Performance of Students in Science through Laboratory Activities by Different Levels of Collaboration at MSU Naawan – Integrated Developmental School

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Abstract

The study aimed to determine the performance of the students in Science with the use of Laboratory Activities, by different levels of collaboration of the students of MSU Naawan-Integrated Developmental School. This study assessed the performance of the students in Science using laboratory activities through different levels of collaboration. One sample quantitative and qualitative research design was used in the study. A total population of one hundred fifteen (115) grade 10 students. Standardized laboratory activity was used to determine the different levels of collaboration of the students. Reliable and validated teacher made test was used to measure their performance in Science. Standardized questionnaire for self, and, group assessments was used to measure the different levels of collaboration of the students. This study revealed that there is a significant difference among the levels of collaboration based on self, peer and group assessment. Encouraging students to be involved in collaborative activities will help the teachers develop higher level thinking skills among the students.

Keywords: Performance of Students by Different Levels of Collaboration

1. Introduction

In the professional literature, the concept of collaborative learning through grouping, and pairing of the students in achieving academic goals are being widely researched and advocated. When students at various performance levels work together in small groups toward a common goal is referred to as collaborative learning (Johnson and Johnson, 1986). Learning among students will be their personal responsibility as well as their peers. Thus, success will be achieved if one student helps another student to be successful. Some proponents of collaborative learning claim that the active exchange of ideas within small groups not only increases interest among the student participants but also promotes critical thinking. There is persuasive evidence that students who quietly work as individuals have poor performance over those cooperative student teams who achieve at the higher level of their thought and has a better retention (Johnson and Johnson, 1986). Students have a better opportunity to engage in discussion, take responsibility for their educational improvement and thus becomes critical thinkers through shared learning (Totten, Sills, Digby& Russ, 1991). Involving them in classroom activities to develop students' higher order thinking skills is very advantageous for them.

Learning is one of the primary reasons why students go to school because of the fear of the subject; there is already an unwillingness of the students to learn. The teachers on the other hand look for better strategies in teaching that they would adapt so that it would fit the learner and would enjoy learning and learn as much as they can. It is already studied that for the students to learn better, they should always be involved in hands-on activities more than the usual way of teaching and learning process. As being practiced in the new K-12 curriculum, the students are being acquainted with different tasks and directed to outputs that would probably measure how well they have learned. Therefore, almost all of the senses were involved in the teaching-learning process, the reason why it would be appropriate for the teachers to utilize the do-it-yourself activities in performing laboratory activities and develop collaborative skill in every student learning.

One of the problems of most schools in the country is the poor performance of the students especially in the field of Science. Since MSU N – IDS is a Science High School, intervention in improving the performance of the students in Science is a must. The use of laboratory activities as a strategy in teaching promotes collaboration. The collaboration will develop the skill of the students in the said school in dealing with other people which is a very vital preparation for them for future employment. Through the advances in technology and changes in the organizational infrastructure, there is an increased emphasis on teamwork. Students are encouraged to think creatively, solve problems and make decisions as a team.

Therefore, there is a development and enhancement of critical-thinking skills among students through collaborative learning. The use of laboratory activities in teaching students serves as a scaffolding to improve the students' performance in Science. With this, the researcher assessed the collaborative skill of the students in the do-it-yourself laboratory activities at MSU Naawan – Integrated Developmental School since this institution wanted to develop every student holistically.

2. METHODS

This study used the one sample group with quantitative and qualitative research design. One sample since the subjects of the study was only the grade 10 students from MSU Naawan – Integrated Developmental School. The students were evaluated quantitatively based on the laboratory report assessment score during the conduct of the laboratory activity and the summative test scores for their performance in Science. The qualitative method was applied using an interview using questions that would support how well they collaborated within the group. This was done to support the quantitative evaluation of the study. Mostly qualitative method is primarily used to gain an understanding of underlying reasons, opinions and motivation. It was used to uncover trends in thoughts and, opinion. While quantitative method was primarily used to quantify the problem by generating numerical data or those data that can be transformed into usable statistics. It also used measurable data to formulate facts and uncover patterns in research.

3. RESULTS

3.1 Performance of the students in conducting laboratory activities in Science

A laboratory report assessment (LRA) which ranges from 0 percent to 100 percent was used to determine the performance of the students in conducting laboratory activities in Science.

Table 7 reveals the students' scores in Science based on the laboratory report assessment with a mean of 73.22 for those who worked by group and 69.13 for those who worked individually. It can be seen that there is a difference of 4.09 on the mean scores of the two (2) groups which is four (4) units far from each other. The total number of laboratory report assessment score of students working in group (93.15) and students working individually (86.37), based on the total laboratory report assessment score passed with 50% passing rate. This implies that students who worked by group has higher scores in laboratory report assessment than those who worked individually because of the collaboration exerted by the students. Regarding the measure of variability, specifically the standard deviation, the group assessment of the students' standard deviation which is 16.24 has a better measure of variability than the individual with 20.25. With regards to the coefficient of variation known as the percentage variation, the group assessment with 22.18% has a better measure than the individual assessment with 29.29% scores of the students

Table 7. Descriptive statistics of students' scores in laboratory activities by the group and individual assessment.

	N	Mean	Standard Deviation	Coefficient Variation
GROUP	20	73.22	16.24	22.18%
INDIVIDUAL	39	69.13	20.2	29.29%

One of the laboratory report assessments of those who worked by group has an introduction that is substantial enough that gave background on what the activity is all about. As for the experimental procedure, important experimental details were covered and there are only minor details lacking like in laboratory activity number 1 phase 2 question number 2 (see Appendix 6) with a question what cause the rise of the liquid in the straw. The answer was not discussed clearly they just merely state the probable cause of the rise of the liquid in the straw. As for the results, the figures could still be improved. As for the discussion of the results, interpretation could have been done better but it has been correctly interpreted. As for the conclusion, all important conclusions have been drawn but it could be better stated While the laboratory report assessment of those who worked individually, as for its introduction there is only a little background information provided, although the information is correct but it is very less substantial. As for the experimental procedure, there are missing details like in laboratory activity number 2 questions number 2 (see Appendix 7) with the question of what are the types of pollution that might be removed by each layer of the filtered material was not being provided with an answer. As for the results, figures were poorly constructed but there were some that is acceptable and correct. As for the discussion, partial but incomplete understanding of the result was still evident in the laboratory report assessment. As for the conclusion, in laboratory activity number 1 there were some points were drawn but in laboratory report number 2 conclusion is missing.

This study further implies that better scores were generated from students working in a group since their critical thinking skills was developed through collaboration which is consistent with the study of Gokhale and Anuradhn (2003) in the study collaborative learning enhances critical thinking, the concept of collaborative learning, the grouping and pairing of students for the purpose of achieving an academic goal, has been widely researched and advocated throughout the professional literature. The students are responsible for one another's learning as well as their own. Thus, the success of one student helps other students to be successful. Proponents of collaborative learning claim that the active exchange of ideas within small groups not only increases interest among the participants but also promotes critical thinking. The interpretation of the result was also true to the study of Johnson and Johnson (1986), there is enough evidence that cooperation achieved at a higher level of thought retains longer than those students who worked quietly alone. Same as the belief of the Science educators according to Fay (1931) that laboratory is an important means of instruction in science since late in the 19th century. Laboratory instruction was considered essential because it provided training in observation, supplied detailed information, and aroused students' interest. Laboratory teaching assumes that first-hand experience in observation and manipulation of the materials in Science. The activity of the student using sensorimotor nature of the experience, and the individualization of laboratory instruction contributes positively to learning. Information cannot usually be obtained, however, by direct experience as rapidly as it can from abstractions presented orally or in print. Thus, one would not expect laboratory teaching to have an advantage over other teaching methods in the amount of information retention. The above mentioned theories supports how important collaboration in improving the performance of the students.

3.2 Levels of collaborative skill among students

Based in Figure 4, self-assessment has 63.16 % or 48 out of 76 of the students belonging to a group considered themselves always collaborative while 31.58 % or twenty-four (24) out of seventy-six (76) students show collaboration often and the remaining 5.26 % or four (4) out of seventy-six (76) students show collaboration sometimes only. Likewise Figure 5 shows peer assessment having 68.42 % or fifty-two (52) out of seventy-six (76) of the students evaluated themselves as always collaborative while 23.68 % or eighteen (18) out of seventy-six (76) students show collaboration often and the remaining 7.89 % or six (6) out of seventy-six (76) students collaborated sometimes only. Similarly the group assessment, 84.21 % or sixty-four (64) out of seventy-six (76) of the students belonging to a group were always collaborative while the remaining 15.79 % or twelve (12) out of seventy-six (76) students only show collaboration often. It can be observed also that in each assessment, a higher level of collaboration has a higher percentage. Looking at the highest level of collaboration, always collaborative, an increase in percentage from self to peer assessment (63.16 % to 68.42 %) and from peer to group assessment (68.42 % to 84.21 %) is apparent. An increase in percentage from self to peer assessment signifies that some students undervalue themselves in the group and thus there is a disagreement of perception on collaboration among members.

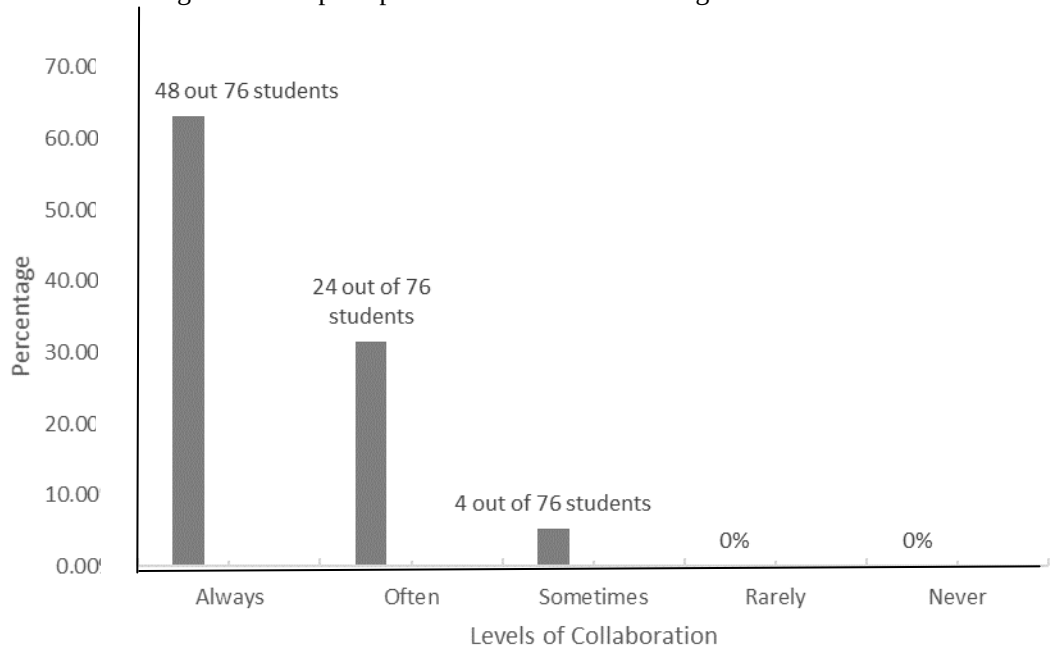

Figure 4. Level of collaboration based on self-assessment evaluation.

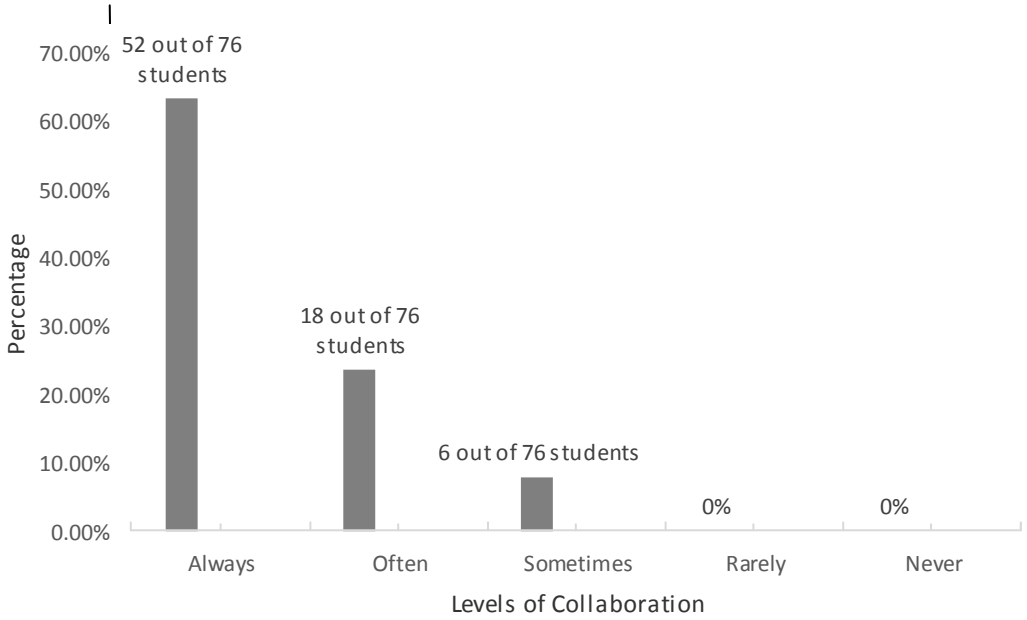

Figure 5. Level of collaboration based on peer assessment.

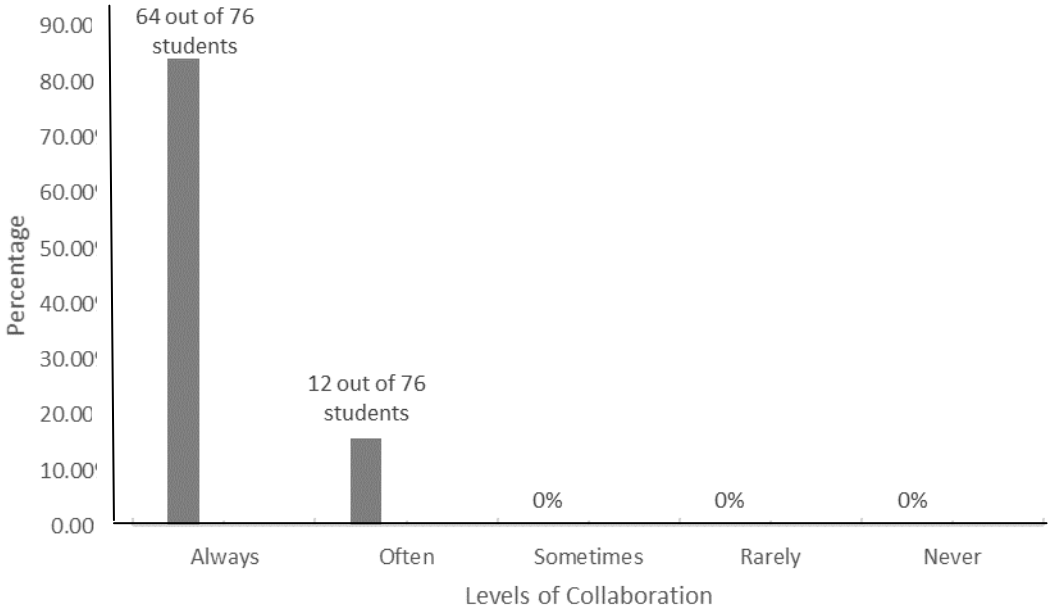

Figure 6. Level of collaboration based on group assessment evaluation.

The result of the study implies that in each assessment, there is a higher percentage on always collaborative level of collaboration from self to peer and peer to group assessment which means that some students undervalue themselves in the group. This is consistent to the study of Dillenbourg (1999) which notes, there are several qualities that characterize truly collaborative interactions. The typical division of labor in cooperative learning structures; partners split up the work, solve sub-tasks individually, and then put their respective contributions together. Learning occurs when all students have roughly the same level of dedication, although they may have different perspectives.

From the results, this proves collaboration within the groups really exists during the laboratory activities and a high laboratory report assessment cannot be attributed to some members but to the whole group instead.

3.3 Performance of students in Science

A summative test (ST) score which ranges from 0 percent to 100 percent was used to determine the performance of the students in Science as shown in Table 8. Those who worked as a group has a mean score of 32.75 while those who worked individually has a mean score of 27.72. There is a difference of 5.03 on the mean scores of the two groups which means that those who worked as a group has a better performance because of better retention of the lesson since the more ideas were shared by each member. As for the standard deviation, a measure of variability, those who worked as a group has a score of 6.67 while those who worked individually has a score of 7.19. The percentage variation as based on the coefficient variation for those who worked in groups is 20.35% compared to those who worked individually with 25.95%.The total number of summative test score of students working in group (31.67) and students working individually (27.71), based on the total summative test score passed with the 50% passing rate. This means that retention is better if the students collaborate with one another for they will value sense of responsibility.

Table 8. Comparison of the summative test scores of the students working as a group and individual.

	N	Mean	Standard Deviation	Coefficient Variation
Group	20	32.75	6.67	20.35%
Individual	39	27.72	7.19	25.95%

This result would suggest that students working in groups have developed sense of responsibility and other skills of a 21st century learner that made them excel than those who worked individually. This is consistent with the Hanover Research, An Overview of 21st century skills, 2016 where, educators and workforce experts suggests that our children need improved 21st century skills. Without these skills, they will not be able to successfully participate in the global economy. They won't be adequately prepared for college and work. 21st century skills are not about computer and technology skills. Analysis on the six major educational frameworks that is designed to improve the development of 21st century skills wherein there are four critical areas for development which are collaboration and teamwork, creativity and imagination, critical thinking and problem solving. It is easy to see how these skills could be valuable to a new high school graduate and to employers as well as how these skills interact with one another.

3.4 Relationship among the levels of collaboration of the students based on self, peer and group assessments

In this study, self, peer and group assessments were used in determining the level of collaboration exerted by all the members in a group. The relationship among the self and peer assessment, peer and group assessment and self and group assessment was determined by using the analysis of variance.

ANOVA results in Appendix 21 reveals that there is a significant difference among self and peer, self and group and peer and group assessments with an F-value of eight point five hundred twenty-nine (8.529) and a P-value of zero (0.000) at a level of significance $\alpha = 0.05$. This means that self, peer and group assessment has a significant difference with one another and therefore contribute in evaluating the level of collaboration exerted by every student.

Table 9. Pairwise comparison using Scheffe's test.

	Mean Difference	P-Value	Interpretation
Self versus Peer	0.03303	0.897	Not Significant
Self versus Group	- 0.236	0.005	Significant
Peer versus Group	-0.269	0.001	Significant

Using the pairwise comparison, computed Scheffe's test statistic result on self versus group and peer versus group with P-values that are less than 0.05 level of significance are both significant. This implies that the students find themselves participative and effective members in each of the group. While on self versus peer appears to be not significant because it has a P-value greater than 0.05 level of significance. This implies that student under rated themselves with their peers. The result is consistent with the study of Slavin and Hopkins (2003) where they have considered how cooperative learning helps children develop social and interpersonal skills. The experts have said that the social and the psychological effect on self-esteem and personal development are just as important as the learning itself and in terms of assessment, it will be beneficial to students on the quality of discussion, engagement and adherence to group norms. The praise given to group members is a good motivation for following collaborative learning standards.

Based from the responses of the students in the interview, as they were asked if they think collaboration is very important in the laboratory activity students coded AH13 said, *Yes maam para nay division of labor (Yes, ma'am so that there will be a division of labor) and* BM79 *Yes, the more ideas will be generated (Yes, there will be more ideas generated* would mean that collaboration will greatly affect the performance of the students in Science.

4. Conclusion

This study focuses on the evaluation of the performance of the students in Science through laboratory activities by different levels of collaboration at MSU Naawan – Integrated Developmental School. This study answered the questions on the performance of the students in conducting laboratory activities in Science; the level of collaborative skill demonstrated by the students in performing laboratory activities in Science based on self, peer and, group assessments; the performance of the students in Science based on the summative test; the significant relationship in the performance of the students on self, peer and, group assessment This study used one sample group with quantitative and qualitative research design with a total of one hundred and fifteen (115) students as the subject of the study. Self, peer and group assessment questionnaires were used to measure the level of performance of the students and a summative test was also given after the conduct of the study to measure their performance in Science. For qualitative evaluation purposes an interview was conducted to randomly selected students of the different groups to support the quantitative evaluation of the students.

The results show there is a difference between the students working individually and working as a group. The group have higher mean scores than those who worked individually. This means that the LRA scores of the students who worked by group have smaller variability than those who worked individually.

In each assessment, result reveals a higher level of collaboration on self, peer and, group assessments. ANOVA result indicates a significant difference on the students self vs group assessment and peer vs group assessment and there is no significant relationship on the students' self vs peer assessment.

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