Development and Analysis of Web-based Discussion System for Elementary School Students

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Abstract

This study develops a web-based discussion system applying Hill's group cognitive map. We apply it to elementary school students and analyze the learning effects.

Web-based discussion allows learners to actively participate in learning activities. It can facilitate multiple opportunities for learner-oriented interactions in web-based environments. Most web-based discussions occur through bulletin boards and data directories with the intention of creating basic communication exchanges among learners. Many instructional systems, however, are not built on rigorous, theoretically sound platforms. To avoid this trend and if we expect effective learning processes to consistently take place, the development of web-based discussion systems should be based on instructional models that are proven to be theoretically sound and effective in this environment. This decision could greatly influence the systems that are developed for online discussion. In an effort to contribute positively to the literature of web-based instruction, this study proposes the development of a web-based discussion system with Hill's Group Cognitive Map and presents the practical effects of the system such as the learners' interest, capabilities for communication, and learning outcomes. The learning resources space was very useful for their learning. Seventy percent of the learners responded that learning through the web-based discussion system was effective. The students actively participated in team discussions on relevant themes in the instant messenger room. Those results could be obtained through the implementation of the system in an elementary school in South Korea.

Keywords**:** *Web-based discussion, Discussion learning, Web-based education system, On-line learning. Asynchronous Online Discussions, Synchronous Online Case Discussions*

1. Introduction

Developments in computer technologies have opened ways for the redesign of teaching and learning. Online education is a new area promising active, self-regulated and reflective learning. When properly designed, the online learning environment can promote collaborative learning; improve interaction and participation supporting learner-centered rather than teacher-centered learning. The use of asynchronous and synchronous discussion system has gained attention due to their potential to provide rich learning experiences and interaction among students and instructors. These systems have commonly been used to enhance collaboration, critical thinking, knowledge building, to create learning communities and to provide a means for the online instructor to develop active learning environments [1].

Increased use of the Internet in education has allowed online learning to become an alternative to traditional face-to-face learning. Online learning provides students with freedom from having to be in the same place at the same time as instructors and classmates.

With this extended freedom and the accompanying reduced visible impetus from the instructor or classmates, students often end up with lowered motivation to participate in course activities [2, 3, 4] fail to construct an active classroom community. Online learning suffers from high dropout rates, isolation, procrastination, and poor motivation [3, 5, 6].

Online discussion is quickly becoming an important part of the educational environment, either as a part of distance education or used to support face-to-face or mixed delivery model coursework. The online discussion format has great potential for bridging the gaps that exist between preservice and practicing teachers, and general and special education teachers, by utilizing computer-mediated discussion groups across times, locations, and student groups. The most valued aspects of online discussion groups are the accessibility to instructors and invited experts, the flexibility and the convenience of asynchronous participation, and inclusion of diverse participants and perspectives from multiple locations [7, 8, 9]. Human interaction in web-based environments has commonly been through email, web-based bulletin boards, instant messaging, chat rooms, computer conferencing, or other asynchronous or synchronous communication systems. In particular, web-based bulletin boards are one of ways we learn and teach on the Web [10, 11]. Learners can discuss assigned tasks and collaborate to complete assigned activities as small groups through web-based discussions. Web-based discussion allows learners to obtain new knowledge and learning experiences via online activities that allow them to share their experiences and knowledge with their peers.

Research, however, suggests that web-based learning is not suitable for all types of students [12, 13, 14]. According to Sikora and Carroll [15], learners in web-based learning environments tend to be less satisfied with totally web-based courses when compared to traditional courses [16, 17]. Moreover, Marino [14] also reported that some students had difficulties adjusting to the structure of web-based courses. They also found it difficult to manage their time in such environments. This may be a reason why some web-based learning through asynchronous discussion boards may suffer from a low frequency of responses over a long period and why some web-based courses suffer more dropouts. Jacobson [18] pointed out that most instructional designs for web-based learning environments have depended very heavily on technology-driven views [19]. As a result, it is not easy to obtain expected learning effects through some web-based learning. Moreover, Hamza & Alhalabi [20] suggested that the practical success of web-based learning depends mostly on how to design and improve their facilitation. Hence, our current concern is no longer whether web-based learning should be introduced in education settings; rather, it should be how it is designed, based on rigorous educational theories that maximize the effects of learning and teaching [21, 22].

This study attempts to develop a systematic web-based discussion learning system by applying Hill's General Discussion Learning Model [23] which resolves general difficulties faced by learners in a discussion class and creates dynamic discussion-oriented learning environments that strengthen the learning effects of discussion-oriented learning as a means of direct learning methodology.

2. Theoretical Framework

2.1 Hill’s Group Cognitive Map

This study developed a web-based discussion system applying Hill’s Group Cognitive Map [23] as shown Figure 1.

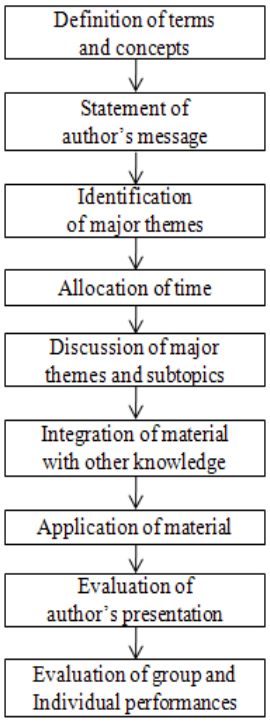

Figure 1. Hill's Group Cognitive Map

Group discussions are often characterized by themes that arise unexpectedly and lack direction. There are many possibilities for group discussions to be too divergent and without a critical focus for the discussion. Considering these possibilities, this study is grounded on Hill's Group Cognitive Map. Hill's Group Cognitive Map is a procedural tool for effective group discussions. It provides an outline which each team member follows to learn effectively from independent readings and small group discussion. Hill's group cognitive map also deals with the characteristics of discussions that arrive at their conclusion through useful argumentations. Learners are required to read learning materials and prepare discussions after their reading. At the beginning of the activity, learners share their knowledge and understanding regarding terms before discussing any theme. In the second step, learners are expected to obtain some grasp of the overall meaning of the assigned reading. Each team member should redefine the purpose of the given assignment in their own words. In the third step, they need to identify the subtopics of the learning materials by analyzing the major themes. After allocating time to team activities (step four), team discussions of major themes and subtopics occur in step five. In step six, team members make a conscious effort to relate learning in the assignment to ideas and concepts acquired in previous learning. Team members are then required to provide an application of their learning material (step seven). Finally, they evaluate each team member's presentation: team and individual performances (step eight and nine). These processes include comparison of different perspectives and evaluations of these positions in an attempt to achieve a shared understanding and ultimately a socially negotiated conclusion.

2.2 Related Works

This is a survey of advanced research concerning on line discussion system development and analysis.

Bhattacharya [28] performed comparative study of use of asynchronous and synchronous for discussion on three learning units based on the cognitive maps developed by the learners has been made. They found that cognitive maps could be an effective tool for learners for discussion in a distributed learning environment. Cognitive maps provided learners to organize their understanding of the learning units.

Mitchem, et. al., [7] analysis the benefits and limitations of three different on line discussion format such as open discussions, prompted discussions, and structured chat discussions. They reported that online chats and discussions provided opportunities for the students to share, discuss, and modify their case understanding and to support each other in using that knowledge to solve case and classroom problems. Their study provides practical implications for instructors using discussion groups in case based instruction.

McLoughlin and Luca [24] reported that most online discussion consists of sharing and comparing information, with little evidence of critical analysis or higher order thinking. Such findings serve to remind us that it is not the technology itself but the manner in which it is applied that is most critical. As teaching and learning become more dependent upon computer technology, educators must consider how to facilitate effective online discussion [25].

Bonk, et. al., [27] compared synchronous and asynchronous computer conferencing about cases and found asynchronous discussions to be more productive with regard to student engagement in the learning process and overall responsiveness. Although participants in synchronous discussions generated a lot of content, participants in asynchronous discussions were more likely to challenge and encourage each other during extended peer interactions and dialogue.

Levin [26] analysis of pre-service teachers' reflective thinking during case discussions about classroom management in two online formats: synchronous versus asynchronous. When participants engaged in synchronous online case discussions they had higher levels of critical reflection than when they engaged in asynchronous online case discussions. Also, he found participants' initial preferences for asynchronous discussions.

These studies developed on line discussion system and analysis the educational effectiveness of the discussion system. But most of discussion system did not support education theory. We need develop the discussion system based on education theory to improve educational effectiveness. Therefore our study applying Hill's cognitive map to discussion system for effectiveness learning.

3. The Development of the Web-based Discussion System

3.1 Development Environment

The system used the Windows server developed by Microsoft as the operating system providing the server environment, MS IIS (Internet Information Server) as a web server enabling the sending of information by using HTTP protocols, and MS Access as a database.

The basic settings of the web-based discussion system was first developed through a Web editor and further upgraded more interestingly through HTML and JavaScript. ASP (Active Server Pages) was also used for interactions among participants for this web-based discussion system.

The web-based discussion system was created based on Hill's Group Cognitive Map whose theoretical framework was illustrated in Chapter 2. We tried to incorporate Hill's nine steps adaptively with the web-based discussion system. The web-based discussion system

consisted of three main parts: a 'Discussion Learning Space', a 'Discussion space', and a 'Learning Resources Space' as shown in Figure 2.

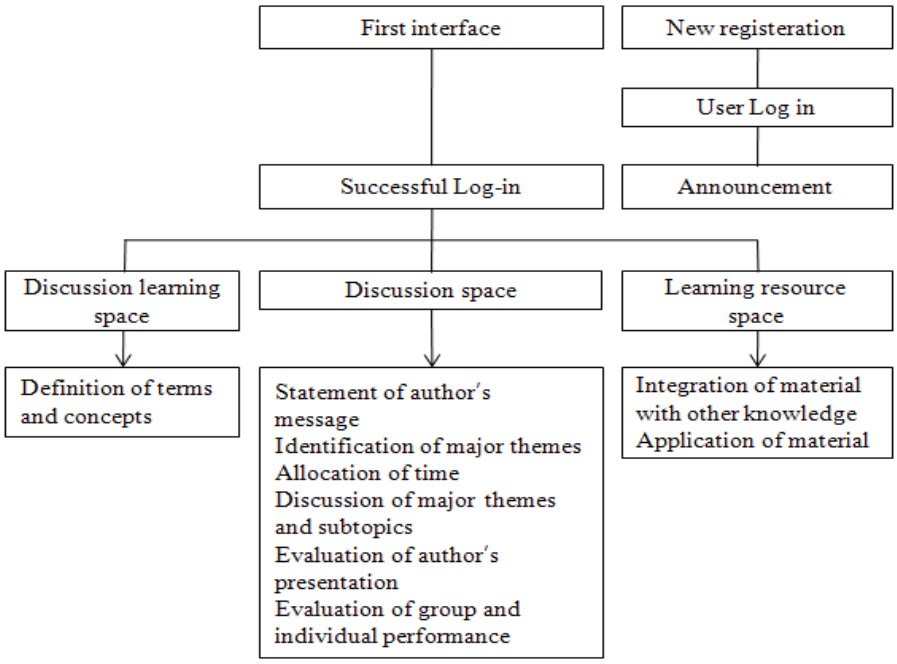

Figure 2. Structure of Web-Based Discussion Systems

3.2. System Development

3.2.1 Initial Screen

The log-in screen, the initial screen, will first appear to enable participation in the discussion learning room. The learner's login screen is necessary for participation in on-line discussion learning. Participation in the discussion learning room is possible only after gaining approval from an administrator through registration. The registrants' data will be stored in the database so that teachers, professionals, or colleagues can use this background information when they are asked for any advice from them.

3.2.2 New Registration and Membership Management

New subscribers can register by filling in basic information as shown in Figure 3 and can be given an ID and password. A registration guide will ask the entrants to use their real names so that they can participate with a sense of responsibility and so that the learning effects of the discussion will increase. Registered information will be constantly used, not only when learning is taking place, but also when learners revisit the room for any new subject.

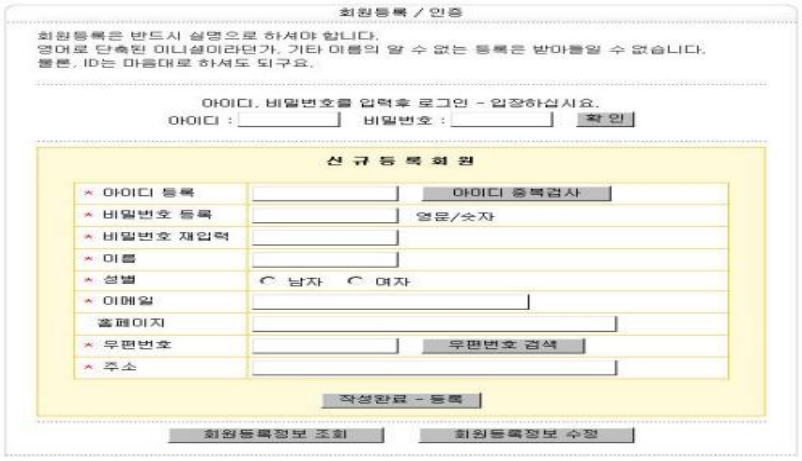

Figure 3. New Registration/ Membership Management

3.2.3 Discussion Learning Space

As shown in Figure 4, the purpose of the 'Discussion Learning Space' is to provide essential information such as the definition of the discussion, discussion methods, discussion procedures, and discussion principles. While learning the basic information, the learners could be expected to actively discuss/speak with one another in the separated 'Discussion Space'.

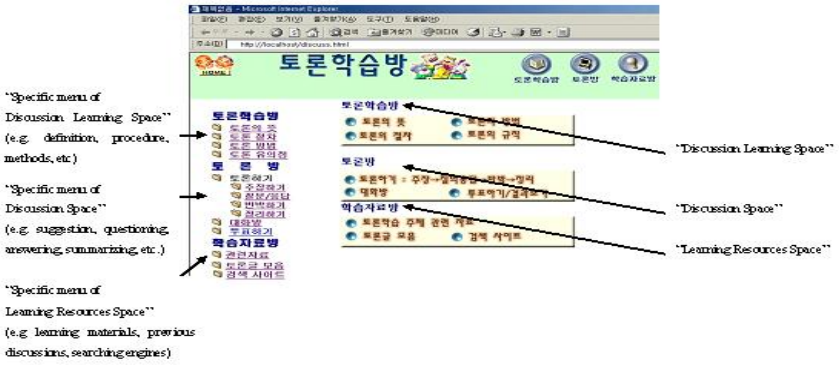

Figure 4. Menu of Discussion Learning Space

3.2.4 Discussion Space

We implemented in this discussion space from Hill's group cognitive map for the discussion of themes and evaluation of authors' presentations and individual performances.

The 'Discussion Space' also provides various opportunities for debate, and polls, as well as thread discussions. The learners can also review previous discussions in the space.

In the 'Discussion Space' shown in Figure 5, the theme is presented at the top of the interface. Regarding the given discussion theme, a theme which can motivate the learners' thinking and discussion is selected. The theme in this study was about human cloning because it had the potential to generate diverse discussions among learners. Depending on their personal perspective, they could post their opinions in the 'agree' space on the left, or in the 'disagree' space on the right.

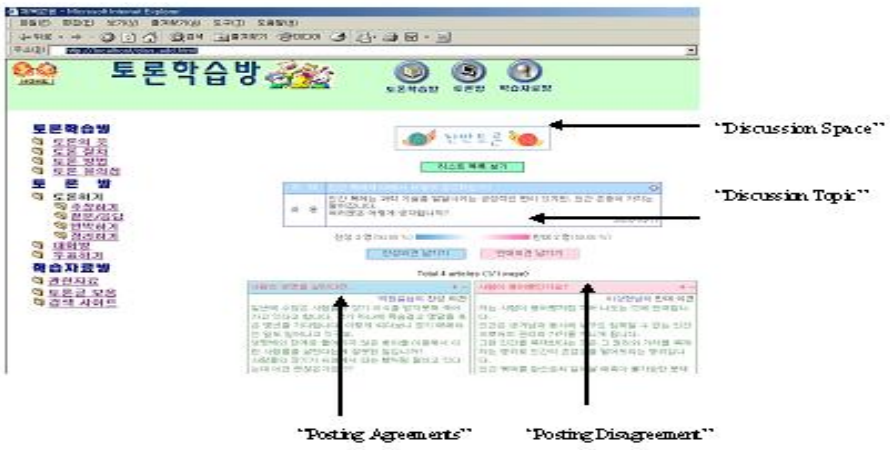

Figure 5. Discussion Space; Agree vs. Disagree

3.2.5 Real Time Debating Room

It would be better if the system could be equipped with functions to put the situation under control with prizes and penalties, and teacher's authority when a student monopolizes the discussion and the discussion deviates from the learning object or theme. This study is designed to make the participants learn the rules and regulations of the discussion room, while the teachers proceed with their class in a planned manner. Learners are allowed to choose their character, the colors of their text, and enter their nicknames at the initial screen for the real-time debating room.

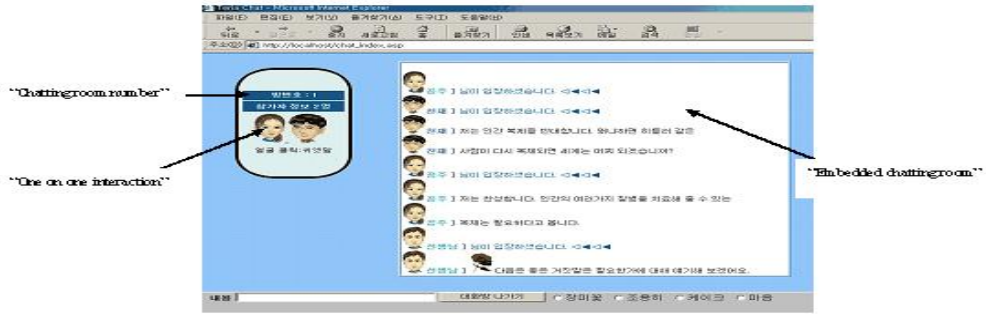

Figure 6. Real-time Debating Room

Learners could discuss the theme through an instant messenger which is embedded in the system. As shown in Figure 6, they can choose the faces that represent themselves. There is also a function to talk to only one person if they want to conduct more private/personal interactions.

3.2.6 Voting and Discussion Results

The learners' opinions can be identified as shown in Figure 7 with a graph. A learning theme-related survey title, survey questions, numbers of questions, and pros and cons to the theme can be decided by the survey management.

Figure 7. Learners' Opinion Results

3.2.7 Learning Resource Space

Finally, learners can search through the learning resources relevant to the discussion theme by using a search engine like Naver, Yahoo, Empas, Dogpile, as shown in Figure 8 and so on in the 'Learning Resources Space'. The Learning Resource Space houses discussion questions and various materials that allow the students to access them as basic materials for discussion. Students can learn discussion theme related information through basic materials and further develop their opinions and thoughts from them. Learners can also store various data on the theme and share them among themselves. This system supports an interface which has a collection of search engines. Consequently, learners do not have to exit the system to find relevant information which could be used as rationale to support their statements.

Figure 8. Learning Resource Space

4. Application of Web-based Discussion System

4.1. Method

4.1.1 Participants

This study was conducted with thirty students who were enrolled in a fifth grade class at an elementary school in South Korea. This group of thirty represented the average number of students in a fifth grade class in the school. The students were of average intellectual ability compared with other fifth graders in the school. The web-based discussion system was used to support their learning activities. Most of them had basic computer skills and experience using the Internet, email, and web-based bulletin boards.

4.1.2 Data Collection and Analysis

The data was collected in a mixed method of qualitative and quantitative ways: survey and observation. The survey was created based on a literature review, and the reliability of the instrument was 0.75 (Cronbach α). With respect to the observations, the thirty students were observed in the school computer lab. They used the web-based discussion system, and three researchers observed, for around one hour, their discussion processes during their team-task activities. The discussion theme was 'What do you think about human cloning?' The observations were recorded and rated based on the number of observers that recorded the same occurrence. Only observations that were recorded by the three observers were recorded.

4.2. Analysis of Application Result

The results of the application of this web-based discussion system were obtained through observation of the discussion processes and a survey conducted after the discussion. The specific results are as follows.

4.2.1 Survey

In general, the web-based discussion system facilitates more frequent learner discussion. He learners also tried to logically persuade other learners who had differing ideas. Through this process, they reached a shared understanding and more appropriate solutions. The results of the survey after the discussions are as follows.

First, 63% (19 learners) of the learners responded that they were interested in the discussion using the web-based discussion systems.

Second, 73% (22 learners) responded that their ability for communication was improved by the system.

Third, 83% said that the learning resources space was very useful for their learning.

Fourth, 70% of the learners responded that they felt that it was effective as a web-based discussion system.

4.2.2 Observations

Observation results show that most of the learners actively searched for relevant learning resources, analyzed them, and participated in their discussion with rationales based on their learning. They had accurate understandings and perceptions about the main theme. The students tried to build on their initial ideas or thoughts by asking questions and through argumentation after reviewing the team members' posted messages. They also discussed the theme with reasonable rationales and responded to each other's questions to support their opinions. The students actively participated in team discussions on the relevant theme in the instant messenger room. The learning resource space also played a significant role in allowing the learners to refer to necessary materials in a setting that was very convenient, thereby reducing unnecessary time spent searching for information. Finally, they had enough time to write their opinions, and had the opportunity to think deeply about the theme during the online discussion.

The following, however, should be considered in a class using this discussion system.

First, a data search on the discussion theme and a discussion learning space should be used to build up the learners' thoughts and opinions. The data should not be copied without being

reconstituted because some students just copy the data without thought or developing opinions. In this regard, a teacher, as a facilitator, should play an important role as a guide.

Second, a user-friendly interface should be completed to multiply the learning effects. Additional functions are also needed to maintain the users' interest.

In summary, it can be said that this web-based discussion could be evaluated very positively; the study found the possibility that this discussion learning system could promote interactions among learners and contribute to discussion learning in a positive way.

5. Conclusion

The Web is a way to improve learning environments; it supports learners' active participation and collaboration by providing various interactions. Ultimately, it has the potential to enhance the effects of students' learning and collaboration abilities. To achieve more promising results through web-based discussion systems, they should be designed based on sound, established instructional theories.

This study presented a web-based discussion system which was created based on Hill's Group Cognitive Map. The purpose of this study was to develop a web-based discussion system based on a robust discussion model to improve the effect of learners' discussions.

We found some significant outcomes: the system was effective in stimulating the learners' interest, communication skills, and learning outcomes. It was also significant in that the students were motivated and became self-regulated learners after their discussions in the web-based discussion system. With respect to suggestions for future studies, the instructor's role may be very important in guiding the learners' effective use of the web-based discussion system.

Although the discussion system was proven as an effective learning tool, the extent of its effectiveness could be different depending on how effectively the instructor guides the learners' use. In addition, the need to teach the ethnics of web-based learning became apparent because some learners tended to copy and paste other students' writings to the online discussion board. As facilitators, instructors should remind them of the importance of originality and citations for materials that do not represent an original idea. Secondly, it would be interesting to design and develop a web-based discussion system grounded on other theoretical foundations. By accommodating many possibilities for the improvement of the current discussion systems, the continuous success of bridges between theory and practice will be assured.

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