A model for developing industry demand-driven e-learning curricula under ADDIE

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ABSTRACT: In practice, the successful introduction of e-learning requires not only the construction of software and hardware facilities but also executives' support and commitment, design of proper instructions, introduction of teaching strategies and assessment by external experts. All these measures should be implemented in cooperation with academia. The Analysis, Design, Development, Implementation and Evaluation (ADDIE) model was applied in this study to develop an industry demand-driven e-learning curriculum for *auditors* in an international accounting firm in Taiwan. In addition, seven elements of designing *situated learning* materials are discussed and summarised in this article.

INTRODUCTION

In the US, more than 90% of all public institutions offered some form of e-learning courses in 2004 and 96.2% of them agreed that e-learning was critical to the long-term strategies of their institutions [1]. Nearly 3.5 million learners in the US were taking on-line courses in 2007 [2]. The number of on-line learners is still continuing to expand, with a compound annual growth rate of 21.5% [2]. As described in Alavi and Leidner's research framework, e-learning is a virtual learning environment in which a learner's interactions with materials, peers and instructors are mediated through information and communication technologies [3]. It differs from a traditional environment because information and communication technology (ICT) is used as a tool to support the learning process. Taking advantage of network infrastructures, learning can occur anywhere using many types of resource. Over the past decade, the rapid developments and growth of ICT in such areas as education and training has offered new paradigms for institutes' training and the topic of electronic learning (E-learning) has deserved careful attention [4].

With the rapid development of e-learning, most enterprises now have a clearer picture of what e-learning is. However, some enterprises' knowledge of e-learning is still limited to construction of a new learning platform and acquisition or development of e-learning content. Even if they invest a huge amount of funds in building an e-learning environment, they may not obtain immediate results and will only leave the established environment unused and wasted. Successful introduction of e-learning requires not only construction of software and hardware facilities but also support of multiple measures, including executives' support and commitment, design of proper instructions, introduction of teaching strategies and assessment by external experts. All these measures should be developed or implemented through co-operation between academia and enterprise. As cases of such co-operation at present are still rare, many enterprises have introduced e-learning without sufficient understanding of it. Certainly, the effectiveness of their investment is usually poor [5].

The advancement of information technology has not only changed the business environment, it has also increased the complexity of accounting practice. Over the past few decades, accounting education has not been adequately adjusted to meet changes in the external environment [6]. Most of the accounting teachers and practitioners in Taiwan have, thus, called for reforms of accounting education [7]. Cheng proposed that accounting education should be changed from supply driven to demand driven [8]. In other words, accounting education should meet the needs of customers (such as accounting firms). Only when customer needs are satisfied, can education and training be cost-effective and the goal of accounting education be achieved.

Based on the Dictionary of Occupational Titles in Taiwan, accounting-related jobs can be classified into 18 occupations, including that of CPA, bookkeeper, clerk, auditor, cashier, system analyst, internal auditor, assistant

accountant, financial auditor, financial planner, sales assistant, assistant auditor, software operator, financial accounting information specialist, computer auditor, accounting manager, financial manager and financial analyst. A 2008 report released by PricewaterhouseCoopers (PwC), one of the world's largest accounting firms, showed that despite economic slowdown around the globe during 2008, PwC enjoyed a total revenue exceeding US$28.2 billion; a 14% growth from last year. Its revenue from *auditing services* was particularly remarkable, reaching US$13.8 billion [9]. These statistics indicate that auditing services are an important part of the accounting industry. Through co-operation with an international accounting firm in Taiwan, this study attempted to develop industry demand-driven e-learning curricula for *auditors* and to set up a model for developing curricula for corporate e-learning.

SITUATED TEACHING STRATEGY

Hamalainen, Winston and Vishik mentioned that information technology has changed the way business is managed and also the demand for, expectation of, and opportunities to access education and learning [10]. Environmental changes have created new needs, and become an important force that propels development of the Internet [11]. In the on-line learning environment, sources of learning are not limited to teachers' knowledge and experience. Brown, Collins and Duguid pointed out that knowledge becomes meaningful when it can be explained by the situation in which it arises and is used [12]. Meaningful knowledge derives from practical tasks, which refer to the culture in our daily life. A situated teaching strategy is to design learning materials based on cases that occur in the workplace. Through real-life situations, learners can acquire meaningful learning experiences and better cope with regular tasks in their workplace.

Situated learning is a learning model developed on the basis of contemporary cognitive psychology. It is a learning activity where learners acquire knowledge through real-life situations [13]. Situated learning stresses that knowledge is situated, being in part a product of the activity, context and culture in which it is developed and used [12]. Knowledge becomes meaningful when it can be explained by the contexts in which it arises and is used. Thus, knowledge cannot be separated from the social context in which it is developed or used [14]. Brown, Collins and Duguid argued that learning in a situated learning environment is not a consequence of knowledge transfer but rather a process of integrating prior experiences [12]. Thus, it is more beneficial to learners to create a learning environment with a variety of real-life situations than to determine and explain what learners should learn. In situated learning, learners can actively involve themselves in the situations, and interact with people and events in the environment to acquire realistic and social knowledge.

Honebein, Duffy and Fishman proposed that constructivist learning environments have two major features, authentic activities and context [15]. In authentic activities, learners must build and monitor their goals and strategies, and also understand the skills required for accomplishing a certain task [15]. Learners are led to put away existing ideas and to generate and evaluate different viewpoints and ideas. Context is to use complexity and diversity of real-life situations to offer learners different ways to think and resolve problems. With the advancement of computer technology, the Internet, and multimedia technology, more and more learners have chosen to acquire knowledge via the Internet. Conventional instructional and learning methods are no longer suitable for the modern fast-changing learning environment. According to Chen and Huang, computers offer a visual field that simulates authentic activities and, thus, can be used to improve learners' learning outcomes [16]. In this study, an e-learning curriculum was developed for *auditors* following the five design principles covered in the situated learning theory.

1. Apply multimedia to the construction of real-life situations: Situated learning stresses that learners must be trained in real-life situations so that they can better apply acquired knowledge in their workplace. Auditing is a professional practice that values customer privacy. Training learners in authentic situations may undermine customer privacy and benefits. The situated learning theory proposes that, if providing training in authentic situations is difficult, a simulated learning environment can be employed. Computers' power to present multimedia, including audio, image, graphics and text, is far superior to conventional books. Therefore, computer multimedia was applied to construct a situated learning environment, which includes real-life work contexts and multimedia-supported work contexts [17].
2. Role playing: In the design of an e-learning system, learners' interactivity with computers is important. Learners' different decisions in e-learning should lead to different interaction results. Learners should not passively receive text-based information. Through role playing in the simulated context, learners can experience the problems they are likely to encounter in the workplace.
3. Instructor's explanation: Through explanation given by the instructor (actor) in the lesson, learners can confirm the content and knowledge they have learned and deepen their understanding of the lesson. The instructor can highlight the key points in the lesson and provide reminders to help learners acquire more knowledge, reduce error at work and improve their work efficiency.
4. Permits trial and error: In authentic situations, learners may be worried about making mistakes when trying a new thing or new way. As a result, they may miss out on many learning opportunities. A well-designed context offers learners opportunities to fail and contemplate why they fail [18]. These opportunities can induce learners' deep thinking about the course content.
5. Allow learners to choose lessons for review: Familiarising learners with the training content can increase their ability to take correct and immediate actions in practice. Curricula in the case of accounting firm have been

designed to allow learners to review and practice lessons repeatedly until they are familiar with them. Learners can also choose a particular unit for review to increase their familiarity with the lesson.

Based on the above five principles, the seven elements of situated learning are shown in Table 1.

Table 1: Seven elements of designing situated learning materials summarised.

Elements of situated learning	Tips on design of learning materials
1. Provide authentic learning activities	1. Activities should relate to the real world 2. Learners are engaged in one single but complicated task 3. Learners are encouraged to accomplish activities and thus define their primary and secondary tasks in the activities
2. Offer views of multiple roles	1. View each issue from multiple perspectives 2. Express different viewpoints through collaboration 3. Allow learners to repeatedly examine their views in the learning environment
3. Support collaborative knowledge construction	1. Tasks should be group-oriented 2. Learning materials should be designed to support group learning 3. Tasks should be designed to provide motivation for group achievement
4. Promote reflection and externalisation of abstract concepts	1. Provide authentic contexts and tasks 2. Provide facilities that support learner reflection 3. Allow learners to compare them with peers
5. Encourage articulation and turning tacit knowledge into explicit knowledge	1. Complicated tasks should be embedded with opportunities for learners to articulate ideas 2. Collaborative learning promotes individual comprehension 3. Public discussion enables learners to articulate or defend their self-learning
6. Offer instructions and scaffolding at proper times	1. Create a complicated and open learning environment 2. Do not offer intrinsic scaffolding and instructions 3. Provide scaffolding and instructions at proper times
7. Provide tasks evaluated by authentic criteria	1. Allow learners to effectively utilise acquired knowledge 2. Provide complicated, undefined and judgment-required tasks 3. Evaluations should be naturally integrated into the learning activities

A MODEL OF DEVELOPING E-LEARNING CURRICULUM

Based on the systematic instructional design model, ADDIE (Analysis, Design, Development, Implementation and Evaluation), a demand-driven e-learning curriculum was developed and implemented for *auditors* in an international accounting firm in Taiwan [19][20]. This accounting firm, being a member of an international accounting company, is among the top four accounting firms in Taiwan. It has branches in northern, central and southern Taiwan, and more than 1,000 employees, including certified public accountants (CPAs), auditors and assistants.

ADDIE consists of five phases, each phase involving certain tasks and goals: 1) Analysis: Determine the instructional content. Context analysis, learner analysis and task analysis are performed in this phase to confirm the objectives, content of the instruction and entry requirements of learners; 2) Design: Design instructional activities. Definition of objectives, design of learning content and activities and compilation of scripts are performed in this phase to develop proper instructional activities; 3) Development: Create the instructional content assets. Development of an e-learning curriculum, putting the curriculum on-line and formative evaluation of the curriculum are performed in this phase; 4) Implementation: Implement the developed instructional activities, conduct placement and formative evaluations during the instructional process; and 5) Evaluation: Conduct summative evaluations of the effectiveness of the developed curriculum.

Schank mentioned that goal-oriented situated learning can better motivate learners to maintain motivation, and ensure learning proceeds in the right direction [21]. Welsh et al also pointed out that in the e-learning environment, perceived usefulness and job relevancy are two major factors that motivate learning [22]. Further, learners have lower intention to take curricula that they perceive as not necessarily needed or beneficial. To offer auditors meaningful learning experiences, and to narrow the gap between *knowledge learnt* and *knowledge used*, common tasks of auditors were selected, and the *goal-oriented situated learning approach* was adopted to design e-learning contexts.

The knowledge that *auditors* are required to possess was analysed first and, then, suitable situated cases that could be integrated into the curriculum were discussed with staff responsible for training development in the case of the accounting firm. During development of the e-learning curriculum, related data from literature, interview and audio records were collected and analysed. The curriculum development process is explained as follows:

1. Analysis phase: The result of this phase affects the direction and decision of instructional design, so it is a critical phase in instructional design. The instructional contexts, learners and tasks were analysed. All these analyses were based on interview data.

    A. Analysis of instructional contexts:

        a. Demand analysis: The purpose of conducting the demand analysis was to explore auditors' current needs for e-learning. The interviews were focused on auditors' tasks, priorities of the tasks, required skills, difficulties, current status of e-learning and expectation of e-learning.
        b. Learning environment analysis: This analysis was aimed at exploring the available media and resources in this case of the accounting firm that could be used to address the needs, as well as the current constraints. Through this analysis, appropriate e-learning content assets and e-learning methods were found. The subjects analysed included media, resources and constraints.

    B. Analysis of learners: This analysis was based on data collected from interviews with directors of the human resources department, CPAs and auditors. The purpose of this analysis was to understand the background, content features and difficulties of e-learning among auditors. Results showed that most auditors expected to learn in simulated contexts related to their current tasks to increase their abilities to cope with customers and practical problems. Besides this, most participants had a high level of computer skills. According to Hsiao, Chou and Duh, learners with better computer skills can better accept the e-learning model [7].
    C. Analysis of learning tasks: This analysis was intended to understand auditors' responsibilities and tasks, and determine the knowledge, skills and attitude required by their job [17]. The interview results showed that the main responsibilities and tasks of auditors are *auditing*, *risk assessment* and *planning of auditing*. According to Welsh et al, perceived usefulness and job relevancy of the curriculum are important factors in learning motivation [22]. Therefore, based on the auditors' three major jobs, namely *auditing*, *risk assessment* and *planning of auditing*, four situated instructional cases were developed, including *pre-audit meetings*, *audit practice I*, *audit practice II* and *post-audit reviews*. The goals of each instructional case are shown in Table 2.

2. Design phase: The results derived from the *analysis* phase were used as a basis for developing the situated curriculum in this phase. The curriculum was developed according to the various auditing contexts and conditions that auditors would encounter in practice. Through dialogue and interaction between roles in the curriculum, learners were expected to increase their impression of the course content and actively construct their own knowledge. The following are the main tips to design the situated learning lessons:

    A. Multimedia can be used to create learning contexts based on real-life situations. In order to create contexts that could make learners feel as if they were in real-life situations, situated videos were made that used the work environment in the accounting firm as the background.
    B. Learners should be collaborators in knowledge construction. Instructional design cannot simply expect to teach learners how to use a particular lesson. They should lead learners to actively construct their own knowledge through use of situated videos or arrangement of situations.
    C. Use questions to lead learners to learn through interactions and increase their motivation. Instructions should not be lecture-based but be given through issue discussion led by the instructor (actor). Learners will be more interested in learning through brainstorming.
    D. Embed the key points of the curriculum in stories to draw learners' attention. Films were shot of stories related to the curriculum or auditors' jobs, to present the key points of the curriculum.
    E. Allow learners to go through constructing, coaching, reflection and articulation in situated learning. Learning correct knowledge embedded in films and receiving guidance from instructors (employees in the firm) are respectively the processes of constructing and coaching. Through arrangement of situations and interaction between roles, learners can also experience reflection, articulation and exploration in the curriculum.
    F. Enable learners to control their learning pace and repeat lessons on their own. Instructional design should provide video replay function to allow learners to access a particular lesson repeatedly, and to satisfy their needs in learning.

3. Development phase: Participants in this research included the researcher, two research assistants, directors and specialists of human resources and the auditing department of an international accounting firm in Taiwan, as well as three multimedia designers invited to provide suggestions on the filming and application of multimedia. This phase involved the production of e-learning materials, development of the e-learning curriculum and formative evaluation of the e-learning materials and curriculum. Formative evaluation was conducted based on *expert review*. Two groups of experts were invited to conduct the evaluation. One consisted of four accounting experts. They examined the compliance of the developed materials and curriculum with generally accepted accounting principles (GAAP), accounting standards and industry demands. The other group consisted of three e-learning experts. They were responsible for checking the compliance of the developed curriculum with e-learning instructional design principles.

Table 2: The goals of four instructional cases.

Instructional case	Domain	Goals of the instruction
Pre-audit meeting	1) Cognitive	1. Understand the functions of the pre-audit meeting 2. Understand the items to be discussed in the meeting 3. Understand the focuses in auditing 4. Understand the meaning of *book-tax differences*
	2) Technical	5. Be able to prepare data necessary for the pre-audit meeting 6. Be able to communicate with customers after the meeting
	3) Affective	7. Realise the importance of the pre-audit meeting and be pleased to hold the meeting before auditing
Audit practice I	1) Cognitive	1. Be able to know where to do an outside-office auditing 2. Be able to know what the outside-office auditing is about 3. Be able to know whether a unified invoice should be issued for interest of a delayed payment 4. Be able to know why consumers need to compile a reconciliation statement for various incomes
	2) Technical	5. Learn how to cope with customers 6. Be able to identify the data that should be provided to customers 7. Be able to identify the data that should be obtained from customers
	3) Affective	8. Realise the importance of maintaining a good relationship with customers 9. Enjoy maintaining a good relationship with customers
Audit practice II	1) Cognitive	1. Understand the responsibilities of auditors at each level in an outside-office auditing 2. Understand the roles of auditors at each level in outside-office work 3. Be familiar with regulations regarding whether a local artist should withhold tax for house rents paid by customers 4. Be familiar with regulations regarding whether income from overseas royalties can be used to as a domestic income tax credit
	2) Technical	5. Be able to learn the steps that auditors take to solve pending items
	3) Affective	6. Realise the importance of accurate auditing 7. Realise why working with customers is important
Post-audit review	1) Cognitive	1. Understand what requires more attention in audit practice 2. Understand the difference between unified invoice, invoice and debit note 3. Understand the focus in inspecting certificates of sales returns and allowances 4. Understand the difference in subject applicability between business tax calculation form 401 and form 403
	2) Technical	5. Learn to clarify misconceptions
	3) Affective	6. Realise the importance of group work and enjoy it

4. Implementation phase: Before implementing the developed e-learning curriculum, the curriculum was first introduced to learners to try to understand their entry perceptions and behaviour (placement evaluation). During implementation of the curriculum, learners' learning processes were observed continuously and feedback was collected randomly. Based on their feedback, the curriculum was further improved and learners' learning effectiveness was increased.

5. Evaluation: A questionnaire survey was administered to learners and executives to evaluate overall effectiveness of the developed e-learning curriculum.

CONCLUSIONS

As a vehicle for delivering information, multimedia technology is being increasingly used. Multimedia involves the integration of hypertext with images, video, sound, animation and simulations [23]. It offers many potential benefits to

teachers for delivering information. Studies have also shown that multimedia-based e-learning can help people learn more effectively than through traditional classroom lectures [24]. Several factors have been attributed to the success of e-learning in helping people learn.

First, information in multimedia-based e-learning is presented in a non-linear hypermedia format. The nature of hypermedia allows learners to view things from different perspectives. Hypermedia systems also allow users to choose information freely. Second, multimedia-based e-learning is more interactive than traditional classroom lecturing. Interaction appears to have a strong positive effect on learning [25]. Third, another feature of multimedia-based e-learning is flexibility. Multimedia programmes are flexible in terms of how they may be used at home, in classrooms, by individuals or in small groups.

Previous research has found that individuals less satisfied with their experiences, or who view the system negatively, are less likely to participate in future e-learning initiatives [26][27]. Therefore, a key future research question is how to design e-learning courses to maximise affective reactions to the learning and intentions to participate in future e-learning initiatives.

A learning model describes the essential instructional and learning process. Based on research, a learning model can be analysed using these components: educational environments, course development, teaching and learning, interaction and evaluation activities [28-31]. Outlined in this article is a successfully applied ADDIE model to develop an industry demand-driven situated e-learning curriculum for *auditors* in an international accounting firm. It is concluded that this model provides a useful tool that can be used easily by organisations to design e-learning modules that contain all the essential ingredients of a high-quality situated learning experience.

ACKNOWLEDGMENTS

This study was funded by the National Science Council of Taiwan under the contract number NSC 99-2511-S-328-001-MY2. Special appreciation must be given to the persons who participated in this study, and to the experts who provided professional opinions.

REFERENCES

1. Allen, I.E. and Seaman, J., Entering the mainstream: The quality and extent of online education in the United States, 2003 and 2004 (2004), 7 December 2009, http://sloanconsortium.org/sites/default/files/entering_mainstream_1.pdf
2. Allen, I.E. and Seaman, J., Online nation - Five years of growth in online learning (2007), 7 December 2009, www.sloan-c.org/publications/survey/pdf/online_nation
3. Alavi, M. and Leidner, D.E., Technology-mediated learning - a call for greater depth and breadth of research. *Information Systems Research*, 12, **1**, 1-10 (2001).
4. Kirschner, P., Kester, L. and Corbalan, G., Designing support to facilitate learning in powerful electronic learning environments. *Computers in Human Behavior*, 23, 1047–1054 (2007).
5. Office of Taiwan e-Learning and Digital Archives Program, 2004 White Paper on E-Learning, Taipei: National Science Council, Executive Yuan (2004).
6. Kau, R. and Rans, D.L., They can add but can they communicate? *Business Forum*, 18, 24-26 (1993).
7. Hsiao, T.C., Chou, C.W. and Duh, R.R., Investigation into accounting education in Taiwan (IV): The gap between skills of accounting graduates and social expectations of them. *Accounting Research Monthly*, 242, 74-82 (2006).
8. Cheng, K.W., The curriculum design in universities from the perspective of providers in accounting education. *Educ.*, 127, **4**, 581-590 (2007).
9. Wu, B.E., PricewaterhouseCoopers seeks 15% growth in revenue next year. *Economic Daily News*, A13, 12 December (2008).
10. Hamalainen, M., Winston, A.B. and Vishik, S., Electronic markets for learning: Education broker-ages on the Internet. *CAMC*, 39, **6**, 51-58 (1996).
11. Chen, N.S. and Shih, Y.C., The Analysis and implementation of e-learning park. *ICCE2001*, Korea, 690-693 (2001).
12. Brown, J.S., Collins, A. and Duguid, P., Situated cognition and the culture of learning. *Educational Researcher*, 18, **1**, 32-42 (1989).
13. Chai, J. and Hannafin, M., Situated cognition and learning environments: Roles, structures, and implications for design. *Educational Technol. Research and Development*, 43, **2**, 53-69 (1995).
14. Chiu, G.F., *Situated Learning and Computer Assisted Learning - A Focus on the Idea about Learning Community*. Taipei: Shita Books (1996).
15. Honebein, P., Duffy, T.M. and Fishman, B., *Constructivism and the Design of Learning Environments: Context and Authentic Activities for Learning*. In: Duffy, T.M., Lowyck, J. and Jonassen, D.H. (Eds), Designing Environments for Constructive Learning. New York: Springer-Verlag, 87-108 (1993).

16. Chen, Y.H., and Huang, C.L., A study of applying situation building to e-learning. *The J. of Commercial Design*, 10, 91-111 (2006).
17. Shyu, H.Y., A study of the e-learning curriculum development model. *J. of Educ. Research*, 116, 15-30 (2003).
18. Roger, C. and Schank, R.C., *Designing World-Class E-Learning*. Taipei, Taiwan: McGraw-Hill Education (2001).
19. Banathy, B.H., *Instructional Systems Design*. In: Gagne, R.M. (Ed), Instructional Technology: Foundations. Hillsdale, New York: Lawrence Erlbaum Associates, 85-112 (1987).
20. Mannaz, M., An expert teacher's thinking and teaching and instructional design models and principles: An ethnographic study. *Educational Technol. Research and Development*, 46, **2**, 37-64 (1999).
21. Schank, R.C., *Goal-Based Scenarios: Case-Based Reasoning Meets Learning by Learning by Doing*. In: Leake, D. (Ed), Case-Based Reasoning: Experience, Lessons & Future Directions. AAAI Press/The MIT Press (1996).
22. Welsh, E.T., Wanberg, C.R., Brown, K.G. and Simmering, M.J., E-learning: Emerging uses, empirical results and future directions. *Inter. J. of Training and Development*, 7, **4**, 245-258 (2003).
23. Uden, L., *Designing Hypermedia Instruction*. In: Rogers, P.L. (Ed), Designing Instruction for Technology-Enhanced Learning. London: Ideal Group, 161-183 (2002).
24. Bagui, S., Reasons for increased learning using multimedia. *J. of Educational Multimedia and Hypermedia*, 7, **7**, 3-18 (1998).
25. Najjar, L.J., Multimedia information and learning. *J. of Educational Multimedia and Hypermedia*, 5, **2**, 129-150 (1996).
26. Lim, C.K., Computer self-efficacy, academic self-concept, and other predictors of satisfaction and future participation of adult distance learners. *The American J. of Distance Educ.*, 15, **2**, 41-51 (2001).
27. Carswell, A.D. and Venkatesh, V., Learner outcomes in an asynchronous distance education environment. *Inter. J. of Human-Computer Studies*, 56, **5**, 475-494 (2002).
28. Lepori, B., Cantoni, L. and Succi, C., The introduction of e-learning in European universities: Models and strategies. *Quality on the Line*, 74–83 (2000).
29. Forman, D., Nyatanga, L. and Rich, T., E-learning and educational diversity. *Nurse Education Today*, 22, 76–82 (2002).
30. Harper, K.C., Chen, K. and Yen, D.C., Distance learning, virtual classrooms, and teaching pedagogy in the Internet environment. *Technol. in Society*, 26, 585–598 (2004).
31. Raab, R.T., Ellis, W.W. and Abdon, B.R., Multisectoral partnerships in e-learning: A potential force for improved human capital development in the Asia Pacific. *Internet and Higher Educ.*, 4, 217–229 (2002).