A Web-Based Multimedia Environment to Support Group Creativity

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Abstract: - The objective of this paper is to investigate how a networking environment affects group creativity and associated creative thinking activity. We believe that, traditional activities are strengthened by the use of information technology. In this paper, a web-based brainstorming system is introduced. It is based on the Internet which provides a multi-dimensional forum to support brainstorming activity. Our system has an session facilitation and management unit, a multimedia supporting unit, an expert assessment unit, and a knowledge management unit. With the assistant of information technology, the quality and quantity of ideas generated during traditional and networked activity is compared and discussed. This system was used in a creativity related course during the spring semester of 2005 at an Institute of Technology in northern Taiwan. The results show that the uniqueness and usefulness of ideas generated during networked activity is superior to those generated in a more traditional manner. The quantity of ideas was also increased using networking. In a questionnaire about student satisfactions, given to students at the completion of the course, most students expressed a positive attitude toward the networked system.

Key-Words: - Multimedia, Creative, Group creativity, Brainstorming, Brainsketching, FlashPaint

1 Introduction

Creativity has been a main topic in many countries. The goal has been to redirect student's thinking about entering a higher education system to include choices that consider multi-disciplinary and multi-intelligent. One of the educational reform issues in many countries is to promote creativity education. When system complexity increases with the growth of technology, system design work tends to more collaborative approaches. Among many group or collaborative approaches, brainstorming is one of the most famous and common usage approaches. Brainstorming was first introduced by Osborn to promote group creativity in design work [1]. For many years, this methodology has been proven useful and effective for promoting the outcome of group creativity. In this information technology era, many traditional activities or approaches can be enhanced by introducing IT into them. Traditional brainstorming activity has some drawbacks which may be cured with IT technology. The objective of this paper is to investigate how a networking environment affects group creativity and associated creative thinking activity. We believe that, traditional activities are strengthened by the use of information technology. In this paper, a web-based brainstorming system is introduced. It is based on the Internet which provides a multi-dimensional forum to support brainstorming activity. This system has session facilitation and management unit, a multimedia supporting unit, an expert assessment unit, and a knowledge management unit. With the assistant of information technology, the quality and quantity of ideas generated during traditional and networked activity is compared and discussed.

The objective of this paper is to present a web-based brainstorming system to support participants in creative thinking activities. Participants gain the following benefits from an experimental creative thinking activity:

1. Better understand a creativity theme and put more effort onto creative activities: participants may get experience through participating in creative activities, understand creativity related themes and stimulate interest in related activities. In addition, the normal learning approach where the "input" is generally bigger than the "output" is redirected to a learning model where the "output" bigger than "input".

2. Let participants become familiar with creative thinking skills: assisting participants familiar with creative thinking skills through this system. When participants are familiar with one type of creative skill, they can learn another skill quickly.

Enhance creative thinking ability through practice: participants' creative thinking ability may be enhanced through experience gained from creative

activities, then creative consensuses and creative thinking ability may be further enhanced.

2 Related Works

2.1 Brainstorming

Brainstorming is an approach used to stimulate creative thinking that was first introduced by Alex Osborn in 1938 [1]. Brainstorming is a kind of skill in which a person or a team applies mental power to practice creative thinking, and generates numerous ideas for a specific problem in a short period of time [1]. According to the observations of Dennis & Williams [2], traditional brainstorming has the following potential advantages:

1. Synergy: it means a participant's idea triggers another participant to create a new idea. This new idea may not be created under other circumstances.
2. Social facilitation: a person's effectiveness is influenced by the presence of other people.
   Brainstorming also has the following potential disadvantages:
1. Production block: only one person is allowed to speak at a time in traditional brainstorming. Therefore, participants speak in a round robin fashion, which may block a participants' output, since they must wait for their turn to speak.
2. Evaluation apprehension: a participant may be afraid of expressing an idea due to worry about his/her idea receiving negative feedback from others.
3. Social loafing: some individuals may tend to create fewer ideas in group brainstorming than in independent brainstorming.
4. Cognitive interference: someone's opinion or comment may interfere with another participant's thinking during group brainstorming.

Kay found that electronic brainstorming has the following advantages over traditional brainstorming [3]:

1. Parallel entry of ideas: all participants may express their ideas simultaneously, which does not affect other's thinking or block other participants from expressing their ideas. With respect to each participant, the chance to express an idea is equally available, and the production block is decreased dramatically.
2. Anonymity: session participants are anonymous in brainstorming sessions therefore they need not worry about criticism from other participants. Anonymity may also stimulate the feeling of participation in the discussion.
3. Novelty: electronic brainstorming is a novel group discussion technology for many people. It may stimulate a participant's interest and curiosity. In addition, since participants know other participant's thinking, they can handle their own opinions and ideas more readily.
4. Size: in contrast to the optimal group size of 5 to 12 persons in traditional brainstorming, the group size has no limitation in electronic brainstorming.
5. Proximity: no matter where session participants are located, all participants can attend sessions. They only need a computer, the proper software and networking capability simultaneously.
6. Memory: even though not all participants may attend a session on time, participant(s) who missed the session may understand the session process and get all session records with automatic session message recording mechanism of an electronic brainstorming system.
7. Software/tools: ideas created during a session should be evaluated and electronic brainstorming sorts and evaluates ideas with the help of software tools.
8. Equality: session participants are not affected by the necessity to wait to give input or by the presence of other participants. No one can affect another's thinking or limit another's participation.

Although there are many advantages of electronic brainstorming, there are some disadvantages as well. Dennis & Williams [4] pointed out that communication speed is an obvious disadvantage. People used to express their ideas or thought through oral communication, while with electronic brainstorming, people use a keyboard to type their ideas or thoughts. Someone who is unfamiliar with the layout of a keyboard, would type slowly, therefore communication would be slower. Stenmark's research found that although electronic brainstorming is a suitable tool to assist creative activity, it lacks group identity [5]. And, if an incentive system, which emphasizes competitiveness and individualism, is used, group identity becomes a key factor. To cope with the situation, electronic brainstorming session needs to construct a suitable approach to identity.

Recently, many researchers have devoted themselves to web-based brainstorming research. Hwang, Chen & Lu [6] proposed a web-based brainstorming approach in which data acquisition, generation and editing of ideas, and evaluation of

ideas are three essential steps. This system has a complete methodology and process which acquires data, improves original ideas, edits ideas, and evaluates ideas.

2.2 Brainsketching

Brainsketching has same functions and advantages as brainstorming but can compensate disadvantages of brainstorming. The procedure of brainsketching is as follows: every participant draws his idea on a paper independently. Then every participant passes his/her ideas to participant near by after 15 to 20 minutes. Any participant who receives other one's idea can draw something follows previous idea or make a brand new idea. This procedure will be continued until the predefined number of times has been reached. Remko [7] took a research on brainskteching and conclude that brainsketching may stimulate creativity by re-annotating someone else's sketch. In addition, it also can stimulate group's creative ability in creative activity. Traditionally, brainsketching is done with blackboard or whiteboard. Recently, web-based sketching function has been realized with the multifunction capability. A web-based sketch board called FlashPaint was developed by FOKHEI STUDIO with Macromedia Flash technology (Figure 1). With the sketch board, people can make a sketch on the web freely, and someone else may view the animation of sketcher's sketching procedure in dynamic fashion. In addition, a person may append another sketching onto existing drawing which was done by other. By incorporating the power of computer and web, traditional brainsketching may be further enhanced.

Figure 1. Example of FlashPaint

3 System Design

To cure the shortage of traditional brainstorming, some network- and information-based technologies are included in to the proposed system. The system functionality consists of a management subsystem, an announcement subsystem, and a session subsystem. User and system administrator can manage and maintain the system through the management subsystem. The announcement subsystem consists of the system announcement and the session announcement. The session subsystem is the core of this system in which the complete creative process of brainstorming is performed. The detailed description of this system is as following.

This system has the following features:

1. As opposed to the text input approach in other web-based or electronic brainstorming systems, this system incorporates multimedia capability which allows participants to express ideas and thinking graphically. That is, participants can not only use the text input method but also can use a graphic approach to express their thinking more precisely. This approach is difficult to achieve even for traditional activity.

2. With the ability of full text search in a web environment, it allows the previous recorded material or content to become reference material for preceding activities. For example, the previous recorded material of students in one class or employees in one department may be accessed and referenced by students in other class or employees in other department at a later time. It is not difficult to achieve with a full text search engine. In addition, Internet is a treasure chest of information. This system is a web-based system; it can easily incorporate existing powerful search engines, such as Google or Yahoo. This mechanism allows participants to search the Internet and get the necessary information to assist them, and they can then share this information with other participants immediately.

3. With the use of the network mechanism, the session master can readily assist participants who need help. Only the session master and the participant that needs help involve in this process, other participants are not aware of it. This avoids embarrassment for participants needing help.

4. Upon a session completion, expert(s) are invited to evaluate the participants' ideas and thinking. Experts can use the network facility to view and rate participants' ideas without gathering together. It makes for a more flexible

approach and allow more experts to participate in the evaluation.

5. Although the system does not allow participants to post comments on other participants' ideas or thinking during traditional activities, there may be an alternative approach for networked activities. The objective of prohibiting comments is to avoid embarrassment. We believe that positive comments encourage participants sharing. In this system, an anonymous commenting mechanism has been constructed which use a set of predefined positive comments in a database of this system. Participant may select an appropriate one to encourage other participant's ideas. That anonymous is essential, but the administrator or session master can view what has been posted and what comments have been made to whom.

Owing to the anonymity of networked activity, it may happen that someone's idea is stolen by another participant who claims the idea as his or her own. In contrast, some participants may hide their ideas because they believe that once posted, their ideas become part of the group, and they don't want their ideas stolen. In this system, a personal reward feature is included. Except for the expert's evaluation of the collected ideas, a participant's contribution is recorded and evaluated separately. The reward to individual is recorded and kept undisclosed until the session is finished. When the outcome of group is evaluated as creative and valuable, then the participant who has contributed the most gets the highest reward. This is an important and necessary feature for rewarding school activities or proposal and idea generating in companies.

The functionality of a management subsystem is classified into user management, announce management, session management, and evaluation component according to the functional requirement. User management assigns different privileges to different identities such as session master, session participant, or system administrator. The announcement subsystem provides an interface for managing announcement affairs, and allows the system administrator or session master to append, delete or edit announcements. The session management unit is the core of the session subsystem. It provides management interface for session administration. The session master can create a new brainstorming session and send Email to all participants using this interface. In addition, the session master can also dispatch instant messages to all participants. At the end of each session, the session master may make a decision on whether or not the session records will be open to others.

The evaluation component provides management functions for expert evaluation. The system administrator or session master may screen ideas generated in each session, select suitable experts, and send evaluation invitations to selected experts. The invited expert can log onto the system and evaluate the generated ideas.

As stated in previous, the session subsystem is the core of this brainstorming system and all related activities are carried out using this subsystem. The session discussion block is divided into text and graphic (painting) input. The graphic input utilizes a software component called FlashPaint, which is programmed using the Marcomedia Flash tool. In the session using FlashPaint each participant has their own drawing pad to express his/her ideas graphically and freely, he/she even can append new additional material to exist drawings made by other participant(s). The session subsystem also monitors each participant's idle time and notifies the session master. Hence, the session master can provide necessary help or hints to participants who are stuck. This function allows the session to proceed as smoothly as possible. In addition, an incentive (or reward) system is used to encourage participants to express their thoughts. Each participant can comment on all ideas generated by any other participant in an anonymous fashion. Only the session master knows who submitted comments in an attempt to avoid negative input, there are predefined comments for participants to choose from, all of which are positive.

4. Experiment and Result

4.1 Experiment design

Upon system implementation, a series of experiments were conducted to evaluate the system's effectiveness. Experiments were conducted at an Institute of Technology in northern Taiwan. There were 49 students in the experiment, 47 of whom were male. These students were juniors and major in automation engineering. At the end of experiment, a questionnaire was sent to all participants to get their feelings and satisfaction about the system. Some aspects of the result are explained as follows:

About 90% of all participants felt more comfortable in expressing ideas in a networked environment. This conclusion is similar to that arrived in previous

research.

75% of students felt more confident about expressing ideas, which confirms to Kay's research [3]. Networked activities obviously have a positive effect on a participant's speaking and comment expression. However, about 60% of the participants felt they also liked the openness of traditional activities. The reasons may be two fold. Most of participants were male and had been classmates for three years, so they felt comfortable talking in public. Or secondly, the problems were about topics easier to get into for that students with engineering backgrounds would normally talk about to each other students with engineering backgrounds.

Most people often feel inconvenienced when inputting data by keyboard, although about 55% of the participants in the experiment felt that it would not block or influence their thinking. The possible reasons are as follows. (1) Contemporary, students are familiar with computer operations and keyboard input which may enhance network activity. (2) There is a drawing pad to assist participants in expressing in the web-based brainstorming system. It is more suitable for engineering background students. (3) All participants could input their ideas or thinking simultaneously, so there was no time or waiting pressure involved and all participants had ample opportunities for their turn to talk. As stated before, Dennis & Williams [4] pointed out that communication speed is an obvious disadvantage. The results of this study do not fully concur with that statement.

Around 85% of the participants thought that it was easier to forget what other participants or they had talked about in traditional activities when using the traditional methods to record the conversation. In contrast, all of the participants agree that is was easier to view and summarize what other participants or they had talked about in networked activities. That is one of reasons why web-based brainstorming is superior to its traditional counterparts.

5 Conclusions

With the assistance of information technology during the creative thinking activities, participants had enumerable opportunities to practice their creative thinking skills. This system indeed improved their creative thinking ability. In addition, participants have further understood the core of creative thinking through actual participation in related activities. This system achieves what Chen [8] mentioned in his research paper about objectives that creative teaching or training wants to achieve. It gives students a creative consciousness and creative attitude; the ability to understand creative themes; the desire to devote more time to creative activities; the ability to select a solving process for creative problems; and, the ability to enhance creative thinking.

Our system is an effective tool for creative thinking that gives positive help to individual as needed. As an example, the drawing pad gives positive help regardless of an individual's thinking process or his/her understanding of other's thinking. We believe that the use of this tool has a key role in the creative thinking process in this information era. By providing a suitable tool, the process of creative thinking and an individual's thinking ability can be continually enhanced. Based on this observation, the model proposed by Csikszentmihalyi and Wolfeis [9] was modified to add a tool component. In this proposed model, except individual, domain, and society, the tool component is added. In the future, more experiments and observations will be conducted to further verify our conclusion about the effectiveness of tool component in creative activities.

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