

## Supporting Struggling Grade 8 Science Students' Motivation, Participation and Performance through Peer-Tutoring Approach

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### ABSTRACT

Research shows that cognitive and affective abilities among science students can be enhanced using peer tutoring approach. However, peer tutoring approach remains an underutilized peer support (Bond & Castagnera 2006). This study determined the effects of peer tutoring approach in motivation, participation and academic performance of grade 8 students. Using regression discontinuity design, the respondents were non-struggling, struggling who accepted peer tutoring and struggling students who declined peer tutoring. Results showed that struggling students who accepted peer tutoring showed better participation, expert-like perceptions of junior high school science, and exam performance relative to their peers who were not attending the peer tutoring sessions. The results of this study provide evidence to teachers who want to plan targeted peer support for students who are struggling in junior high school science.

*Keywords:* motivation, participation, performance, peer tutoring approach, struggling students

### INTRODUCTION

In transition to K-12 spiral curriculum, low academic performance was apparently observed. Teachers are encourage to make intervention to struggling students. One solution is using peer tutoring approach.

Peer tutoring refers to the 'use of teaching and learning strategies in which students learn with and from each other without the immediate intervention of a teacher (Batz et al 2015, Bowman-Perrott et al 2013, Cohen et al 1982, Willis et al 2012). Saunders (1992) described peer tutoring as "more advanced learners helping less advanced learners with their studies".

The literature shows evidence that peer tutoring is being increasingly used across all disciplines as a type of supplemental instruction (Batz et al 2015, Grubbs & Boes 2009, Higgins 2004, Lake 1999, Thurston et al

2007), mathematics (Topping et al 2011, Topping et al 2003), reading (Topping 1996, Topping & Bryce 2004), sports (Comfort 2011), learning disabilities (Santrock 2012) and elementary and high school science (Batz et al 2015, Romano & Walker 2010, Thurston et al 2007) and among others. Peer tutoring is a flexible, peer-mediated strategy that involves students serving as academic tutors and tutees (Batz et al 2015, Cohen et al 1982, Topping 1996). Peer tutoring comes in different types (Burton 2012, Topping 1996). Typically, a higher performing student is paired with lower performing student to review critical academic or behavioral concepts. Class-wide (Topping 1996) and cross-age peer tutoring (Karcher 2009, Topping et al 2003) become common because of manageability on supervising role models such as older students to younger students (Karcher 2009). These programs have definite and encouraging effects on the academic performance and attitudes of those who receive tutoring (Batz et al 2015, Cohen et al 1982).

Effects of peer tutoring procedure has been documented in different year levels. For example, Fantuzzo, Polite, and Grayson (1990) reported doubled baseline rates of arithmetic proficiency for disadvantaged children in elementary school settings. In a study of science students in the primary school, assessing the understanding of scientific concepts and keywords, the tutored group made significant gains than the control group (Topping, Peter, Stephen & Whale 2004). Among high school students, Topping (2004) stated significant gains in use of mathematical words, strategic dialogue and praise between partners. Positive feedback was observe among teachers and peers. In higher education, Arco-Tirado, Fernandez-Martin, and Fernandez-Balboa (2011) noted differences in which the tutored group posted better grade point average, performance rate, success rate and learning strategies. These studies demonstrated the potential benefits of peer tutoring in different levels.

Several studies pointed out the effectiveness of peer tutoring on students' participation (e.g. Batz et al 2015), motivation (Cohen et al 1982, Santrock 2012) and performance (Batz et al 2015, Lake 1999, Thurston et al 2007). Students who are exposed to learning opportunities with their peers boasted their confidence to perform better. Studies recommended peers as tutors because they can relate to their age group (Bond & Castagnera 2006).

An essential element of peer learning contexts is the quality of talk that takes place. Peer dialogue enables learners to reconstruct and elaborate their ideas. It is essential that teachers develop a classroom atmosphere that establishes and maintains effective discourse and dialogue. Researchers (Topping 1996, Topping et al 2011, Thurston et al 2007, Willis et al 2012) suggested that peer learning needs to be embedded into the pedagogy and planning in individual curriculum areas to achieve maximum impact. In order that peer dialogue will be promoted in the peer tutoring, tutees are encourage to provide an explanation of their answer

during sessions (Thurston et al 2007). In affective development of mentees, reveal that role of companion who are trustworthy, committed, and reliable is essential for supporting mentees' engagement in new or challenging learning activities. Because mentors and mentees are almost the same age, it appears that mentees tend to focus on their classroom work and engage in learning situations seeing mentors' support (Willis et al 2012).

In a metaanalysis, it was observed that tutoring has positive effect on academic performance and attitude toward the subject matter (Cohen et al 1982). The examination performance of students who were tutored was better than that of students in a conventional class. Student attitudes were more positive in classrooms with tutoring programs. Self-concepts were more favorable for students in classrooms with tutoring programs. (Bowman-Perrott et al 2013) in a more recent metaanalysis found that peer tutoring is effective in promoting academic gains across content areas, and is effective for elementary, middle, and high school students. In their analysis, greater academic gains were achieved by students engaged in peer tutoring. On a long term cross-age peer tutoring, tutored students showed improved beliefs about student competence (Topping et al 2011). The studies mentioned showed the potential of peer tutoring on improving on both cognitive (Batz et al 2015, Higgins 2004) and affective levels (Batz et al 2015, Cohen et al 1982). In this study, struggling student's motivation, participation, and performance in grade eight science students were assessed along the process of peer tutoring exposure.

Additionally, peer tutoring in basic science course at college level appeared to be an effective mechanism to improve student performance in gross anatomy course. It was very well received among tutored students. One plausible explanation is that tutors and tutees are almost of the same age in which interaction is within their level (Lake 1999). In an attempt to alleviate nursing shortage, Higgins (2004) studied peer tutoring, which proved to have significant effect on the academic performance and retention of at-risk students. Peer tutoring during practical sessions on applied sports science programs can enhance the achievement of tutees during practical assessments. It was recommended that peer tutoring can be adopted as an effective teaching and learning method for the development of students' practical skills during undergraduate sports science degrees (Comfort 2011).

Peer tutoring may be useful at the high school level and that high school students are very receptive to and enjoy working with a peer tutor despite using no extrinsic reinforcers that focus on students with disabilities (Romano & Walker 2010). Students respond favorably to the peer tutoring intervention because of their intrinsic desire to learn, behave well and enjoy class more. As result of peer tutoring, tutees acquired substantial understanding and skills and exhibited encouraging behavioral changes (Burton 2012). The results indicated that peer tutoring is a viable

intervention to use with middle school students enrolled in a science curriculum.

Considering foregoing facts, peer tutoring offers much promise of helping the students to perform better; however, peer support remains an underutilized resource (Bond & Castagnera 2006, Damon 1984). Hence, this study is conceptualize help struggling students. Teachers have tried to implement peer tutorials within their classrooms. Partnership between high and poor performing students (Romano & Walker 2010) was the usual scheme, perhaps, because of poor documentation, it is hardly appreciated as an effective intervention. This study utilize peer tutoring approach to help struggling students cope with academic demands as they continue their basic education.

This study aimed to help struggling science students particularly on motivation, participation and performance using peer tutoring approach. Specifically, it sought to answer the question: how do struggling students who participated in peer tutoring differ in the motivation, participation and performance from those who declined significantly contributed to the goal of improving and accelerating the performance of the junior high school science students. This study provided insights to initiate changes, plan, modify existing practices and encourage teachers to be more creative and constructive thinkers for the benefit of the students.

## RESEARCH METHODS

### *Research Design and participants*

This study followed the regression discontinuity design (Jacob et al 2012) for grade eight science students composed of three sections taught by a single teacher. The structure for the peer tutoring in this study was based on Batz et al (2015). The participants were Grade 8 science students in Caridad National High School. The study was done during the third quarter of the school year 2015-2016 it covered Biology subject. The peer tutoring approach was used as supplement to subject discussion. Volunteer tutors were those who have taken Grade 8 science.

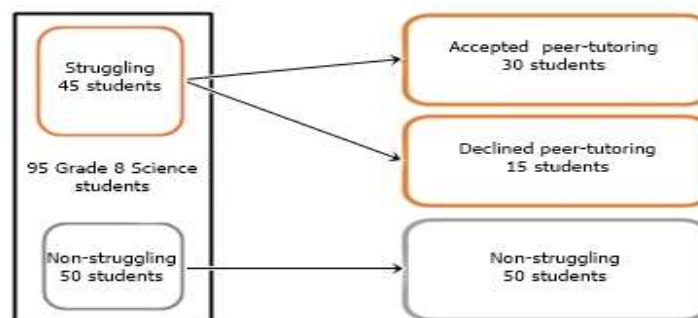


Figure 1. Grouping of Grade 8 Science students

### *Research Environment*

This study will be conducted in Caridad National High School, Caridad, Baybay City, Leyte. It is a government-run basic education institution with around 500 students enrolled yearly. Most students are from the locality and nearby barangays. Primarily a farming and fishing community, it is 20 km away from the city proper.

### *Research Instrument*

Motivation in science was measured using the Science Motivation Questionnaire II (SMQ-II) with internal consistency reliability coefficient of  $\alpha = .92$  (Glynn et al 2011). Participation was determined through regular classroom attendance. Academic performance was determined using the scores in the test with six units test subjected through expert validation. There are three topics for third quarter, the teacher planned to give two 15-item tests on each topic. For a total of six tests for the entire duration.

### *Data Gathering Procedure*

The tutors were volunteers from Grade 9 who underwent orientation in each topic prior to peer tutoring sessions with tutees. The SMQ-II (Glynn et al 2011) was administered before and after the intervention to collect the mean score of the non-struggling and struggling students. The scores for academic performance was based on the examination results. To track relative changes in student perceptions during the course, percentage of favorable responses on the SMQ-II posttest by struggling students who accepted peer tutoring, struggling students who declined peer tutoring, and non-struggling students were compared.

### *Structure of Peer Tutoring*

The structure in this study was based Batz et al (2015). Peer tutoring included 1) twice a week meeting with up to five struggling students and the peer tutor and 2) question packets prepared by the researchers and faculty instructor that were given to the students each week. The question packets included five multiple-choice questions selected from exams given in previous years. The questions aligned with course learning goals and, when possible, were at the application and analysis levels. Students worked together in small groups to answer each question and wrote a justification of why their answer was correct along with additional justifications why the other choices are incorrect. While students worked, peer tutors circulated to monitor their progress and answer questions. Toward the end of the session, the peer tutor would bring the group back together to review their answers and justifications. To ensure that

peer tutors were prepared for these sessions, they attended weekly meetings with the subject teacher to go through the questions before their sessions with students. The peer tutors were expected to complete the question packet on their own before coming to the instructor meeting. During each meeting, the peer tutors collectively reviewed their answers to and justifications for each question.

### *Subject performance*

In addition to the motivation and participation, subject performance was analyzed. For the pre-intervention period, grades on the first grading were examined to identify who need the help. While there critics of using the grade because of unstandardized nature, Grade in the first grading was used in the study because this is what is understood among stakeholders (Rogers et al 2009). For the intervention period, scores on exams 1–6 were studied to see the progress of struggling (accepted and decline peer tutoring) and non-struggling students. Performance of the two groups was placed in the context of the entire class' performance.

### *Statistical Treatment of Data*

Descriptive statistics was employed such frequency counts, mean and standard deviation to describe student profile. Paired t-test was employed to determine the significant difference in the mean gain on motivation. ANOVA was used to determine the difference of the scores in motivation, participation and academic performance and a post hoc test was employed to find the difference.

## RESULTS AND DISCUSSION

This study, looked into the efficacy of peer tutoring to help struggling students. At the pre-intervention period, struggling students who accepted and declined the peer tutoring did not significantly differ in their grades which suggested similarity at the start of the intervention phase.

A paired-samples t-test was conducted to determine gain in motivation. There was a significant difference in the scores for pre-intervention ( $M = 66.18$ ,  $SD = 17.878$ ,) and post-intervention ( $M = 69.89$ ,  $SD = 1.14$ );  $t(94) = -4.42$ ,  $p = 0.0001$ . These results suggest that the intervention did have an effect on students' perception of biology. Generally, the results suggest that students who underwent peer tutoring, improved in motivation towards learning biology.

Moreover, further test using analysis of variance showed the main effect of peer tutoring on their motivation,  $F(2, 92) = 5.08$ ,  $p = .008$ . Post hoc analysis using Tukey's HSD did not significantly differentiate in terms of motivation among students who accepted and declined peer tutoring.

Given that the intervention was relatively short, the finding can be interpreted to mean that motivation takes time to develop (Santrock 2012) especially for students who are disengaged in science classrooms. However, the post hoc test reveal difference in the mean score for non-struggling students ( $M = 2.12$ ,  $SD = 8.75$ ) was significantly different from that of struggling who accepted peer tutoring ( $M = 7.73$ ,  $SD = 6.68$ ). A caution is necessary because non-struggling students may have rated very high early on resulting to ceiling effect on their score. At the end of the third grading period, struggling students who accepted peer tutoring ended the quarter with significantly higher SMQ-II scores than struggling students who declined. Like other studies (e.g Batz et al 2015, Burton 2012), this study found that peer tutored students displayed improved motivation towards learning junior high school science subject.

Table 1 Multiple Comparisons using Tukey HSD on the students' motivation

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Bound	
					Lower	Upper
Non-struggling	Struggling-accept	-5.61*	1.77	.006	-9.82	-1.41
	Struggling-decline	-1.55	2.25	.772	-6.91	3.82
Struggling-accept	Non-struggling	5.61*	1.77	.006	1.41	9.82
	Struggling-decline	4.07	2.42	.218	-1.69	9.83
Struggling-decline	Non-struggling	1.55	2.25	.772	-3.82	6.91
	Struggling-accept	-4.07	2.42	.218	-9.83	1.69

\* The mean difference is significant at the 0.05 level.

In addition to their poor performance early in the year, struggling students who accepted and declined peer tutoring both had poor participation as evident in their poor attendance. The study aimed to establish the level of participation among the students as affected by peer tutoring.

Analysis of variance showed the effect of peer tutoring on participation,  $F(2, 92) = 119.35$ ,  $p = .0001$ . Post hoc analysis using Tukey's HSD (Table 2) indicated that the mean score for non-struggling students ( $M = 21.80$ ,  $SD = 2.86$ ) was significantly different from struggling students who accepted and declined peer tutoring. Moreover, struggling students who accepted peer tutoring ( $M = 16.93$ ,  $SD = 5.25$ ) was significantly different from struggling students' who declined ( $M = 4.80$ ,  $SD = 2.54$ ).

Taken together, these results suggest that students who accepted peer tutoring showed improvement in participation.

Table2. Multiple Comparisons using Tukey HSD on the students' participation.

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Non-struggling	Struggling-accept	4.87*	.87	.000	2.80	6.93
	Struggling-decline	17.00*	1.10	.000	14.37	19.63
Struggling-accept	Non-struggling	-4.87*	.87	.000	-6.93	-2.80
	Struggling-decline	12.13*	1.18	.000	9.31	14.96
Struggling-decline	Non-struggling	-17.00*	1.10	.000	-19.63	-14.37
	Struggling-accept	-12.13*	1.18	.000	-14.96	-9.31

\* The mean difference is significant at the 0.05 level.

Analysis of variance showed the main effect of peer tutoring on class performance,  $F(2, 92) = 61.64, p = .0001$ . Post hoc analysis using Tukey's HSD indicated that the mean score for non-struggling students ( $M = 65.58, SD = 10.48$ ) was significantly different from struggling students' who accepted peer tutoring ( $M = 53.47, SD = 10.88$ ). Moreover, struggling students who accepted peer tutoring had significantly different score from struggling students ( $M = 32.07, SD = 9.05$ ). Taken together, these results suggest that students who accepted peer tutoring showed improvement in performance relative to struggling students who declined peer tutoring throughout the intervention. Furthermore, when averaged scores on exams 1–6 were compared, non-struggling students outperformed struggling students. However, the exam performance of struggling students who accepted peer tutoring was significantly better than struggling students who declined peer tutoring (Fig. 2). These results suggest that attending peer tutoring helped struggling students improve their exam performance.

Table3. Multiple Comparisons using Tukey HSD on the total score of the examination.

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Non-struggling	Struggling-accept	12.11*	2.403	.000	6.39	17.84
	Struggling-decline	33.51*	3.064	.000	26.21	40.81
Struggling-accept	Non-struggling	-12.11*	2.403	.000	-17.84	-6.39
	Struggling-decline	21.40*	3.291	.000	13.56	29.24
Struggling-decline	Non-struggling	-33.51*	3.064	.000	-40.81	-26.21
	Struggling-accept	-21.40*	3.291	.000	-29.24	-13.56

\* The mean difference is significant at the 0.05 level.



This study shows that, peer tutoring approach can provide a distinctive way for teachers to reach struggling students. At the end of the one grading period, struggling students who accepted peer tutoring showed improved motivation and significant gain in test scores. The finding provide insight to teachers who want to design targeted academic support for students who are struggling in junior high school science.

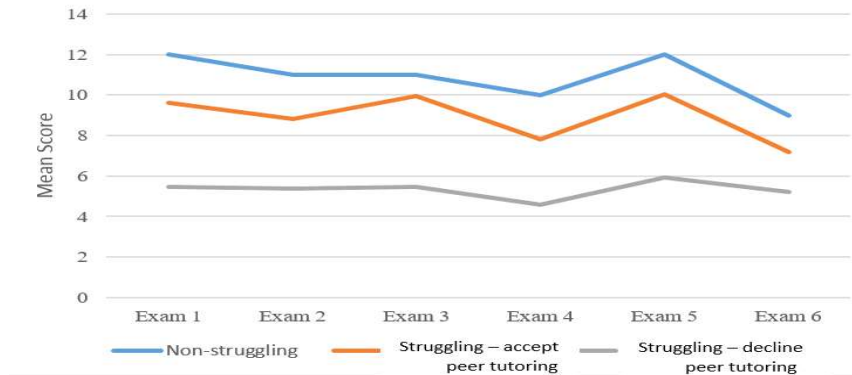


Figure 2. Raw average exam grades throughout the third grading period by group

## CONCLUSION AND RECOMMENDATIONS

This study shows peer tutoring can help both cognitive and affective capacities of students. Students who accepted peer tutoring sessions had better participation, achieved improved exam performance and ended the third quarter with more improved perceptions of biology compared to their struggling peers who declined help. Eventually, these outcomes led to increased motivation and performance in the class and suggest that peer tutoring can be an effective means for reducing the failure of at-risk students at the regular classroom setting. It is evident that peer tutoring can be applied on top of the regular class. Since the peer tutoring works with struggling students who actively participate in the process, teachers need to work on engaging at-risk students in the learning process. It is suggested to embed peer learning into the pedagogy and planning in individual curriculum areas to achieve maximum impact (Topping & Bryce 2004). Continued effort should be extended to struggling students who declined the learning support, other forms of peer support such as group peer learning, though beyond the study, was explored to help struggling students to succeed. In this study, it is worth to establish the qualitative changes both tutors and tutees underwent in the process.

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