# A Study on Participants' Attitudes toward an Instructional Design Skill Standards for E-Learning

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***Abstract*****—**The purpose of this study was to examine the development and implementation of an instructional design competency framework for e-learning in Taiwan through the analysis of item attributes and participants' perceptions. The results revealed that the e-ID competency tests obtained moderate discrimination indexes for distinguishing competent participants from less competent ones. The difficulty indexes, however, indicated that the competency tests were more difficult than expected. The low passing rate and participants' negative perception of the applicability of the e-ID competency tests suggested that the target audience of the competency framework needs to be re-positioned and commonly recognized by educational institutions, practitioners and researchers in the field of e-learning. Therefore, the instructional design competency framework can serve as a common platform for all e-learning participants.

***Keywords*****—**E-learning, Instructional design, Skill standards

## I. Introduction

THE design of quality e-learning courseware relies on competent designers and sound quality assurance procedures. In Taiwan, the "National Science and Technology Program for e-Learning" (ELNP) was launched in 2003 and aimed to build a high quality e-learning environment and enhance the nation's manpower cultivation quality. To achieve the optimal goal of quality e-learning, ELNP developed three quality assurance mechanisms, the competency framework of instructional design for e-learning, the quality framework of e-courseware, and the quality framework of e-learning service, to ensure the development and delivery of quality e-learning in the nation [1].

The development of the competency framework of instructional design for e-learning started in 2004 and followed the framework of IT Skill Standards of Taiwan. The framework of IT Skill Standards of Taiwan was implemented in 2001 based on the results of APEC Ministerial Meeting and referred to the IT Skill frameworks of NWCET (the National Workforce Center for Emerging Technologies of the United States of America) and METI (the Ministry of Economy Trade and Industry of Japan) for mutual recognition [2], [3], [4]. IT skill standards are a clear and systematic set of proficiency indicators for the types of skills needed in companies offering IT-related services. It defines the professional knowledge, skills, and abilities required to succeed in today's digital workplace [4], [5]. IT skill standards serve as a common framework for educators, industry, and other stakeholders to develop educational and training tools and programs to prepare students and workers to resolve workplace challenges [4], [5], [6].

The competency framework of instructional design for e-learning follows the framework of IT Skill Standards of Taiwan and contains four components, including "major tasks", "skill criteria", "competency structure", and "certification subjects", to define an e-learning instructional designer's specialization. The competency tests for the certification of instructional design for e-learning have been provided quarterly through e-testing by the Computer Skills Foundation (CSF) since 2005 [7], [8].

## II. The Development of Skill Standards for E-Learning

In responding to the rapid growth of e-learning and fostering better e-designers' quality, a competency framework of instructional design for e-learning was established by the Industry Bureau of the Ministry of Economic Affairs of Taiwan in 2005 through a series of expert panels, practitioner panels, and focus groups [8]. The Instructional Design Skill Standards for E-Learning (e-ID Skill Standards) intended to define the general and core competencies of an e-learning instructional designer (e-ID). The e-ID Skill Standards can serve as a guideline to help e-learning service providers to hire qualified employees, measure employees' capabilities against the skill standards, and provide training programs to help develop employees' capabilities. Further more, for educational and training organizations, the e-ID Skill Standards can provide an objective basis for the design of training programs to cultivate quality prospective e-designers.

As shown in Figure 1, the e-ID Skill Standards were developed by means of defining the major tasks of e-ID, conducting e-ID task analysis, analyzing e-ID performance indicators, analyzing prerequisite knowledge and skills,

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defining e-ID competency structure, and defining e-ID certification subjects. Annual evaluation was conducted against the compliance of the e-ID Skill Standards and possible revision suggestions were discussed through the annual committee meeting. The framework of the e-ID Skill Standards follows the ITE framework and contains 4 major components, including “major tasks”, “skill criteria”, “competency structure”, and “certification subjects”, in defining the e-ID profession. The major components of e-ID Skill Standards are briefly introduced as follows.

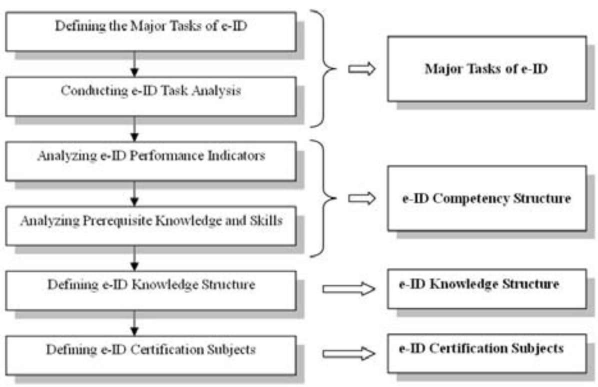


Fig. 1 The development process of e-ID competency framework

### A. *Major Tasks of e-ID*

Instructional design refers to “the systematic process of translating principles of learning and instruction into plans for instructional materials and activities” [9]. The primary task of an instructional designer is to plan the instruction so that the student can use cognitive strategies to learn the material actively [10]. Instructional design for e-learning must include suitable learning principles and conditions of learning that particularly meet the needs of learners [11], [12], [13], [14]. Furthermore, instructional models for e-learning emphasize the key elements such as learner consideration, learning task, learning content, content organization, instructional strategies, instructional media, learning environment, quality assessment of instruction, selection of materials for delivery, evaluation, and feedback [15], [16]. The systematic instructional design process is largely a matter of organizing learning events in some order determined by the teacher. The process is generally recognized as consisting of five distinct stages, analysis, design, development, implementation and evaluation [9]. Therefore, according to the tasks conducted by an e-ID, the major tasks can be described as the sequence of “Analyzing training needs”, “Designing course and instructional material”, “Developing instructional material”, and “Implementation and Evaluation”(ADDIE) for the e-ID Skill Standards. The major tasks of e-ID and sub-tasks for each major task are identified and shown in Table 1.

### B. *Criteria of e-ID Tasks*

The skill criteria are measurable performance indicators linked to certain knowledge or skills conducted by an e-ID during the e-learning development process. For example, there are two performance criteria in the sub-task of “1-1 Analyzing training needs”, which means being able to a) judge the performance gaps from the results of gap analysis on the target audience and the organization’s training goals, and b) identify training needs and objectives, and plan a training program.

Table 1 e-ID major tasks and core competency

| Major task | Task description |
|---|---|
| 1. Analyzing training needs | 1-1 Analyzing training needs<br>1-2 Analyzing target audience<br>1-3 Analyzing the content<br>1-4 Analyzing the learning environment |
| 2. Designing course and instructional material | 2-1 Planning the mode of e-learning<br>2-2 Designing course content<br>2-3 Developing course objectives, test items, and instructional methods<br>2-4 Developing instructional strategies<br>2-5 Planning and designing e-activities |
| 3. Developing instructional material | 3-1 Designing the learning interface<br>3-2 Designing storyboard<br>3-3 Planning learning resources<br>3-4 Integrating course material and learning resources |
| 4. Implementation and Evaluation | 4-1 Assisting the implementation of e-learning activities<br>4-2 Conducting formative evaluation<br>4-3 Conducting summative evaluation |

### C. *Competency Structure of e-ID*

The competency structure describes the general and core competency required by an e-ID and is especially useful for planning training programs to cultivate competent e-ID. The competency structure of e-ID Skill Standards contains three levels of knowledge. The first two levels of e-ID competencies are described by the major tasks and sub-tasks shown in Table 1. Then the third level competency is elaborated on each second level competency. In spite of the “Analysis”, “Design”, “Development”, “Implementation and Evaluation” core competencies, the competency structure of e-ID Skill Standards also contains a skill category of “e-learning case design” in which a prospective e-ID needs to integrate and practice the ADDIE core competencies in the hands-on e-learning courseware case design.

### D. *Subjects of e-ID Competency Tests*

The subjects of the e-ID competency tests were designed to cover the general and core competencies described in the competency structure of e-ID in order to assess a participant’s proficiency level. There are two subjects designed for assessing e-ID competencies, including “Introduction to e-learning” and “Instructional design for e-learning.” “Introduction to e-learning” assesses a participant’s general competency of e-learning. Accordingly, “Instructional design for e-learning” assesses a participant’s core competency of instructional design for e-learning. A participant will be awarded the e-ID competency certificate when passing both the general competency subject and the core competency subject.

## III. PRINCIPLES OF E-ID TEST ITEM DESIGN

The e-ID competency tests followed the ITE test design principles in the design, development, and evaluation of ITE competency tests. The principles of test item design are shown in Table 2. The total score of a competency test is 100 points, the cut-point is 70 points, and the expected passing rate is 20%. The test items are designed to follow the principles of (a) the item difficulty arrangement of difficulty: medium: easy is 1 ： 2 ： 1, (b) the ratio of multiple-choice items of single-answer vs. multiple-answer is 4 ： 1, and finally, (c) the general competency test contains 50 multiple-choice items, and the core competency test contains 20 multiple-choice items (60%) and 2 hands-on case design items (40%).

Table 2 Test item design principle for e-ID certification examination

| Aspects of Item Design | Principle or Criterion |
|---|---|
| Total score | 100 points |
| Cut-point | 70 points |
| Expected passing rate | 20% |
| Difficulty arrangement | difficult: medium: easy = 1 : 2 : 1 |
| Type of knowledge | Comprehension vs. Application |
| Type of test item | Multiple-choice and Case design |
| Ratio of multiple-choice items | Single-answer: multiple-answer = 4 : 1 |

## IV. METHODS AND RESULTS

In this study, the profile of test items was analyzed by skill category, followed by the analysis of item difficulty and item discrimination indexes. Then, the Analysis of Variance (ANOVA) was conducted to examine the effects of knowledge level (comprehension vs. application), item type (single-answer vs. multiple-answer) and presumed-difficulty (easy, medium, and difficult) on participants' performance (average rates of correctness). Finally, participants' perceptions of usefulness, appropriateness, applicability of the e-ID Skill Standards and the competency tests were examined.

### *A. Profile of e-ID Competency Tests*

Since the e-ID competency tests were administered in June 2005 by CSF, the core competency tests, Instructional design for e-learning, were offered twice a year. By the end of 2006, four e-ID core competency tests were administered. In the present study, the test items of these e-ID core competency tests were analyzed to validate the item design and explore participants' core competencies. The structure validity of the e-ID core competency test was ensured by means of a series of expert reviews during the development of the e-ID competency framework. The reliability coefficients of the core competency tests measured by Cronbach's Alpha were .55, .63, .58, and .85, respectively, with an average reliability coefficient of .65 for the four competency tests.

Among the 79 participants taking the e-ID core competency tests, only 11 participants passed the tests. The overall passing rate of the core competency tests was 13.93%. The profile of e-ID core competency tests is shown in Table 3. The average rates of correctness on the five skill categories of the core competency tests ranged from .45 to .63 with an overall rate of correctness of .55. The results revealed that the e-ID core competency tests were difficult for all skill categories with comparison to the .70 cut-point. As shown in Table 3, the lowest average rate of correctness (.45) on the hands-on case design indicated that the test items of hands-on case design were the most difficult to the participants. This might imply that the items of hands-on case design were inappropriately designed or were aimed at more experienced target audiences.

Table 3 Test item profile of the e-ID core competency test

| Competency category | Type of item | Number of items | Percentage | Rate of correctness | SD |
|---|---|---|---|---|---|
| 1. Training Needs analysis | Multiple-choice | 5.00 | 10.0% | .546 | .242 |
| 2. Course and instructional material design | Multiple-choice | 9.75 | 19.5% | .568 | .166 |
| 3. Instructional material development | Multiple-choice | 9.50 | 19.0% | .632 | .194 |
| 4. Implementation and Evaluation | Multiple-choice | 4.75 | 9.5% | .574 | .231 |
| 5. Hands-on case design | Case design | 3.00 | 40.0% | .447 | .247 |
| Total/Average | | 33.00 | 100.0% | .553 | .216 |

Note. N = 79

### *B. Analysis of Difficulty and Discrimination indexes*

On the analysis of difficulty and discrimination indexes of e-ID core competency tests, the top 27% and the lowest 27% participants were identified and extracted as the hi-scoring group and the low-scoring group, respectively. Calculation of the average rates of correctness for each skill category for the hi-scoring group and the low-scoring group was also included. Then, for analyzing the overall difficulty and discrimination indexes across competency tests, the average difficulty indexes and discrimination indexes were calculated for each competency category. Finally, independent sample t-tests were conducted to examine whether the discrimination indexes were significant.

As shown in Table 4, the difficulty indexes for all skill categories of the e-ID core competency tests ranged from .47 to .63. The difficulty indexes indicated that the test items were somewhat difficult against the .70 cut-point for all skill categories, especially for "Hands-on case design". The effect of difficulty reflected on the low passing-rate (13.9%) of the e-ID core competency tests. The five skill categories, however, showed significant discrimination indexes, ranging from .18 to .57. The significant discrimination indexes indicated that the test items of all skill categories were appropriately designed and were able to distinguish between competent and incompetent participants. Among the significant discrimination indexes, the skill category of "Hands-on case design" assessing a participant's practical e-ID skills showed the highest discrimination index (.58). In other words, the "hands-on case design" obtained the best capability in distinguishing competent e-ID competency. Therefore, the lowest average rate of correctness and the highest discrimination index of "Hands-on case design" confirmed that the items of "Hands-on case design" were appropriately designed and were aimed at more experienced target audiences than those who had taken the e-ID core competency tests.

Table 4 Difficulty and discrimination of e-ID core competency

| Competency category | Hi-scoring group: rate of Correctness | Low-scoring group: rate of Correctness | Difficulty (P) | Discrimination (D) | t | Sig. |
|---|---|---|---|---|---|---|
| 1. Training needs analysis | 0.679 | 0.503 | 0.591 | 0.176 | 2.49* | .017 |
| 2. Course and instructional material design | 0.649 | 0.458 | 0.554 | 0.191 | 3.70* | .001 |
| 3. Instructional material development | 0.775 | 0.490 | 0.633 | 0.285 | 5.58* | .000 |
| 4. Implementation and Evaluation | 0.710 | 0.445 | 0.578 | 0.265 | 4.00* | .000 |
| 5. Hands-on case design | 0.758 | 0.184 | 0.471 | 0.574 | 14.56* | .000 |

Note. Hi-scoring group: N=21, Low-scoring group: N=21, * $p<.05$

### *C. Analysis on Differences of Group Performance*

For analyzing the effects of item attributes on rate of correctness, ANOVAs were conducted to examine the effects of knowledge level (comprehension vs. application), type of item (single-answer vs. multiple-answer), and presumed-difficulty of test items (easy, medium, and difficult) on participants' rates of correctness. First, Levene's test of equality was conducted on participants' average rates of correctness for the 86 multiple-choice items of the e-ID core competency tests. The result was not significant ($F_{(11, 108)}$ = 1.095, $p$ = .372). The null hypothesis that the error variance of the dependent variable is equal across groups was accepted. Therefore, ANOVAs were proceeded. The average rate of correctness, standard deviation, and number of items by knowledge level, type of test item, and presumed-difficulty are shown in Table 5. It is suspicious that the average rate of correctness on the application-level items (.59) was higher than the average rate of correctness of the comprehension-level items (.55). Whether the difference between the two means is significant or not is further analyzed by means of ANOVA.

Table 5 Group means of rates of correctness of e-ID core competency

| Dependent variable | Group | Avg. rate of correctness | SD | Number of items |
|---|---|---|---|---|
| Knowledge level | Comprehension | .553 | .252 | 49 |
| | Application | .584 | .195 | 71 |
| Type of item | Single-answer | .590 | .233 | 65 |
| | Multiple-answers | .550 | .203 | 55 |
| Presumed difficulty | Easy | .598 | .215 | 36 |
| | Medium | .555 | .235 | 69 |
| | Difficult | .577 | .160 | 15 |

Note. Total multiple-choice items = 120

Table 6 ANOVA summary of knowledge level, type of item, and presumed-difficulty on rates of correctness

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Knowledge level | .049 | 1 | .049 | .996 | .320 |
| Type of item | .042 | 1 | .042 | .865 | .354 |
| Presumed-difficulty | .038 | 2 | .019 | .387 | .680 |
| Error | 5.631 | 115 | .049 | | |

The ANOVA summary of the effects of knowledge level, type of test item, and presumed-difficulty of test item on rate of correctness is shown in Table 6. The main effects of knowledge level, type of test item, and presumed-difficulty were not significant. In other words, the participants performed equally no matter the test items' knowledge level, the type of items, or the presumed-difficulty of the test items. The non-significant result of knowledge level on the rate of correctness suggested that the application-level items provided more contextualized information and helped the participants understand the items better. Therefore, the participants could perform the application-level items as well as the easier comprehension-level items. Accordingly, the non-significant result of type of item indicated that item type stood a neutral position in delivering the test items to the participants through the e-testing interface. Therefore, the participants performed equally on the single-answer items and the multiple-answer items. Finally, the presumed-difficulty of test items did not affect the participants. The participants performed equally on different presumed-difficulty items. Therefore, it is suggested that the difficulty level of each test item should be updated based on the rate of correctness in order to maintain an accurate item bank.

## V. Participants' Perception of e-ID Competency Framework

An attitude questionnaire was conducted to examine participants' perception of usefulness, appropriateness, and applicability of the e-ID Skill Standards and the competency test. The attitude questionnaire employed 5-point Likert-type items with 1 to 5 standing for "strongly disagree", "disagree", "neutral", "agree", and "strongly agree", respectively. There were three items for each component measure of the attitude questionnaire. The questionnaire was reviewed by peer experts and revised for use in the present study. Forty-five responses were gathered from seventy-nine invitations sent to the participants of previous e-ID core competency tests, and with a response rate of 59.96%. The reliability coefficients of the component measures of usefulness, appropriateness, and applicability were .84, .92, and .79, respectively, as measured by Cronbach's α with an overall reliability coefficient of .84.

The mean scores of participants' overall perception of the e-ID Skill Standards and tests are shown in Table 7. The participants possessed positive attitudes toward the usefulness and appropriateness of the e-ID Skill Standards. However, participants showed negative attitude toward the applicability of the e-ID competency test. In other words, although the participants possessed positive attitude toward the e-ID Skill Standards, they felt that the e-ID competency tests were not appropriately implemented. The attitude of negative applicability might come from the high difficulty of the e-ID competency tests.

Table 7 Mean scores of participants' overall perception of e-ID

| Perception | Mean | SD | N |
|---|---|---|---|
| Usefulness | 3.51 | 0.74 | 45 |
| Appropriateness | 3.51 | 0.68 | 44 |
| Applicability | 2.58 | 0.74 | 36 |

Two-way Multivariate Analysis of Variance (MANOVA) was conducted to examine the effects of gender and working experience in e-learning on participants' perception of usefulness, appropriateness, and applicability of the e-ID Skill Standards and the competency tests. The significance level was set to .05 for the analysis. The mean scores of participants' perception of usefulness, appropriateness, and applicability of the e-ID are shown in Table 8 by gender and e-learning experience. Box's Test of equality of covariance matrices was not significant (Box's M = 18.83, $F$=1.157, $p$ = .298). The homogeneity assumption was sustained. The group means of participants' perception of usefulness, appropriateness, and applicability are shown in Table 8 by gender and working experience in e-learning, respectively.

The MANOVA summary of working experience on participants' perception of the e-ID Skill Standards is shown in Table 9. The main effect of gender on the usefulness of the e-ID Skill Standards was significant ($F_{(1, 32)}$ = 7.254, $p$ = .011), whereas the other main effects were not significant. That is to say, the female participants showed higher level of positive attitude toward the usefulness of e-ID Skill Standards than the male participants. The result indicated that the female participants possessed higher level of expectation toward the e-ID Skill Standards than the male participants. The reason, however, was not answered in the present study. Furthermore, gender did not affect participants' positive attitude toward the appropriateness of the e-ID skill standards and negative attitude toward the applicability of the e-ID competency test. Whereas, the non-significant main effects of working experience on the dependent measures indicated that participants' positive attitudes toward the usefulness and appropriateness of e-ID and negative attitude toward the applicability of the e-ID competency tests were not affected by participants' working experience in e-learning.

In sum, the analysis of participants' perception of the e-ID Skill Standards and the competency tests suggested that despite gender or working experiences, the participants possessed positive attitudes toward the usefulness and appropriateness of e-ID Skill Standards and negative perception of the applicability of the e-ID competency tests. Participants' affirmative perception of the usefulness of the e-ID Skill Standards confirmed the necessity of the development of the instructional design skill standards for e-learning to respond to the rapid growth of the e-learning related applications and industries. Participants' affirmative perception toward the appropriateness of the e-ID Skill Standards also verified that the construct validity of the e-ID Skill Standards. However, the e-ID competency tests were proved to be difficult and inadequately implemented by the participants' negative perception. It is, therefore, suggested that the target audience of the e-ID Skill Standards needs to be re-positioned in order to suit the demands of e-learning related industries in recruiting, training, and evaluating employees' instructional design competency.

Table 8 Group means of participants' perception of e-ID by gender and e-learning experience

| Independent variable | Perception | Group | Mean | SD | N |
|---|---|---|---|---|---|
| Gender | Usefulness | Male | 3.23 | 0.79 | 25 |
| | | Female | 3.81 | 0.60 | 20 |
| | Appropriateness | Male | 3.53 | 0.64 | 24 |
| | | Female | 3.50 | 0.73 | 20 |
| | Applicability | Male | 2.54 | 0.73 | 21 |
| | | Female | 2.73 | 0.76 | 15 |
| Working experience in e-learning | Usefulness | Less than 6 months | 3.47 | 0.80 | 10 |
| | | 6 months ~ 2 years | 3.65 | 0.66 | 19 |
| | | More than 2 years | 3.45 | 0.81 | 16 |
| | Appropriateness | Less than 6 months | 3.67 | 0.73 | 10 |
| | | 6 months ~ 2 years | 3.49 | 0.68 | 18 |
| | | More than 2 years | 3.38 | 0.68 | 16 |
| | Applicability | Less than 6 months | 2.85 | 0.92 | 8 |
| | | 6 months ~ 2 years | 2.66 | 0.65 | 14 |
| | | More than 2 years | 2.39 | 0.74 | 14 |

Note. N = 45

Table 9 MANOVA summary of gender and working experience on participants' perception of e-ID

| Source | Dependent Variable | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| Gender | Usefulness | 2.796 | 1 | 2.786 | 7.254* | .011 |
| | Appropriateness | .010 | 1 | .010 | .018 | .893 |
| | Applicability | .287 | 1 | .287 | .520 | .476 |
| Working experience in e-learning | Usefulness | .313 | 2 | .157 | .408 | .668 |
| | Appropriateness | .427 | 2 | .214 | .392 | .679 |
| | Applicability | 1.139 | 2 | .569 | 1.033 | .367 |
| Error | Usefulness | 12.288 | 32 | .384 | | |
| | Appropriateness | 17.458 | 32 | .546 | | |
| | Applicability | 17.636 | 32 | .551 | | |

Note. * $p < .05$

## VI. Conclusions

The e-ID Skill Standards employed a systematic process to ensure the validity and reliability of the competency framework. Participants' positive attitudes toward the usefulness and appropriateness of the e-ID Skill Standards verified the needs and suitability of the competency framework. The analysis of discrimination indexes also indicated that the e-ID competency tests were able to distinguish competent participants from less competent ones. The difficulty level of the e-ID competency tests, however, was relatively high for the novice e-learning participants. Participants doubted the applicability of the e-ID competency tests. Therefore, the target audience of the e-ID Skill Standards needs to be re-positioned in order to meet the needs of e-learning related industries and participants.

In sum, the development of an instructional design competency framework for e-learning should be able to serve as a common platform to help e-learning service providers to hire qualified instructional designer, measure employees' competency in instructional design, and provide training programs to fulfill employees' capabilities. The low participation and passing rate of the e-ID competency tests suggested that the implementation of the e-ID Skill Standards only bring about partial effects of evaluating in-service and prospective instructional designers' professional competency. Further efforts need to be made to fulfill the goal of making the competency framework serving as a common platform for all e-learning participants.

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