

Conceptual Graphic Design and Interaction Design of Learning Management System ATutor

Sasan Bahrami*

Eastern Mediterranean University, Cyprus; rampage.sasan@gmail.com

Abstract

Learning Content Management System ATutor, according to data found in this study, has multitudes of faulty User Interface and Interactive controls that should be resolved appropriately as per learners' needs. In relation to this, Learning Management Systems (LMS) and Learning Content Management Systems (LCMS) act as efficacious facilitators in educational environment. This study has evaluated the quality of LMSs, LCMSs and ATutor as case in Human Computer Interaction checklist to increase the fluency of these systems. This research has been assessed ATutor an Open Source Learning Content Management System based on Human Computer Interaction criteria in terms of Conceptual Graphic Design and Interaction Design that had been conducted on a General Survey Model based on descriptive analysis data. Appropriate suggestions to faulty controls including solutions for elimination of redundancy and errors in some controls, substitution of proper technologies and expansion on system capabilities in other controls has been provided based on this assessment.

Keywords: ATutor, Conceptual Graphical Models, Interaction Design, Learning Content Management Systems, Learning Management Systems

1. Introduction

In today's world of population explosion and rapid technological advancement, people are required to be educated, while universities and educational institutions do not possess enough space to allocate all learners. Thus technology plays a prominent role as an optimized learning medium, and Web would be of great communication channel for transferring knowledge. In modern world, the same amount of attention for quality of education that has been given in universities and educational institutions in past should equally be provided for the technologies of today, owing to the fact that they are as crucial as the physical learning institutions.

Learning Management Systems and Learning Content Management Systems are learning technologies that were assessed in this research. These systems are technologies running on web browsers, and the quality of presenting and interaction of them affect directly on learning quality, subsequently their presentation and user interaction should be established as flawless as possible.

This study has dealt with assessment of LCMS (that has chosen ATutor as the case study) in terms of Conceptual Interface design and Interaction criteria stated as Basic Principle Bloopers and Interaction Design Bloopers by Johnson¹.

1.1 Conceptual Graphical Design

Graphical Conceptual Design of ATutor is one of the measurement which this research has taken into consideration; these graphical concepts are of those that are very basic protocol that every interactive application and interface should assess at early prototyping stage of a system's interface, while there are multitudes of these criteria, this author had chosen followings:

1.1.1 Balancing Consistency

"User Interfaces should foster the development of usage habits"¹.

*Author for correspondence

1.1.2 Display Inertia

“Closely related to the principle that the screen belongs to the user is the principle of display inertia”¹.

1.1.3 Responsiveness

Required availability of the system upon user's requests.

Listed above criteria are stated as bloopers by Johnson¹, that ought to be resolved from a system to decrease users' confusion and increase his/her comfort and satisfaction during the time she/he utilizing the system.

1.2 Interaction Design

The second category of criteria which has been assessed in this study is the Interaction of ATutor/LCMS. Fundamentally interaction here is correlated with interaction as a part of Human Computer Interaction, which consists of the definition of interaction between machine and human with the consideration to both disciplines' constructing criteria. And in other respect HCI fabricated from metaphors and analogies each of which establish an analogy to different concept that has specific impact in the design of User Interface². These metaphors consist of:

- Desktop metaphors; In other words display screen contain arrangement of objects.
- Direct Manipulation Metaphor; User interaction with object on the screen.
- Document Metaphor; Browsing and entering data on electronic documents.
- Dialog Metaphor; Interaction with computer as modes of carrying a conversation and dialog.

In some studies, authors define HCI with three terms that consist of User, Computer and Interaction. User is a specific individual or a group of individuals, Computer as a technology or as a medium and Interaction as the act of getting Computer and Users interact³.

Since this research is pertaining to the assessment of ATutor, there are some criteria for its evaluation in the perspective of Interaction. Some of them have been defined as bloopers by Johnson¹ these criteria are as follow:

- User Restriction Interactions; constrained controls causes user to consume more time that it needed to finish a task.
- Confusing Conceptual Models; Concepts in design where it is uncomfortable for users to digest and learn to work.

- Unnecessary Choices; Listing options that are not required to be chosen.

1.3 Learning Content Management

Learning Content Management System (LCMS) has been designed properly to authorize, sequence and establishing aggregation tools that construct content to help the learning system and process. LCMS has the possibility of customizing in the form of its interface according to particular organizational requirements to be considered by its users, and it has the ability to manage the learner's profile, course catalogue and Etc.

Course director in LCMS possess the capability to intermingle all contents in a single system, these contents include Word files, PowerPoint presentations, Flash animations and assessments, and thus distribute throughout the departments. It could be utilize to apply structure to create and thus deliver specific courses⁴.

1.4 ATutor

ATutor is an open source fully accessible and adaptable LCMS which has been designed to be this way. ATutor is the first LCMS that comply with the accessibility feature of W3C WCAG 1.0 at AA+ level that provide access and privilege to types of users view and administrations. It also possesses conformity with XHTML 1.0 that interceded to ensure that ATutor is running consistently in all compatible technologies^{5,6}.

Developers of ATutor stated that it is merely fully accessible LCMS which is available in the market. ATutor has been stated in many scholarly articles and multitudes of technical reviews, and also lots of third party extensions in world have been provided to use ATutor^{6,7-11}.

2. Methodology

This research has been conducted in survey (screening) model based on descriptive analysis data. In this study ATutor a LCMS has been assessed in terms Conceptual Interface design and Interaction design, Basic conceptual design and Interaction design principles have been defined by Johnson¹. The assessment checklist includes two main criteria (Conceptual design and Interaction Design) and 6 sub criteria (Consistency, Displaying Inertia, Responsiveness, User Restriction Interactions, Confusing Conceptual Models, and Unnecessary Choices) among others. The most recent published version (version 2.0.3) of ATutor LCMS has been installed and utilized on a personal computer¹².

3. Findings

3.1 Conceptual Graphical Model

3.1.1 Balance the Consistency

As Johnson¹ stated “User interfaces should foster the development of usage habits. When using interactive software and electronic appliances, users want to fall into unconscious habits as quickly as possible”¹.

With the consideration to Consistency rule (John et al., 2005), the specific LCMS ATutor contains some pages where it has been lost consistency and on the contrary in some other parts it had exceeded the usage of consistency; e.g. instead of having fluent workflow, users make difficult attempt to navigate the system to find the parts like Management of the courses or when they enter a Course, the architecture of the page layout totally changes to a different layout from Start page to Course Home, where it contains multitudes of nested tabs that could be a cause for confusion for general users (Figure 1).

In terms of graphical layout, author should provide a design that are same in other parts and others systems that have been experienced previously¹. ATutor's Instructor's

view, too many nested tabs causing user confusion; it should have been designed in such a way that is easily accessible. In addition, Index page could have been more consistent where all menus and sub-menus for courses to be same (Figure 2), thus follow the consistency rule (John, 2005).

3.1.2 Displaying Inertia

The principle of Displaying Inertia is one of the crucial issues which most LMSs and specially ATutor has the problem.

“Closely related to the principle that the screen belongs to the user is the principle of display inertia”¹p.58.

ATutor is one of the LMSs with poor UI design which user-centered principle is not considered, and it is not focus on user's task. If the instructor needs to change the content of the course and even such change is small, the page will refresh and it scrolls to the user's/instructor's top page and then the user should examine the page and then confirm where s/he was, which cause a bit of user confusion and s/he would became disoriented.

For these kinds of issues it is highly suggested to use web technologies which do not reload the page to retrieve data and come back. Thus it is more efficient to use technologies which would not cache like JavaScript and AJAX. However, it is not recommended to use systems to cache the system in high speed where you need to change huge amount of details, for instance all course's layout and design of the major layout. Although this principle has been considered in LMSs previously, but it should be focused for clearer and consistent User Interface.

3.1.3 Responsiveness

In view of user interaction of a system, Responsiveness plays an important role. In LMSs, in this case ATutor,

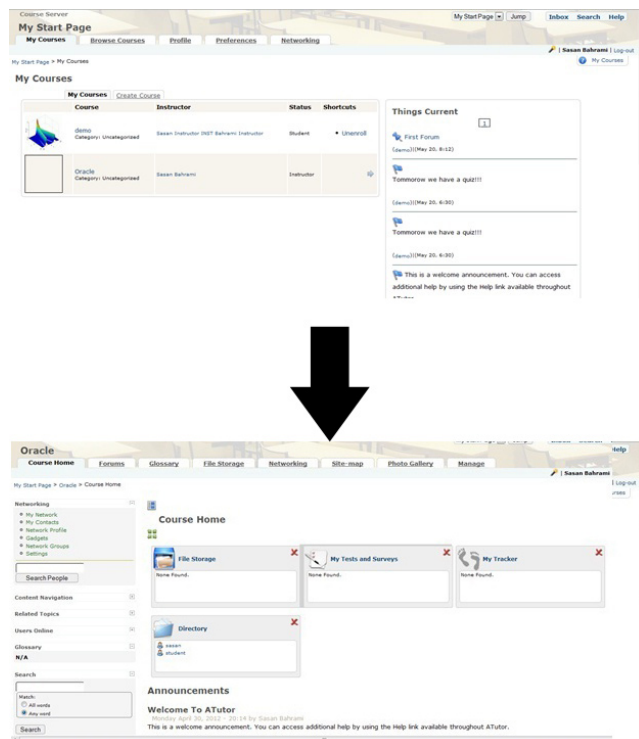


Figure 1. Starting page to Course home and the amount of inconsistency and independency.

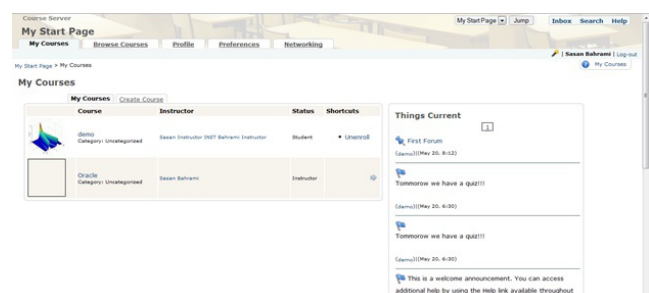


Figure 2. Start Page, where all published courses will be viewed in the same page.

the time user required to interact with system the issue of responsiveness of it would become a crucial criterion to be taken into consideration. Because in learning systems, time and concentration have great importance. So far as it has been highlighted that LMS is a system which implemented on web platform, one of the issues which accounts for weaknesses of the system and always has been dealt with, was responsiveness of web from past up to now. In the case of ATutor, when system refresh the page each time it needs to retrieve information from the server then display it on the browser. The process may cause time consumption in larger perspective, by that it cause loss of concentration by technical affairs like scrolling the page, therefore a constructive suggestion here should be provided in terms of fluency and flexibility of the system¹.

According to author's view the suggestion that noteworthy is the utilization of programming techniques which dissolve the gap from the user's request time and its response time that is recommended for LMSs. Owing to the fact that they are learning systems they must not have so much difference from desktop applications in response time and usage of techniques like Asynchronous JavaScript and XML or better to say AJAX could make a great progress in parts where users want to interact with information that is going to be retrieved from server or just the contrary when users required to update data and information on server.

3.2 Interaction

3.2.1 User Restriction Interactions

It has been proved that a robust user-centered design should contain any user restrictions. These kinds of restrictions could be in multitudes of places and different controls of the system that cause a user to waste so much time in finishing a task that they required to do. Generally anything that limits users in terms of interaction and a kind of bothering them should not be attempted.

These types of restrictions is obvious in different menus where the user required to upload particular data and they have some limitations such as restriction in number of characters for a data field, or in some other parts expose them to a specific executions that are meaningful only to the developers, or in some other parts utilizing numbers and symbols that have meaning for developers in places that users need to change a property according to numbers to the power of two and restrict them (Figure 3).

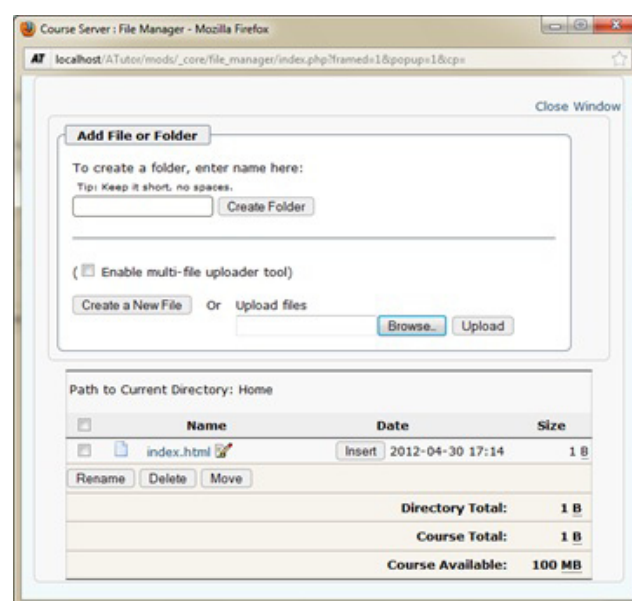


Figure 3. Course content File Manager Prompt.

As far as this research concerned and observed, not all parts but some parts provide restrictions to users, one of these restrictions that is crucial to users of this web based system is in places where the instructors required to upload data and course materials for the lessons which it accepts merely some specific file extensions which could be taken into consideration (Figure 3).

Because of these kinds of restrictions users are not fully satisfied, and they need to conduct something more than that limits of restriction to reach their specific task's objectives.

In any of the provided parts restrictions are kinds of problems for users of the system. Might these types of restrictions are clear to developers' technical mindset such as limitations in set of characters for a specific form, it cause time consumption for users. LMSs are provided to fasten the educational systems' speed, thus if they take more time than it is expected then it is not worth to implement.

In case of ATutor has same type of restrictions in instructor's view, and when an instructor required to upload the course content for his/her students, actually it is limited to same set of file extensions (Figure 3). This research suggests to heightening the functionality of the system to accept different formats and open slots for varieties of extensions that users could possibly have in their system.

3.2.2 Confusing Conceptual Models

The Conceptual model is one of the important issues in terms of interaction which a system provide its users with. It is the part of system's requirement to provide systematic and easy to learn conceptual model for its users. Therefore, they digest the functionality of the system and it is like the heart of the design which would be designed by storyboards in the early prototyping stage in a way to be functional for users. Thus users learn the system with ease and in less amount of time and utilize it for a long time.

The conceptual design of ATutor contains some weaknesses as conceptual model. One of them is the networking link two times in Course Home, once in tabbed panel at top of the page and another in quick panel on the left which both of them redirect user to the same page with no difference. Such problems cause confusion for the user at the first glance (Figure 4).

Another weakness in conceptual model is the redundancy of course notification in multiple places. When a course have been created by an instructors it will be announced in all others pages, thus the user would confuse if they have taken that particular course; same is the case for the instructor if they should assist and instruct that course; they might also have confusion by its initial label of status which is "Student" (Figure 2).

The suggested solution for this problem is to eliminate the Networking link on the left, in this way not only developer omit this redundancy, but also s/he opened a new space for other links which have been placed underneath it like content navigation, related topics and others.

The next issue to mention that could be allocated in this principle's framework is the suggestion for publishing a course by instructor, which cause confusion in

users because they might not require enrolling a specific course, and they will see all other instructors' courses. Therefore when they need to open their own course, they face multitudes of courses and consume some time to find their own course. Owing to this fact this author recommend ATutor to dissolve this issue by providing a specific emailing system that privately email each user containing students, assistants or second instructor of the course, by sending each an invitation to whom have been chosen by main instructor or administrator by a self-generated emailing system.

3.2.3 Unnecessary Choices

Another item to mention in terms of interaction design of either desktop or web applications is to avoid putting unnecessary choices for users. Including an option that are not required to be chosen is another problem in interaction which this research has taken into consideration.

Although this problem has been mentioned in previous problem statement, it is also included in this principle as well for ATutor/LMS interaction design. In this author's view containing course list that have not been enrolled and/or not been instructed by a particular instructor does not required to be in the course list (Figure 2).

These types of mistakes cause extra time consumption and wrong interactive system fabrication in the area where smooth interactivity with users is compulsory for a web application. This research provide suggestion for course list in previous part, it required to be expressed again from another point of view.

The suggestion is to eliminate courses that have not been enrolled in the course list, and again by same opinion the time that a new course have been created, system could send email notification to course crew and students and checking their verification in the time sign in, in advance of enrollment. Thus in general view it could have provided first an automatic emailing system and, required an email verification by web to verify its users if they are actual users or instructors.

4. Discussion

The purpose of this research is dealt with the quality assessment of LCMS in this case ATutor in terms of Conceptual Graphical Design and Interaction design and to provide more fluent design approach. The criteria per se consist of sub criteria of Balancing Consistency, Displaying Inertia and Responsiveness included in

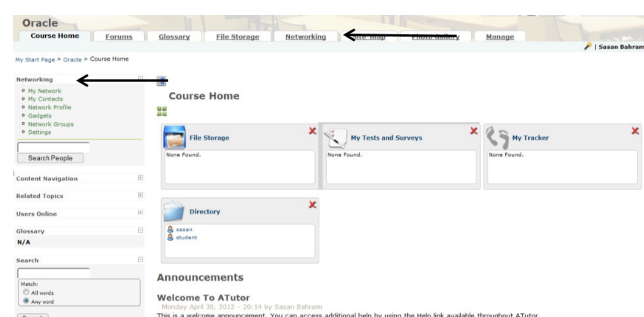


Figure 4. Course Home, where networking link have been used both in tabbed and side panel.

Conceptual Graphical Design discipline and User Restriction Interactions, Confusing Conceptual Models and Unnecessary Choices included in Interaction design. These criteria have stated as Bloopers by Johnson¹. This study has been established to decrease the troublesome interacting features of LMS and LCMSs and suggestion for better design of such systems, hence increase the productivity of learners online.

Generally the solutions suggested in this study were assessed according to human computer interaction usability and user experience checklist from the principles defined by Johnson¹ and in a larger perspective they suggest to decrease the redundancy and troublesome design in parts like Consistency of the system, and employ different technologies in Displaying Inertia and Responsiveness, and expanding the system capabilities in User Restriction Interactions. Last but not least apply another technology in the purpose of more privacy and organization in Confusing Conceptual Models and Unnecessary Choices.

This study raises the problematic controls of LCMS ATutor, like lack of Consistency, Displaying Inertia, Responsiveness, User Restriction Interactions, Confusing Conceptual Models, and Unnecessary Choices.

The suggestions that have been given to the problems mentioned would overcome the faulty controls of ATutor LCMS either by removing problematic parts or substitution of different techniques and technologies. The reason for bringing these suggestions is that they will make system flawless in terms of Conceptual Graphical Design and Interaction Design, thus a LCMS with higher quality would be the outcome.

Because the criteria has been proved previously by Johnson¹ and are of appropriate filters that every interactive systems would be run through that to improve the quality and to make it more fluent and sensible user interaction, It is taken that it would be proper criteria for ATutor as well. The suggestions given to problems in this research would omit these faults, therefore they are appropriate and logical solutions, and would be proper response for the problems and suffice them.

Each individual suggestion in the findings take part in improvement of the whole idea of increasing the quality of LCMS ATutor as a whole, owing to the fact that each of them are more qualified alternative to the existing controls that have been used. Conceptual Graphical Models, Interaction design and their sub-criteria that has been highlighted earlier have strong relationship together in a

way that both are part of wider perspective Machine-Man Interaction, and both are complimentary criteria to each other, and ought to be created based on each other, hence the unity of these, which has been designed in a proper way that has been suggested for each would provide a fully fluent interactive system, thus in general they form fluent and flexible system which optimize the time and resources of learners.

According to the author's view it is vitally suggested that every interactive Learning Management System or Learning Content Management System ought to run through all criteria that has been assessed here to be molded in an appropriate manner. The suggestions for the future is to expand these criteria and their sub-criteria to its highest level of accuracy and adding other criteria like Graphical User Interface, Layout, Textual controls, Navigation and Management Controls to compliment these as a more complete assessment, and utilize it as a filter for usability testing and user experience design of other distance educational systems such as Massive Online Open Course (MOOC) which is widely used today.

5. Conclusion

In today's world where education plays an important role in growing societies, online education would be indeed a great way to suffice this need. LMS and LCMSs are of the systems which could be used for this purpose; these systems are using not only in distance education but also in actual type education where there exists face to face interaction, hence the evaluation of such systems seen as important issue to increase the quality of education.

This study has been dealt with quality assessment in terms of Conceptual Interface Models (Including Consistency, Displaying inertia, Responsiveness) and Interaction design (User Restriction Interactions, Confusing Conceptual Models, Unnecessary Choices) on ATutor one of the Open Source Learning Content Management Systems, and to suggest more fluent and flexible design for them.

The findings in this research provide robust solutions that would be best substitutions instead of technologies and the controls that have been used in ATutor. In some cases like redundancy the elimination of problem has been suggested and in other parts the substitution of more appropriate technologies has been recommended.

It is seen that fluency in such systems is highly required, and the same type of assessment would be required for

different LCMSs that begin to spread in future as well. Furthermore future LCMSs should be evaluated in terms of Interactivity, Conceptual Design, User-centered ness and usability to decrease the possibility of problems and faulty designed controls which the users would face in future and increase the performance of education.

6. Acknowledgement

This research has been done fundamentally in Eastern Mediterranean University and under School of Computing and Technology as part of the thesis for Master of Technology, with the supervision of Assist. Prof. Dr. Ersun Isgioğlu, and with the support of School of Computing and Technology's dean Assoc. Prof. Dr. Mustafa Ilkan.

7. References

1. Johnson J. GUI-bloopers 2.0 common user interface design don'ts and do's. The Morgan Kaufmann Series in Interactive Technologies. USA: Elsevier; 2008. p. 8–288.
2. John W, Satzinger J, Robert B, Jackson D, Burd. Object-oriented analysis and design with the unified process. Thomson Course Technology; 2005. p. 440–527.
3. Beale R. Introduction to HCI. Lecture in Birmingham University; 2007. Available from: <http://www.cs.bham.ac.uk/~rxb/Teaching/HCI%20II/intro.html>
4. Greenberg L. LMS and LCMS what's the difference. ASTD's Sources for E-learning; 2002. Available from: http://scripts.cac.psu.edu/staff/g/m/gms/fa07/IST-440W/LMS%20and%20LCMS_%20What's%20the%20Difference_.pdf
5. Gay G. General documentation on ATutor. ATutor; 2005. Available from: <http://www.atutor.ca>
6. Chisholm W. W3C recommendation. Web Content Accessibility Guidelines 1.0; 1999. Available from: <http://www.w3.org/TR/WAI-WEBCONTENT/>
7. Looi C. Artificial intelligence in education supporting learning through intelligent and socially informed technology. Netherlands: IOS Press; 2005.
8. Amant K. Handbook of Research on Open Source Software: Technological, Economic, and Social Perspectives. USA: Information Science Reference Idea Group Inc (IGI); 2007.
9. Li Q. New horizon in web-based learning. In: Cheung R, editor. 2004 Proceedings of the Third International Conference on Web-based Learning (ICWL 2004); Beijing: World Scientific Publishing Company; 2004 Aug. ISBN 981-256-029-7.
10. Clark S, Baggaley J. Technical Evaluation Report 37. Assistive Software for Disabled Learners. Int Rev Res Open Dist Learn. 2004; 5(3):1–6. Available from: <http://www.irrodl.org/index.php/irrodl/article/viewArticle/198/280>. ISSN: 1492-3831.
11. Tweddell Levensen K, Orngreen R. Locating student's competencies: a prerequisite for collaboration. In: Williams R, editor. Proceedings of the 2nd European Conference on e-Learning (ECEL 2003). Glasgow, Scotland: Caledonian University Glasgow; 2003 Nov 6–7. p. 261–6.
12. Iscioglu E, Bahrami S. Graphical user interface and graphic design and layout of ATUTOR LCMS. 2012 Fifth International Conference of Education, Research and Innovation. Madrid, Spain: International Academy of Technology, Education and Development (IATED); 2012 Nov 19–21. p. 3121–7.