Engaging Collaborative Learning to Develop Students' Skills of the 21st Century

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Abstract

Collaborative approaches to teaching and assessing students have been long practised by educators in a variety of educational settings. Collaborative learning is useful in developing students' ability to learn to work as a team while getting them engaged in the learning activities. This study investigates the impact of collaboration in the learning of secondary school Statistics in three government secondary schools in Brunei Darussalam. In total, 71 Year 7 students participated in this study. A series of lessons and group-based activities on Statistics were conducted that consisted of hands-on activities and application of mathematical concept to real-life problems and worksheet-based instruction. Data were collected using pre- and post-tests on secondary school Statistics; a readily available 4-point student work rubrics was used as reference on collaboration that focused specifically on the level of collaboration skills acquired; and a questionnaire on students' attitudes on collaborative learning. The results from the pre- and post-tests revealed an 11.8% increase in the test scores, and 47.9% of the students worked collaboratively within their groups and shared the responsibility towards the given tasks. The responses from the questionnaire indicated that 96% of the students found working collaboratively as a group assisted them in enhancing their learning of Statistics. Majority of the students also believed that they gained more knowledge and learnt specific skills and processes when they work in groups. This study has shown that collaborative learning helped to improve students' performance academically as well as to develop the necessary skills of the 21st Century.

Keywords: collaborative learning; secondary school statistics; students' attitudes; Brunei Darussalam

1. Introduction

The curriculum for Brunei Darussalam had undergone several changes due its development in education. In the early 20th century, schools were established to provide all Brunei citizens with the opportunities to learn and become literate. The focus of education then was to provide knowledge and the basic skills of reading, writing and arithmetic (3Rs). With the implementation of the new education system in 2009, *Sistem Pendidikan Negara Abad ke-21* (SPN21) in the Malay Language, or the 21st Century National Education System, it is hoped that the national education in Brunei be raised to higher level of excellence and thus produce highly educated, skilled and successful future generations of Bruneians (Curriculum Development Department – CDD, 2011; Ministry of Education, 2013). The SPN21 curriculum was implemented in phases to both the primary and secondary level to provide students with the most effective and engaging learning experiences possible and to help students achieve their fullest potential and be successful citizens of Brunei in this 21st Century.

Traditional teaching approaches that employ narrow tasks to emphasize rote memorisation or application of simple procedures will not help students to become critical thinkers or be actively involved in the learning process (Abdullah et al., 2014; Ang & Shahrill, 2014; Duraman et al., 2015; Hamid et al., 2013; Matzin et al., 2013; Ong & Shahrill, 2014; Pungut & Shahrill, 2014; Sarwadi & Shahrill, 2014; Shahrill, 2009; Shahrill et al., 2013; Yassin et al., 2015). Students need to take part in the learning process that requires them to be continuously engaged. Educators around the world are seeking ways to prepare and develop the necessary skills for students to be living and working in the changing information environment of the 21st century. As stated in the SPN21 secondary mathematics curriculum framework and guidelines (CDD, 2011), the SPN21 curriculum encourages teachers to prepare learning activities that allow students to work actively as individual or in groups and teachers to take the role as facilitators in these learning processes (student-centred). Teachers are also encouraged to use diverse methods and be more creative in their teaching techniques to suit the ability and learning styles of their students.

In 2012, Brunei has joined a collaboration project programme between the Microsoft Partners in Learning, the

Ministry of Education of Brunei Darussalam and the Sultan Hassanal Bolkiah Institute of Education (SHBIE) of Universiti Brunei Darussalam called the 21 st Century Learning Design (21CLD), formerly known as the Learning Educators Advancing Pedagogy for the 21 st Century (LEAP 21). This program has been designed to enhance the teaching and learning experience in line with each country's national goal which is to equip students with the 21 st Century skills. The 21CLD has provided teachers with rubrics on six dimensions and collaboration is one of them. Thus, in this research study we investigated the effective use of collaboration as one of the many teaching and learning process to help students achieve better academically in mathematics as well as develop one of the 21 st century skills. Besides that, this research also investigated students' attitude towards collaborative learning. The 21CLD rubrics were used as a reference for this study.

2. Literature Review

Gokhale (1995) referred collaborative learning as an instruction method in which students at various performance levels work together in small groups toward a common goal. This means that each member of the group are responsible for one another's learning as well as their own. Thus, the success of one student helps other students to be successful. Research suggests that effective use of collaboration in classrooms structure can have powerful effects on student learning and performance. For example, seventh-grade students working in collaborative small groups of 3 – 4 on computational math problems earned significantly higher scores working in groups than equivalent-ability students working individually (Webb, 1993).

In addition to this, students who received further assistance during collaboration and who tried to understand the assistance they received earned much higher math scores at post-test than did students who passively received assistance. Collaboration also promotes in the discussion of task given and expectations of students' learning outcomes that leads to improve teaching and learning process. As Van Boxtel, Van der Linden, and Kanselaar (2000) described, collaborative learning activities such as allowing students to provide explanations of their understanding, can help students elaborate and reorganize their knowledge. The social interaction between group mates stimulates elaboration of explanations and conceptual knowledge, which improves student comprehension of concepts. Collaborative approaches may also be related to motivation. Students usually tend to enjoy the whole learning process when they were placed in group settings. According to Bossert (1988), peer encouragement may improve task engagement, and the novelty of collaborative learning tasks causes students to shift attentional resources. Working with others in groups promotes students to be academically engaged through the added responsibility of group performance.

3. Research Questions

This study examined students' performance and understanding after being taught several lessons on one particular mathematics topic with the use of collaborative learning. The research questions developed to guide this study were: How effective was collaborative learning towards students' achievement in mathematics regardless of their level of ability? What number code according to the 4-point rubric did students demonstrate after the implementation of collaboration to their learning process, based from the use of 21CLD Student Work Rubric on Collaboration as reference? And What were students' attitudes towards collaborative learning?

4. Methodology

4.1 Sample and data collection approach

This is a classroom research study consisted of convenient sampling consisting of 79 Year 7 students of mixed ability group with ages ranging from 11 to 12 years old. These students were taken from three selected government secondary schools in the Brunei-Muara district that were involved with the 21CLD research project in 2012. The three mathematics teachers involved in this study were those that have participated in the 21CLD research project in 2012. The topic chosen to be taught to the students under the research study was Statistics.

The data collected consisted of a pre-test, a series of lesson using collaborative learning, a group project and presentation, post-test and questionnaires. The pre-test was conducted in May 2013 at the three respective schools. About one month later, the three teachers involved conducted four lessons on the topic Statistics by using collaborative learning. Throughout the lessons, students were grouped mostly in fours, although a few had to be grouped in threes. All activities prepared for the four lessons were based on group-work to promote collaboration among students within the

group. The lessons consisted of hands-on activities and application of mathematical concept to real-life problems (data collection) and worksheet based instruction (data representation). At the end of lessons taught, the three mathematics teachers gave students group project and presentation which took another two lessons. Once presentation was done, students were given post-test followed by questionnaires. Both the pre-test and post-test was conducted under the supervision of their respective mathematics teacher and researcher. Each test took 30 minutes.

The following research framework explained the administration of the collaborative learning that took place between 4 – 8 weeks in the main study (refer to Figure 1).
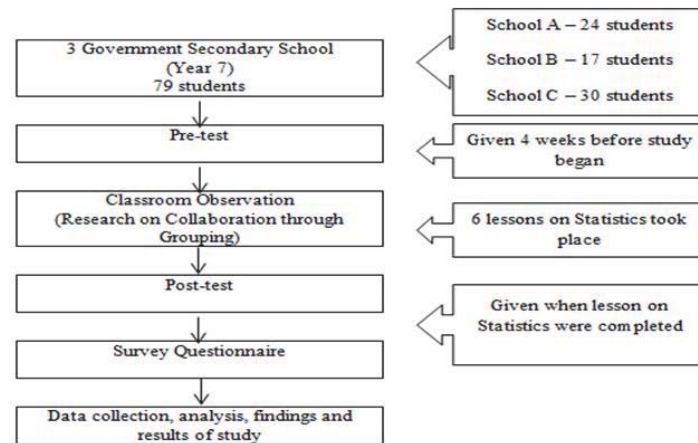

Figure 1. The research framework of study

4.2 Instrumentation

The methods of data collection included pre-test and post-test papers, students' questionnaires and students' work (group project and group presentation) to be number coded using the 21CLD Student Work rubric for collaboration. The collaboration rubrics were used as a reference only, however, each student who was working according to their respective groupings were coded individually. The research used a combination of both qualitative and quantitative methods of data collection to answer the research questions.

The pre-test used in this study was to find out student's prior knowledge on statistics whereas the post-test was used to find out students' newly acquired knowledge on statistics after collaboration was being used in the lessons conducted. The items used for both the pre-test and post-test consisted of the same questions so that comparison on students' achievement can be made. The overall results of the pre-test and post-test were analysed using quantitative method. These results were analysed using SPSS Statistics version 20. The questionnaires used in this study consisted of 22 items with a 4-point Likert scale. This questionnaire was used to analyse and get information on students' attitude towards collaborative learning, students' experiences with collaborative learning and also students' satisfaction with collaborative learning. The data from the questionnaire were analysed by qualitative method using Microsoft Excel, SPSS Statistics version 20 and Descriptive Statistics.

Students' work in the form of group project and presentation were designed by respective mathematics teachers from each of the three schools involved which was based on the 21CLD Learning Activity Rubrics. These were used by the three respective mathematics teachers to determine how strong the collaboration skill has been demonstrated from the students' work. The 21CLD Student Work Rubric on Collaboration was used by respective mathematics teachers as a reference to give the number code according to the 4-point rubric. Students' works were coded individually using these rubrics depending on their participation within their group. The results were analysed using Microsoft Excel. The results obtained for each number code from 1 to 4 was gathered and converted to percentage. The highest percentage obtained for the particular number code can be considered as major collaboration skill demonstrated by students in this research study.

5. Results and Discussion

The results of both pre- and post-tests for 71 students were compared. Table 1 provides the comparison of results between the pre-test and post-test given. As mentioned in the earlier section (methodology), the number of students

involved in this study was 79 but since 8 students were not present for the post-test at their respective schools, it was decided to eliminate these students' pre-test results from being analysed. The SPSS version 20 was used to calculate the mean of pre-test and post-test using paired t-test statistics.

Table 1. The results between pre-test and post-test

Test	N	Total mark	Highest mark	Lowest mark	Range	Mean mark	Standard Deviation
Pre-test	71	50	46	12	34	31.00	9.23
Post-test	71	50	50	22	28	42.80	6.21

The description described for both the pre-test and post-test showed that there were improvements on students' performance in the post-test compared to the pre-test. The highest mark in the post-test was 50 which is a full score of 100% compared to the pre-test which was 46 a score of 92%, showing an increase of 4 marks. The lowest mark in the post-test was 22 (44%) compared to the pre-test. The highest mark in the post-test was 50 which is a full score of 100% compared to the pre-test which was 46 a score of 92%, showing an increase of 4 marks. The lowest mark in the post-test was 22 (44%) compared to the pre-test which was 12 (24%), showing an increase of 10 marks. From Table 1, the post-test mean score were 42.8 whereas the pre-test mean score were 31, showing the mean has an increase of 11.8. From the pre-test there were 19 failures out of the 71 students but in the post-test the number of failures decreased to 1 student only with a score of 22 (44%). Based from the results obtained, it can be seen that marks have increased for both the highest and lowest score in the post-test. This indicated that students definitely improved their understanding in the topic Statistics. It showed that most students have shown good improvement in their newly acquired knowledge on Statistics in terms of the achievement of mathematics test given on Statistics.

A paired sample t-test was conducted to compare the results of means of pre-test and post-test. From table 2, the result showed that there was a significant difference in the pre-test (M = 31, SD = 9.23) and the post-test (M = 42.8, SD = 6.21), with t = 10.832, df = 70 and p = 0.000 (p < 0.005 indicates significance changes). Significant differences between the results of pre-test to the post-test indicated that the use of collaborative learning in students' learning process on the topic Statistics has helped students to improve in the topic and thus achieved better results.

Table 2. Paired t-test for the mean difference of pre-test and post-test

	Mean difference	Standard Deviation	T	Df	Sig. (2-tailed)
Post-test – Pre-test	11.803	9.182	10.832	70	0.000

A paired sample correlation was conducted to compare the results of pre-test and post-test. From table 3, the result showed there was a significant difference in the results obtained for the pre-test and post-test with correlation = 0.344 and p = 0.003 (p < 0.005 indicates significance changes). Significant differences between the results of pre-test and post-test indicated that students scored better marks in their post-test compared to their pre-test. This suggested that the use of collaborative learning in the teaching and learning process of the topic Statistics helped to improve students' understanding of the topic.

Table 3. Paired samples correlation between Pre-test and Post-test

	N	Correlation	Sig.
Pre-test & Post-test	71	0.344	0.003

The results reported in this subsequent findings were from the rubric rating scales of 1 to 4 based from the 4-points 21CLD Student Work rubrics. These rubric rating gave the number code for each student based on their participation in working collaboratively through their respective group projects and presentations. The researcher compared the results of the given number code for 71 students. Table 4 shows the frequency of each number coded given to the 71 students. The Microsoft Excel was used to calculate the frequency in percentages for each number code from 1 to 4.

Table 4. Frequency and mean from the group project and presentations for each number coded from the 4-point rubrics

	4-point rubrics for the dimension collaboration of the 21CLD Student Work rubrics			
Number code	1	2	3	4
	Students are NOT required to work together in pairs or groups	Students DO work together BUT they DO NOT share responsibility	Students DO have shared responsibility BUT they are NOT required to make substantive decisions together	Students DO have shared responsibility AND they DO make substantive decisions together
Frequency	0	24	34	13
Frequency in percentages (%)	0	33.8	47.9	18.3

The result from the table showed that the number coded 3 has the highest frequency with a record of 47.9% and the number coded 1 has the lowest frequency with a record of 0%. Based from the results obtained, it showed that most students in the study have demonstrated the code number 3 from the 4-point rubrics of the 21CLD Student Work rubric. With this number code 3 being the highest number code among the four, 47.9% of the students demonstrated that they did work collaboratively in their group and shared responsibility towards their given task namely their project and presentation. However, they did not demonstrate that they made substantive decisions together regarding the content, process or product of their given task. There was no record for number code 1 indicating that every student knew that they had to work together in a group. Whereas for number code 2, 33.8% of the students demonstrated that they did work collaboratively in their group but somehow did not share the responsibility in completing their given task. Whereas for code number 4, only 18.3% of the students demonstrated that they actually worked collaboratively within their group by having shared responsibility and making substantive decisions regarding the content, process or product of their given task.

From the results obtained, it can be seen that even though the students demonstrated they worked in groups, they needed to be more exposed on working collaboratively and at the same time students need to be reminded of their role(s) when working collaboratively with their group. This is to ensure that they all really understood their role when working together towards the success of their group.

In relation to students' attitudes towards collaborative learning, the analysis of the results from the feedback received on the questionnaires was used. All the 71 students involved in the study were required to answer the questionnaires. The questions are mainly focused on students' feedback regarding the collaborative learning used during the lessons conducted on Statistics. Tables 5a, 5b and 5c below shows the frequency of each item in percentage in the questionnaires. Again, the Microsoft Excel was used to show frequency in percentage of each item whereas the SPSS version 20 was used to calculate the mean for each item.

Based from the overall results of the questionnaire, it can be seen that most of the students gave either 'agree' or 'strongly agree' as their answers to questions that relates to collaborative learning. From Table 5a, question 6 showed a total of 96% (58% 'agree' and 38% 'strongly agree') of the 71 students actually enjoyed working collaboratively. Based from the Table 5a, questions 1 and 3 indicated that these students believed they gained more knowledge and learned more through collaborative learning than working on their own.

Table 5a. Frequency in percentage for items1, 3 and 6 in the questionnaire on collaborative learning

No.	Survey Questions	Strongly Disagree	Disagree	Agree	Strongly Agree
1	I learn more in collaborative groups.	1%	3%	59%	37%
3	I gain more knowledge by working with my peers.	3%	4%	42%	51%
6	I enjoy collaborative learning.	1%	3%	58%	38%

From question 7 of Table 5b, a total of 89% (59% 'agree' and 30% 'strongly agree') of the students again indicated that they preferred collaborative learning. From Table 5b, questions 8, 12, 15, 16, 17 20, 21 and 22 indicated students agreed or strongly agreed that collaborative learning has helped them to participate more in class, be more responsible, committed, work effectively, improved communication with peers, enhanced their learning and learned to respect group's ideas and opinions towards the success of the group.

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Table 5b. Frequency in percentage for items 8, 12, 15, 16, 17, 20, 21 and 22 in the questionnaire on collaborative learning

No.	Survey Questions	Strongly Disagree	Disagree	Agree	Strongly Agree
7	I prefer learning that has collaborative learning component	1%	10%	59%	30%
8	I felt responsible for the success of each individual in the group.	0%	11%	62%	27%
12	Group work encourages me to participate more in class.	3%	7%	58%	32%
15	Working in groups improves my relationship with my classmates.	4%	1%	25%	69%
16	All of the members of my group were committed to the success of the group.	1%	7%	59%	32%
17	Members of my group felt a commitment to other individuals in the group.	1%	7%	75%	17%
20	Collaborative learning has helped me to learn to work effectively in groups.	1%	6%	55%	38%
21	The collaborative learning approach forced me to take on more responsibility for learning.	3%	7%	58%	32%
22	The collaborative learning experiences in my class enhanced my learning.	3%	1%	69%	27%

From Table 5c, question 4 indicated that a total of 96% of students (58% 'agree' and 38% 'strongly agree') mentioned that they do their fair share of work during group project. However, from question 5, a total of 51% of students (42% 'agree' and 7% 'strongly agree') actually mentioned that they do more work than some members in the group. From Table 5c, question 19 indicated a total of 89% of the students (56% 'agree' and 32% 'strongly agree') stated they 'agree' or 'strongly agree' that they worked towards an agreement before an action is taken which indicated that they all have to have mutual agreement and made substantive decision before they finalised their work.

Overall, from the questionnaire given, it can be concluded that although students indicated that they enjoyed and preferred collaborative learning to individual, majority still agreed that they learned more from direct teacher instruction. This can be seen from question 10 of Table 5c with 65% 'agree' and 24% 'strongly agree' that they learned more from direct instruction. This indicated that students were so used to the traditional method of teaching that they believed that they will gain more knowledge through this method.

Table 5c. Frequency in percentage for items 4, 5, 10and 19 in the questionnaire on collaborative learning

No.	Survey Questions	Strongly Disagree	Disagree	Agree	Strongly Agree
4	I do my fair share of work during a group project.	0%	4%	58%	38%
5	I do more work than some members of my group.	3%	48%	42%	7%
10	I learn more from direct teacher instruction.	1%	10%	65%	24%
19	When I work in small group, the group works toward agreement before an action is taken.	3%	8%	56%	32%

The description described earlier using frequency from Tables 5a, 5b and 5c shows that most students preferred collaborative learning compared to individual learning. Like the frequency table, the mean from Tables 6a and 6b also showed most students preferred collaborative learning. This was indicated with Mean > 3.00, for example all items except for 5 and 11 where the means are more than 3.00, for agreeing to the 20 out of 22 questionnaires. Only two questions indicated Mean < 3.00 which indicated 'disagree' or 'totally disagree'. The mean for question 5 was 2.54 which is halfway between agree and not agree whereas the mean for question 11 was 1.97 which indicated that most students disagree to this question. Question 5 is the question which indicated that students believed that they do more work than some members of their group whereas question 11 indicated that students disagreed that they prefer to work on their own. Thus it indicated that students actually preferred to work in groups compare to individual learning.

Table 6a. The descriptive statistics for questionnaires for each item

	1	2	3	4	5	6	7	8	9	10	11
N	71	71	71	71	71	71	71	71	71	71	71
Mean	3.31	3.03	3.39	3.34	2.54	3.32	3.17	3.15	3.03	3.11	1.97
Std. Deviation	.600	.755	.707	.559	.673	.604	.654	.601	.828	.622	.810

Table 6b. Continuation of Table 6a

	12	13	14	15	16	17	18	19	20	21	22
N	71	71	71	71	71	71	71	71	71	71	71
Mean	3.20	3.08	3.41	3.59	3.23	3.07	3.15	3.17	3.30	3.20	3.21
Std. Deviation	.689	.732	.688	.729	.637	.543	.768	.697	.641	.689	.607

6. Conclusions

The findings of this study showed that there were significant differences between the pre-test and post-test given on Statistics. The increase in the number of students who passed in the post-test and the good results obtained were sufficient to answer the first research question. This showed that the use of collaborative learning done through grouping on the topic Statistics did have an impact on students' achievement regardless of students' ability. There was an increase in both the lowest and highest marks obtained in the post-test administered as well as a great decrease in the number of failures. And thus, displayed a great improvement overall in students' mathematics achievement.

The information provided on how well the students involved in the study have demonstrated the collaboration skill after the use of collaborative learning in their lessons on Statistics. Since the highest frequency was recorded code 3 with 47.9%, it indicated that our students were considered to be performing quite well in working as a group. Only 18.3% of the students actually acquired code 4 on the rubrics rating which indicated only this small amount of students actually understood the meaning of working collaboratively in a group.

The findings obtained in this study also showed that students demonstrated a positive attitude towards collaborative learning as they preferred collaborative learning compared to the individual learning. The responses from the questionnaire indicated that they found working collaboratively as a group has helped them to enhance their learning having the highest frequency of 96% (69% 'agree' and 27% 'strongly agree') followed by improvement in their relationship with their classmates 94% (25% 'agree' and 69% 'strongly agree'). Students also believed that they gained more knowledge 93% (42% 'agree' and 51% 'strongly agree') and learn specific skills and processes 92% (41% 'agree' and 51% 'strongly agree') when they work in group. Furthermore they enjoyed working as a group especially when they were given group project instead of the norm teacher 'chalk and talk' method. Group members helped and encouraged each other to participate well and through collaborative learning, they learned to work effectively, respect every member's ideas and opinions, and were able to be committed and responsible towards the group's success. Although the responses showed positive attitudes towards collaborative learning, some students still lack knowledge in working collaboratively as in one of the response, from Table 6a question 5, were in the borderline of agreeing and not agreeing. This was on one of the questionnaire items where some member of the group felt that not everyone did a fair share of work during the group project.

This study also indicated that mathematics teachers should try to expose their students more on collaborative learning through group assignments, projects and presentations. From the study, students showed that they enjoyed learning when they are being put in groups. It not only arouses students' interest in learning a mathematics topic taught but it also involves them to take part in the learning process. Different ideas may arise among group members during discussions, which may lead to arguments, but it also teaches them to work together as members in reaching the common solution that will lead to the success of their group. It also teaches them to take responsibility, respect every member's ideas and opinions, work efficiently as well as improve their communication skills with members within their group. This not only will improve the student's skill in collaborating but leading to several other skills as well such as communication skill and critical thinking through their group discussions. These skills are not only necessary for their learning skills with their peers but also for their working and lifelong skills to work as a team. Overall, this study has shown that collaborative learning helped to improve students' performance academically as well as develop the necessary skills to prepare them for living and working in the changing environment of the 21st century.

7. Recommendations

Based on the findings and conclusions of this study, here are a few suggestions recommended that may be useful for mathematics teachers who wish to practice collaboration in their mathematics lessons as well as for future further research.

Firstly, we need to give students the proper guidance in using collaborative learning. Students can learn mathematics effectively using collaborative learning if the teacher promote positive attitudes towards mathematics and

teach students how to work collaboratively with their group members. In collaborative learning, students are expected to be involved in the whole learning process namely:

1. Every member working together when they work in pairs or groups.
2. Every member must share responsibility when they work in pairs or groups to develop a common product, design, or response.
3. Every member must share responsibility fairly when all members on a team are engaged in the work, and all are contributing toward the final outcome.
4. Every member must make substantive decisions when they are actively resolving important issues that will guide their work namely the content, process and product of their group's work.

If students understood the criteria mentioned based from the 4-point 21CLD Student Work rubrics, then students may benefit more using collaborative learning. Having strong collaboration skills not only will help students to improve their academic performance but it also helps students to improve their communication skills.

Secondly, there must be patience and commitment in implementing collaborative learning. As with any kind of teaching, to design and guide students to do group work definitely takes time in order for them to learn and practice. For students, learning to learn well in groups also does not happen overnight. It takes time but they will overcome these problems through continuous practice. Both parties, teachers and students, need to be patient and be committed in trying to make it work. Learning to work collaboratively requires responsibility, perseverance and sensitivity, because the result can be very rewarding.

Next, the 21CLD were introduced to Brunei Darussalam in 2012. Only selected schools and teachers were involved with the 21CLD research project. This means that there are only few skilled mathematics teachers using these rubrics and even then, they are also in the learning stage in using these rubrics as their guidance in improving their own teaching practices. Thus, to further improve future research study, it will be better if someone who is skilled in using these rubrics be involved to assist these mathematics teachers in order for them to gain more experience in using these 21CLD rubrics. Besides that, future research may try to include the other five dimensions of the 21CLD as this study only concentrated on one dimension namely collaboration.

Finally, the findings from this study could be used by the Curriculum Development Department of the Ministry of Education of Brunei to improve the secondary mathematics curriculum. Mathematics lessons can be designed by preparing teaching and learning activities that involves collaboration through group work to selected mathematics topics in the syllabus. This is also to fulfil the Ministry of Education's vision and mission which is to raise students' achievement and develop life-long learning skills and to prepare them with valuable and marketable skills (CDD, 2011).

References

Abdullah, N. A., Shahrill, M., & Chong, M. S. F. (2014). *Investigating the representations of students' problem-solving strategies*. Paper presented at the 37th Annual Conference of the Mathematics Education Research Group of Australasia, Sydney, Australia, 29 June-3 July 2014.

Ang, L. H., & Shahrill, M. (2014). Identifying students' specific misconceptions in learning probability. *International Journal of Probability and Statistics*, *3*(2), 23-29.

Bossert, S. T. (1998). Cooperative activities in the classroom. *Review of Research in Education, 15,* 225-250.

Curriculum Development Department (CDD). (2011). Framework and guidelines for curriculum and assessment mathematics year 7 and year 8. Ministry of Education, Brunei Darussalam.

Duraman, H. S. A. H., Shahrill, M., Morsidi, N. M. H. (2015). Investigating the effectiveness of collaborative learning in using the snowballing effect technique. *Asian Journal of Social Sciences & Humanities*, *4*(1), 148-155.

Gokhale, A. A. (1995). Collaborative Learning Enhances Critical Thinking. *Journal of Technology Education*, *7*(1). Retrieved from http://scholar.lib.vt.edu/ejournals/JTE/v7n1/gokhale.jte-v7n1.html

Hamid, M. H. S., Shahrill, M., Matzin, R., Mahalle, S., & Mundia, L. (2013). Barriers to mathematics achievement in Brunei secondary school students: Insights into the roles of mathematics anxiety, self-esteem, proactive coping, and test stress. *International Education Studies*, *6*(11), 1-14.

Matzin, R., Shahrill, M., Mahalle, S., Hamid, M. H. S., & Mundia, L. (2013). A comparison of learning styles and study strategies scores of Brunei secondary school students by test anxiety, success attributions, and failure attributions: Implications for teaching at-risk and vulnerable students. *Review of European Studies*, *5*(5), 119-127.

Ministry of Education. (2013). The national education system for the 21st century: SPN21 (Revised ed.). Ministry of Education, Brunei Darussalam.

Ong, J. K., & Shahrill, M. (2014). Investigating students' competence level in secondary school statistics. In F. Uslu (Ed.), *Abstracts and Proceedings of the International Conference on Social Sciences and Humanities* (pp. 912-922). Istanbul, Turkey: International Organization Center of Academic Research, OCERINT.

Pungut, M. H. A., & Shahrill, M. (2014). Students' English language abilities in solving mathematics word problems. *Mathematics Education Trends and Research*, [Online] 1-11.

Sarwadi, H. R. H., & Shahrill, M. (2014). Understanding students' mathematical errors and misconceptions: The case of year 11 repeating students. *Mathematics Education Trends and Research*, [Online] 1- 10.

Shahrill, M. (2009). *From the general to the particular: Connecting international classroom research to four classrooms in Brunei Darussalam*. Unpublished doctoral dissertation, University of Melbourne, Melbourne, Australia.

Shahrill, M., Mahalle, S., Matzin, R., Hamid, M. H. S., & Mundia, L. (2013). A comparison of learning styles and study strategies used by low and high math achieving Brunei secondary school students: Implications for teaching. *International Education Studies*, *6*(10), 39-46.

Van Boxtel, C., Van der Linden, J., & Kanselaar, G. (2000). Collaborative learning tasks and the elaboration of conceptual knowledge. *Learning and Instruction*, *10*(4), 311–330.

Webb, N. M. (1993). Collaborative group versus individual assessment in mathematics: Group processes and outcomes. *Educational Assessment*, *1*(2), 131-152.

Yassin, N. H. M., Shahrill, M., Jaidin, J. H., & Harun, H. Z. H. (2015). The Effects of Streaming on Secondary School Students' Achievements in Additional Mathematics. *European Journal of Social Sciences*, *46*(2), 148-158.