Degree of Centrality for the Student Classroom Activities using Offline Social Network Analysis

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Abstract— **The research study regarding degree of centrality is applied to student's collaborative communication using offline social network analysis for classroom performance of the student during collaborative activities. Offline social network analysis examines the dynamics and interactions of the students in the classroom activities as participants in the learning collaboration which be valuable in the programs that focused on teamwork, communicative skills and teacher preparation programs. The research study applied to the programs, offline social network analysis can provide information regarding the instructional practices such as facilitating student interaction and classroom collaboration across different student population. To apply the degree of centrality in the offline social network which be converted into numerical points which refer to academic performance of the students that participate in the classroom collaborative activities. The researchers used descriptive, T-Test, simple random sampling, frequency, percentage, and weighted mean, which were used to tabulate and analyze the data. Sample size for students is 40 or 80% while faculty respondents is 10 or 20%. The grand weighted mean for the students regarding the assessment of the E-Thesis Repository was 4.45 with a verbal interpretation of 'acceptable'. Meanwhile, the grand weighted mean for the faculty regarding the assessment of the research study was 4.17 with a verbal interpretation of 'acceptable'. The weighted mean for the significance was 2.035 and the grand weighted mean for the acceptability of the research study was 4.31 with a verbal interpretation of 'acceptable'. In this study the researchers conclude that there is enough evidence to support between the assessment of students and faculty using offline social network analysis tool. Using the T-test statistical methods, the researchers determined the acceptability of the system in terms of the reliability, efficiency, usability and functionality for student classroom activities. The research study is to overlay the increase skills of critical thinking, skills of reflection and construction of knowledge.**

Keywords— **Constructivist Learner-Centered, Degree of Centrality, Collaboration, Social Network Analysis, Peer Interaction**

I. INTRODUCTION

Social network analysis (SNA) is a kind of structure analysis method developing in many research fields which focuses on the relationship research and is mainly used to describe and measure the relationship and information individually[1][2]. Theories of SNA have been proved to be successful in studies of scientific collaboration network [3][4].

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The social network analysis used in relationship network of academic institutions in student classroom activities collaboration is of great significant to the educational mechanism, influence factors and academic information exchange model in classroom activities collaboration. Using social networks in educational and instructional contexts it can be considered as a potentially powerful idea simply because students spend a lot of time on these online networking activities [5]. The social network analysis was used to identify the patterns between individuals who are part of the same social network such as students in the same class.

The social network analysis is a method to determine the student's communication and interaction which will be. The researcher used degree of centrality to measure the academic performance of the student's collaboration in the classroom activities using offline social network analysis. The researcher used grading criteria for the course which will be break into three (3) parts. Twenty percent (20%) is given to measure the individual performance of student's collaboration in classroom activities which will be given or uploaded by the teacher in the offline social network analysis. The twenty percent (20%) was divided into three parts; the ten (10%) percent will be in the degree of centrality, five (5%) percent will be in closeness centrality, and another five (5%) percent will be in betweenness centrality. The students can be viewed their academic performance in collaboration classroom activities using offline social network analysis.

A. Statement of the Problem:

Specifically, the researcher sought to answer the following questions:

1. What is the status of classroom collaboration of the students?
2. What are the evidence that critical thinking skills can be exercised well in constructivist learner-centered courses involving peer interaction?
3. What student moderation should be implemented to promote interaction and critical thinking?
4. How do the respondent (teacher and expert) assess the research study in term of the following criteria: Reliability, Efficiency, Usability and Functionality.

B. Conceptual Framework of the Study

The conceptual framework discussed the flow of the study. The study used the systems theory approach. The system has

three frames which is composed of input which went through the process and emerged as the output.
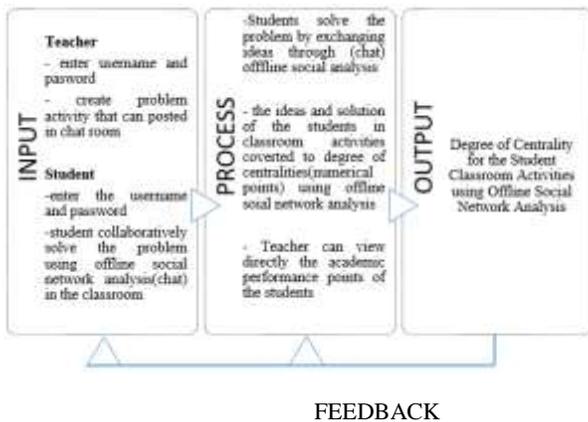

FEEDBACK

Fig 1: Conceptual model of the proposed research study

C. Objective of the Study

The general objective of the study is to develop a degree of centrality for the student's classroom activities using offline social network analysis that will enhance student learning activities from their course.

Specifically the researcher aim to:

1. To develop a student classroom activities model using degree of centrality to improve the learning process activities
2. To develop a offline social network analysis that show the benefits in learning process of the students in classroom activities.
3. To identify the different social analysis to be used in student classroom activities during collaboration.
4. To convert the student classroom activities using offline social analysis into numerical points that serve as academic performance of the students.

D. Significance of the Study

The researcher want develop a study that can offer new learning development through offline social interaction inside the classroom. The facets that were looked into was the engagement of the students in collaborating to solve a problem. The learning network (Offline Social Network Analysis) can make the process of collaboration will be more transparent because of the transcript of conference messages (chat communication) can be used in assessing individual performance role and contribution in activities and collaborative process. The student will be interact in collaboration by sharing and comparing of the knowledge, discovering and exploring new ideas in the classroom activities given by the teacher. Through this new innovation, their thinking, analysing, decision making and communication skills will be tested through the use of the proposed study.

II. RELATED LITERATURE

Social Network Analysis (SNA) is a useful tool for studying relations. It is a collection of graph analysis methods that researchers developed to analyse networks in social sciences, communication studies, economics, political science, computer

networks, and others. SNA methods provide precise mathematical definitions of five groups of characteristics of the actors and of the network itself [6, 7].

Social interactions between students are a major and underexplored part of undergraduate education. Understanding how learning relationships form in undergraduate classrooms, as well as the impacts these relationships have on learning outcomes, can inform educators in unique ways and improve educational reform. Social network analysis (SNA) provides the necessary tool kit for investigating questions involving relational data. [8]

Social network analysis offers a unique way for instructors to visualize collaboration and communication within a course and see relationships between individuals, groups, teams, or cliques. We used social network analysis to measure the growth of collaboration in the capstone [9]. SNA has been widely applied to study the social aspect of students learning [10]. This way [11] analyzed networks in order to identify the people from whom an individual learns. Here [12] proposed a methodology to analyze students' interactions in a collaborative learning environment, which consists of using SNA to get meaningful statistical indicators, such as the student reputation. [13] Emphasized the use of SNA techniques to discover relevant structures in social networks so that the instructors were able to better assess participation.

Social Network Analysis (SNA) to analyze the structure of interactions between the students in these forums. Various metrics are introduced for ranking and determining roles, while clustering and temporal analysis techniques are applied to study the student communications, the forming of groups, the role changes, as well as scrutinizing the content of the exchanged messages. Our approach provides the instructor with better means to assess the participation of students by (1) identification of participants' roles; (2) dynamic visualization of interactions between the participants and the groups they formed; (3) presenting hierarchy of the discussed topics; and (4) tracking the evolution and growth of these patterns and roles over time [14].

In considering student experiences with respect to interaction and collaboration, social network analysis offers a useful way to organize inquiry and analysis. Social network analysis is an increasingly popular means of identifying patterns of interaction among participants in online networks, particularly variables such as degree (the number of members with whom each member interacts), centrality (how important or "central" each member is within the network), and clustering (the ways in which various members form cliques or groups). There are various measures of centrality, including closeness centrality (a measure of the direct or indirect connections between group members), betweenness centrality (a measure of the way in which each member helps to connect other members of the network), and Eigenvector centrality (the degree to which a participant is connected to other active participants)[15, 16, 17, 18]

Shea et al considered the dynamics of a social network in university coursework, finding that interaction among participants can be described in terms of qualitative and

quantitative measures such as frequency of participation, quality of reflection evident in postings, and depth of analysis [19].

A. Synthesis of the Study

Social network analysis (SNA) is a kind of structure analysis method developing in many research fields which focuses on the relationship research and is mainly used to describe and measure the relationship and information individually [20, 21]. Theories of SNA have been proved to be successful in studies of scientific collaboration network [22, 23], in this study, researcher used SNA to analyze the collaborative connection of students and teacher. Degree of Centrality, which reflects status and rights of activities in their social network, is one of the most important content in network analysis.Peer-collaboration is an effective teaching strategy for students in inclusive classrooms in terms of their social and academic development[24].

In relation of the research study, the researcher formulated the idea by combining the used of social network analysis and collaborative classroom activities as an effective tools in analysing the social interaction and academic performance of the students. Which will be monitor the activities of the user by communication with the network using offline communication and therefore the result in observing created throughout the student classroom collaboration.

III. METHOD OF RESEARCH

The review of related literature has shown recurring themes and discussion about the importance of social network analysis. It was shown that the different application of social network analysis can be used in many ways. This chapter discusses the methodologies and strategies used in the design of the utilities and how the various mechanism discussed and presented in the conceptual framework were implemented.

A. Research Design

Descriptive Research Design. This method is primarily concerned with the description of facts; a fact-finding method with adequate interpretation. It helps the researcher to formulate the best possible alternative for the improvements of the current existing procedure in classroom activities through careful analysis, interpretation, and determination of its defects and how it can be reduced and eliminated.

Through the use of descriptive research design in the development of the research study, the process of the existing procedure in classroom activities was identified and described. It enables the researcher to know the problems in the existing procedure in classroom activities. One of the types of Descriptive Research Method is survey method. In survey method research, the respondents answer questions administered through interviews and questionnaire by the researcher. In order for the survey to be reliable and valid, it is important that the questions are constructed properly. Questions should be written diligently clear and easy to comprehend.

Constructive Research Design. Constructive research involves evaluating the "construct" being developed analytically against some predefined criteria or performing some benchmark tests with the prototype, (Wensveen, 2012).

The researcher focused on developing better solutions, through careful analysis and comparison. With the use of this research design, the researcher had developed a new and a better tool as compared to the existing procedure in classroom activities.

B. Sample and Procedure

Respondents of the Study were:

1. Users - sample were 40 3rd year students enrolled in the Bachelor of Science in Computer Science program. These students have already taken up Software Development Course;

2. Faculty - sample were 10 faculty. They were asked to assess the proposed research study.

The researchers used survey questionnaire to gather data and to assess the Degree of Centrality for the Student Classroom Activities using Offline Social Network Analysis. The researchers scheduled hands-on trial sessions for the students and faculty, for them to be able to get acquainted with the review for the research study and assess it according to its suitability for research and instructional purposes.

The researcher prepared questions based on the statement of the problem and distributed the questionnaires to the students and faculty after their hands-on trial session of the review the research study. The researchers waited for them to finish filling out the survey questionnaire, as this will serve as their assessment of the Degree of Centrality for the Student Classroom Activities using Offline Social Network Analysis. The researchers assured confidentiality of the survey sheets. Other participants were given time to respond as they needed to try out the system first before answering the questionnaire. There were no incentives offered for participating in the research.

C. Data Gathering Procedure

Before the administration of the copies of the instrument, permission sought first from the Associate Dean Department Computer Studies and Systems. Once the permission had been granted, the researcher disseminated the questionnaires to the undergraduate students and teachers.

The researcher distributed the questionnaires to the respondents. Some of the copies were retrieved immediately after the copies were accomplished by the respondents and some were retrieved after few days. After which, the data were collated, tallied, and computed. The data were encoded using SPSS program and excel worksheet program.

D. Software Development Model

The software development model that the proponent will be using is the Rapid Application Development (RAD) Model. It is primarily used for small, short-lived projects and an architected approach, used for large, heavily designed, and systematic development. James Martin (2000) first coined the term Rapid Application Development in the late 1980s. RAD is a development lifecycle designed to give much faster development and higher-quality results that those achieved with the traditional life cycle. It is designed to take the minimum advantage of powerful development software that has evolved

recently. RAD compresses the step-by-step of conventional methods into an iterative process. The RAD approach thus includes developing and refining the data models, process models, and prototype in parallel using an iterative process. User requirements are refined, a solution is designed, the solution is prototyped, the prototype is reviewed, user input is provided, and the process begins again.
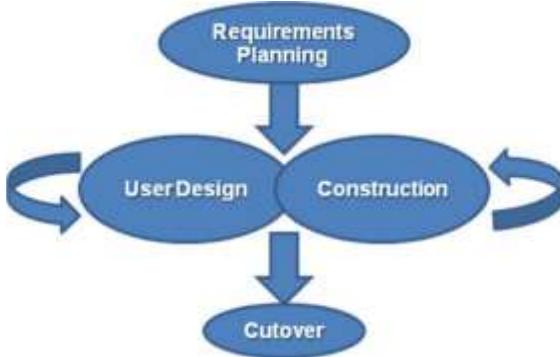

Fig. 2. Rapid application development (RAD) model
(Sommerville, 2010)

During the requirements planning, the researcher analyzed the problems encountered in the current process and listed the solutions to each problem. Based from the solution listed, the researcher created a quick design of a system. During the prototyping process, the researcher will build the system and demonstrate it to the client. After demonstrating the system, the client will give comments and suggestions that will improve it. Based from the feedback of the client, the researcher will refine and make necessary changes with the system. If the client is already satisfied with the system, the prototyping process will end, and will proceed to the cutover phase. The cutover phase includes data conversion, testing, changeover to the new system, and user training.

Requirements Planning. It is also known as Concept Definition Stage. This stage defines the business functions and data subject areas that system will support and determines the system's scope.

Relevant information such as the students and school information were collected and analyzed to support and determine the scope of the proposed research. The researcher conducted an interview and observation of how the teachers and the school facilitate academic learning activities in classroom. In this stage, the researcher determines the proposed study's scope.

User Design. The User Design is also known as the Functional Design Stage, uses workshops to model the system's data and processes and to build a working prototype of critical study components.

After the research study's scope has been elicited, the researcher will design the functionalities of the proposed research study. Data flow diagram will be created that shows the data and the processes involved in the system as well as the use case diagram that illustrates the functionalities of the proposed research study.

Construction. This is also known as the Development Stage. This stage completes the construction of the physical application research study, builds the conversion study, and develops user aids and implementation work plans.

In this stage, the researcher will design the user interfaces of the users. The diagrams from User Design stage will be converted into a physical research output using PHP as the front-end and MySQL as the back-end.

Cutover. Also known as the Deployment Stage, includes final user testing and training, data conversion, and the implementation of the application tools.

Software development cost will be created to determine the overall cost of the product. The research study output will be tested by the researcher to determine whether it meets the user requirements.

E. Statistical Treatment of Data

The data gathered were tallied, categorized and subjected to descriptive analysis. The descriptive measures used were frequency distribution, percentage and weighted mean and arbitrary values. Frequency distribution was used to show the responses of the respondents under the different categories.

The responses for the different categories were presented in relative frequency distribution or percentage using the following formula:

$$P = \frac{f}{F} x\ 100\%$$

Where: P = Percentage
F = Frequency
F = Total frequency of all categories

The study also made use of the T-Test. T-test was used to compare the means of the two samples (students and Faculty). In simple terms, the T-Test compared the actual difference between the two means in relation to the variation in the data (expressed as the standard deviation of the difference between the means.

The T-Test formula was utilized wherein:

$$t = |\bar{x}_1 - \bar{x}_2| \div \sqrt{A * B}$$

Where,

$$A = (n_1 + n_2) \div n_1 n_2,$$

and

$$B = [(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2] \div [n_1 + n_2 - 2]$$

Likert Scale. To interpret the perception of the respondents as to the effectiveness of the motivation factors, the five-point Rating Scale was used with the following equivalent points.

Index of Verbal Interpretation

TABLE 1: LIKERT SCALE

Range	Interpretation
4.50 – 5.00	Highly Acceptable
3.50 – 4.49	Acceptable
2.50 – 3.49	Neutral
1.50 – 2.49	Slightly Unacceptable
1.00 – 1.49	Unacceptable

Legend:

HA – Highly Acceptable
A – Acceptable
N – Neutral
SU – Slightly Unacceptable
U - Unacceptable
X - Weighted Mean
VI – Verbal Interpretation

IV. RESULT AND ANALYSIS

A. Requirements Analysis

The researcher defined the functions and data course areas that the research study will support. Students, teacher, where gathered to come up with the conceptual framework of the proposed research study. With the gathered information, the researcher was able to carefully plan of how will the research study tool work. The proposed research study can be accessed by two types of users: student and teachers. The teacher will create a classroom collaboration activities. Students and teachers will have their accounts created through registration in the class before they can gain full access to the research study tool. The teacher will login and post a problem activities the chat room using offline social network. The students will also login to their account and start used student classroom collaboration using offline social network analysis (chat communication). The degree of centrality is used as a tool inside the offline social network analysis (chat communication) to evaluate the academic performance activity of the students.

B. User Design

Sample screenshots of the proposed system are presented as follows:

The user login of the teacher and students in classroom collaboration activities.


This is the teachers account for posting the activity problem for the students in the class

The students use their login account to answer the activities posted the offline network (chat room). The student select a teammates in the collaborative activities given by the teacher. Then the students start answering the problem activities using offline social network (chat communication) with their teammate.

Username	Degree Centrality	Closeness Centrality	Betweenness Centrality	Total
ALLANIGUE_Rafael Quizon	1.7	-1.15	0	0.55
DACUNO_Christian	6.7	-0.65	0	6.05
EBAJAN_Jenifer	5	-0.65	0	4.35
MARINO_Joemari	5	-1	0	4
MAUL_John	1.7	-0.15	0	1.55
Robert_Lim	3.3	-0.35	0.05	3.6
SABILE_Blessy Ricafranca	1.7	-0.15	0	1.55

This is to show results of the students collaborative activities performance based on the social network analysis.
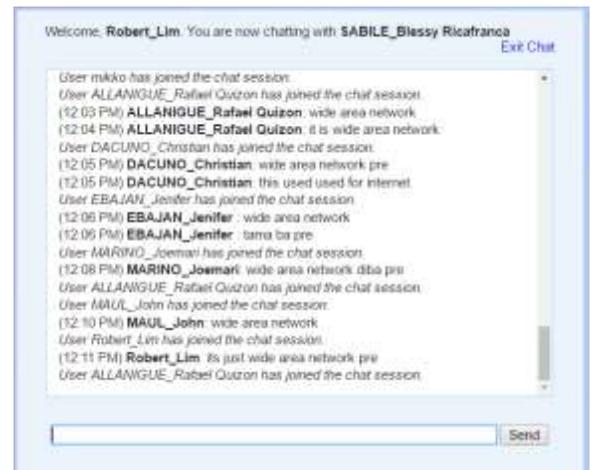
C. Data Interpretation

TABLE II: DISTRIBUTION OF RESPONDENT ACCORDING TO STUDENT AND FACULTY

Respondent	Frequency	Percentage
Faculty	10	20 %
Student	40	80 %
Total	50	100 %

TABLE III: ASSESSMENT ON RELIABILITY ACCORDING TO FACULTY AND STUDENT

Reliability	Faculty		Student	
	$\bar{x}$	VI	$\bar{x}$	VI
1. The offline social network tool reduces frequency of failure	4.33	A	4.60	A
2. The offline social network tool produce or maintained items to perform as required over the specified times	4.20	A	4.25	A
3. The offline social network tool is reliability maintenance centered	4.07	A	4.60	A

The grand weighted mean was 4.20 with a verbal interpretation of 'Acceptable'. Majority of the faculty respondents rated the functionality of the degree of centrality for the student classroom activities using offline social network analysis as 'Acceptable'

The grand weighted mean was 4.48 with a verbal interpretation 'Acceptable'. Majority of the student respondents rated the functionality of the degree of centrality for the student classroom activities using offline social network analysis as 'Acceptable'

TABLE IV: ASSESSMENT ON EFFICIENCY ACCORDING TO FACULTY AND STUDENT

Efficiency	Faculty		Student	
	$\overline{x}$	VI	$\overline{x}$	VI
1. The offline social network tool be light weight and run very efficiently	4.33	A	4.55	HA
2. The offline social network tool response time given thruput	4.20	A	4.39	A
3. The offline social network tool has resource behavior	4.13	A	4.22	A

The grand weighted mean was 4.22 with a verbal interpretation of 'Acceptable'. Majority of the faculty respondents rated the efficiency of the degree of centrality for the student classroom activities using offline social network analysis as 'Acceptable'

The grand weighted mean was 4.38 with a verbal interpretation 'Acceptable'. Majority of the student respondents rated the efficiency of the degree of centrality for the student classroom activities using offline social network analysis as 'Acceptable'

TABLE V: ASSESSMENT ON USABILITY ACCORDING TO FACULTY AND STUDENT

Usability	Faculty		Student	
	$\overline{x}$	VI	$\overline{x}$	VI
1. The information provided for the offline social network tool is easy to understand	4.00	A	4.40	A
2. The interface of the offline social network tool is pleasant	4.07	A	4.50	HA
3. It easy ti find information needed	4.20	A	4.25	A

The grand weighted mean was 4.09 with a verbal interpretation of 'Acceptable'. Majority of the faculty respondents rated the usability of the degree of centrality for the student classroom activities using offline social network analysis as 'Acceptable'

The grand weighted mean was 4.38 with a verbal interpretation 'Acceptable'. Majority of the student respondents rated the usability of the degree of centrality for the student classroom activities using offline social network analysis as 'Acceptable'

TABLE VI: ASSESSMENT ON FUNCTIONALITY ACCORDING TO FACULTY AND STUDENT

Functionality	Faculty		Student	
	$\overline{x}$	VI	$\overline{x}$	VI
1. The output information of the social network tool is accurate	4.27	A	4.55	HA
2. The social network tool initially delivered to function without errors or problem	4.13	A	4.25	A
3. The social network tool initially delivered to function without crashes or service interruption	4.07	A	4.30	A

The grand weighted mean was 4.15 with a verbal interpretation of 'Acceptable'. Majority of the faculty respondents rated the functionality of the degree of centrality for the student classroom activities using offline social network analysis as 'Acceptable'

The grand weighted mean was 4.36 with a verbal interpretation 'Acceptable'. Majority of the student respondents rated the functionality of the degree of centrality for the student classroom activities using offline social network analysis as 'Acceptable'

V. CONCLUSION AND RECOMMENDATION

A. Conclusion

The researcher used descriptive method, T-Test, frequency, percentage, and weighted mean, which were used to tabulate and analyze the data. Sample size for students is 40 or 80% while faculty respondents is 10 or 20%. The grand weighted mean for the students regarding the assessment of the degree of centrality for the student classroom activities using offline social network analysis was 4.45 with a verbal interpretation of 'acceptable'. Meanwhile, the grand weighted mean for the faculty regarding the assessment of the degree of centrality for the student classroom activities using offline social network analysis was 4.17 with a verbal interpretation of 'acceptable'. The weighted mean for the significance was 2.035 and the grand weighted mean for the acceptability of the proposed application was 4.31 with a verbal interpretation of 'acceptable'.

In this study the researchers conclude that there is enough evidence to support between the assessment of students and faculty using degree of centrality for the student classroom activities using offline social network analysis.

Using the T-test statistical methods, the researchers determined the acceptability of the offline social network analysis tool in terms of the reliability, efficiency, usability and functionality for student classroom activities. This research study measured the acceptability of the proposed Degree of Centrality for the Student Classroom Activities using Offline Social Network Analysis to help the Faculty elevate the level of motivating student in tantamount to increasing their critical thinking, increase problems-solving skills that help students apply principles to scenarios found in the real world.

B. Recommendation

A policy may be developed by the faculty of CAS-EARIST for the utilization of the proposed Degree of Centrality for the Student Classroom Activities using Offline Social Network Analysis which would be beneficial to the institute and the academe. Related course and other programs may also make use of the research study to develop their own, according to their needs and preferences.

Future researchers may further improve the research study by making it online, altering the settings to suit researchers need, filtering in and generating reports according to the need of a programs and institution.

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