

ORIGINAL ARTICLE

DEVELOPING AN E-LEARNING EDUCATION PROGRAM FOR CASEMIX SYSTEM; PROCESS AND OUT COME

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ABSTRACT

Realizing the huge potential of e-learning in casemix education and since there was no e-learning program on casemix and clinical coding available globally. International Centre for Case-mix and Clinical Coding (ITCC) proposed to establish a universal case-mix education programs through providing an e-learning program (ELP) for case-mix and clinical coding and evaluate its success. The aim of this study is to describe the process of development of e-learning program for casemix system and clinical coding. The introduction of course about casemix and clinical coding was redesigned for e-learning program by applying ADDIE model (refer to Analysis, Design, Development, Implementation, and Evaluation). A total number of 57 learners attended to the course from around the world (40 different countries). The mean age of subjects was 34.70±8.66 years. Regarding profession, the largest percentiles (40.4%) of e-learners were belonging to academic sector and healthcare sector. All of the participants felt satisfied or very satisfied with the program. There was a significant difference between pre-test and post-test for e-learners knowledge score at the 0.05 alpha levels. The findings of the evaluation of the case-mix e-learning program indicated that e-learners found the educational performances of the case-mix online program to be satisfactory. With the advent of modern computer networking systems, organizations can employ these systems to enhance learning and performance improvement of case mix system.

Keywords: E-learning, Casemix System, Clinical Coding, Online education, ADDIE model,

INTRODUCTION

Technology has become the key to a new world of education. With the advancement of technology and the Internet, educational institutions are changing their learning techniques to meet demands of user in providing an ideal learning environment. E-learning is becoming part of training in both fields of education and industry¹. It is defined as the delivery of learning by electronic media; internet, intranets, extranets, satellite broadcast, audio/video tape, interactive TV, and CD ROM². In the healthcare industry, e-learning is particularly attractive for a number of reasons.

The flexibility provided with online learning is helpful to healthcare professionals whose schedules do not always accommodate classroom attendance particularly during the daytime hours. Healthcare is provided 24 hours, seven days a week, 365 days of the year, so the capability for healthcare staff to train anytime and anywhere with only an Internet connection is very helpful³. E-learning can be applied for capacity building in casemix system which is a form of patient classification system that combines the types of diseases seen in a hospital with the costs and outcomes of treatment given to patients. Case-mix

classifications are based on patient information, which is routinely collected and is derived from patient medical record⁴. Realizing the huge potential of e-learning in casemix education and since there was no e-learning program on casemix and clinical coding available globally.

International Centre for Case-mix and Clinical Coding (ITCC), considering its experience and technical capacity to conduct training in this field, proposed to establish a universal case-mix education programs, especially for developing country, through providing an e-learning program (ELP) for case-mix and clinical coding and evaluate its success. The most widely used methodology for developing new education and training programs is called Instructional Systems Design⁵. Instructional design is a systematic method for conceptualizing, creating, and carrying out instructions⁶. This approach provides a step-by-step system for the evaluation of students' needs, the design and development of training materials, and the evaluation of the effectiveness of the training intervention⁵.

Almost all Instructional System Design models are based on the generic ADDIE model⁵. ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model is one common way to

develop and evaluate an Internet education program⁷. The ADDIE model is a generic, systematic approach in instructional design, which clarifies the instructional framework to the designers or researchers in order to ensure the effectiveness of instructional products with creative processes⁸. This study describes the instructional system design processes of development of first e-learning program for casemix and clinical coding and evaluates the program in terms of users' satisfaction and learning effectiveness. The findings of this study can provide a framework for health service management and educators and hospital administrators to develop ELP for casemix system. The aim of this study is to describe the process of development of e-learning program for casemix system and clinical coding.

METHODS

Developmental research has been applied for this part of the study. ADDIE model (refer to Analysis, Design, Development, Implementation, and Evaluation) was selected as the means for developing casemix e-learning program. The ADDIE model provides a systematic methodology to plan, develop, and test the course before it launches.

Analysis

First, to address developmental situations before the development of e-learning program for the Case-mix and clinical coding courses the researcher reviewed current courses through interview with current program instructors and attended the case-mix traditional learning program in Case-Mix unit in Hospital University Kebangsaan Malaysia several times.

The goal of developing e-learning program is to provide accessible, affordable, continuous and high quality training program to support implementation of case-mix system in developing countries. The online component of this training program gives trainees and participants background information on the casemix system in order to prepare them for more advanced casemix training. Objectives of the e-learning program were developed as follows: 1) Provide time and place flexibility educational program. 2) Provide an alternative method for healthcare staff to meet their learning needs about case-mix system and clinical coding. 3) Provide learners with early and regular opportunities to test their understanding. 4) Provide various opportunities for learners to allow printing hands on materials. 5) Provide user interfaces to effectively support online learning activities. 6) To support the use of casemix system as a tool to improve efficiency and quality of care. The target participants include medical records Clinical Coders, Medical Record Officers,

and clinical coordinator for casemix implementation, senior finance staff & finance hospital director, senior clinician, medical service hospital director, head of hospital medical committee, Pharmacists, Hospital Financial Officers, Nurses and Nursing Managers, Healthcare Managers and Clinicians from different countries.

Asynchronous e-learning was chosen as communication method. Asynchronous tools allow people to connect together at each person's own convenience and own schedule from multiple time zones. The contents delivered to the audience using slides with audio and visual effects. Lessons are also provided in PDF formats, and participants are encouraged to use the course forums for discussion with the instructors. The casemix e-learning program is available 24 hours per day, 7 days per week and is maintainable by a Webmaster.

Contents were provided by International Center for Case-Mix and Clinical Coding. The instructor manages the Web-based learning environment by providing informative feedback on e-learners' work and discussion. The stages of studies were clearly set in the planning phase to monitor the progress and to ensure milestone achievement was accomplished according to schedule. The possible user activities (or tasks) on the web-based distance learning system was identified.

Design

Following the analysis phase, the courses for case-mix and clinical coding program was redesigned for e-learning delivery method based on the analysis phase and availability of the resources to have a logical flow of event using multimedia. Case-mix Unit in HUKM gave Input to ensure that the training design meets specification and training needs. The web designer designed a World Wide Web Pages. A working group consisting experts in pedagogy, multimedia and information technology was established to support the Case Mix content experts and to develop the Case Mix training materials. A two days workshop was held to teach the casemix lecturers how convert their material from traditional learning format to suitable format for e-learning.

The first module contains 7 Lectures. The module covered the following topics: Introduction to Casemix (45 min), Diagnosis Coding In Casemix System (20 min), Procedure Coding in Casemix (40 min), Costing Methodology In Casemix (30 min), Role of Clinical Pathways In Casemix System (15min). Data Requirement In Casemix System (20 min) Plan For Implementation of Casemix System (15min).

A quiz includes a series of single choice questions designed as an assessment tool so the learners can randomly pick questions from a bank. This prevents the cheating on quiz session, by providing different series of question for different learners. Each quiz include 40 questions, the total score is 40 and the passing mark is 20 and above. A time frame was set for learner to complete the quiz and scores is automatically calculated after completing.

The definitions for specialized terms were listed and alphabetized the term list that has been used in the casemix e-learning course. It can help to read the terms first to get a basic review of the concepts that was covered, and then to attend to the course with the definitions fresh in the mind. Course flowchart shows how the course progresses from start to finish including main menu, lessons, quizzes, course map, help, discussion forums, events calendar and any other components of the course. Similarly, flowchart reveals the structure and sequence of the instruction.

A tutor for each course will be available for questions through a message exchange. To give the credit for the information the name, the email address or contact number of the instructors was included in the site this shows that the author is willing to defend his or her particular web site to users. To insure the accuracy of the content, the educational background of the author stated on the web site. Moodle was chosen as an e-learning delivery platform for casemix e-learning program. The Moodle is a software package written in PHP language designed to help educators in the creation of quality internet-based courses. It is a free web application that educators can use to create effective online learning sites. Moodle (www.moodle.org) platform is characterized by a moderate level of technological requirements in order to reduce the risk of technical difficulties due to user lack of computer knowledge. The main advantage of Moodle is the platform's code transparency, enabling users and developers to adapt the platform to individual needs and develop new, advanced features and add-ons.

This step also specified technology capabilities that are needed to successfully support potential users. As a minimum browser, Internet Explorer (7 or above) and a minimum connection speed of 56k or above shall be required (connection type: modem, cable, DSL, or Ethernet, etc.). Software requirements are Word 97 or higher - PowerPoint 97 or higher - Windows 98 or higher for PC, OS 8.x or higher for Macintosh, Acrobat Reader and Flash Player installed shall be required.

Development

The third procedure was to develop the E-learning program and test questions for the course. The instructors converted their presentations into e-learning suitable format; Audio video and pdf format for this mean was chosen. All courses were recorded using Camtesia Studio Software. After recording all courses, each course was divided into subsections and converted to e-learning material for delivery on the World Wide Web-pages.

After complementing the projects, the files were uploaded into website for delivery through an online course. A time frame was set for learner to complete the programs. Questions appeared at the end of each course, and scores will automatically calculate after completing the courses. To prevent cheating, participants will give the password to log in to the course. After creating, evaluating and refining the paper prototype, a programmer was hired to implement the program on the Web Wild World. A face-to-face meeting was holding and a first draft of the course materials was delivered to the experts to have a tabletop review of the course. During the tabletop review, the key subject matter experts checked the accuracy and completeness of the content. They walk through the course materials looking for errors before any learners interact with the course.

Implementation

The casemix e-learning program was implemented at the World Wide Web-page. First, at the beginning of each course, learners will be asked to provide their demographic factors (age, level of education, years of working experience, and weekly hours of Internet or www access, type of internet connection). For each course, post-test questions will administrate, with a maximum score of 100%. After beginning the programs, learners can take courses any time, but before they need to obtain a user name and password to sign in. For the support, an instruction email address was provided. Third, one research assistant helped to keep track of records. In the Implementation phase the final product, developed based on needs and errors discovered while testing with a prototype product, was put into action and presented to the target audience.

The Interface Design of E-Learning Course

Anyone signed up for the "Introduction to casemix" course can login the e-learning program by using a 7.0 or greater version of the Web browser such as Microsoft Internet Explorer and Mozilla Firefox Communicator. It is available 24 hours per day, 7 days per week and is maintainable by a Webmaster. On-line quiz and certificate are utilized to enhance participants' motivation for attending to the course. Participants can access to this course within two weeks after first log in to

the course in one month after receiving the user name and password. After one month, the username and password will be inactive. The e-

EVALUATION

An evaluating procedure including a pre-test, post-test was performed to assess of users' satisfaction and learning outcomes for the proposed system. After registration to the e-learning platform, a user name and password was given to the users to sign in for the program. Currently one module (Introduction to Casemix) is open to the users. At the beginning of the module, learners are asked to provide their demographic factors (age, level of education, and years of working experience) and knowledge regarding casemix. After that learners can take courses any time between, 2 weeks time frame to complete the program.

Upon completion of the course a questionnaire including Satisfaction Instrument (SI) and knowledge Instrument (KI) was sent to every learner and asked them to fill in the questionnaire and send it back to the researcher's email address in one week after receiving the questionnaire. An Approval letter from the ITCC was attached to the email for confidant of participants.

The Satisfaction Instrument (SI) contains of 5 items in a five-point Likert scale (from 1 = strongly disagree; 5 = strongly agree). Scores on the (SI) was obtained by summing the participants' responses. The minimum possible score on the SI was 5, and the maximum possible score was 25. The internal consistency reliability result for the Si was $\alpha = 0.81$.

The knowledge instrument comprised 15 close-ended questions, presenting yes/no/I do not know options. Answers were graded from zero (false answer/no answer) to two (true answer). The sum of the responses was the knowledge score that fell between a minimum score of zero and a maximum score of 30. Scores from zero to 15 were

learning course is available 24 hours per day, 7 days per week.

considered as "poor knowledge" and scores from 16 to 30 considered as "good knowledge". The knowledge scale had a Cronbach's alpha reliability coefficient of $\alpha = 0.739$. Knowledge test on case-mix system which was the same for the Pre-test and post-test

DATA ANALYSIS

Descriptive analysis, were performed to determine the demography of subjects participating in this study and analysis of end-of-course evaluations completed by case-mix learners. E-learners' satisfaction with the casemix online course was evaluated and Wilcoxon Signed-Rank Test was conducted to determine the learning effectiveness of e-learning program.

ETHICAL CLEARANCE

The study was approved by the UniversitiKebangsaan Malaysia Research Ethics Committee. (Code: FF-173-2012). All subjects had given written informed consent.

RESULTS

Demographics of E-learners

Demographic data from e-learning course shown 35 subjects or 61.4% of the participants in the e-learning course were male and 38.6% of them were female. The mean age of the e-learners was 34.70 ± 8.66 years, ranged from 22 to 52 years old. For level of education, Bachelor holders had the highest percentage for groups, e-learners and traditional learners. Mean length of job experience was 6.4 years. Regarding profession, the largest percentiles (40.4%) of e-learners were belonging to academic sector and healthcare sector. It was also first experience of 70.2% of e-learning group for attending to case-mix course.

Table 1. Demographic Factors of Participants in the Study (N=57)

Variables	n (%)
Gender	
Male	35 (61.4)
Female	22 (38.6)
Age	
20-29	21 (36.8)
30-39	16 (28.1)
40-49	19 (33.3)
50 and above	1 (1.8)
Educational Level	
Diploma	3 (5.3)
Bachelor Degree	19 (33.3)
Master	18 (31.6)
PhD	11 (19.3)
M.D	6 (10.5)
Profession	
Healthcare	23 (40.4)
Financial	2 (3.5)
Information technology and Medical Coding	4 (7.0)
Academic	23 (40.4)
Management	5 (8.8)
Year of Employment	
< 1 year	8 (14.0)
1-3 years	24 (42.1)
4-6 years	9 (15.8)
7-9 years	1 (1.8)
≥ 10 years	15 (26.3)
Casemix Experience	
Yes	17 (29.8)
No	40 (70.2)

Learners' Satisfaction about Casemix Learning Course

There were five statements in this section of questionnaire in assessing the participants' satisfaction level about casemix e-learning course. Participants were asked to rate the statements on a scale from one to five where one was the most negative score and 5 was the most positive score. The minimum possible score for this questionnaire was five and the maximum possible score was 25. The score ranged from 14 to 25. The mean satisfaction score of e-learners was 20.4±3.1. The mean score for each item in satisfaction questionnaire is presented in the Table 2. The two highest scores of the e-learners, 4.2 out of 5, were on the statements 'I would recommend this course to others' and 'My time spent in the course was worthwhile' and the least score (3.9) were on the

statement 'The content of this class meets my expectations'.

The highest percentile given by e-learners stated that they agree that they were satisfied with the performance of casemix learning course. The highest percentile the group also agrees that the content of the course meets their expectation. The highest percentile of the group indicated the reply 'agree' for the statement 'As a result of my experience with this course, I would like to take another casemix course in the future'. The highest percentage of e-learners highly agreed with the statement 'I would recommend this course to others'. The highest percentage of both groups agreed that their time spent in the course was worthwhile. The results of e-learners' responses to satisfaction are listed in table 3.

Table 2. E-learners' Responses to Satisfaction Instrument (N=57)

Item	Strongly Disagree %	Disagree %	Natural %	Agree%	Strongly Agree%	Mean Score of 5
1. I am satisfied with the performance of course.	0.0	0.0	24.6	52.6	22.8	4.0
2. The content meets my expectations.	1.7	3.5	28.1	35.1	31.6	3.9
3. I will take another casemix course.	1.7	0.0	15.8	52.6	29.8	4.1
4. I will recommend the course to the others.	0.0	1.8	22.8	28.1	47.4	4.2
5. My time spent in the course was worthwhile.	0.0	1.7	12.3	47.4	38.6	4.2

Satisfaction Level of Participants in E-learning

Table 3. Shows the results of User's satisfaction level by ranking them as Very Satisfied, Satisfied, and Not Satisfied Based on the score for satisfaction questionnaire. Score ≤13 represent unsatisfied, score between 14 to 19 grouped as

satisfied and score from 20 to 25 grouped as highly satisfied. In overall, all of e-learners were satisfied with the casemix educational program. 63.2% of the e-learners felt very satisfied and 36.8% of them felt satisfied with the educational program.

Table 3. Participants Satisfaction Level toward CasemixE-learning Program (N=57)

Variable	Frequency	Percentage%
Unsatisfied (score ≤13)	-	-
Satisfied(14<Score≤19)	21	36.8
Highly Satisfied (20<score≤25)	36	63.2
Total satisfaction score=25		

Effectiveness of E-Learning Program

Wilcoxon Signed-Rank Test was conducted to compare the knowledge score of the e-learner between pre-test and post-test to determine if there was a significant difference on knowledge score on casemix and clinical coding before and after attending to the course. The result indicated

that the p-value for comparing post-test and pre-test (0.000) was lower than the 0.05 alpha level: there was a significant difference between pre-test and post-test for e-learners knowledge score at the 0.05 alpha level. This result indicates a significant increase in knowledge score after taking the course.

Table 4. Changes in Knowledge Score of the Subjects after Intervention (N=57)

Variable	Pre-test		Post-test		P-value * Wilcoxon Signed-Rank Test
	Median	IQR ¹	Median	IQR ¹	
Knowledge Score	16.00	12.0-22.0	20.00	20.0-24.0	0.000

*Sig at p-value< 0.05, Total knowledge score=30, ¹Interquartile Range

DISCUSSION

The first purpose of this study was to determine the level of satisfaction with e-learning. The learners were very satisfied with the casemix course, with 81.94% (overall mean 20.42 out of 25) based on the result from the learners' responses to the satisfaction questionnaire that taken at the end of the courses, user satisfaction of the group

has been pretty good. The result of evaluation of users' satisfaction towards casemix e-learning program suggests that learners were satisfied or very satisfied with the program. Therefore, casemix e-learning program is worth implementing for health staff to obtain knowledge from websites. The result was similar to a study by Beta-Jones and Avery⁹, Chang et al.¹⁰ and Connolly et al.¹¹, who found that students who participated

in a web-based course were pleased with the course overall. Roach & Lemasters¹² mentioned that more students taking the online course found the course to be better than expected than those who found the course to be what they expected or less than they expected.

The casemix e-learning course is new and learners are always in search of something new inside the web therefore it is expected if they are satisfied with the course. The Second purpose of this study was to evaluate the effectiveness of the program. Users' knowledge acquisition has been considered as indicators of effectiveness. Therefore, to ascertain if there was a significant difference between the pre-test and post-test knowledge score for e-learners, Wilcoxon Signed-Rank Test was completed. The finding illustrated that there was a significant difference between pre-test and post-test for e-learners at the 0.05 alpha levels ($p=0.01$). The results of pre-test and post-test suggest that e-learner group showed a significant increase in knowledge about casemix system after attending to the casemix online course. This indicated that the casemix online program was successful in educating students about casemix system and it was effective in improving of knowledge of the participants of the course.

The finding is similar to other studies Belcher & Vonderhaar, 2005¹³; Jeffries, 2005¹⁴; Wang et al., 2006¹⁵; Connolly et al., 2007¹¹; Hugenholtz, 2008¹⁶; Mazzoleni et al. 2009¹⁷, which all proved the effectiveness of e-learning program in terms of knowledge acquisition. The results confirm that e-learning can be used as a delivery method for casemix and clinical coding educational program.

CONCLUSION

Our findings do suggest that e-learning is at least as effective as face-to-face learning for casemix education. The findings of the study support the use of e-learning for teaching about casemix system to health staff. The flexibility of this method was one of the most positive aspects of this method. It was evident that the e-learners very satisfied with casemix educational program. Also, 81.8 % the participants on casemix e-learning course would like to take another casemix course through online. Therefore, e-learning program for casemix is worth making available to health staff and should be implemented in future in-service health staff education to meet their training needs within the strictures of their busy professional lives.

In terms of effectiveness of the course in improving the knowledge of participants, our study showed improvement of post-test versus (vs.) pre-test score at significant level, $p<=.01$.

The result showed that e-learning can be applied for delivery of educational program for all age group, both gender with different computer or internet skill since satisfaction level of e-learners was regardless of their demographic variable. Except for the educational level of e-learners, other demographic variable have no relevance with satisfaction level, and PhD holder had the higher satisfaction level toward the case-mix e-learning program. This study is the first to demonstrate that e-learning can be useful for Case-mix system and clinical coding. Starting from the experience here reported, the authors are confident that e-learning will continue to gain ground and evolve as an effective and appreciated educational mean for Case-mix system.

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