International Journal of Computer & Information Technologies (IJOCIT)
www.ijocit.org & www.ijocit.ir
ISSN = 2345-3877

Identifying and Prioritizing the Necessary Indicators for Producing Standard Electronic Content

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Abstract: - The development of information technology and internet give e-learning a chance to find its place in the educational system quickly. With the appearance of new subjects like smart schools and nationwide school networks, the subject of electronic content production is introduced. Considering the fact that standardization of produced content will lead to reproduction cost reduction and educational goal integration, in this paper the necessary indicators and their prioritization is studied. This study is applicable from objective point of view and its research method is descriptive/survey. The random sampling method is applied for the statistical population of this study which includes experts from academic group of Fars state of IRAN. To gather the required data and literature review, the basic information was acquired from libraries studies and related available documents and in the next phase field and survey methods were utilized. To analyze developed information and statistical data SPSS software and to prioritize necessary indicators for producing standard electronic content Analytical Hierarchy Process techniques (AHP) and the Expert Choice software were utilized. The necessary indicators are categorized in six groups or main indicators and 16 sub indicators which the results show that these factors in order of priority are: Quality, Enabling the learner, Performance, Accuracy, Organization and universality, and Multimedia.

Keywords: E-Learning, E-Content, Standardization, indicators, AHP.

1. Introduction

Generally E-Learning is using new technologies to provide appropriate access to information and equal educational opportunities for everyone via the Internet [1]. Considering E-Learning applications, repeating the same contents and concepts in different educational systems will be waste of time, scientific assets and economic costs. Thus standardization of electronic content in order to solve the aforementioned problems is necessary.

In a general form, the documents in electronic format that build the interaction between learner and educator are called Electronic Content. E-learning content typically includes text, images, audio, video, animation and simulation [2]. There is no doubt that using electronic content with animation and video in teaching and learning, provide a better understanding of the course material.

Standardization of educational content is an important topic. Although in standardization we are always looking for obstacles and restrictions, but it improves the consistency and the ability to aggregate content in the standard system [3].

In this research, standard e-content factors are identified and prioritized with AHP method. In the following, section 2 declares a general outline of the study. Then section 3 represents methods. Section 4 presents the study results and discussions. The content of paper will end with the conclusions in section 5 and some recommendations in section 6.

2. General Outline of the Study

The main goal of this study is identifying and prioritizing the necessary indicators for producing standard electronic content. In the following, the secondary objectives are listed:

2.1 Secondary objectives

1. Evaluating the effect of accuracy in the production of standard electronic content
2. Evaluating the effect of organization in the production of standard electronic content
3. Evaluating the effect of enabling learner in the production of standard electronic content
4. Evaluating the effect of performance in the production of standard electronic content
5. Evaluating the effect of quality in the production of standard electronic content
6. Evaluating the effect of multimedia in the production of standard electronic content

2.2 Research hypotheses:

Considering the identified factors via studying library resources and survey among different teachers from different grades following research hypotheses were obtained and then analyzed:

1. The accuracy, organization and universality, enabling learners, performance, quality and multimedia have the positive impact on the production of standard electronic content.

2. The content, accuracy, age-appropriate learning, having rich content have a positive impact on the accuracy of the standard electronic content.

3. The content logical organization, cover all the topics of content and proportion between time, and content have the positive impact on the organization and universality of standard electronic content.

4. The attractiveness, grounds to learn more and research oriented have the positive impact on enabling learner in the standard electronic content.

5. The reusability, interactivity and consistency with the SCORM model have the positive impact on the performance of the standard electronic content.

6. Having general information and resources, accessibility, layout and assessment have the positive impact on the quality of the standard electronic content.

2.3 The Conceptual Model of Research

In the first stage of research, according to studies and surveys, a number of indicators in producing standard electronic content process were chosen. By utilizing the evaluation of teacher considerations, a number of indicators with lower importance were eliminated and the numbers of indicators were declined. The indicators are listed in "Table1".

Table1. Selected indicators for producing standard electronic content

Goal	Main Indicators	Sub Indicators
Necessary indicators for producing standard electronic content	Accuracy	Content accuracy
		Age-appropriate learning
		Having rich content
	Organization and universal	Logically organized
		Cover all topics of content
		Proportion between the time and content
	Enabling learner	Attractiveness
		Grounds to learn more
		Research oriented
	Performance	Reusability
		Interactive
		Consistency with SCORM model
	Quality	Having general information and resources
		Accessibility
		Layout
		Assessment
	Multimedia	

The conceptual model of research and selected indicators are shown in "Figure.1". Necessary indicators to produce standard electronic

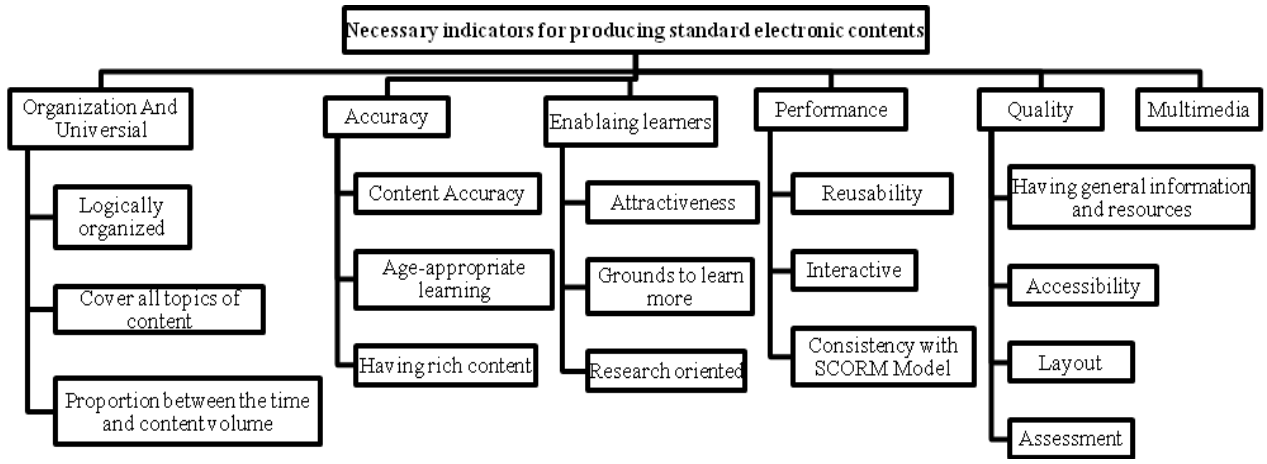

Figure. 1: The Conceptual Model and Hierarchical Structure

contents are classified in three levels, including six main indicators and 16 sub indicators.

2.4 Introduction of selected indicators for the production of standard electronic content

2.4.1 Accuracy Indicator

Electronic content production should have sufficient accuracy. The main indicator is consisted of the following three sub indicators:

- **Content Accuracy:** The produced content should not have spelling and grammatical mistakes.
- **Age-appropriate learning:** Content should be appropriate to the learning level and age group and should consider the student's abilities and capabilities.
- **Having rich content:** The produced content should contain images, forms, tables and correct examples related to the topic.

2.4.2 Organization and universal indicator

In addition to the training, organization and arrangement of the material together as a unit to follow the standard is important in the production of electronic content. This indicator is consisted if the following three sub indicators:

- **The logically organized:** The Course content should be organized into a logical sequence in which the principle is followed.
- **Covering all topics of content:** The electronic content should cover all topics of curriculum and the principle of comprehensiveness should be valued in it. Additionally insignificant cases should be ignored.
- **Proportion between the time and content volume:** Time period considered for each training topic should be determined in accordance with all relevant standards.

2.4.3 Enabling a learner indicator

In learning, student activities are very important. The provider of educational content should make the student more active in the learning process. This indicator includes the following three sub indicators:

- **Attractiveness:** Standard electronic content should possess enough attractiveness for students and encourage them to use digital content.
- **Grounds to learn more:** Any content should provide the necessary infrastructure for future learning and training.
- **Research oriented:** Content should be able to create questions in the mind of students and direct them toward it.

2.4.4 Performance indicator

Standard Electronic content should be efficient enough and very close to the educational goals. This indicator includes the following three sub indicators:

- **Reusability:** The generated content should be used in various electronic training systems. The course content does not need reproducing.
- **Interactivity:** It is better that the generated content ensure interactive and two-way communication with the audience. Such as language training software that allows the learner to repeat the text with his or her voice and compare it with the original sound.
- **Consistency with SCORM model:** SCORM is a set of technical standards for e-learning software products. SCORM tells programmers how to write their code so that it can "play well" with other e-learning software. It is the de facto industry standard for e-learning interoperability. Specifically, SCORM governs the fact that how online learning content and Learning Management Systems (LMSs) should communicate with each other. SCORM does not relate to instructional design or any other pedagogical concern; it is purely a technical standard [4]. In fact, SCORM is a software model of the connection between course components, data models and protocols to establish objects that contain educational content across a system that is compatible with this model and can be shared [5]. If you have educational content with Flash, Adobe Acrobat, word or any other software manufacturers, these components can easily help a suitable software to convert SCORM examples.

2.4.5 The Quality Indicator

Each course should have some quality characteristics to reach educational goals. These features include four categories as follows:

- **Having general information and resources:** The general information such as course summary, educational goals, and course topics, the approximate time required for learning content and course materials, and resources should be provided for a student before the learning starts.
- **Accessibility:** The user can easily provide the required information. Returning to the previous page or going to the next page is also possible.
- **Layout:** Using pleasant fonts, nice icons and layout and highlighting the main topics are also important indicators of editing standard electronic content.
- **Assessment:** To be aware of e-learning success rate, a few tests should be prepared.
- **The Multimedia indicator:** It is better; that the standard electronic content avoids monotony and possess multimedia capabilities, such as facilities, audio, video, animation and film to motivate learners.

3. Methods

This study is applicable, because its results can be used for producing electronic content and course training software. The research method is descriptive - survey. First, by using library research, reviewing relevant documents, the factors are identified as the production of electronic content standards and in the later stages of the research, field research and questionnaire are utilized. The indicators to produce the standard e-content are prioritized by using Analytical Hierarchy Process techniques (AHP) and the Expert Choice software.

3.1 Sample size

In the second stage, the population was formed of experts of the Department of Fars Province, Iran and 30 questionnaires were distributed among them and 22 complete responses were received. The return rate of questionnaires was 73% and the value is acceptable1.

3.2 Tools and scale of measurement

Tools used in the first stage of this study are library studies and review documents and in the second stage, is the researcher questionnaire.

[1] The necessary range of response in AHP method to prioritize the indicators is between 20 to 25

The questionnaire is consisted of two stages; first, the effect of each indicator in the production of standard electronic content is determined and second, pairs of indicators are compared with each other based on the "scale of the relative importance of paired comparisons" table. Measurement scale in the phase one is six-choice Likert type (1 for no impact and 6 for very high impact) and for determining priorities is the mated comparison.

3.3 Reliability and validity of research

"Validity content method" is used. For finding indexes, previous studies, teachers and experts' ideas in this field are used to indicate the validity of the content. The questionnaire survey is in the standard form and is based on the preferences for paired comparisons designed based on the AHP model which has a high reliability.

3.3.1 The Analytic Hierarchy Process (AHP)

AHP is a structured technique for organizing and analyzing complex decisions.it is based on mathematics and psychology and was developed by Thomas L. Saaty in the 1970s .it has been extensively studied and refined since then.

AHP has particular application in group decision making [6] and has been used around the world in a wide variety of decision situations, in fields such as government, business, industry, healthcare, and education.

The procedure of utilizing AHP technique in different applications can be summarized as following steps:

1. Model the problem as a hierarchy containing the decision goal, the alternatives for reaching it, and the criteria for evaluating the alternatives.

2. Establish priorities among the elements of the hierarchy by making a series of judgments based on pair wise comparisons of the elements. For example, when comparing potential real-estate purchases, the investors might say they prefer location over price and price over timing.

3. Synthesize these judgments to yield a set of

4. Overall priorities for the hierarchy. This would combine the investors' judgments about location, price and timing for properties A, B, C, and D into overall priorities for each property.

5. Check the consistency of the judgments.

6. Come to a final decision based on the achieved results.

4. Discussion & Result

Contents are things that are supposed to be taught or be learned. Content can include material, concepts and information about a desired course [7]. The important difference between digital and non-digital content is the presentation of them. Non-digital contents are released to the learner through texts and static images, but digital contents use text, images, audio and animation [8].

The hierarchical structure and relative weights of indicators in Expert Choice software are shown in "Figure. 2". Final weights of sub indicators are shown in "Figure. 3". The final weights of main indicators are shown in "Figure. 4". Final weights and relative weights of sub indicators are shown in "Table 2-7". The Inconsistency rate is 0.08 and it is less than 0.1, so the value is acceptable. According to the results in tables, all of six hypotheses of this study are provable.

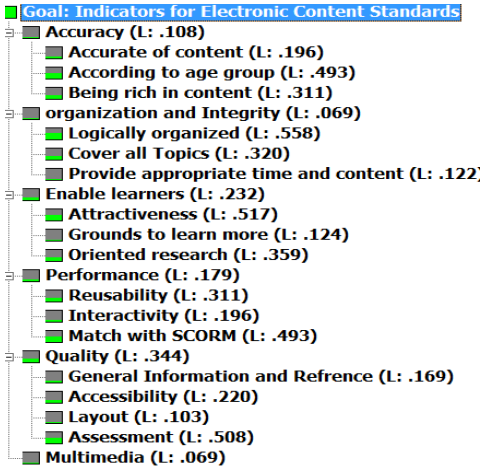

Figure. 2: The hierarchical structure and relative weights of indicators in expert choice software

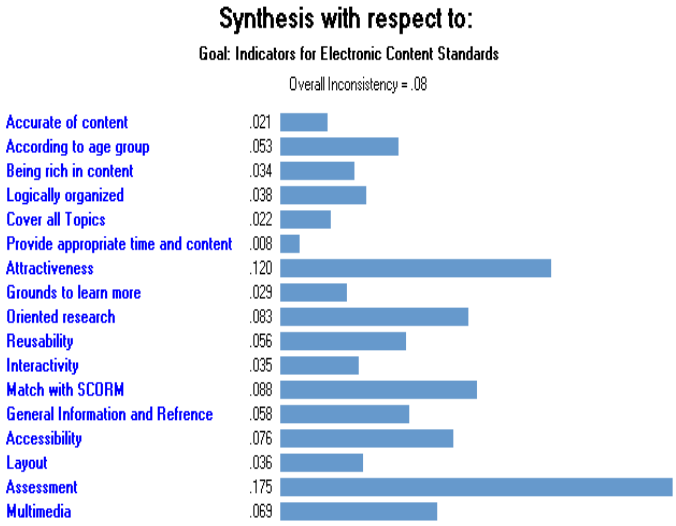

Figure. 3: Final weights of sub indicators (Inconsistency = 0.08)

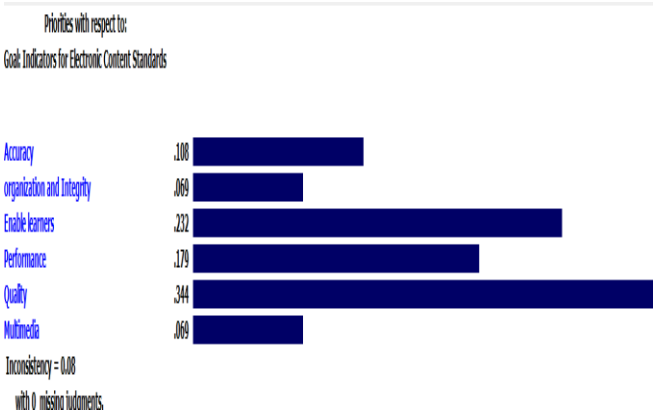

Figure. 4: Final weights of main indicators

Table2. The relative and final weights of necessary indicators for producing standard electronic contents

	Sub indicators	Relative weight	Final weight	Priority
Necessary indicators for producing standard electronic content	Accuracy	0.108	0.108	4
	Organization and universal	0.096	0.096	5
	Enabling a learner	0.232	0.232	2
	Performance	0.179	0.179	3
	Quality	0.344	0.344	1
	Multimedia	0.069	0.069	5

Table3. The relative and final weights of sub indicators of Accuracy

	Sub indicators	Relative weight	Final weight	Priority
Accuracy	Content accuracy	0.349	0.021	3
	Age-appropriate learning	0.493	0.053	1
	Having rich content	0.311	0.034	2

Table4. The Relative and final weights of sub indicators of Organization and universal

	Sub indicators	Relative weight	Final weight	Priority
Organization and universal	Logically organized	0.558	0.038	1
	Cover all topics of content	0.320	0.022	2
	Proportion between the time and content volume	0.122	0.008	3

Table 5. Relative and final weight of sub indicators of enabling a learner

	Sub indicators	Relative weight	Final weight	Priority
Enabling a learner	Attractiveness	0.517	0.120	1
	Grounds to learn more	0.124	0.029	3
	Research oriented	0.359	0.083	2

Table 6. Relative and final weight of sub indicators of Performance

	Sub indicators	Relative weights	Final weights	Priority
performance	Reusability	0.311	0.056	2
	interactive	0.196	0.035	3
	consistency with SCORM Model	0.493	0.088	1

Table 7. Relative and final weight of sub indicators of Quality

	Sub indicators	Relative weight	Final weight	Priority
Quality	Having general information & resources	0.169	0.058	3
	Accessibility	0.220	0.076	2
	Layout	0.103	0.036	4
	Assessment	0.508	0.175	1

5. Conclusion

Efficiency and effectiveness depends on a flexible and integrated instructional design of electronic course content and the purpose of having standards and criteria in the design. Therefore, the content design as one of the most important components of e-learning systems is of great interest for learners [9].

When the statistical analysis was done; six key indicators and 16 sub-standard indicators were identified in the electronic content production

process. The quality indicator was recognized as the most important factor in producing electronic content. The main indicators in order of priority are: Quality (relative weight: 0.344), Enabling a learner (relative weight: 0.232), Performance (relative weight: 0.179), Accuracy (relative weight: 0.108) and indicators of the Organization and the Multimedia (relative weight: 0.069).

The Quality sub indicators, in order of priority are: Assessment, Accessibility, and Having general information and resources, and Layout. The Enable learner sub indicators in order of priority are: Attractiveness, Research oriented and Grounds to learn more. The Performance sub indicators in order of priority are: Consistency with SCORM model, Reusability and Interactive. The Accuracy sub indicators in order of priority are: Age-appropriate learning, having rich content and content accuracy.

6. Recommendations

Since the quality was identified as the most important factor, it is better to pay a special attention to this factor in standard electronic content.

Suggestions for future research:

- Evaluate and prioritize the impact factors of other parts of electronic courseware
- Do the similar research by other methods like TOPSIS and compare the results
- Do the similar research in other countries and make a comparative study

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