerned and involved in the e-learning process.
The group was students of Artificial intelligence course in the 2nd semester 2009 in the Hashemite universities in Jordan and recorded excellent results where success of the model.

4.2. FUTURE WORK:

We would like to suggest some interesting issues and ideas that could not be reached because of limited time, resources and other constraints and they will aid as an improvement on the proposed model. As future work:

- Full implementation of the proposed model for designing and development e-learning content. This can be done by designing a whole educational course according to our proposed design approach, implementing model on the course and finally applying an experimental test by allowing a group of learners to try out the system and assess the learning experience and the effectiveness of the adaptation criteria in fulfilling their desires.

- Development an intelligence e-content design model that tracking of the student interests and the way that the student prefer to receive the educational content, it could see student's interests and the way he/she prefers without the need to question the student, but appear automatically, thereby increasing the level of quality and efficiency in the design of educational content and the level of attracting students (i.e. students who prefer always to read the summary, the design will present the summary automatically). .

- Apply and deliver the content design to the Moodle learning management system, using all features offered in this Moodle, and assess the design by learner using Moodle.

- Using e-learning design tools better than Lectora in the design of educational content to avoid all the problems of Lectora.

- Apply the "user center design" in the future during design e-course.

4.3. DIFFICULTIES AND PROBLEMS

- Inadequate resources
- Limited time
- Problems during use Lectora program, where the software turns off from time to time without doing any thing and our work lost if it doesn't save.
- Also the program is static and doesn't have database or question bank so, lack the flexibility.
- Experience was in the Hashemite University, where the university does not use the Moodle, and the content design loaded to the black board which is lack to the feature that the Moodle had.

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APPENDICES

Q#	Items	High	Above Average	Average	Below Average	Bad
1	How would you evaluate the accuracy of the e-content?					
2	How compatible is the content to the syllabus in this software?					
3	How beneficial is the presence of educational objectives in this software?					
4	How flexible are the examples, activities, exercises, and assessment?					
5	What type/s of media was/were used in this software?					
6	How would you evaluate the effectiveness of these inter-merging media types on enrichment of the e-content in this software?					
7	How would you evaluate the interactive nature of the user interface?					
8	How logical is the sequencing in the e-content?					
9	How effective was the use of real world examples on comprehension of educational content?					
10	How attractive to the learners was the audio and visual presentation?					
11	How compatible was the font size and type to all of the operating systems and web browsers used (Arial, Times New Roman)?					
12	How accurate is it to claim that there was a single idea in each page?					
13	Do you think that the e-content suffered any of the following inaccuracies?					
14	How effective was navigating the site map in helping to browse the e-content?					
15	How helpful was dividing the educational material into chapters, sections and lessons?					
16	How comprehendible was the icons and buttons in the software (did they need any guessing to understand)?					
17	How were the colors patterns of fonts and demo matching?					
18	How easy was it to locate which page you were in throughout the software?					
19	How helpful was the presence of "help"?					
20	How easy was it for you to reach any particular objects directly (key word, site map ,and drop down list)?					
21	How accurate is it to say that any particular object was reachable within three clicks?					
22	How beneficial was the use of a page counter (example, 1 of 5 pages)?					
23	How accurate was the linking used in the software?					
24	How helpful was it that the content was accessible via multiple routes?					
25	How advantageous was the presence of a timer and a progress bar in the software?					
26	How compatible are examples, activities, exercises, and assessment to the study objectives?					
27	How would u evaluate the interactive nature of the e-content?					

Curriculum Vitae

GENERAL INFORMATION:

- Name: Rasha Fae'q Suleiman Ja'afreh
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EDUCATION:

- MSc in Computer Information Systems / Middle East University For Graduate Studies / Amman /Jordan May 2009.
- BSc in Computer Information Systems / The Hashemite University / Zarqa / Jordan July 2006
- High School Certificate / Ministry of Education /Zarqa /Ajnadeen high school / August 2002

PROESSIONAL TRAINING:

- Developing Appli cation with The .Net Framework 2.0 Foundation ,
- Core Data Access Development with visual Studio 2005(ADO.NET),
- Advance Data Access Development with visual Studio 2005(advance ADO.NET),
- Core ASP.NET with Visual Studio 2005.
- Advance ASP.NET with Visual Studio 2005 Venue: ExecuTrain advanced training Company (July / 2006 to Aug/ 2006) with 180 training hours.
- Microsoft Office suite: Microsoft Word, Excel, Access, PowerPoint, Publisher, FrontPage.
- Operating Systems: WindowsXP, Windows2000, & Windows 98.
- Programming with: VB.NET, ADO.NET, ASP.NET, C++, Java, Visual Basic Web design with ASP and   HTML, fundamental of oracle & sql.
- MCP certificate with Developing Application with The.Net Framework 2.0 Foundation.

- Computer maintenance -- Hashemite University (Sep 2004).
- Total English (B) – ISP Center (Aug 2005 to Oct 2005) Grade: 96 (Excellent).

LANGUAGES:

- Arabic: Fluent in written and spoken.
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WORK EXPERIENCE:

- Teaching: Private School / Zarqa.
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