The design of a framework for cooperative learning through web utilizing data mining technique to group learners

Pensri Amornsinlaphachai*

Department of Computer Education, Faculty of Science and Technology, Nakhonratchasima Rajabhat University, Thailand

Abstract

The purpose of this research is to design of a framework for cooperative learning through web utilizing data mining technique to group learners. The research and development methodology is employed in this study; however simply the framework design phase is presented here. The design phase composes of 5 steps as follows: 1) Studying and analyzing the related principles and theories, 2) Studying the context of learning environments, 3) Designing a framework for cooperative learning through web using data mining technique to group learners, 4) Assessing the framework by six experts and 5) Improving the framework. Many theories and principles are employed in this research; for instance, data mining technique, constructivist theory and the principle of media symbol system. Two results are revealed as follows. Firstly, the learning model consists 5 components that are (1) forecasting and grouping module, (2) cooperative learning community, (3) expert community, (4) learning resources and (5) quiz module. Secondly, the results of the evaluation from 6 experts are expressed that the framework comply with computer science principles and learning theories and the experts accept to the usability of the framework in a high level at 71.15 percents overall. To summarize, the framework can be employed to design and develop a learning model appropriately.

Keywords: data mining, cooperative learning, constructivist

* Asst.Prof.Dr.Pensri Amornsinlaphachai. Tel.: +668-6100-3876
E-mail address: kokkoy@hotmail.com
1. Introduction

Nowadays, many educators believe that learners can construct their own knowledge (Slavin, R. E., Learvey, M., et al., 1986, Mayer, R. E., 1996a, Atherton, J. S., 2013, Amornsinlaphachai, P. and Deejring, K., 2012) that corresponds to Thai National Education Act 1999 and Thai National Economic and Social Development Act 2012-2016 stating that all learners are able to learn and develop themselves and the education system must promote lifelong learning by exploiting internet technology and human society. These notions conform to constructivist theory (Vygotsky, L. S., 1962, Spiro, R. J.; Feltovich, P. J.; et al., 1991). However in the real world, most of learning environments still concentrate on knowledge transmission instead of knowledge construction. Thus the researcher would like to take advantage from online social network and information technology to enhance learners' competency according to the concept of the current educators and Thai National Education Act as well as Thai National Economic and Social Development Act.

Today, cooperative learning is always used to develop learners; however instructors frequently group learners randomly or let learners organize groups by themselves. Often, instructors group weak and stronger learners together by using their judgment; nevertheless instructors' ideas may be incorrect because learners have different kinds of intelligences (Gardner, H., 1999) thus; learners with high GPA may have some weakness in some subjects. For this reason, if academic performance level of learners in each subject can be predicted before teaching, the cooperative learning will be more effective. From this reason, we will use a data mining technique to forecast the academic performance level since this technique has accuracy of prediction. The academic performance level will be used to group learners automatically according to the cooperative learning principle (Slavin, R., 1996, Stevens, R. J. and Slavin, R. E., 1995). This assists learners in constructing their own knowledge by dint of social mechanism that corresponds to Social Constructivist (Vygotsky, L. S., 1962). Besides learner interaction, tools to communicate with instructors are provided and learning resources are presented as a conceptual model to show a relationship between cause and reason of learning content to help learners comprehend the content easier (Mayer, R. E., 1996b).

2. The Purposes of Research

Two main purposes of this study are as follows.

2.1 To design a framework for cooperative learning through web utilizing data mining technique to group learners.

2.2 To evaluate the framework.

3. The Scope of Research

The scope of research described here consists of the target group, the scope of content and the research variable as the following details.

3.1 Target group

The target group used in designing the framework comprises 6 experts in 3 facets that are (1) learning content, (2) design based on theories and (3) media and technology.

3.2 Scope of Content

The content utilized in this research is a part of the computer programming subject at Nakhonratchasima Rajabhat University, Thailand. The topics of the content are variable and control structures.
3.3 Research variable

The research variable studied in this study is a framework for cooperative learning through web utilizing data mining technique to group learners.

4. The Research Instruments

4.1 The opinionnaire of learning environment and instructional context in the course of computer programming is used to study the opinion of lecturers and learners. The questions in the opinionnaire are open-ended questions.

4.2 The record form of document analysis comprising of 4 aspects of principles and theories that are (1) data mining technique, (2) psychology of learning, (3) science of teaching and (4) principles of media and technology.

4.3 The assessment forms to confirm quality and usability of the designed framework. The assessment form to confirm the quality of the framework is created by utilizing the principle of assessment in learning environment and web-based learning (Khan et al., 1997). Open-ended questions are employed in this form. For the evaluation form to confirm the usability of the framework, the percentage of suitability of the usability must be specified for each questions.

5. Data Collection and Analysis

The data are collected and analyzed as follows.

5.1 The learning environment and instructional context is analyzed by summarizing interpretation.

5.2 The review of literatures are collected and analyzed by describing and summarizing interpretation. The result from document analysis is used to design the framework.

5.3 The designed framework is evaluated by the experts. Three facets of assessment are (1) learning content, (2) design based on theories and principles and (3) media and technology. For the usability of the model, the average of percentage is calculated for the proper of the usability. The result is analyzed by summarizing interpretation.

6. Results

The results of the research in the phase of designing a framework for cooperative learning through web utilizing data mining technique to group learners are as follows.

6.1 The framework for cooperative learning

The framework for cooperative learning through web using data mining technique to group learners based on several major principles and theories composes of five components that are (1) forecasting and grouping module, (2) cooperative learning community, (3) expert community, (4) learning resources and (5) quiz module as shown in Figure 1.
From Figure 1, five components in the framework which are the elements of the cooperative learning model have details as follows.

1. Forecasting and Grouping module

The prediction of learners' academic performance level in Forecasting and Grouping module is calculated by utilizing ID3 algorithm (Ross Quinlan, 1979), an algorithm in data mining technique, since this algorithm is appropriate for discrete value and the academic performance level can be classified as excellent, good, fair and poor. After forecasting academic performance level, this module will suggest how to group learners; nevertheless instructors can group learners based on the result of the prediction by themselves as well.
2. Cooperative Learning Community

Cooperative Learning Community consists of two genres of community that are social network and face-to-face meeting. The social network includes both synchronous and asynchronous communications (Amornsinlapachai, P., Inpress). Learners of each group in the community comprise weak learners and strong learners predicted by data mining technique. Grouping Learners is based on cooperative learning principles (Slavin, R. E., Learvey, M., et al., 1986, Slavin, R., 1996).

3. Expert Community

Similar to Cooperative Learning Community, Expert Community composes of two types of community that are social network and face-to-face meeting. The social network includes both online and offline communications. Thus learners can communicate with instructors through online social networks such as face-book or twitter; besides they can leave messages to one another on a web-board as well.

4. Learning Resources

The design of Learning Resources is based on various theories and principles. The elements in the resources are rooted in the design principles of multimedia presentation media symbol system and cognitive load (Sweller, J. and Chandler, P., 1991). The contents in the resources are selected, organized and integrated (Mayer, R. E., 1996b) to create mental representation (Frederiksen, J., White, B., et al., 1999) since information processing using audio, visual and animation can get more effectiveness than information processing by lecturing.

5. Quiz Module

Questions in Quiz module are classified according to the learning level of Bloom’s Taxonomy theory. In Bloom’s Taxonomy theory (Bloom, B. A., 1956), there are 3 facets of learning behavior that are cognitive domain, affective domain and psychomotor domain; however only cognitive domain will be evaluated by using Quiz module.

6.2 The results
The results of evaluating the framework by six experts are exposed as follows. Firstly, the algorithm used to anticipate academic performance level is suitable for data. Secondly, the framework complies with learning principles and theories employed as the foundation for designing the framework. Thirdly, the principles used as the fundamental of synthesizing the framework indicate the appropriateness of media utilizing; moreover the internet technology used in the framework is desirable, renowned and up-to-date. Finally, the learning content is essential for education in the computer field; thus the content is worthwhile to research to enhance learners’ competency because computer programming courses are difficult for ungrounded learners; furthermore the content is general standard; hence this study can be used widely. The experts accept the usability of the framework in a high level at 71.15 %. To conclude, designing a learning model based on this framework is practicable and there is high feasibility to improve learners’ competency by using the model derived from the framework.

7. Summary and Concluding Remarks

The design of the framework is bases on several theories and principles such as data mining technique, multiple intelligence, Bloom's Taxonomy, social constructivist, cooperative learning, cognitive load, mental model, SOI and media symbol system. The framework composes of five elements that are forecasting and grouping module, cooperative learning community, expert community, learning resources and quiz module. The results derived from experts’ assessment are revealed that the algorithm used to foresee academic performance level is proper and the framework conforms to learning principles and theories. Moreover the media and technology used in the framework is in vogue and the learning content is worthy to study; furthermore the usability of the framework is accepted in a high level.

For the further work, a learning model based on the framework will be designed and developed. The developed model will be assessed by experts for internal validation (Deejring, K. and Chaijaroen, S., 2012). For external validation, the model will be tested with learners studying in a computer field at NakhonRatchasima Rajabhat University, Thailand (Deejring, K., Inpress). In addition, the developed model will be tested with learners of other institutes to insist upon the generalization of application.

Acknowledgements

The publication of this work was supported by Nakhonratchasima Rajabhat University, Thailand.

References

Amornsinlaphachai, P. (Inpress). Designing a learning model using the STAD technique with a suggestion system to decrease learners’ weakness. Procedia - Social and Behavioral Sciences, Inpress.
Deejring, K. (Inpress). The design of web-based learning model using collaborative learning techniques and a scaffolding system to enhance learners’ competency in higher education. Procedia - Social and Behavioral Sciences, Inpress.


