Indian Journal of Science and Technology, *Vol 11(24), DOI: 10.17485/ijst/2018/v11i24/123052,* June *2018*
ISSN (Print) : 0974-6846
ISSN (Online) : 0974-5645

A Group Comparison of E-learning Authoring Tools in Educational Production and Management

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Abstract

Background/Objectives: Cloud computing could be considered of vital paradigms in IT which allows services to be delivered to the users via the internet on demand and on pay as you go basis. The growing demand on cloud computing environments increasing the number of datacenters which in turn increase the amount of power consumption in datacenters along with cooling equipment. Load balancing is considered a major challenge affecting in cloud performance **Methods:** An existing problem is how to allocate Virtual Machines (VMs) to Physical Machines (PMs) or hosts. This process is called VM placement. An algorithm is proposed that can reduce power consumption. **Findings:** The proposed algorithm assigns VMs onto PMs based on first fit decreasing algorithm and improves an existed one through reducing power consumption by turning-off some under load hosts if available and migrating their VMs to other active hosts. **Application:** The presented approach could decrease significantly energy consumption in comparison with the existing one through migrating VMs from underload hosts and turns them off.

Keywords: Adaptively, Authoring Tool, E-learning, Selection Criteria

1. Introduction

Rapid advancement in information technology and its tremendous impact on learning fields and combining IT with theories of education creates a new and interdisciplinary field called "Electronic Learning" (E-learning); such a field that while approximating ideas of educational scientists with IT and computer scholars has brought an appropriate basis for quality improvement in educational environments through utilizing advantages of technology and also matching it with personal characteristics and strengths of learners. Noticing the high number of internet users globally and even in developing countries, especially Asian countries having high number of internet users, such as Iran with 37 Millions of internet users as of 2017 (Report on national newspaper, Donyay-e-Eghtesad, dated 7th March 2017) and developing knowledge services in universities and placing E-learning development in long-term plans along with serious investment in this field shows the importance of E-learning industry. The key role of authoring tools in accordance with knowledge development is revealing.

- Increasing the quality of leaning and knowledge of learners.
- Easing accessibility to high volume of existed knowledge and data of the whole world.
- On-time and rapid access to information in a very short period of time.
- Reduction of some educational costs.
- Accessibility and possibility of interaction between researchers and more number of scholars and scientists.

As lots of educational centers especially universities considered this kind of training in their long term plans, they have invested a large amount of money in this field. Among all of software and tools related to this kind of training,

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the importance of authoring tools regarding their key role in educational content authoring is inevitable. These tools were present since the time of emergence of computer based trainings and have been used since the early years of 1990s for creating multimedia CDs[1,2]. Ending years of 1990s, due to empowering the role of internet in distance learning, main market players started to provide educational content authoring tools in high volume files and in special formats through internet[3,6]. Eventually with the rapid advancement of technology and to overcome the issues related to these kind of special formats, a new generation of authoring tools in E-learning emerged which have been designed especially for content authoring in E-learning. Nowadays, there are a vast number of authoring tools with various capabilities and facilities in E-learning market and also there are special weakness and strength points for each of these tools, which seems choosing the suitable one for users of these kind of tools is not that easy. Therefore, determining the base factors and criterions in choosing these tools is always the main concern of researchers in this field[4,5]. But it should be kept in mind that surely presence of these kinds of criterions is not enough on its own, because what is led to increase understanding and facilitate decision making for education industry owners is comparative and consensus analysis of advantages and disadvantages of these tools and comparing weaknesses and strengths of them which so far, a few number of studies has been done in this area.

2. Review Literature and Background

2.1 Content Authoring: Definition and Investigating Authoring Tools

The term "Authoring tools" might seems referring to advance software used by professional authors which is designed for word processing, while the abilities of authoring tools in E-learning is not limited to just "writing" or "word Processing". There are various definitions for these tools which their common concept can be referred as: "the E-learning authoring tools helping professors in utilizing a wide range of media for creating professional, interactive, and attractive educational materials. Also, some of these tools include features that provide the possibility of repurposing educational elements and subjects of a course for reusing them in future courses". Considering various goals and approaches utilization of these kinds of tools, there are various outlooks in classifications of these tools in E-learning that can be summarized into three main groups of:

2.1.1 Web Authoring Tools

In each course, the materials that should be presented in electronic format can be considered as a webpage; therefore, any tools which is used for creating web pages is also can be used as a tool for creating e-courses. Some of these tools can be named as HTML editors [such as 'Dreamweaver', and 'Front Page'] and interactive advance software [such as 'Director' or 'Flash']. Today, most of the e-courses are presented with the help of these tools.

2.1.2 Course Authoring Tools for Common User

For using these kinds of tools users do not need programming skills and so on and are usually provided as templates or form based software and learning and using them is very simple.

'Lectora Publisher', 'Tactic!' and 'Web Course Builder' are some of these types of software.

2.2 Professional Course Authoring Tools

These tools are designed specifically for creating e-courses and have the ability of flexibility while designing. Some of these tools such as 'Authoware', 'Tool Book' and 'Quest' can be mentioned. It is surprising that e-courses designed with these authoring tools in terms of advance graphical features and animations are competitive with E-sports games.

Advantages and disadvantages of each mentioned group is summarized and compared in Table 1; it is also worth mentioning that two other groups can be added to the mentioned groups which might have not those features and capabilities but promising emergence of new generation of these tools.

3. Findings

3.1 PowerPoint Format Convertors

These types of tools can automatically create e-courses from created documents by common software such as Microsoft word/PowerPoint. Some of them are capable of simply converting a PowerPoint format file into a Flash file or any other format related to web pages. Some of these

Table 1. Comparison of various types of authoring tools

Group	Advantage	Disadvantage
Web Authoring	Common in market, stability of tool and having various features	Being multipurpose tool, not specially designed for E-learning
Course Authoring Tools for Common User	Simplicity of learning and great for rapid development	Limitation in framework of tool
Professional Course Authoring Tools	Flexibility and freedom of action in creativity, the possibility of designing course with all considered capabilities	Need programming and coding skills and assembling elements by the user

tools can be mentioned like 'Impatica for PowerPoint', 'Power Convertor', 'Viewlet Builder'. Some other tools such as 'Articulate Presenter' provides the possibility of adding electronic educational elements like tests and tracking learners. This is conducted by adding some additional menus to Microsoft PowerPoint software. Utilizing these kinds of software is very easy and the time spending for design is also short but the final product will look like an electronic presentation rather than an e-course.

3.2 Simulator Authoring Tools

Simulator software is not a new concept but what is new is the utilization of simulation technology in E-learning. Almost 75% of contents of E-learning is allocated to topics related to application of software which among them, the simulation tools plays an important role. Some of these tools can be mentioned as 'Dazzler Max', 'Demo Robo' [last version of this software named Captivate], 'RapidBuilder' and 'Camtasia'.

3.3 Effective Factors in Selecting Appropriate Authoring Tool

Various factors are effective in selecting the appropriate authoring tool that out of them factors such as cause and the traits of conditions that learning/teaching is occurring should be mentioned. Determining the needs, facilities and priorities of organization in the form of a checklist and also clarifying managers' expectations from E-learning system can help dramatically in decision making and optimal selection of tools among a wide range of features and facilities of existed tools[7]; the most important characteristics and features are as following:

- The ease of use against unlimited creativity.

Noticing the five studied group and facilities and features of each group, it is better to consider a balance between the ease of use and features of tool in creativity while selecting the suitable software.

3.4 Compatibility with Other Software and Systems of E-learning/training

Each software system can interact with other systems of the same filed through compatibility to certain related standards and hence the E-learning/teaching technology is also follows the same rule. While discussing topics related to E-learning, there are multiple sets of technological standards and some others are also developing. As of now, four fundamental standards are: IMS Global Learning, AICC, SCORM, Consortium and Microsoft LRN. Also, this point should be regarded that authoring tools are supporting different standards; therefore, compatibility with educational management system of the organization is one the characteristics that should be considered while selecting the aimed tools.

3.5 Evaluation Features

Evaluation features might be considered as one the most attractive sections of an authoring tool for teachers that can cover various testing methods such as multiple choices, writing quiz, fill the blank, true-false, etc. Meanwhile, noticing this point seems essential that selecting the authoring tool in accordance to considered testing method of designer will definitely be effective in presenting richer and more productive contents.

3.6 Multiple Educational Paths

Each e-course can be considered as a linear path that should be walked by learners. This path can have multiple branches due to compliance with various needs of learners and the possibility of personalization To answer this issue, some of the authoring tools have special features to create variables of determining branch that can

be authored based on criterions such as educational goals, users' preferences, method of studying, etc.; therefore, each learner can follow 'his/her own customized path' by applying these variables. These kinds of courses, despite the complexity in design process, can definitely lead to increase efficiency of E-learning systems.

3.7 Supported Files and Media

Most of the authoring tools support common file formats such as JPG, WAV, GIF, etc. More advanced voice and video formats can be found in more complex tools. While selecting this feature of tools noticing some factors such as software-hardware facilities of user, bandwidth and such are inevitable.

3.8 Developability

Some of the organization should apply some changes in their authoring tool to comply with their specific goals; this trait called developability. For this reason, the necessity of using an open source tool and having skilled programmers in designer team is highly effective in achieving the goals of organization.

3.9 Cost

The cost ranges of authoring tools vary from a few hundred dollars to multi thousand dollars. Choosing an effective, efficient and meanwhile within the estimated cost is undoubtedly as of a great importance for managers and industry owners.

3.10 Comparative Analysis of the Most Existed Tools

Noticing features and facilities of various types of authoring tools, main criterions in choosing tool and also the most famous and common tools of each group, these tools can be compared to each other from stated viewpoints (Table 2). Costs till $1000 are indicated with "A" and between $1000 to $5000 are indicated with "B".

4. Ease of Use

As it can be seen in Table 2, increment in the level of capabilities and features of software will lead to complexity and using the software is harder for common users and needs higher levels of knowledge to use the tool. This

Table 2. Comparison of the most important authoring tools from the studied criterion's viewpoint

No	Tool criterion	Ease of Use	Standard	Evaluation Features	Develop ability	Platform	Cost
1	Articulate	Very simple	Limited aspects of AICC, SCORM	A question per page	-	IBM	A
2	Author ware	Hard	AICC, SCORM IMS,ADL	Multiple choice, T/F Matching, Drag and Drop	-	IBM–MAC	A/B
3	Dazzlermax (Standard and Deluxe)	Simple	AICC, SCORM IMS	Question wizard	-	IBM	A/B
4	Flash	Mid Range	-	Multiple Choice, T/F, Drag and Drop	-	IBM/ MAC	B
5	Lectora	Simple- Mid range	AICC, SCORM	Multiple choice, Matching, Drag and Drop, hotspot, the possibility of weighting questions, can receive input file	-	IBM	B
6	Quest	Simple	AICC	Multiple Choice	√	IBM	B
7	Toolbook and (Instructor(Assistant)	Mid range, Hard	AICC, SCORM IEEE IMS, ADL	Multiple choice, T/F Matching, Drag and Drop	√	IBM	A/B
8	Web Course Builder	Simpler than PowerPoint	AICC, SCORM 508	Multiple choice, T/F fill the blank	-	IBM	A

spectrum of knowledge can be varying from pressing a button in the simplest studied software ('Articulate') to needs to programming in the most advanced tool (such as 'Authorware', 'ToolBook' and 'Quest').

4.1 Supporting Existed Formats

In terms of supporting existed formats all of the investigated tools somehow support some of the existed standards in E-learning/teaching field (Table 2) among them; 'Web Course Builder' is the only tools that support 508 regulations. Courses built upon the fundamentals of this regulation provide access to electronic documents for disable people (especially blind people in e-leaning filed).

4.2 Evaluation Features

Regarding Table 2, among all of the investigated tools, Lectora placed in the first rank in terms of evaluation features. Moreover to the common features for designing a test, using this tool will provide the ability of defining "sensitive points" (points that connect a question to a certain object), which this feature is very helpful in such tests for recognizing a product or locating a place and so on. Also, Lectora made it possible to determine weight and point for each question or saved file in 'Excel' or 'Access' format can be used as input for saving time.

4.3 Develop Ability

Among mentioned tools, only 'Quest' and 'Toolbook Instructor' give their user the ability to develop their own tool (Table 2). 'Quest' with having a tool called 'Quest C' provides access to 'DLLs' of Windows Operating system and C Programming Language. Also, with the help of a robust error detector it is possible to rectify errors in all of the designed programs and objects. Users of 'Toolbook Instructor' are also can code on their own using 'Open Script' programming language or without the need of coding through a programming tool called 'Action Editor' without pressing a button on keyboard, use the mouse key strokes.

4.4 Efficient Infrastructure

Considering the global reception of IBM PC infrastructures, created courses by all of the studied tools can be running on this infrastructure. Only two advanced tools of 'Authorware' and 'Dreamweaver' ('Flash' to limited levels) provides running on Apple Macintoch that can distinguish them among all other competitors.

4.4 Cost

As it can be seen in Table 2, with the increment of features and capabilities, the price tag of these tools increased. In this term, one of the advantages of 'Authorware' is that, it is supplied with the $1000 price tag for educational and academic purposes. Also, 'Course Builder' is also can be ordered for free along with 'Dreamweaver' as a helper application.

4.5 Other Features and Facilities

Some of the authoring tools have features and capabilities that distinguish them from competitors. For example, precise lookout, analysis of answers of learners to questions and providing feedback in two 'Quest' and 'Toolbook Instructor' tools can be mentioned.

'Authorware' with the help of a media library is performing highly sophisticated in designing multilingual courses. One of the advanced features of 'DazzlermaxDelux' is called 'Predictive pre-load'. This feature identifies the bulky files that should be preloaded while progressing the course to avoid any lag in presenting the educational materials.

5. Conclusions

Considering the results of comparative analysis of authoring tools, it can be stated that the method of choosing the best tool is highly depended on the condition of its usage. Before any analysis, determining the range of training, cause, condition and method of presenting it are of great importance. Moreover, for each of the authoring tools, its features and capabilities should be analyzed separately and proportionality rate of that tool with needs, priorities and approaches of considered organization and educational environment should be assessed.

Regarding the fact that today's two concepts of "compliance with the needs of learners" and "personalization" have special place on all of the applications based on internet and specially E-learning/teaching tools and also noticing this fact that development of most of the E-learning systems that somehow cover these two concepts has taken place in research facilities and universities and hardly a

commercial tool can be found that covers these concepts; authors of the current study can suggest study and analysis of necessities and required backgrounds for developing such authoring tools and also investigating applied views and methods in laboratory and research samples as further investigations consistent with the objectives of this study.

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