

Framework of micro level e-Learning quality dimensions

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ABSTRACT

This study was to analyze important dimensions and its factors of micro level of e-learning determining the quality of e-learning. E-learning dimensions and their factors were identified and developed from the analytical review of related researches. From literature review and survey as well as expert interview, six categories of e-learning identified from this study were: 1) curriculum content, 2) usability, 3) instructional design, 4) evaluation –both process and results, 5) management, and 6) refinement and improvement. A total of thirty-seven factors determining the quality of the e-learning six categories were identified. The rank order and contribution rates for each categories and factors were calculated to explain how importantly they contribute to the quality of e-learning. Also three dimensions such as controlling the e-learning quality, e-learning fundamental dimension e-learning process dimension, and e-learning product dimension, were explained. This study suggests a useful guidance for e-learning quality and evaluation framework for better results.

Key words: e-Learning quality, e-learning evaluation, e-learning factors

1. INTRODUCTION

Finding e-learning quality controlling categories and factors are difficult and controversial because they require not only clearly identifying categories and factors including in processes and products of e-learning, but also scientific impacts on student learning achievements and other outcomes such as student attitudes, instructional cost-effectiveness, and institutional philosophy as well. Frequently, the quality of e-learning is subjectively evaluated upon degree of sophistication and alignment of content, usability, design and development, and evaluation [1]. In e-learning environments, there has been a tendency to adopt measurement systems that are widely accepted in traditional education such as Kirkpatrick's four-level model consisting of reaction, learning, behavior, and results [2]. Many research pointed out that the quality of e-learning in micro level which means the program level of e-learning delivery, is based on ongoing process enhancement and focus on continuous content development and articulation [3], [4].

The successful development and implementation of e-learning require a wide range of supports and activities from organizational policy, management, and technical infrastructure to the detailed level of program design and development [5]. A comprehensive evaluation model should cover the entire range of supports and activities required to successfully develop and implement high quality e-learning programs and environments [6]. Ahn and Kim identified rather broad supporting factors such as macro and micro level of e-learning development and management [7]. Many research indicated that organizational supports such as facilities, technical infrastructure, human resources, financial, and other resources are fundamental to

increase learning achievement from e-learning [3], [4], [7]. It is also important to provide evaluation guidelines for learning and instructional activities, technical support, appropriate human resources and financial support as well as management [5]. These factors have been very important research topics in e-learning and are still handled as significant core elements controlling e-learning quality [8], [9]. Institute of IT Training in England proposed five aspects of e-learning to use as standards in increase of macro level e-learning quality: 1) personnel requirements such as capable trainers, curriculum developers, and e-learning designers/developers.; 2) organizational support for IT training such as policies and guidance for trainers and e-learning providers; 3) training implementation capacity; 4) e-learning organizational support such as guidelines for e-learning providers, standards for e-learning materials and utilization, and 5) guidelines for e-learning organization management [10]. The Institute developed detailed guidelines to provide supports for e-learning students, development of contents, instructional design, evaluation, navigation, flexibility, and content and technical quality of e-learning materials.

ECC in Singapore and MVU in the USA identified evaluation factors for three aspects of e-learning: 1) contents – accuracy, completeness, clarity, and appropriateness and organization, etc., 2) usability – navigation, support for students, interface, and operation, etc., 3) instructional design – explanation, practice, assessment, feedback, and study plan [11], [12]. developed specific evaluation items for each of the Similar standards and indicators for e-learning development and evaluation have been also proposed in many researches, however not many research mentioned about different dimensions of e-learning evaluations such as students achievement from e-learning, organizational support for instructional performance, and fundamental bases for e-learning establishment. [5], [6], [13]-[17].

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The purpose of this study was to analyze important categories and its factors in micro level of e-learning which determines the quality. The first step to analyze e-learning dimensions was to identify the significant factors including in e-learning quality and achievement from literature review. The next step was to conduct a survey including interviews to find core elements in e-learning for better learning performance. The last was to set up a synthesized evaluation model to be utilized in e-learning content development and implementation. Finally, this study suggested the important factors in different dimensions to contribute the e-learning quality and provide a guidance to adopt e-learning program.

2. METHODS AND RESULTS

To find different categories and dimensions of comprehensive e-learning evaluation, an extensive literature review was conducted to identify factors and/or indicators at first. After selecting important factors from literature review, seven e-learning experts who were university professors in e-learning field, researchers at Korean government research institute, and corporate e-learning experts, reviewed and validated the selected categories and factors. Finally, a survey was conducted from 75 experts who had at least three years experience in e-learning industry and academic field to analyze and determine the e-learning evaluation categories based on their knowledge and experience in the field as well as factors in each category. Validating categories and factors from a survey was important to see what and how field experts received e-learning evaluation categories and their factors as critical indicators of e-learning effects. In the survey, the experts were asked to rate the importance level of each category and the factors on a five-point Likert scale.

From the literature review and experts interview as well as a survey analysis, this study identified six primary categories for e-learning development and implementation in micro level. They are course content, usability, instructional design, evaluation, management; and refinement and improvement. For these six categories, a total of thirty-seven factors determining the relevance and quality of the dimensions were also identified. The factors for each of the six categories are explained detail as follow.

2.1. Course Content

- 1) Accuracy: Is the content accurate and clear?
- 2) Completeness: Is the content sufficient for the students to learn the learning objectives?
- 3) Appropriateness: Are the difficulty and depth of the content, including sentences and words, examples, scenarios, practice problems, etc. appropriate for the student?

2.2. Usability

- 1) Position in learning process: Can the student know where he or she is located in the process of studying the content?
- 2) Content readability: Are text readability, font sizes and styles, displayed locations and methods consistent?

- 3) Quality of multimedia features: Are the texts, pictures, audios, and video error-free and interesting?
- 4) Self-monitoring of learning progress: Can the student monitor his or her own learning progress, including tests and the results, completion of units, etc.?
- 5) Navigation: Can the student easily navigate using 'forward, backward, next, main menu' and other menus or buttons?
- 6) Help: Can the student easily find 'Help' when he or she needs to study the learning materials and use the technology features, including navigation?
- 7) Technical reliability: Are hyperlinks, programming, multimedia displays, server functions, on-line interactions and communications are reliable and error free?
- 8) Learning activity Support: Does it provide appropriate and easy-to-use tools such as glossaries, information resources, search tools, note-taking aids, and calculators?

2.3. Instructional Design

- 1) Consistency between learning objectives and contents: Are the learning objectives clearly presented? Are contents consistent with and adequate to achieve the objectives?
- 2) Effective presentation: Are the explanations and examples effectively presented for the student to learn the content?
- 3) Systematic orientation: Does it provide appropriate introduction to the learning objectives, contents, and study procedures?
- 4) Motivation strategies: Does it apply various strategies to maintain and increase student attention and motivation using animation, simulation, story-telling, games, and examples?
- 5) Performance-based learning: Does it provide opportunities for the student to learn and practice what he or she learned on real-world or simulation projects?
- 6) Effective feedback: Does it provide effective feedback with appropriate level of information and at appropriate time?
- 7) Interactions: Are the interactions between the student and on-line tutor appropriate and effective? Can the student communicate with instructor and other students as needed during the on-line instruction?

2.4. Evaluation

- 1) Appropriateness of evaluation methods: Is the evaluation free from legal or ethical problems? Is the evaluation helpful for the student learning? Is the evaluation method appropriate for the student and content?
- 2) Applicability of evaluation results: Can the evaluation results be effective feedback for the student learning? Can they be effectively used by the student and instructor?
- 3) Feasibility and practicability of evaluation: Is the evaluation practical in terms of the required time and expenses?
- 4) Consistency between evaluation and learning objectives: Are the evaluation contents are consistent with the learning objectives and contents?
- 5) Achievement of learning objectives: Can the student achieve the learning objectives?
- 6) Staff qualifications: Are the designer, developer, instructor, manager, and technical people who participated in the e-learning highly qualified?

- 7) Management efficiency and effectiveness: Are the implementation and management of the e-learning efficient and effective and resulted in positive impact on student learning?
- 8) Technology quality: Is the technology used in the e-learning, including computer network and platform, high quality?
- 9) Appropriateness of design and development: Is the e-learning appropriately designed and developed for the student to achieve the learning objectives?
- 10) Organizational support: Are the organizational supports, including administration and finance, strong and consistent?
- 11) Quality of content presentation: Are the contents effectively presented and helpful for the student motivation?

2.5. Learning Support

- 1) Student guidance: Does it provide appropriate guidance for the student to clearly understand the registration, study schedules, study procedures, etc.?
- 2) Instruction and learning management: Does it provide appropriate supports for the student to study, such as guidance for learning activities, questions and answers, tutoring support, technical support, etc.?
- 3) Utilization of management results: Do they analyze and utilize the results of e-learning management such as student databases, evaluation results and the applications, management procedures, etc.?
- 4) Post-learning support: Do they provide supports for the student to apply what they learned in the real world environments?

2.6. Refinement and Improvement

- 1) Organizational support for improvement: Does the organization intend to analyze and apply evaluation results to improve the quality of the e-learning?
- 2) Use of e-learning results: Does the organization use the e-learning results in planning future education and training?
- 3) Actions for improvement: Does the organization take actions to improve the e-learning?
- 4) Examination of improvement results: Does the organization review the results of improvement actions?

From the survey result, the relative contributions of the six categories to the overall quality of e-learning in micro level were calculated. Also, the importance levels of the factors in each categories were calculated from the results of the five-point Likert scale questionnaire (Critically important; 5, Very important ; 4, Fairly important; 3, Somewhat important; 2, Little important; 1).

Table 1 shows the mean scores in each category and contribution rate on overall e-learning quality. Contribution rate explains that how much each category can role as an important indicator to decide overall e-learning quality and its effectiveness in terms of learning results. The survey was asked to mark the rank order on each six categories.

Table 1 Mean score and relative contribution rate of six categories

Categories	M	SD	Rank	Contribution Rate
Course Content	4.63	0.63	1	22%

Usability	4.06	0.75	4	12%
Instructional Design	4.31	0.69	2	27%
Evaluation	4.06	0.83	5	16%
Learning Support	4.13	0.7	3	15%
Refinement/Improvement	3.98	0.72	6	8%
Total	4.18	0.75		100%

From table1, the experts' ratings on the important levels of each category are not consistent with their estimates of the relative contributions rate. For example, experts rated that the mean score of course content, 4.63 in the combined average, is more important than those for instructional design, 4.31 in the combined average. However, they estimated that course content contributes 22 percent to the overall quality of e-learning, while estimating that instructional design contributes 27 percent. The usability and evaluation categories show the same results as well. These results are shown that the importance of each category by e-learning experts may sometimes mismatch in the real field when comparing e-learning planning and adopting stage and e-learning managing and executing stage by different personal resources in different organizations.

Table 2 presented the mean scores of the and its ranks in each category along with standard deviations. This table shows the rank order of each factor within categories by their mean scores. The factor rank in each category shows the important consideration indicators when adopting e-learning course content up to refinement and improvement of e-learning delivery.

Table 2 Importance levels of categories and its factors

Categories	Factors	M	SD	Rank
Course Content	Accuracy	4.63	0.63	1
	Completeness	4.68	0.58	2
	Appropriateness	4.36	0.76	3
	Average	4.63	0.63	
Usability	Position in learning process	4.05	0.71	4
	Content readability	3.95	0.97	6
	Quality of multimedia features	4.41	0.64	1
	Self-monitoring of learning progress	3.97	0.69	5
	Navigation	4.19	0.78	3
	Help	3.92	0.72	7
	Technical reliability	4.38	0.72	2
	Learning activity Support	3.62	0.79	8
	Average	4.06	0.75	
Instructional Design	Consistency between learning objectives and contents	4.43	0.73	2
	Effective content presentation	4.60	0.60	1

	Systematic orientation	4.16	0.73	6
	Motivation strategies	4.32	0.75	3
	Performance-based learning	4.11	0.66	7
	Effective feedback	4.30	0.70	4
	Interactions	4.27	0.65	5
	Average	4.31	0.69	
Evaluation	Appropriateness of evaluation methods	4.08	0.95	6
	Applicability of evaluation results	4.16	1.01	5
	Feasibility and practicability of evaluation	3.73	0.73	10
	Consistency of evaluation and learning objectives	4.32	1.03	2
	Achievement of learning objectives	4.27	0.77	3
	Staff qualifications	3.89	0.77	8
	Management efficiency and effectiveness	4.22	0.79	4
	Technology quality	3.62	0.79	11
	Appropriateness of design and development	4.46	0.73	1
	Organizational support	3.87	0.79	9
	Content quality	4.08	1.14	7
	Average	4.06	0.86	
	Learning Support	Student guidance	4.16	0.69
Instruction and learning management		4.51	0.73	1
Utilization of management results		4.14	0.75	3
Post-learning support		3.70	0.62	4
Average		4.13	0.70	
Refinement and Improvement	Organizational Support for Improvement	4.14	0.71	1
	Use of e-learning results	4.11	0.66	2
	Actions for improvement	3.87	0.79	3
	Examination of improvement results	3.78	0.71	4
	Average	3.98	0.72	

3. DIFFERENT DIMENSIONS OF E-LEARNING QUALITY

The findings of this study were also discussed with e-learning experts to see how they can apply in the field considering of usability. Experts strongly suggested that a synthesized model could draw from the results of the analyses, and it could provide guidance to the field. This study was finally integrated the results and analyses into a synthesized

framework to illustrate how the different categories could be related to each other in micro level of e-learning process and its product which explain e-learning achievement and performance. Figure 1 shows that design, development, management, and improvement are the basic dimensions for controlling e-learning quality and value. In this framework, evaluation dimension was divided into two levels: 1) process evaluation assessing the program quality of e-learning and its implementation and 2) outcome evaluation assessing student learning achievement. However, process and product evaluations should go after the basic dimensions were fulfilled well. In other words, if the basic dimensions are not composed properly, process and product evaluation can be meaningless to measure to see the effects of e-learning.

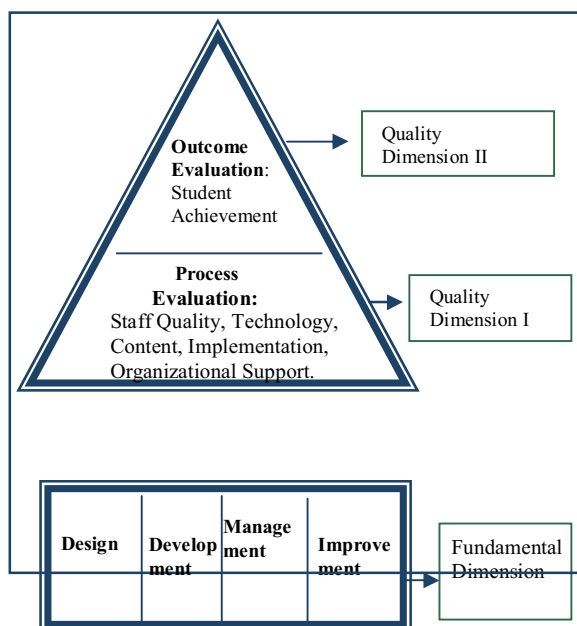


Fig. 1 Synthesized model of e-Learning evaluation

Most e-learning programs emphasize the design, development, and management categories, but pay little attention to the improvement, although the continuous change of e-learning context, including technology, student characteristics and course content, requires close attention to it. An important implication of this framework is that the different dimensions of e-learning quality can be selectively used and controlled depending upon the needs of e-learning. For example, to adopt an existing e-learning content, it should focus on the two levels of evaluation dimensions instead of fundamental dimension. However, it should focus on all three dimensions when adopting new e-learning program because the fundamental categories should be set up to get better results from newly adopted e-learning program. However, a difficulty is that evaluation, particularly the outcome evaluation, requires significant resources, including evaluation expertise and time to guide accurate analysis of e-learning quality. Although numerous e-learning programs are available in the market and have been used in various learning and training situations, very

few programs have been scientifically evaluated to assess the outcome – student achievement. Since different dimensions of e-learning are integrated in a modular form, this framework provides flexibility to selectively apply the categories along with the factors constituting the e-learning quality for the given situation.

4. CONCLUSION

The purpose of this study was to analyze important categories and its factors of e-learning determining the e-learning quality in micro level from literature review and field experts' survey and interview. This study analyzed different e-learning categories and its factors which can control quality of e-learning. The important levels of factors were rated in each category by experts to see which factors are more significant than others. Although there were relatively important categories and factors comparing each other, the contributions and importance of the e-learning categories and their factors examined in this study can be different based on the specifications of e-learning contexts and programs.

Therefore, the contributions of e-learning categories and factors which found in this study should be further refined according to e-learning contexts and environments, such as different student types (e.g., elementary to high school, college level, and adult learner or industry trainees, etc.), different purposes of e-learning, and different subject contents. Nevertheless, this study provides conceptual guidelines to identify important categories and its factors to suggest evaluation indicators to weight and interpret the evaluation results for better e-learning quality. Further study should be conducted to provide detailed context based evaluations and assessments. Also the e-learning quality framework suggested in this study should be extended to include the broad support categories and related factors in macro level containing different organizational policies and philosophy.

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