









used as a public wiki, discussion forum, blog, invisible backend for a personal website, intranet CMS, personal organizer and memory support, presentation framework, community-maintained user manual, and etc.

## V. IMPLEMENTATION

### A. Participants

Thirty undergraduate students who registered in the multimedia course in the computer engineering department at Siam University were recruited to participate in the virtual classroom on the Internet application for a semester which lasts for four months. The teacher and students use a virtual interactive classroom on the Internet instead of using a traditional classroom for learning and teaching.

### B. Virtual Interactive Classroom and Web-based Collaborative Work

1) *A Virtual Interactive Classroom:* We installed the virtual classroom as an Internet application on a streaming web server. A Flash media server and IIS must also be installed on the server. We tested the application and corrected the bugs in the application for two months before it was ready. The client side must contain the flash player application in order to display flash movies correctly. The experiment is set up and run on a windows platform. Fig. 6 shows a screenshot of a user login web page. A student and teacher must login with the correct username and password to enter virtual classroom. In the classroom, they are allowed to use shared objects or resources. Fig. 7 shows a screenshot of a virtual interactive classroom. The classroom has four main portions: 1) the picture screens for the teacher and students, 2) a workspace, 3) a list of people screen, and 4) a real-time chat screen. In this virtual classroom, the teacher has the full authority to control all kinds of things such as a white board, presentation, chat, and audio/video presence by clicking on a menu item above the workspace. For example, the teacher can just click on the presentation button to control the powerpoint slideshows. The students cannot edit any contents of the slideshows. Next, the teacher clicks on the whiteboard button to change the workspace to a shared whiteboard. This feature allows anyone in the classroom to edit text messages or draw a picture on the whiteboard. The VDO feature is used in two aspects. First, the teacher clicks on the VDO button to select the VDO file in the computer and play it. Second, the students click on the VDO button to record what their teacher is teaching. Moreover, the teacher can talk to the students and/or the students can also talk to their friends in the classroom through a microphone. The teacher can mute the voice of any students by clicking on the mute button. Using a web camera, they have access to a large amount of information about one another. The students can observe how their friends feel physically and emotionally. Both teacher and students can enter a web-based collaborative work by clicking on the Collabwork button. Fig. 8 shows a screenshot of a whiteboard function.



Figure 6. A screenshot of a user login web page.



Figure 7. A screenshot of a virtual interactive classroom application.

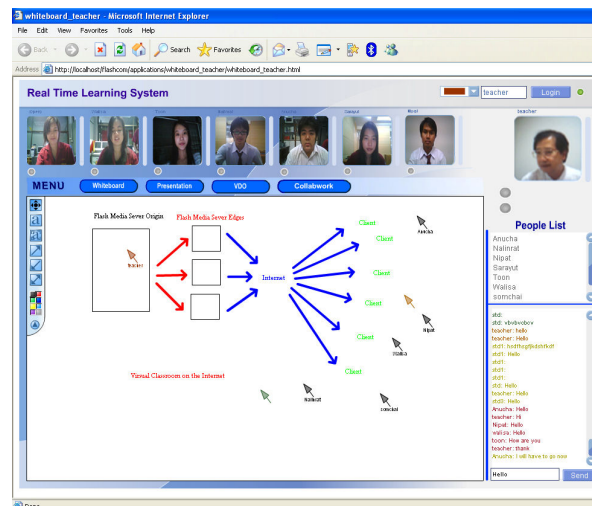


Figure 8. A screenshot of a whiteboard function.

2) *A Web-based Collaborative Work:* A web-based collaborative work capability was installed on a web server. It was created for a teacher who taught a multimedia course and used it for managing tasks or assignments for the students. The teacher posted a task every week on a teacher's workspace.

The students were arranged into teams to solve the given task. Using a web-based collaborative application, the students can collaborate or help each other to solve the given task, share the resources and materials, and generate additional ideas through the student's workspace and in the comment area. In addition to the task assignment and problem solving, the teacher can use this tool to monitor the progress of the given task and the student's behavior during an online collaborative work. The screenshots of the web-based collaborative work application are shown in fig. 9, 10, and 11.

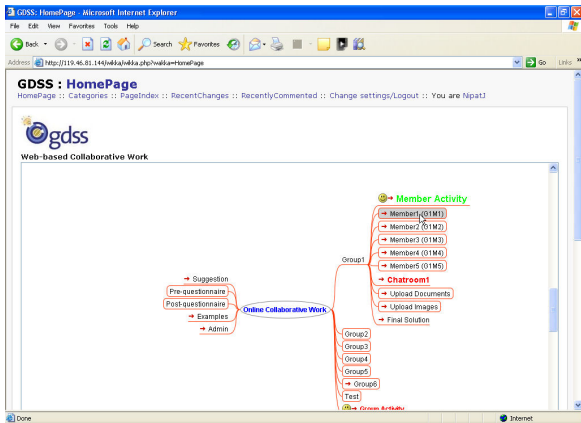


Figure 9. A screenshot of a web-based collaborative work homepage.

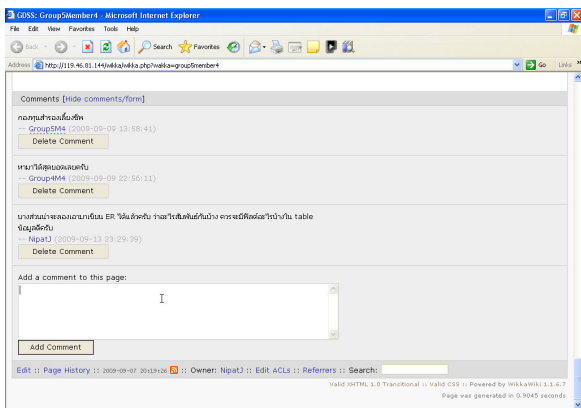


Figure 10 A screenshot of a comment tool in a web-based collaborative application.

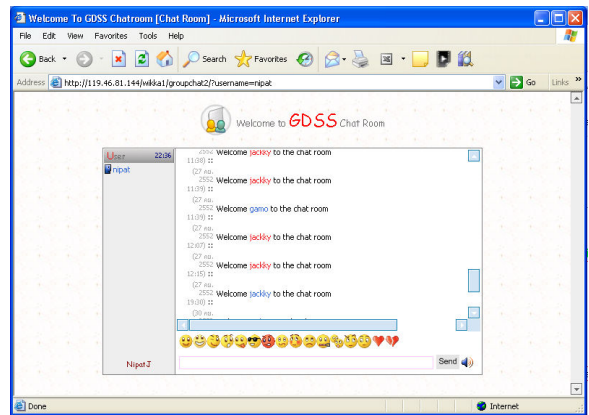


Figure 11 A screenshot of a chat room in a web-based collaborative application.

## VI. CONCLUSION AND FUTURE WORK

This article presents the potential of integrating two concepts, namely those of a virtual interactive classroom and a web-based collaborative work application in order to enhance teaching and learning performance in distance learning. In addition to the concepts, the framework has been designed and implemented. The virtual interactive classrooms and the web-based collaborative work application work well according to their predefined functions. They can work as a substitute for any classroom in the school. With the use of computers and information technologies, the barriers of space and time can be eliminated. This virtual interactive classroom is an opportunity for a number of students in rural areas with homes that are far away from a school. They have a chance to study and communicate with the teacher and other students. We do not mean to imply that by using this virtual interactive classroom on the internet that it is better than the real classroom in the school but it is a choice in order to move schools closer to students who lack of the opportunity of physically attending a school. We want the virtual interactive classrooms on the internet to be one standard feature of several possible features for e-learning or distance learning.

In future research, based on this study, we intend to summarize the feedback received from teachers and students and take the results and recommendations obtained from the experiment into the consideration for improving the quality of the virtual interactive classroom and web-based collaborative work application in the future.

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