

Clustering from Grouping: A Key to Enhance Students' Classroom Active Engagement

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A research paper.

Abstract:

Despite the increased application of technology in the classrooms, students' active participation and classroom engagements are still at the low level as noticed by professors. Students are becoming passive audience in the classroom discussions and participation is growing colder and quieter daily in the academic arenas. Classrooms teaching has turned into one way communication and students continually accepting the idea of keeping to oneself in the classroom. The importance of students' participation in our colleges classrooms cannot be underemphasized, as a result, every professor included in his/her grading policy a certain percentage for student participation. As much as students understood the significant of classroom participation on final semester grade, many still refused to be unshelled.

Professors have implemented several motivating strategies to improve student classroom engagement such as punishment, rewards, hands-on, research etc. However, studies have shown that motivating through punishment is the least effective method to motivate an individual. Therefore, this study outlined ways in which a technique called "*clustering from grouping*" had improved students' classroom engagement. This technique was implemented in three different classes and in two semesters. Participants included, graduate and undergraduate students with ages ranged from 19 to 46 years old. The first undergraduate class enrolled 16 students, the second class enrolled 20 students and the graduate class enrolled 24 students. Twenty-two students completed the survey that assessed the techniques effectiveness on three forms of student classroom engagement. Findings on the students' cognitive, behavioral and affirmative engagement revealed that 95%, 97% and 85% of the students respectively were actively engaged in the classroom activities. Only one student affirmed that learning through the technique was boring. Fifty-five percent of the students affirmed that the technique encouraged them to use the professors office hours more often than they would have for another professors classes. Of the 18-students who responded to the open-ended question, 94% affirmed that the technique was the best they had ever experienced to actively engaged students in the classroom activities. Findings further revealed 15% improvement in students participation in the classroom where the technique was implemented compared to another classes taught by the professor. The professor experienced a 10% increase in undergraduate students and 5% increase in graduate students who utilized his office hours. Professor affirmed that an appreciative email was also received from a parent who acknowledged the effectiveness of the technique on his son's skill to communicate and to engage in an effective discussion. This paper assessed, compared and documented the impacts of *clustering from grouping teaching technique* on students' classroom engagement.

Keywords: Engagement, clustering, cognitive, behavioral, affirmative.

1. Introduction:

Technology increase in our society had greatly impact students' interaction in various classrooms discussions and had in one way or another, degraded student classroom engagement. Although, student low engagement has been attributed to instructor inability to motivate students in the classroom. Notwithstanding, student classroom engagement is a complex issue, which demanded the attention of many stakeholders such as school leaders, educators, parents, students and school culture/policy makers. Schalock and Schalock [1] findings revealed that student active classroom participation should be considered as a basis for teacher evaluation. In the same direction with the [1] study, a poll result on students' classroom engagement of 2013, revealed that approximately 55% of students across the United States (US) were engaged in the classroom activities, while 28% were disengaged, and 17% were actively disengaged [2]. The poll results indicated larger percentage of students were disengagement during classroom teaching. Axelson and Flick acknowledged in their findings that student classroom engagement is increasingly seen as indicator of academic success [10]. Aside the indicator acknowledged in Axelson and Flick study, many other factors have been determined to influencing student classroom engagement. Examples are; anti-social behavior among students who are actively involved in using personal devices on daily basis, teachers' inability to coordinate the classroom, students' unpreparedness, etc. Due to the complexity in the student engagement, student classroom engagement has been given different definitions. This paper define student classroom engagement as the process of re-claiming student back from his/her shell to actively participate in the classroom discussion and to contribute to the topic at hand. This area of study has attracted many researchers, and with time student classroom engagement strategies has changed and redirected to the way classroom behaviors can best be managed. Recently, student engagement has been built around the hopeful goal of enhancing all students' abilities to learn how to learn or to become lifelong learners in a knowledge-based society [3]. Classroom engagement is a strategic process for student learning, the more the students are engaged in the classroom activities, the better the students learn from the activities. Likewise, it is acknowledged in Marzano et al, [4] article that an effective classroom behavior, primarily lies in the hand of the classroom manager, who is the instructor. Marzano et al study was built on the findings from the study conducted by [5] on 324,851 students. Sander et al's [5] article reported the following in the findings:

“The results of this study will document that the most important factor affecting student learning is the teacher. In addition, the results show wide variation in effectiveness among teachers. The immediate and clear implication of this finding is that seemingly more can be done to improve education by improving the effectiveness of teachers than by any other single factor. Effective teacher appear to be effective with students of all achievement levels regardless of the levels of heterogeneity in their classes. If the teacher is ineffective, students under that teacher's tutelage will achieve inadequate progress academically, regardless of how similar or different they are regarding their academic achievement (p.63)”

As confirmed by many authors, the impact of teachers/instructors effectiveness on student learning is unquantifiable. These days, many universities have increased the funds allocated into faculty development, hoping that the outcome will directly influence student classroom engagement and participation. Likewise, it is generally believed that personal technology usage among students is a factor that can significantly impact student classroom engagement and resulted into student low participation in the class discussion as expected. However, many researchers have concluded

that personal devices use in the classroom has improved student classroom engagement [6], [7], [8], [9]. Certainly, these findings were true, but the studies were based only on student perspectives, whereas, student final grades were not included in the analysis to confirm students report. Student classroom engagement greatly involves peer-to-peer interaction and not student-to-machine interaction. Nevertheless, student classroom engagement is complex and broad to be handled in one direction. Some researchers classified student behavior as a predictor of classroom engagement [11]. Likewise, Appleton, Christenson, and Furlong [12] classified factors that affected student classroom engagement into two categories namely; the indicators and the facilitators. The author further divided indicator factor into three categories namely: affective, behavioral, and cognitive and the facilitator factor into two categories namely; personal and contextual factors that influenced engagement. Psychologically, the term affirmative has been used to describe student classroom engagement [13]. According to Appleton et al.'s [12] findings, indicators are considered as the student levels of connection with learning. This paper on clustering and grouping technique primarily focused on the indicators, because students are the primary target in the classroom engagement.

Further, Marzano et al acknowledged in their findings that the dynamics of how a teacher/instructor produced the skill required for an effective classroom management is not easy to come by. Therefore, it is necessary that teachers are creative in their teaching strategies. Likewise, in 2011, Li, and Lerner's [14], findings revealed that student engagement is essential for schools to promote positive youth development in the society. This serves as the main goal for all institutions desired to build the future generations. Additionally, student school engagement has been classified as a positive student behaviors, which includes student attention in the classroom, class attendance, student contribution/participation in the class discussion, respect for other, and readiness to involve in other school activities [15]. Anti-social characters of current college students have seriously watered student active classroom engagement. The anti-social attributes of college students has grown to the extent that different professionals had shown concerns in the student classroom engagement. This had led to the development of several conceptual frameworks for student engagement [16], [17], [18] and campaigns in different publications to improve student classroom engagement. Rather for the trend to be decreasing, it increases daily. It is generally believed that unprepared and quiet students found it difficult to contribute in the classroom discussions, when they believed that their peers are smarter. Thus, this paper borrowed a word from a statistics data-mining course called "*clustering from grouping*" to improve student classroom engagement. Clustering is the process of combining things that are similar in characteristics/attributes in one group. Clustering has the potential to eliminate inferiority/complexity among group members and can help to bring out the best from under-represented groups of people. Statistically, grouping people of different capability together has the potential of skewing the mean performance either to the right or to the left. Thus, those with low abilities may drift up toward the mean, whereas, those with very good fit may drift down toward the mean. Therefore, this study employed research based process to implement the clustering from grouping teaching strategy to improve student classroom learning and engagement. Engaging students in research work in the colleges has been proved to directly impact student community engagement [19].

2. Methodology

2.1. Method

This study explored a statistical word called “*clustering*” to build student classroom active participation on a subject matter. The strategy was tested in three classes at one university in the Midwest region of the US. Two of the classes were undergraduate and one graduate class. The undergrads classes were evaluated in two semesters. The focus of the undergraduate course was to build students on teamwork, meeting effectiveness, and professional presentation style. Sixteen students registered for the first undergraduate class, 20 students registered for the second undergraduate class sections include both male and female in each of the semesters. Graduate class had twenty-four students and the technique had only be implemented one time in the graduate class. Clustering from grouping strategy is a teaching technique that separate set of students who possess different attributes in one group and re-assign them into another groups of people with a similar attributes/characteristics (called a **cluster**). Twenty-two students of the graduate students responded to the survey made available at the end of the semester. Students who responded to the survey included four females and eighteen males. Their ages ranged from 24 to 46 years old.

2.2. Procedure

The technique was implemented in three classes and tested with students in one class. The process involved seven steps; each step has its own uniqueness. The steps were: build the background, form the group, professor-students interactive section, form student cluster,, cluster brainstorming, progress report presentation and professor feedback. At the end of one semester, students in one of the classes completed questionnaire that requested for student demographic information (i.e., age and gender), and student levels of engagement in three aspects of learning: cognitive, affirmative and behavioral. Four questions were asked on each of the engagement levels. The questionnaire was developed using a standardized questionnaire retrieved from online materials. A Doctor of Philosophy in Leadership and Higher Education reviewed the questionnaire to validate its contents. All questions were presented in Likert scale options except one which was presented as open-ended question.

Step I: Build the Background

Build the background was the process followed before the actual classroom activity. One week prior to the start of the process, a topic was created and made available on Blackboard for students to study before the class. Likewise, the course syllabus was posted on Blackboard at the same time. An announcement was also created to prompt student’s attention about the activities posted on Blackboard and particularly, the grading policy for the course. In the grading policy, 50% of the entire semester grade was allocated to class project assessment, this includes; student presentation, discussion session, write-up, PowerPoint, and project defense. Through a weekly announcement, the professor provided pre-knowledge on what to be discussed in the sub-subsequent classes on the Blackboard.

Step II: Form the Group

Students were given the privilege to choose group members of their interest as the first stage in grouping. After formed the group, each group was allowed to brainstorm on the topic made

available on the Blackboard and outlined the key points agreed on by all group members. Each group was given approximately 30 minutes to complete the brainstorming process in the class. Part of the instructions in step II was that each group member wrote every point discussed during brainstorming. Professor emphasized with the students that every point written by each group member will be graded during professor's visit to each group. Figure 1 indicates the pictorial description of each group, which is the subset of the entire class population. The color code in the pictorial description represents different attributes noticed in each group member during the group discussion with professor.



Figure 1: Initial Group Make-up

Step III: Professor-Students Interactive Section

During step III, professor visited each group and asked questions from each group members on the topic selected for discussion. During this session, every member's in each group written document was assessed and each member was questioned by the professor. Professor assigned number to every group member based on the way questions asked were answered. The assigned number indicates the level at which each group member contributed and participated in the questioning section. At this point, none of the students understood or were familiar with the professor intended method. The professor intentionally did not informed the students the goal of the method, so that students can be of their normal behavior.

Step IV: Form Students Cluster

During step IV, professor separated each group and re-grouped each member to form a cluster. Student cluster was formed based on the cluster definition given early in this paper. Students observed to possess the same attributes in the first group were assembled together to form a new project group members. Figure 2 shows the pictorial representation of the student cluster formed from the first group. The argument here, can be why do the students of the same level of contribution and participation (same attributes) were assembled together to form a group? This was done to hold each students accountable for his/her action and to create sense of responsibility and belonging. As revealed in [17] findings, allowing student to share their information and experiences in the classroom on an issue tends to improve student quality and accountability on

decision making processes. Activities in step I through IV were performed in a 3-hours class. Students were asked to retain the assigned number till the end of the semester. Now that each of the unprepared/underprepared students noticed that each member in his/her group possess similar study attribute, the tendency to open-up increased. This grew student potential to contribute more and felt the sense of belonging in the new group. Most students discovered each new group member's characteristics in the first meeting.

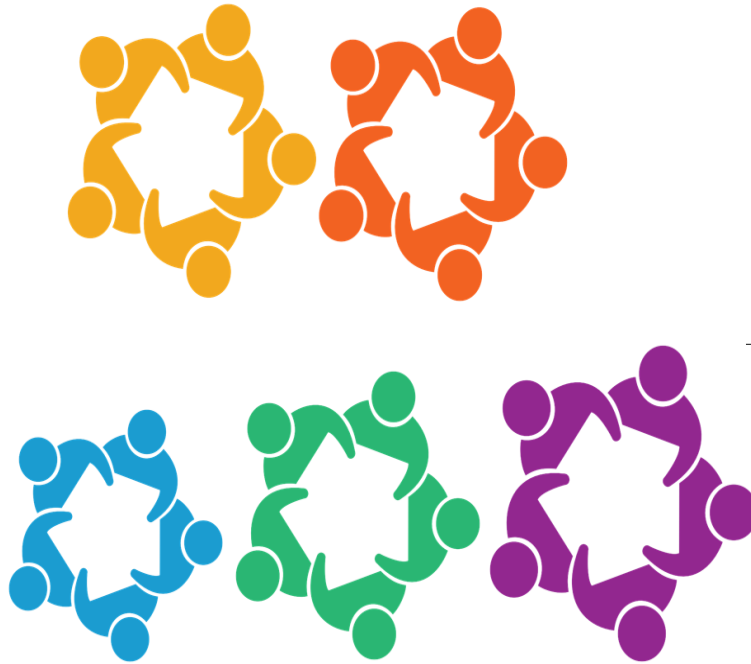


Figure 2: Pictorial Representation of New group.

Step V: Cluster's Brainstorming

Students were given another 30 minutes to brainstorm on the new topic assigned by the professor. Students were told to write down at least 5-key points discussed during the brainstorming process. The new assigned topic was assumed as the semester project for each new group. At the end of the lecture day, each group selected a representative who presented the group idea to the entire class. Rubric was developed to assess each group representative presentation. Table 1 shows the points assessed in the rubric during group representative presentation to the entire class. Every student was told to assess each representative presentation except the group members. Scores for each representative presentation were recorded for the entire group as part of the grade for every project presentation.

Table 1: Rubric for students' discussion assessment

	1	2	3	4	Score
Organization	Audience cannot understand presentation because there is no sequence of Information.	Audience has difficulty following presentation because student jumps around.	Student presents information in logical sequence which audience can follow.	Student presents information in logical, interesting sequence which audience can follow.	
Subject Knowledge	Student does not have grasp of information; student cannot answer questions about subject.	Student is uncomfortable with information and is able to answer only rudimentary questions.	Student is at ease with expected answers to all questions, but fails to elaborate.	Student demonstrates full knowledge (more than required) by answering all class questions with explanations and elaboration.	
Elocution	Student mumbles, incorrectly pronounces terms, and speaks too quietly for students in the back of class to hear.	Student's voice is low. Student incorrectly pronounces terms. Audience members have difficulty hearing presentation	Student's voice is clear. Student pronounces most words correctly. Most audience members can hear presentation.	Student uses a clear voice and correct, precise pronunciation of terms so that all audience members can hear presentation.	

Step VI: Progress Report Presentation time

During step VI, discussion and feedback were conducted in every meeting (class) for 14 weeks. At the sixteenth week of the semester, a compressive project presentation was completed by each group. Each group representative had 10 minutes to discuss the progress of his or her group project and answer any question arose from the class members. In every class, we spent an hour on project progress reports. During this time, each group representative presented the status of the group project and the professor gave remarks/comments on each representative presentation. Class activities took approximately 2-hours in every lecture day. Professor emphasized that each student in the class must ask questions during representative presentation to earn point towards individual final grade for the semester. Peer-to-peer evaluation was encouraged in the process to create effective strategy that optimized communication between students.

Step VII: Professor Feedbacks

Professor ensured closed feedback loops by communicating information regarding outcomes of the student engagement back to all students in every subsequent classes. The professor feedbacks were based on the summary from the peer-to-peer assessment and from the professor's observation. Professor gave each student presentation feedbacks at the beginning of every classes before each group representative gave the progress report of his/her group project to the entire class.

3. Concerns

Implementing the technique in the undergraduate classes, brought the question, why was the technique implemented with the undergraduate students? Generally, it is believed that any class activity conducted in the form of research has the potential to improve student learning and instill teamwork, which can foster active student engagement. This was clearly stated as one of the twelve tips for enhancing student engagement "an important educational aim is that students learn to understand and apply research evidence in their future professional life. Research is more than just teaching the techniques or processes, it is about engaging in communities of practice and becoming a contributing member" [19]. Positive outcomes about student participation in research have proven the necessity of research with undergraduate students to engage student in the university [20]. Undergraduate students have the tendency not to participate in-group work, but when final grade is tied to students' performances, this directly changed students' behavior.

4. Findings

The findings from this study are divided into two parts: the professor phase and the student phase.

4.1. Professor Phase:

The clustering from grouping technique had empowered and increased students classroom engagement, but the process was time consuming and hectic to be implemented. At the end of each

class section, students' scores from peer-to-peer assessment was compiled and analyzed using Excel[®] Spreadsheet version 10 for students' feedbacks in the subsequent classes. Students' expectation to have good discussion/presentation in every class increased the number of students who used professor office hours by 10% among the undergraduate students and by 5% among the graduate students. Clustering from grouping technique has not only actively engaged the students, but has led to internal proposal submission, which received a university internal grant award. Through the grant, a conference paper has been developed and accepted in Clute Institute International conference 2019 proceeding [21]. Another idea generated from the graduate class has been developed into a project and paper written from the project findings has been accepted in Applied Human Factor and Ergonomics conference 2019. Professor noticed that students' participation has improved by 15% compared with the classes where the technique has not been implemented. One parent confirmed the effectiveness of the technique on his son by emailed the professor to acknowledge his work. As recognized in [4] findings, engaged and well-managed classrooms will enhance students' behavior and achievement.

4.2. Students Phase:

Findings from the student responses on the technique effectiveness, revealed positive feedbacks. Approximately, 95% of the sampled students affirmed that the *clustering from grouping* technique improved their cognitive engagement during classroom discussion and participation. Responses to the questions asked on the behavioral engagement revealed that 85% of the sampled students felt to be actively engaged in the classroom. Likewise, responses on the affirmative engagement of the student received 97% students support. Figure 3 shows students' responses on one of the questions asked on cognitive engagement. Students were asked whether the technique actually helped them to figure out how the information shared in a group and presented to the class fit into real-life situations. Figure 3 indicates that none of the students was left out from connecting what they have learned with real-life situation.

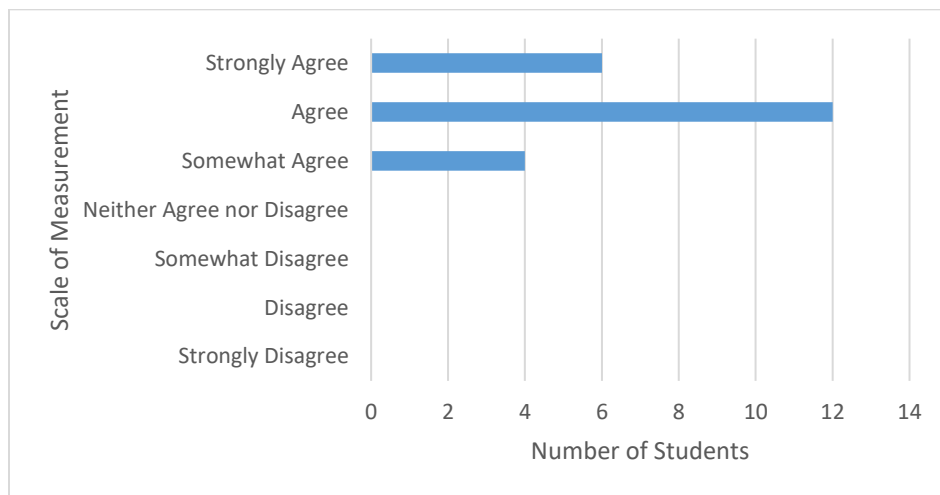


Figure 3: Student responses on cognitive engagement.

Another question asked on affirmative engagement, which was; is learning through the clustering from grouping technique a boring method? Figure 4 shows students' responses. This figure

indicates that 27% of the sampled students strongly disagreed, 32% disagreed, and 18% somewhat disagreed, and only 5% agreed that learning through the technique was boring.

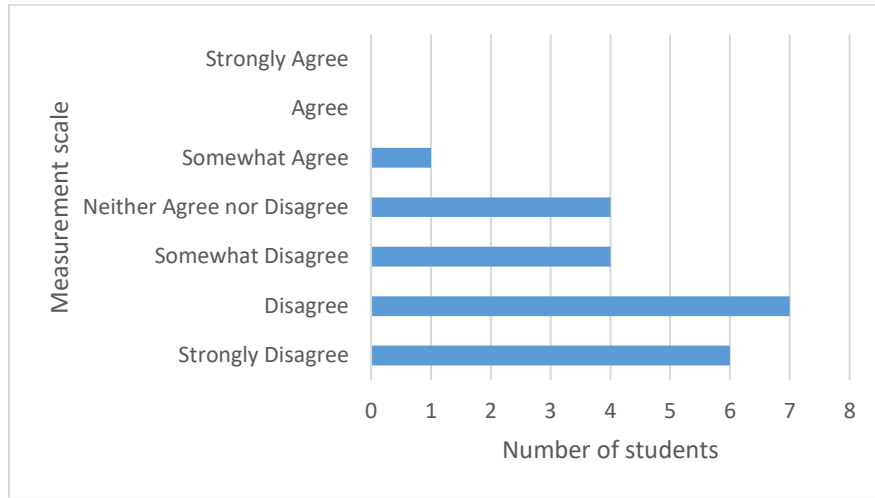


Figure 4: Student responses on one of the affirmative engagement.

Another question asked on whether students studied harder through learning with the technique when grouped with students that possessed similar attributes with them. Students' responses are shown in Figure 5. This figure indicates that 27% of the sampled students strongly agreed, 41% agreed, and 14% somewhat agreed whereas, none of the students indicated to be disagreed with the technique as a motivator to study harder.

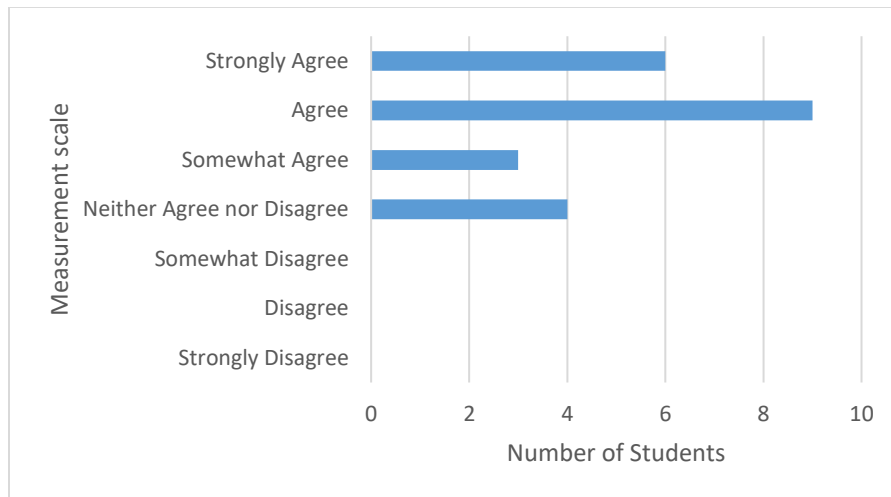


Figure 5: Students responses on efforts to study harder

Students' responses on the question asked whether the technique actually forced student to visit the course professor more than other professors, revealed that 23% of the sampled students strongly agreed that they visited the professor more than they visited professor of another class. Of the entire students sampled 9% somewhat agreed, only 18% disagreed that the technique had forced them to use the professor office hours than they would have use another professors office

hours. Figure 6 indicates the graphical representation of the students' responses for professor office hours' usage.

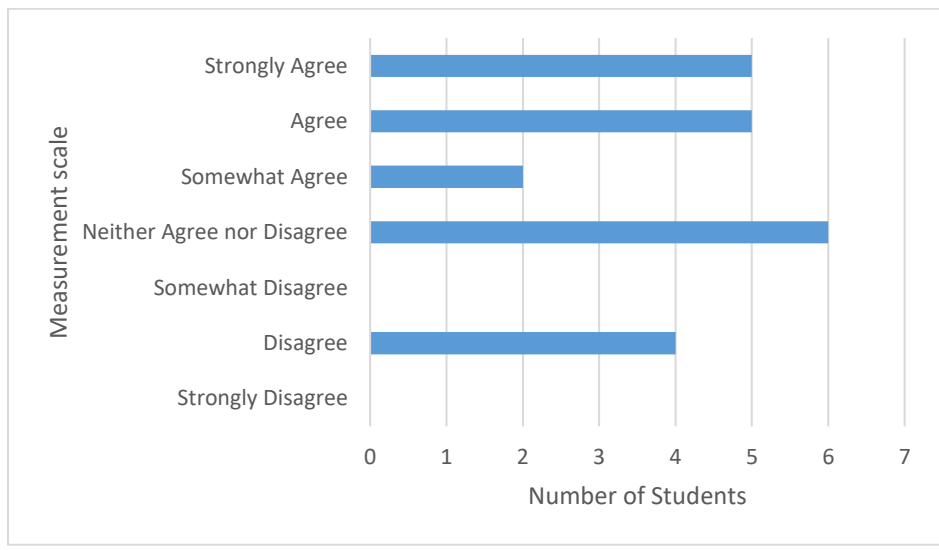


Figure 6: Students responses on whether the technique forced them to use professor office hours more.

Students' responses to the open-ended questions revealed that 72% of the sampled students believe that the clustering from grouping technique can be considered as one of the best techniques they had ever experienced to actively engaged students in the classroom activities. One student approximately, 6%, of the eighteen students who responded to the open-ended question thought that sometime the technique was boring. Approximately, 17% confirmed that the clustering from grouping technique motivated them to attend every class throughout the semester. Another 17% responded that the technique was more challenging and force them to think critically in every classes.

5. Discussion

There have been great deal of researches on student classroom engagement, findings from those studies have not adequately resolved the issues associated with classroom engagement. The purpose of this study was to present how a teaching technique called "*clustering from grouping*" works as a proper tool to improve student classroom learning and engagement. In general, results demonstrated that behavioral, affirmative, and cognitive students engagement during classroom activities were associated with professor creativity. This finding aligned perfectly with previous findings on student classroom engagement that teachers' is an important factor that can affect student learning [1], [4], [5], [22], [22]. This is not surprising, given what we know about positive influence of mentors on mentees. Teachers are indirectly the role model for the students. However, this study is unique in that it used data mining (statistical) tool to improve student classroom engagement, peer-to-peer discussion, active brainstorming and increased the number of students who utilized professor's office hours. As affirmed by the students, 55% responded that the clustering from grouping technique had in one way or another forced them to use professor's office hours more than they would have use another professor's office hours.

Additionally, findings from this study indicated that after the implementation of the technique, students who rarely speak in the class opened up to share idea with others. The clustering from grouping technique had also changed students' perception about one another and improved their peer-to-peer relationship quality. This finding agreed with [15] who concluded that students' classroom engagement positively influenced students' perception and quality of relationship. Further, the clustering from grouping technique can help to train students on how to build self-consciousness behaviors that generate excellent outcomes in studying patterns. The clustering from grouping technique reported in this study can be repeated, replicated and reinvented across different education levels. It can also be explored by researchers to train upcoming investigators research processes and how to become good research initiators. It has been acknowledged that when learning is very hard or too simple learners get frustrated easily [23]. The clustering from grouping technique implemented in this case study was neither too hard nor too simple for students to understand, it only pushed students to engage in peer-to-peer discussion and to brainstorm actively with peers. Overall, this technique had proved to be positive in student classroom engagement. Findings from the implementation of this technique "clustering from grouping" supported [4] Marzano et al.'s finding.

6. Conclusion

The implementation of different classroom techniques to improve student engagement can play a vital role in improving students' academic performances and teamwork. Successful student engagement requires instructor's creativity and ability to actively control the classroom. Findings from this study aligned with [2] findings that instructor inability to motivate students in the classroom plays vital role in students' engagement. Student curiosity and passion to study, as well as activity to perform (such as hands on, brainstorming, project development etc.) can eliminate student dizziness in the classroom and improve student classroom engagement. The increased in the number of students who utilized professor's office hours was because students were more curious to know what the professor requirement of the assigned project might be. The clustering from grouping technique implemented in the case study presented in this paper is not to be considered as one size fit all, but it is a good technique that can actively improve student classroom engagement. It is better implement in the post-secondary school (colleges) among the senior undergraduate and graduate students.

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