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Research Article

A Learning Quality Evaluation Model in Food Sciences and Engineering in the MOOC Learning

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Abstract: This study proposes a knowledge unit-based learning quality evaluation model in food sciences and engineering that is adapted to the MOOC environment based on the fuzzy comprehensive evaluation method with the combination of the characteristics of the classroom-based learning pattern. The result of the teaching experiment proves that this model in food sciences and engineering is able to enhance efficiently the ability of the learning feedback acquisition and the processing capacity of an e-learning system, promoting the collaboration between the on-line educators and strengthening the learning quality monitoring function provided by the educator. It has played a significant role in the improvement of the knowledge unit-based learning quality. Hence, this model in food sciences and engineering will have a promising prospect of application with the rapid development of the MOOC-based learning pattern.

Keywords: Food sciences and engineering, learning quality evaluation, MOOC

INTRODUCTION

Recently the three e-learning courses released by Stanford University, have opened the door to the MOOC (massive open online courses) era (Pappano, 2012). With millions of registered users are participating in the MOOC every year and the market having been growing at a rate near to 23% (Breslow *et al*., 2013), which has promoted the M-learning to act as a pioneer in the “education revolution” (Aguaded-Gómez, 2013). However, the course completion rate is only 7-9% on the Coursera website, where most of data is about the learners who have obtained the relevant degree (Rivard, 2013), forcing the researchers to think about the problems of the MOOC itself more soberly.

M-learning has been conducted mainly through the online video and the online testing (Mazoue, 2014), where the learners and the educators are isolated from each other (Mak *et al*., 2010). Since it focuses on the approach that the learners can acquire knowledge during their learning, ignoring the approach that the educators might get the teaching feedback, then the online educators might lose the control over the learning quality since they are unable to evaluate the learning quality of the learners about the target knowledge, nor could they make a specific adjustment on the content and the strategy based on the evaluation result. Then due to the lack of target, the learners can hardly feel a sense of integration and that they’re concerned about. Hence the learners’ persistence in learning activities always puts them on their mettle.

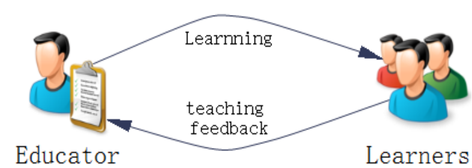

Fig. 1: Knowledge flow loop in a classroom

As shown in Fig. 1, the approach that the students acquire knowledge forms a closed knowledge flow loop with the approach that the teacher gets the feedback in a classroom environment (Scrivener, 1994). The purpose that the teachers should collect the teaching feedback is to evaluate the current learning quality of the learners (Branch and Paranjape, 2002), so as to adjust their teaching content and strategy to control the learning quality within the expected range based on the evaluation result. At this moment, the teacher will work like a “quality inspector” in the assembly line of the factory. Actually the learning quality evaluation made by the teacher can be grouped into the curriculum-based evaluation and the knowledge unit-based evaluation in a classroom environment. The knowledge unit-based learning quality evaluation, which is conducted in the classroom teaching process, has not only become one of the important sources that make the students feel a sense of integration and that they’re concerned about, but also become a fundamental link in the control of teaching quality.

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The knowledge unit-based learning quality evaluation consists of the following three parts, including the student's subjective evaluation, the assessment on the procedural learning material and the assistant's or the teacher's subjective self-evaluation. The student's subjective evaluation result will be fed back to the relevant teacher through the following classroom exchange methods including the students' movements, their facial expression, their questions and discussion when the students are attending the class. However the assessment on the procedural learning material is reflected in the teacher's daily work, such as the check of the study notes, the homework correcting, the experimental report, the unit test and the paper etc. As to the assistant's or the teacher's subjective self-evaluation, it's the evaluation made by the teacher, who acts as the third party on the teaching process, including the completeness of the target knowledge that has been taught, the degree that the background knowledge has been elaborated and the comprehensiveness of the training tasks, which even cover the training of various abilities. The evaluation results from these three aspects finally bring about a relatively comprehensive evaluation result with the combination of the teacher's working experience.

MATERIALS AND METHODS

Solution design: In this MOOC era, there're big differences between the M-learning and the classroom learning, such as the early preparation for the video recording, the large number of learners and the discreteness of the learning time and places etc. Therefore it's impossible that the knowledge-unit based learning quality evaluation can be made independently by the educators that are shown in the video. On account of this, this study proposes a mathematical algorithm for the comprehensive knowledge unit-based learning quality evaluation model in food sciences and engineering based on the fundamental features of the MOOC-based learning. Then based on such a model in food sciences and engineering, this study designs a solution for the experimental e-learning system that is applicable to the MOOC environment and capable to collect teaching feedback, make learning quality evaluation and support the strategy adjustment.

The target users of this experimental system include the online educators, the learners, the evaluator for procedural materials and the learning quality facilitator. The role function of the online educator has been defined simply, which refers to the video resources contributed by the system to the e-learning courses.

The learner, which is the core and the target user of the system, is able to use the following functions including the support for the e-learning, the input of the procedural materials, review and maintenance as well as the subjective evaluation on the effect of the knowledge unit-based learning.

The evaluator for procedural materials is responsible for the evaluation on the subjective procedural learning materials including the online study notes created by the learners, their homework, the experimental report, the paper and the design works etc. in addition to the provision of the relevant revision suggestion. As to the objective procedural learning materials, they will be assessed by the evaluation system.

Mathematical model in food sciences and engineering: The learning quality evaluation index system consists of the objective indexes and the subjective indexes. Since all of the indexes are rather fuzzy, then this study chooses the Fuzzy Comprehensive Evaluation (FCE for short) to construct a learning quality evaluation model in food sciences and engineering. However in order to avoid the great difference in the human factors for the evaluation index weights, this model in food sciences and engineering adopts the Analytic Hierarchy Process (abbreviated as AHP) to calculate the weight vector of the evaluation index set (Jin *et al*., 2004).

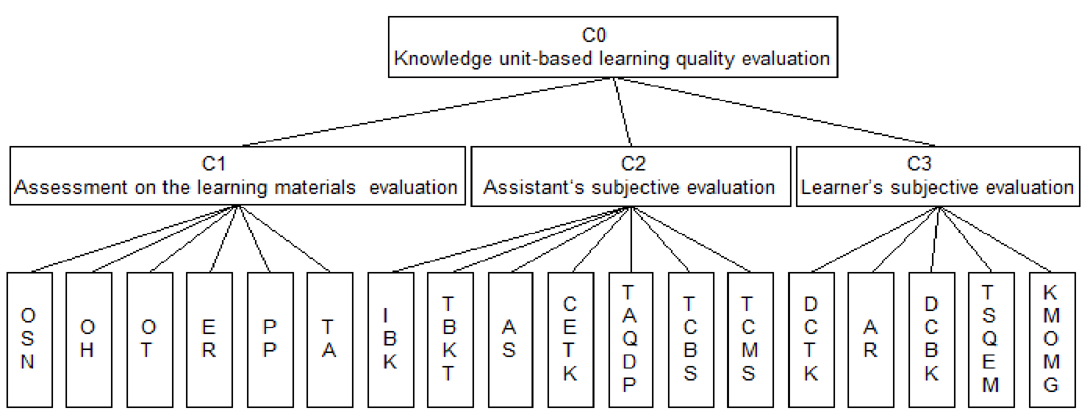

Fig. 2: Knowledge unit-based learning quality evaluation index system

Index set: In Fig. 2, this study has built a hierarchical structure where knowledge unit is considered as the evaluation target with the combination of the composition characteristics of the assessment on the knowledge unit-based learning effect and the features of the MOOC-based learning in the classroom learning mode. Assume that the set of the rule hierarchy is C0 = {C1,C2,C3}, then the indicator-based evaluation will contain three subsets, including C1, the subset for the assessment on the learning materials, C3 the subset for the subjective evaluation made by the online teaching assistant and C2 the subset for the learner's subjective evaluation:

C1 = {OSN, OH, OT, ER, PP, TA}
C2 = {IBK, IBKT, AS, CETK, TAQDP, TIA, TCBS, TCMS}
C3 = {DCTK, AR, DCBK, TSQEM, KMOMG}

RESULTS AND DISCUSSION

In order to verify the effect of the knowledge unit-based learning quality evaluation model in food sciences and engineering and the deficiency in the analysis, firstly the paper takes the evaluation model in food sciences and engineering as the core to build a basic experimental environment for the e-learning. Also it takes the teaching video that is recorded in the name of "Basic Operation of Microsoft Excel" as the target learning content. Figure 3 is the display of the comprehensive evaluation result with the following information having been displayed, including the evaluation result vector, the evaluation grade and the membership matrix that acts as an intermediate result.
Then mobilize separately the learners, the evaluators for subjective learning materials and the online teaching assistant to conduct the teaching experiment, where 5 college students who have passed the curriculum examination have worked as the subjective evaluators for learning materials, 1 teacher acts as the online teaching assistant and 61 college students that never attend the course have worked as the volunteers of the e-learning. This teaching experiment has been conducted on a basis of five groups to measure the influence of the knowledge unit-based evaluation model in food sciences and engineering on all of the learners who have taken the same course.

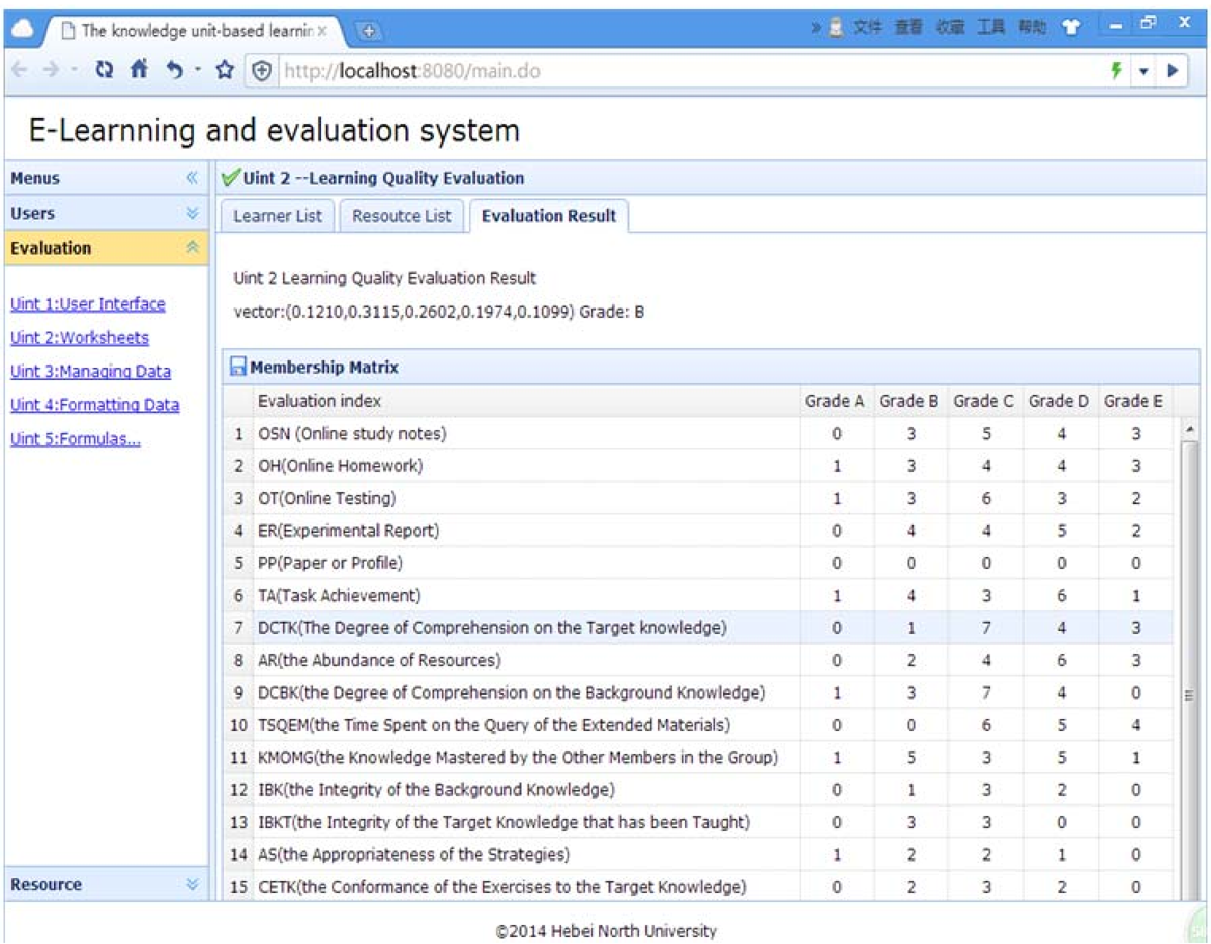

Fig. 3: Interface for the comprehensive evaluation result

Table 1: Comparison result in the e-learning experiments

No. of group	No. of leaner	Evaluation	Expected grade	Result vector	Grade
1	15	1st round	A	(0.0412, 0.1820, 0.4211, 0.2241, 0.1307)	C
1	15	2nd round	A	(0.1210, 0.3115, 0.2602, 0.1974, 0.1099)	B
2	11	1st t round	A	(0.0534, 0.2167, 0.3773, 0.2502, 0.1023)	C
2	11	2nd round	A	(0.1341, 0.2681, 0.3497, 0.1803, 0.0678)	C
3	16	1st round	A	(0.1130, 0.3232, 0.2301, 0.1051, 0.2287)	B
3	16	2nd round	A	(0.1740, 0.3401, 0.3031, 0.0591, 0.1237)	B
4	15	1st round	A	(0.2013, 0.2911, 0.2451, 0.1609, 0.1016)	B
4	15	2nd round	A	(0.33090.2173, 0.2841, 0.0761, 0.0916)	A
5	14	1st round	A	(0.1230, 0.2538, 0.3047, 0.1382, 0.1803)	C
5	14	2nd round	A	(0.1530, 0.4101, 0.2313, 0.1357, 0.0699)	B

What have been recorded in Table 1 are the results of this teaching experiment. The column of the expected result indicates the expected learning quality based on the target knowledge unit with the values corresponding to the comment set in the evaluation model in food sciences and engineering. The results in the second round of evaluation reflect the learning quality of the learners after they study again when the learning materials have been supplemented and the strategies have been adjusted according to the first round of the comprehensive evaluation. The result vector is the direct calculation result of the evaluation model in food sciences and engineering, while the evaluation grade refers to the result corresponding to the comment set obtained according to the maximum membership principle. The comparison of the results in these two rounds of evaluation shows that the evaluation results in Group 1, Group 4 and Group 5 present a significant improvement. However there’s no change in the evaluation grade of Group 2, Group 3 and Group 5, where the result vectors have changed to some extent. For example, the sum of the last two membership functions for the result vectors in the first round is 0.3812. However it’s 0.2431 in the second round. Even in the third group, it’s separately 0.3338 and 0.1828 in the first and the second round. The experiment result proves that the knowledge unit-based learning quality evaluation model in food sciences and engineering proposed in this study has played a role in the improvement of the e-learning quality.

Prospect and deficiency: In the knowledge unit-based learning quality evaluation model in food sciences and engineering, the degree that the learner should master all of the knowledge points in the target knowledge unit is considered as the evaluation object. By virtue of the relevant e-learning system, this model in food sciences and engineering has integrated the e-learning and the feedback process as a whole to avoid the shortcoming in the traditional e-learning system that focuses on the learning procedure, neglecting the feedback information. Therefore our model in food sciences and engineering is able to provide an objective basis for the online educator to guide the learners specifically about their learning process and content. Also it will make the online learners feel that they’re concerned about to bring about a stronger sense of integration. Actually in the teaching experiment, our model in food sciences and engineering has contributed to the significant improvement of the e-learning quality. Therefore it has a promising prospect of application under such a background that the MOOC-based learning has been developed quickly.

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