

# A SNS-INTEGRATED COLLABORATIVE LEARNING SYSTEM TO SUPPORT PROGRAMMING LANGUAGE LEARNING

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## ABSTRACT

Today, using and accessing to Social Network Services (SNS) are part of our daily activities and have gained popularity to attract learners in the socialization engagement. This motivates the adoption of Social Network Services into collaborative learning environment which strongly encourage communication and interaction between learners. The engagement of learners to use the learning system is always a challenge to improve as they are easily distracted, lack of motivation and interest. The factors which contribute to the problems are mainly the availability of the learning resources, variety of the communication mode within the system, and also lack of real time interaction. With the implementation of Social Network Services (i.e. Facebook services and Twitter services) into collaborative learning environment, learners will feel motivated and engage more eagerly with the learning process as reflected from the heavy usage of social media recently. Real time communication and interaction are being promoted and learners can express and share real thoughts and feelings with the help of SNS while going through the learning process. In this proposed work, we design and implement a SNS-integrated collaborative learning system that allows learners to collaborate and learn anytime and anywhere. We have chosen the subject domain of learning programming language to realize our proposed solution.

**Keywords:** *Social Network Services, collaborative learning, Facebook, communication, collaboration, interaction*

## 1. INTRODUCTION

Nowadays, with the wide and heavy usage of internet by people, Social Network Services (SNS) are developed and to provide convenience to people around the world. Social Network Service is a medium for establishing social networks of people who are sharing common interests and activities. Social networking sites allow learners to share ideas, activities, events, and interests within their individual networks. Most of the available Social Network Services are web-based services and provide means for learners to interact in various ways, such as e-mail, discussion and instant messaging. Social Networking Services are rapidly changing the ways in which people use and engage with the Internet and with each other. According to [1], social media explores opportunities to add a new dimension to learning and knowledge processes and social networking sites allow students to connect formal and informal learning settings.

Due to the popularity and heavy usage of Social Network Services by people, we would like to explore potential to use and adopt the services for collaborative learning purpose. Collaborative learning plays significant roles in learning process as it promotes collaboration among peers to achieve learning objectives together. This type of learning approach encourages brainstorming among a group of learners as well as increases their engagement and interest in the learning activities. Collaborative learning is one of the highly encouraged and adopted learning methods as students can group together with their peers for learning purposes such as solving assignment task together and share information and knowledge between each other. Instead of spending time and resources to arrange for face-to-face collaborative meeting, collaborative learning system can be used to better improving the learning process. They can discuss and interact using the same common workspace to achieve common and individual learning objectives. The nature of collaborative learning systems which focus on collaboration and communication

motivates the effort to integrate SNS in expanding its functionality and usage varieties.

With the integration of social network services in the collaborative learning environment, learners can communicate with each other anywhere and anytime as long as internet connection is available. There exists a practice that students and academicians in the universities and higher education are also picking up the adoption of social media to communicate and facilitate their class teaching or learning activities. [2] utilized Facebook as a learning resource in a graduate-level course for learners to share knowledge and experience. The findings show that Facebook is an easy-to-use social media for learners to leverage their social networking for knowledge sharing within the small group environment. Millennial Generation is significant users of social media as they are more engaged with the way on how information is shared among their peers or groups [3]. An online survey conducted by [4] shows that millennial participants reported higher positive collective self-esteem, social networking site use for peer communication, and social compensation. In this proposed work, we have designed and implemented a SNS-integrated collaborative learning system which allows learners to learn programming language in a group.

Programming subjects are among the core subjects for Information Technology (IT) and Computer Science (CS) undergraduate programs [5]. Learning computer programming is a difficult process as it is a multi-layered hierarchy of skills and students will be either overwhelmed or bored [6]. We have chosen Programming subject as our domain to realize the proposed work as they show higher failure rate among the students and also commonly served as Pre-requisite subject in the course. Thus, failure in these subjects will affect their study duration. [5] recommended that peer tutoring, pair/group programming and problem solving teaching strategies should be adapted to provide better opportunities for learners to interact with their peers. The proposed system design includes real time chatting and discussion; facilitating problem solving and brainstorming activities as well as allowing programming practice for editing, compiling and executing the programming codes.

## 2. RELATED WORK

[7] describes that collaborative learning is a situation in which two or more people learn or attempt to learn something together. According to

[8], collaborative learning is a student-centered, task-based, activity-based learning approach that provides several advantages to the student. It assists students to enhance communication, interpersonal and social skills. On the other hand, shared feedback as mentioned by [9] allows users to gather the most relevant knowledge provided to them and presents awareness information through the shared workspace. The awareness creation and coordination are playing important role for facilitating better collaboration environment [9]. Social network has becoming a very common platform for users to have better interaction, sharing culture and promotes brainstorming. The effort of integrating social network services into collaborative learning environment is able to improve the learning resources accessibility and classmate bonding.

Social Network Services has been adopted and used widely for the recent few years. According to [10], SNS can be broadly defined as internet or mobile-based social spaces designed to facilitate communication, collaboration, and content sharing across networks of contacts. Similarly, [11] states that Social Network Services can be described as a website or service where people talk to, or connect with other people with same interests by using network. [10] and [11] show that communication and interaction are greatly improved by using SNS. According to [12], there are many types of Social Network Services which are available; such as profile-based SNS, content-based SNS, Micro-blogging or presence updates, Multi-user virtual environment and etc. Social network sites have the great potential to facilitate interaction, communication, and collaboration, and as a result have been prominently featured in discussions which emphasizing on the use of technology to support and amplify educational endeavors [13].

[14] used group awareness support and argumentation scripts to investigate how these instruction methods influence learning in social networking sites like Facebook. [15] concludes that students tend to communicate and interact more frequently through SNS to support teaching and learning process. Due to the phenomenon occur, [15] proposed to discover and evaluate the potential of using social networking services such as Facebook services in education; through applications, resources and activities that could support the teaching and learning and with the aim of obtaining a more attractive way for students to collaborate. [15] describes that Facebook can be used as a resource or teaching tool to encourage students to participate, communicate, and

collaborate in the educational process; in addition to encourage the content or knowledge sharing among students. According to their case study's results findings, Facebook that has been used in education are accepted by teachers and students and it shows that functionality provided by Facebook is sufficient for providing an environment for learning purpose. [16] reported a positive experience in the use of social network services to increase engagement with the subject learning and to improve collaboration among students and teaching staffs. [17] revealed that majority of the respondents use Facebook approximately 30 minutes to 2 hours daily to share entertainment materials and discuss with their classmates on the course-related topics. This leads to the motivation of integrating SNS in collaborative learning system instead of only utilizing the SNS in order to achieve communication and interaction in an informal environment. As shown in Table 1, we review and compare the current existing collaborative learning systems, which are [18], [19], [20] and [21] with our proposed SNS-integrated collaborative learning system.

Table 1: Comparison of Existing Collaborative Learning Systems

	[18]	[19]	[20]	[21]	Proposed System
Platform	Linux, GNU	Cross-platform	IOS, Android	Cross-platform	Cross-platform
Chat	Yes	No	Yes	Yes	Yes
Collaborative Space	Yes	Yes	Yes	Yes	Yes
Discussion Space	No	No	No	No	Yes
SNS Integration	No	No	No	No	Yes

[18] is a new web tool, still under development, is used to create environments of constant intercommunication, collective intelligence and knowledge sharing. [19] is a free mobile collaborative whiteboard which allows users to draw and chat in real time. [20] is a web-based collaborative writing software which enable group of any size to edit their ideas in a single text file. It provides a collaborative space for a group of users to edit the file at the same time. [21] is an open-

source easy-to-use web conferencing system. It is used for collaborative meeting, course review session and it supports sharing of slides, video, audio, whiteboard, private or public chat and desktops.

Most of the existing systems included in the comparison are mainly web-based systems and consists of collaboration and communication components. We have researched and included the features that are available in the existing collaborative learning systems as part of our user requirements elicitation process to reach the requirements. By reviewing the current existing collaborative learning system, it shows that most of the systems provide a flexible, creative and high adaptability system for learners. However, most of the collaborative learning systems require registration upon login to access and use the provided functionalities. Besides, most of the systems are not being integrated with SNS despite that there's a shift of focus that learners prefer to use SNS for their learning purpose as shown in [13]. There is a need to determine how informal learning using SNS can be structured and leveraged for purposes of formal education [14]. Besides, with social networking, students can discover like-minded people and organize informal knowledge exchange for educational purposes [1]. We aim to improve based on all these limitations by incorporating the SNS integration approach in our collaborative learning system.

### 3. PROPOSED SOLUTION

Our proposed system aims to provide learners a system in Social Network Services equipped with collaborative learning elements. The ultimate goal is to encourage learning, interaction, communication and collaboration activities anytime and anywhere as long as internet connection is available. Besides that, it helps to improve student learning interest and engagement. The proposed work focuses on facilitating the collaborative learning process among undergraduate students who are learning C++ programming language. The C++ programming language subject serves as one of the fundamental subjects in most of the undergraduate computing course. Therefore, we would like to highlight the importance of understanding and learning programming by collaborating and sharing knowledge during coding activities. Students are required to have a Facebook account in order to access the system. For each of the collaborative task session, the group consists of two to four members and one group leader. Basic

information of learners (i.e. user profiles) will be retrieved from their Facebook account upon successful login. The major components in the proposed system are presented as follows:

### 3.1 User and Group Management

Learners are required to have a Facebook Account to login and use the function of the system. After successful login, learners are allowed to invoke the group functions such as creating a new group, changing a group name, deleting groups, adding new learners into the group and removing learners from a specific group. Learners are able to view group member list and the active (online) member(s) in the group. After creating and adding learners into a group, members in the group are allowed to add a discussion, view and comment to the discussion using the Facebook comments component. Group leaders are allowed to create and manage a collaborative task and also to manage the information of the collaborative task.

### 3.2 Collaborative Task

Group leaders are responsible for creating a collaborative task and allowing all members to join for collaborative activities and perform the assigned task simultaneously. Group leaders can configure the group information such as changing group name, adding new users to a group, and deleting members from a group or deleting discussions. The collaborative tasks will focus mainly on solving a C++ programming problem. The task will be itemized into a few to-do sub tasks to ease the problem solving. In the Collaborative Task page, members are allowed to edit and write programming code simultaneously in the code editor space.

Besides that, members are able to communicate using real-time chatting component in page during their collaboration activities. For the code compilation control flow, members are able to request for compiling the code. Once a member requests to compile the code, the editor space will become un-editable. Subsequently, all members are able to compile and execute the code and the result of the execution will be displayed in a new window. After completing the coding activities, members can download the code from the editor to their computer for reference or records with the file extension of .cpp format.

### 3.3 Social Network Services and API Integration

Facebook services are the main SNS to be integrated in our proposed system as it is one of the largest social networks which surpass 1 billion registered accounts. The main contribution of this integration is to improve the collaboration and communication between the learners in a sociable environment. Learners can log in to the system with their Facebook account with no registration needed (implemented with API-FacebookRedirectLoginHelper). User's information is retrieved from Facebook by using Facebook Graph API. Learners can write comments in the system by using Facebook Comment Plugin. While learners comment and reply in discussion, notifications can be viewed in their own Facebook page. Learners can also chat with other members in the collaborative task room using io.socket server API. Besides, learners can collaborate in collaborative task room using ace editor API and io.socket and view the active member list in group using io.socket server API as well. In summary, Table 2 reflects some of the SNS and APIs that have been integrated in our collaborative learning system to improve the learners' engagement in learning process.

Table 2: SNS and API INTEGRATION

API	Details
FacebookRedirectLoginHelper	<ul style="list-style-type: none"> <li>Implemented in start-up login interface of the system.</li> <li>Redirect user to a URL Facebook to initiate a login request.</li> <li>Redirect user to system callback URL, providing session data.</li> <li>Process and validate the data from Facebook.</li> </ul>
User (FacebookGraphAPI)	<ul style="list-style-type: none"> <li>Retrieve user information from Facebook.</li> <li>User's Facebook id will be the primary key for user database</li> </ul>
Facebook Comment Plugin	<ul style="list-style-type: none"> <li>Implemented in discussion page.</li> <li>Can be implemented on various types of content on Facebook.</li> <li>User can Like others' comment.</li> </ul>



Io.socket API	Server	<ul style="list-style-type: none"> <li>Implemented in group page and collaborative task page.</li> <li>While user is in the group page or collaborative task page, user's information will be retrieved and shown in the active member list.</li> <li>Once user left the group page or collaborative task page, user's information will remove from the active member list.</li> </ul>
ace editor API		<ul style="list-style-type: none"> <li>Implemented in collaborative task page.</li> <li>User can edit and write programming codes in collaborative task page.</li> </ul>

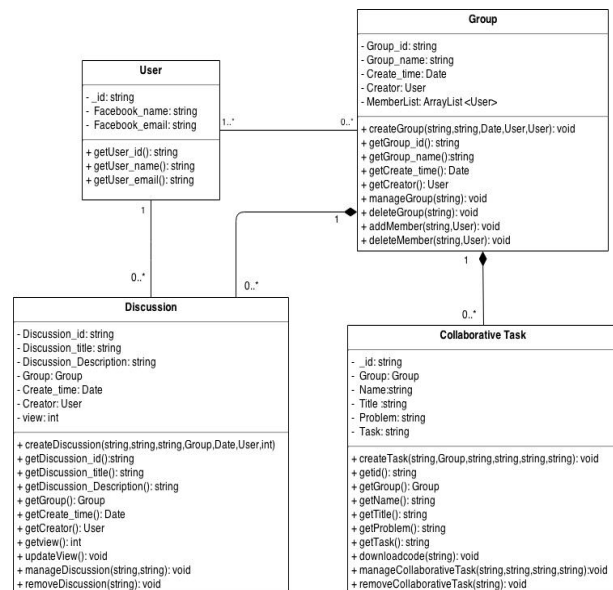


Figure 2: Class Diagram

#### 4. SYSTEM DESIGN

Based on the proposed solution, we have used notepad++ and node.js for the development of the system and mongoDB server for database design and development. Node.js is a cross-platform runtime environment for server-side and networking applications. Programming languages that have been used for developing this system are HTML, JQuery and Jquery. Figure 3-9 show some of the screenshots design of our proposed SNS-integrated collaborative learning system.

Figure 3 represents the login page of the system. Learners login to the system by clicking on the blue button in the middle of the page. For the first-time-login learners, an authentication from Facebook will be shown to the learners and notifies learners that basic information of learners will be retrieved from their Facebook account to be displayed in the system. Learners have to complete the authentication in order to login and access the functions of the system. Learners will be motivated to access the system due to the convenience of login in using their Facebook account.

Figure 1 represents the Use Case Diagram which captures the interactions of users with the system and Figure 2 shows the Class Diagram of the system design.

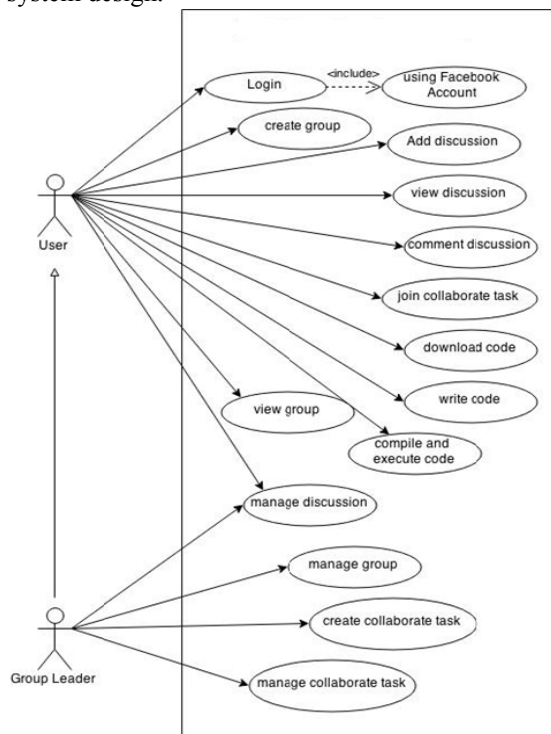


Figure 1: Use Case Diagram

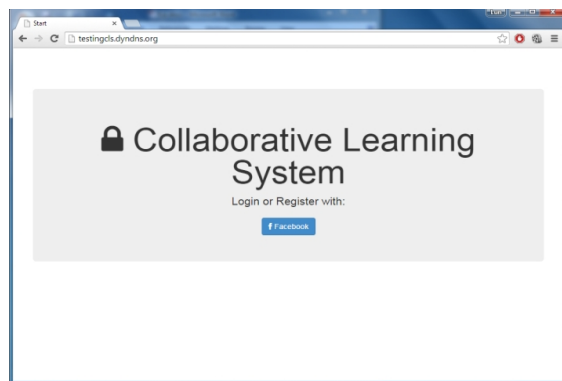


Figure 3: Login Page

Figure 4 represents the home page of the system and will be displayed upon successful login. In the Home page, a list of groups that learners involved in will be displayed in the middle of the page. Learners are able to view the group details by clicking on the name of the groups which they are interested to view and join. Besides that, learners are also allowed for creating a new group in this page to start a new discussion topic. The group creator's name will be shown in the page too.

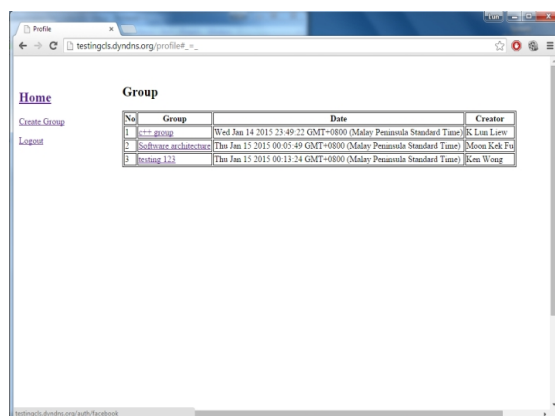


Figure 4: Home Page

Figure 5 represents the group page of the system and will be displayed after learners have selected a particular group as mentioned in Figure 4. A list of discussion (discussion trace) that has been created in the group will be displayed in the middle of the page. All members are allowed for adding new discussion and viewing discussion details. Group leaders are allowed to edit all the discussions in the group while members are only allowed for editing discussions that had been created by them. Besides, only group leaders are allowed to create and manage a collaborative task. All members are able to join the collaborative task session once collaborative task is being created. All the members' Facebook profiles can be viewed by

clicking on their names on the member list display. At the top right of page displays active (online) members in group which are available whereas at the bottom right of page displays all the participated group members.

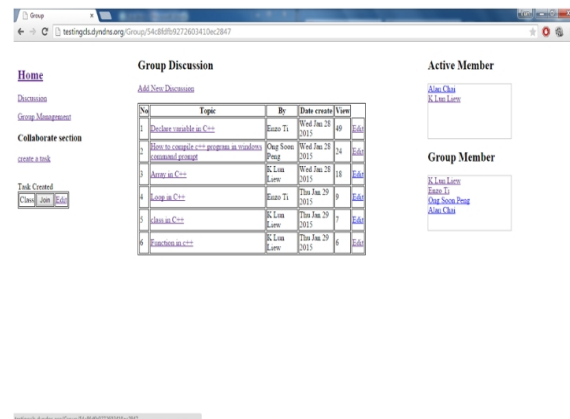


Figure 5: Group Page

Figure 6 shows the discussion page and will be displayed when learners view a discussion. In discussion page, members are allowed to comment and reply to other members' comments. For instance, when 'member A' replies to 'member B's' comment, a notification will be sent to "member B's" Facebook account and "member B" is able to view the notification (as shown in Figure 7). 'Member B' will redirect back to discussion page when he or she presses the notification alert. This encourages rich interaction between learners and thus, improves collaborative learning process.

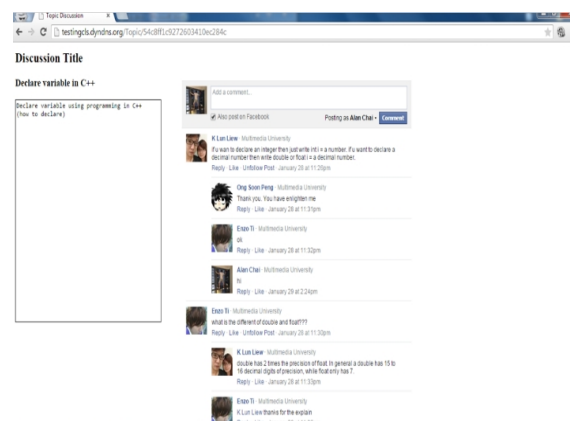


Figure 6: Discussion Page

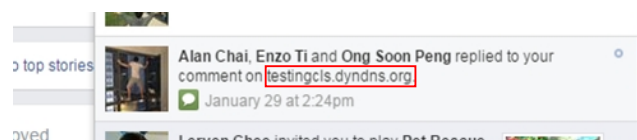


Figure 7: Notifications Shown in Facebook

Figure 8 shows collaborative task page that contains a real-time chat box which allows learners to chat while they performing collaborative activities. Besides that, there is a code editor space for learners to write and edit codes to solve the problem scenario given simultaneously. Upon completing the code writing, members are able to request for compiling and executing the code.

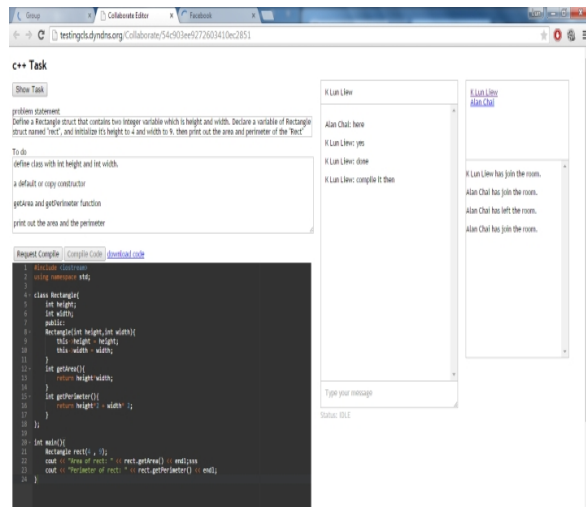


Figure 8: Collaborative Task Page

Once a member requests for code compilation, the editor space will be un-editable and members can click on 'Compile and Execute' (as shown in Figure 9) to get the executed code output being displayed. Members are able to download the code from the system in .cpp format. Active learners will be shown on the top right side of the page. Room status (i.e. idle) will be shown on the right bottom of page. Learners can compile and run the code after they finish writing the code. A new window will be popped out and to display the output of the compiled code. Top of the page displays the assigned problem statements and collaborative tasks to be completed.

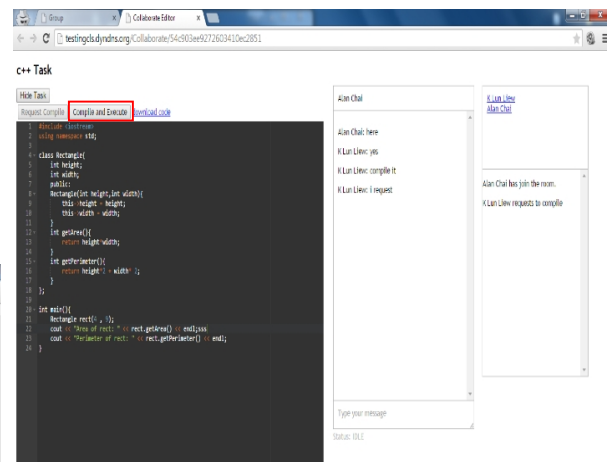


Figure 9: Compile and Execute Page

## 5. CONCLUSIONS

Nowadays, people can chat, communicate and interact with others through Social Network Services. This phenomenon shows that Social Network Services are important and indispensable in our daily life. It also shows the significance and convenience of using Social Network Services for collaboration, interaction and communication. With the increasing interest of social media among students, we are motivated to integrate this informal mode of socialized learning into collaborative learning system to engage students for their learning activities. Students can express their attitudes towards learning and perform brainstorming with other group members with the use of SNS. The adoption of Social Network Services in collaborative learning system will make the communication and interactions between learners become easier, faster and more interactive. Besides that, our proposed system also solved the geographical constraints for the learners who need to group together to learn or solve a task but yet far from each other. For the future work, learning efficiency and effectiveness of different collaborative task groups will be measured. User testing will be conducted among computer science and IT undergraduate students which are enrolling in programming language subjects. More suitable and relevant Social Network Services will be analyzed and considered to be integrated in our collaborative learning system to allow more functionality to be used by the learners. Besides, we are also planning to perform social learning

analytics on our proposed system to derive and discover social connections among students and to understand their learning experience or behavior.

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