

Peer Tutoring: Its Effects on Subject Mastery and Mathematics Anxiety among Elementary Education Teaching Interns

(Tunjuk Ajar Rakan Sebaya: Kesannya terhadap Penguasaan Mata Pelajaran dan Kebimbangan Matematik dalam kalangan Guru Pelatih Sekolah Rendah)

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ABSTRACT

Teachers' subject mastery and anxiety towards mathematics affect their performance in teaching the subject. This quasi-experimental study aimed to determine the effects of peer tutoring on mathematics subject mastery and mathematics anxiety among teaching interns. Intact groups of 35 Bachelor of Elementary Education (BEEd) students participated as tutees and 32 Bachelor of Secondary Education (BSEd) students with specialization in Mathematics participated as tutors in this study. Quantitative data were analysed using inferential statistics. Results revealed that peer tutoring was effective in increasing mathematics subject mastery; however, it had not been effective in reducing mathematics anxiety. Moreover, albeit insignificantly, as the participants' subject mastery increases, their anxiety decreases, and that mathematics anxiety is an insignificant predictor of subject mastery. The findings implicate that a peer tutoring program can be beneficial in equipping general education prospective teachers with sufficient content knowledge and confidence to teach mathematics; hence, further research on a functional peer tutoring process is recommended. Moreover, it is also suggested that future research be conducted on peer tutoring for other subject areas and prolonged period of peer tutoring sessions.

Key Words: Mathematics anxiety; peer tutoring; subject mastery; teaching internship; quasi-experimental

ABSTRAK

Penguasaan subjek dan kebimbangan matematik mempengaruhi prestasi guru dalam mengajar subjek. Kajian eksperimen kuasi ini bertujuan untuk mengetahui kesan tunjuk ajar rakan sebaya terhadap penguasaan subjek matematik dan kebimbangan matematik dalam kalangan guru pelatih. 35 pelajar Sarjana Muda Pendidikan Rendah (BEEd) terlibat sebagai pelajar dan 32 pelajar Sarjana Muda Pendidikan Menengah (BSEd) dengan pengkhususan Matematik terlibat sebagai pengajar. Data kuantitatif dianalisis menggunakan statistik inferensi, sementara data kualitatif dianalisis menggunakan analisis tematik dan dokumen. Hasil kajian menunjukkan bahawa tunjuk ajar rakan sebaya berkesan dalam meningkatkan penguasaan subjek matematik; namun, tidak berkesan untuk mengurangkan kebimbangan matematik. Tambahan lagi, walaupun tidak ketara, apabila penguasaan subjek meningkat, kebimbangan mereka menurun, dan kebimbangan matematik adalah peramal penguasaan subjek yang tidak signifikan. Hasil kajian mengimplicasikan bahawa program tunjuk ajar rakan sebaya adalah bermanfaat dalam melengkapkan calon guru pendidikan umum dengan pengetahuan dan keyakinan kandungan yang mencukupi untuk mengajar matematik; oleh itu, kajian lanjutan tentang proses tunjuk ajar rakan sebaya yang berfungsi adalah disarankan. Tambahan lagi, dicadangkan juga kajian lanjutan tentang tunjuk ajar rakan sebaya untuk bidang-bidang subjek lain dan tempoh sesi tunjuk ajar rakan sebaya yang dipanjangkan.

Kata Kunci: Kebimbangan matematik; tunjuk ajar rakan sebaya; penguasaan subjek; guru pelatih; experiment kuasi

INTRODUCTION

Teachers' subject mastery level has a direct bearing on their teaching performance (Jadama 2014). Moreover, teachers' anxiety towards mathematics affects their performance (Haciomeroglu 2013), whereby teachers with high anxiety towards mathematics have low

confidence in their own abilities to teach mathematics effectively. Thus, teachers should have deep knowledge about the subject that they are teaching so that they have lower levels of anxiety to prepare for and carry out the lessons.

In the Philippines, it has been observed that the teaching interns of the Bachelor of Elementary

Education (BEEd) are highly anxious and have a low level of mastery, especially in higher grades Mathematics since they do not have a subject area of concentration (Ganal et al. 2015a; Ganal et al. 2015b). This is observed in the conceptual depth of their submitted lesson plans and their ability to guide students in connecting various interrelated topics. On the other hand, the secondary teaching interns of the Bachelor of Secondary Education (BSEd) have deeper knowledge and exposure to Mathematics.

Hence, peer tutoring strategy that involves BSEd interns as tutor and BEEd interns as tutee should be considered to improve the subject mastery and reduce Mathematics anxiety among the BEEd interns. Not an altogether novel strategy, peer tutoring has been employed implicitly or explicitly in education, but it has become more formalized and even popular in a shifting higher education setting (Arrand 2014).

The establishment of peer tutoring systems is much encouraged with the recent developments and initiatives within higher education, as peer tutoring offers one approach to improve learning outcomes in higher education (Pugatch & Wilson 2018). Peer tutoring has a positive impact on learning with benefits for both tutors and tutees (Education Endowment Foundation 2018). It is considered economical because more-knowledgeable students serve as the tutors. It is also primarily aimed to increase students' academic performance by engaging the students in behaviour geared towards achieving the said goal (Pugatch & Wilson 2018). As it aids in student learning, motivation, and empowerment, it is being used in higher education more frequently (Colvin 2007). Furthermore, peer tutoring promotes academic and social development for both the tutor and tutee while increasing student engagement, time on task, and students' self-confidence and self-efficacy (Hott & Walker 2012). There is a need to come up with strategies to improve mathematics content knowledge and reduce mathematics anxiety among teaching interns. This is because the anxiety level of teachers who had it as students could get worse when they teach and may even transfer their anxiety to their learners (Stoehr 2017). Furthermore, the anxiety level of the teacher is inversely related to the student's math achievement (Ramirez et al. 2018).

While studies abound on peer tutoring among higher education students to help in improving academic performance, only a few researches have focused on examining how peer tutoring impacts subject mastery and mathematics anxiety among teaching interns. Researches on elementary teaching interns' mathematics anxiety have been done in various contexts (Sloan 1999; Hadley 2005; Nyaumwe 2010) but none have considered conducting it in the context of teaching internship.

Therefore, this study aimed to determine the effects brought about by peer tutoring on subject mastery and mathematics anxiety, the relationship of subject mastery and mathematics anxiety of the BEEd teaching interns, and a model that best expresses this relationship. The specific objectives of this study are:

1. To determine the differences in the mathematics subject mastery and anxiety level of the teaching interns in the control and experimental groups before and after the peer tutoring sessions
2. To determine the differences in the pre-post mean score of mathematics subject mastery and anxiety level of the teaching interns in the control and experimental groups after the peer tutoring sessions
3. To determine the correlation between the mathematics subject mastery and anxiety level of the teaching interns before and after the peer tutoring sessions
4. To model the relationship between subject mastery and the mathematics anxiety of the teaching interns after the peer tutoring interactions

These hypotheses were tested in this study:

- Ho₁ There is no significant difference in the pre-test and post-test scores of the mathematics subject mastery of the experimental group
- Ho₂ There is no significant difference in the pre-test and post-test scores of the anxiety level of the experimental group
- Ho₃ There is no significant difference in the pre-test and post-test scores of the mathematics subject mastery of the control group
- Ho₄ There is no significant difference in the pre-test and post-test scores of the anxiety level of the control group
- Ho₅ There is no significant difference in the pre-post mean gain/loss of mathematics subject mastery of the experimental and control groups
- Ho₆ There is no significant difference in the pre-post mean gain/loss of anxiety level of the experimental and control groups
- Ho₇ There is no significant correlation between the pre-test score of mathematics subject mastery and anxiety level of the teaching interns
- Ho₈ There is no significant correlation between the post-test score of mathematics subject mastery and anxiety level of the teaching interns
- Ho₉ There is no significant influence of mathematics anxiety level on the mathematics subject mastery among the teaching interns

PEER TUTORING

Peer tutoring is described as a strategy that is flexible, peer-mediated and involves a higher performing student, the tutor, being paired with a low performing student, the tutee, to receive one-to-one assistance (Hott & Walker 2012). Tutees must ask tutors questions in order to obtain relevant information on a certain topic. The main role of the tutors is to answer questions, provide feedback and help their tutees during the learning process (Topping 2018). Peer tutoring is also referred to as “peer learning”, “cooperative/collaborative learning” and “peer collaboration” that includes teaching and learning approaches whereby even without the teacher’s intervention, students learn with and from each other (Boud et al. 2001).

In this strategy, tutors and tutees can both benefit from the exchanges. Tutees can benefit by getting help from a peer in clarifying a concept; tutors can benefit as they strengthen their understanding of a concept by answering the tutees’ questions. Studies have shown that peer tutoring can influence the tutees’ performance and success rates (Arco-Tirado et al. 2011), metacognitive regulation (De Backer et al. 2015) achievement of course outcomes (Colver & Fry 2016), learning strategies (Ali et al. 2015; Arco-Tirado et al. 2011), and confidence (Young 2011). On the part of the tutors, peer tutoring can impact their cognitive and metacognitive, psycho-emotional, social (Arco-Tirado et al. 2011; Chin & Chang-Chen 2011) and even teaching skills (Young 2011). The interactions between tutors and tutees altogether stimulate active learning (Moliner & Alegre 2020).

The most frequently used peer tutoring models are class-wide peer tutoring, cross-age peer tutoring, peer-assisted learning strategies (Hott & Walker 2012). And with the advancement of technology, peer tutoring is also being conducted online. Such mode of conducting peer tutoring can positively affect the interaction and learning of the students (Evans & Moore 2013) and engage the tutors and tutees in active learning (Chu et al. 2017). In the new normal of education, peer tutoring then still has a place with the online delivery modality.

THEORETICAL AND CONCEPTUAL FRAMEWORK

This study is anchored in Vygotsky’s (1978) Social Learning Theory and Lave and Wenger’s (1991) Situated Learning Theory. The Social Learning Theory puts forth the idea that the attainment of cognition is the final result of socialization (Culatta & Kearsley 2015). It also stipulates that the range of skills that an individual can acquire with the help of more knowledgeable others can exceed what he can learn on his own in the concept of scaffolding and the Zone of Proximal Development. Meanwhile, the Situated Learning Theory (1991) of Lave and Wenger states that for learning to take place, social interaction and collaboration are essential (Culatta & Kearsley 2015). Social interaction – an important component of situated learning – necessitates the immersion of learners in a “community of practice” as a venue where relevant ideas, experiences, actions, and tacit knowledge are to be shared and learned. In this community of practice, people who have the same interest and inclination for a particular activity interact frequently to learn how to improve their performance in such activity (Smith 2009). Figure 1 shows the conceptual framework of this study.

In this study, the Student Teaching Internship can be likened to this community of practice, whereby the teaching interns take turns in demonstrating their knowledge of teaching principles and strategies as well as mastery of the subject matter as they teach the different subject areas under the guidance of their respective student teaching mentors. Furthermore, through peer tutoring, what the BEEed teaching intern can acquire with the help of his BSEd peers can surpass what he can learn by himself, as Vygotsky emphasized. During the tutoring process within the community of practice of teaching, BSEd Mathematics teaching interns act as the tutor that supports the BEEed teaching intern in clarifying concepts about the topic to be taught to help them to acquire subject mastery and gain more confidence, thus lowering their Mathematics anxiety. Learning for the BEEed teaching interns is both social and situated as they interact with their BSEd Math peers during the peer tutoring sessions where math concepts and skills can be learned and teaching strategies can also be acquired. On the side of the BSEd Math teaching interns, they also get to hone their ability to teach and deepen further their knowledge of the Math concepts and skills that they are tutoring to their BEEed peers.

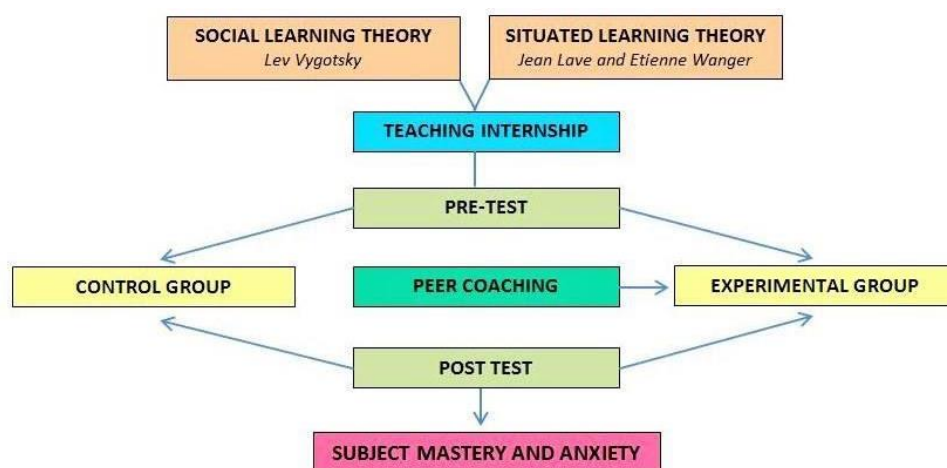


FIGURE 1. Theoretical and Conceptual Framework

METHODOLOGY

RESEARCH DESIGN AND PARTICIPANTS

This study uses the quantitative method, specifically a quasi-experimental design, with control and experimental groups to determine the effects of peer tutoring on the teaching interns' subject mastery and anxiety. The treatment in this study was eight sessions of peer tutoring in the course of three months. Formal ethics approval for this study was obtained from the Cebu Normal University Research Ethics Committee (REC) where the research was conducted.

This study made use of intact groups in a laboratory school in Cebu, Philippines. The population of the BEEed teaching interns was 145 for the first semester of the Academic Year 2018-2019. This population was further divided randomly by the home-base mentors into three groups corresponding to the three shifts: i) Home Base, ii) Off Campus (Public Schools), and iii) Off Campus (Private Schools). The second group of the BEEed teaching interns (N=35) was chosen to take part in this study for their availability for the peer tutoring sessions and to match the number of BSEd Mathematics teaching interns (N=32) who will serve as the peer tutors. The participants gave their consent before participating in this study. For privacy, anonymity and confidentiality, the participants were assigned numbers that were used on the questionnaires.

Before the study commenced, 35 BEEed teaching interns answered a pre-test to determine their level of subject mastery and mathematics anxiety which was used as the criteria to divide them into control or experimental groups. A number of them with high levels of anxiety and low levels of subject mastery (N=13) were selected to be in the experimental group, while the others (N=18) were put into the control group. The participants in the experimental group

received the peer tutoring intervention from BSEd teaching interns while the participants in the control group received conventional mentoring from their respective teaching mentors. During the peer tutoring session, one tutor (BSEd teaching intern) was paired with one or two tutee (BEEed teaching interns) from the experimental group. The tutors were given a list of the competencies for Grade 6 Mathematics which served as their guide as they proceeded with the tutoring sessions. At the end of the peer tutoring sessions, 31 participants from both control and experimental groups answered the post-tests.

The level of difficulty of the math topics that BEEed students had to teach as the semester progressed was not controlled by the researchers, as it would otherwise become unethical and would deprive the laboratory school pupils taught by the BEEed students of the curriculum that they should receive. Both experimental and control group participants taught different levels of mathematics for the duration of this research depending on their home base assignment.

RESEARCH INSTRUMENTS

To collect data for the study, two instruments were used as the pre-test and post-test, which were the Grade 6 Mathematics Achievement Test (2007) (Grade 6 MAT) and the Revised Mathematics Anxiety Rating Scale (RMARS). The Grade 6 MAT was a 40-item multiple choice question test to determine the teaching interns' Grade 6 Mathematics content knowledge, since this is the highest level of Mathematics that they will be teaching as BEEed teaching interns. The test was developed based on the Grade 6 Mathematics competencies as stipulated in the K to 12 Mathematics Basic Education Curriculum for content validity. Some items were contextualized to suit the Philippine setting. The Revised Mathematics Anxiety Rating Scale

(RMARS) was developed by Alexander and Martray (1989) to determine the teaching interns' Mathematics anxiety levels. The RMARS is a questionnaire that contains 25 items with 5-point Likert scale (1: Not at All; 2: A Little; 3: A Fair Amount; 4: Much; 5: Very Much). A pilot test was conducted among 60 BEEEd teaching interns to determine the instrument's reliability and obtained Cronbach's Alpha value of 0.83, which is good.

DATA ANALYSIS METHOD

Parametric inferential tests were used as the data sets did not differ significantly from a normally distributed one based on the results of the Kolmogorov-Smirnov Test of Normality. To test the difference between the mathematics subject mastery and anxiety level of the teaching interns before and after peer tutoring, paired samples t-test was used with the data sets satisfying the assumptions. To test the difference between the pre-post mean gains on the mathematics subject mastery and anxiety level of teaching interns from the control and experimental groups attributed to peer tutoring, independent samples (Welch's) t-test was used since the data sets met the assumptions of normality and independence. To test the correlation between the teaching interns' mathematics subject mastery and anxiety level before and after peer tutoring, Pearson rank moment correlation was utilized. To determine the model that expresses the relationship between subject mastery and the mathematics anxiety among the teaching interns after the peer tutoring interactions, a linear regression model was used with the data sets satisfying the assumptions of normality, linearity, independence and homoscedasticity.

FINDINGS AND DISCUSSION

DIFFERENCES IN THE BEEEd TEACHING INTERNS' MATHEMATICS SUBJECT MASTERY AND ANXIETY LEVEL BEFORE AND AFTER PEER TUTORING

Findings show that there is a significant difference in the mathematics subject mastery of the experimental group before and after the peer tutoring sessions ($t(12) = -5.0$, $p < 0.05$). Therefore, H_{01} is rejected. This means that on average, the level of mathematics subject mastery of the BEEEd teaching interns after peer tutoring (Mean=32.08, SD=3.12) significantly increased than before peer tutoring (Mean=27.08, SD=2.75). There was a substantial increase of 5 points in the mean, reflective of their improved mathematics subject mastery after going through the peer tutoring sessions. Such an increase is considerable since the achievement test was made up of 40 items, and 5 points made up 12.5% of the total number of items in the test. As Topping (2005) discussed, peer tutoring can aid students in an in-depth learning of content areas. This is of paramount importance since they are general education teaching interns who teach mathematics to elementary pupils.

On the other hand, there was no significant difference in the mathematics anxiety level of the experimental group before peer tutoring (Mean=3.21, SD=0.46) and after peer tutoring (Mean=2.94, SD=0.73), ($t(12) = 1.17$, $p = 0.27$). The teaching interns' mathematics anxiety level generally decreased after peer tutoring, but such reduction was not statistically significant. Therefore, H_{02} failed to be rejected. However, the RMARS instrument utilized in this study focused on statements pertaining to math tests, numerical tasks and math courses, which could be a factor why the decrease in mathematics anxiety after the peer tutoring sessions was not significant.

TABLE 1. Paired differences in the pre-test and post-test scores of the experimental group

| | Experimental Group (n = 13) | | | | | | |
|-------------|-----------------------------|------|-----------|------|-----------------------|----|---------|
| | Pre-test | | Post-test | | Paired Samples t-test | | |
| | Mean | SD | Mean | SD | T | df | p-value |
| Grade 6 MAT | 27.08 | 2.75 | 32.08 | 3.12 | -5.0 | 12 | *0.00 |
| RMARS | 3.21 | 0.46 | 2.94 | 0.73 | 1.17 | 12 | 0.27 |

*significant at $\alpha = 0.05$

TABLE 2. Paired differences in the pre-test and post-test scores of the control group

| Scores | Control Group (n = 18) | | | | | | |
|-------------|------------------------|------|-----------|------|-----------------------|----|---------|
| | Pre-test | | Post-test | | Paired Samples t-test | | |
| | Mean | SD | Mean | SD | T | df | p-value |
| Grade 6 MAT | 30.39 | 1.85 | 30.94 | 2.13 | -0.93 | 17 | 0.36 |
| RMARS | 2.58 | 0.53 | 2.92 | 0.60 | -2.83 | 17 | *0.01 |

*significant at $\alpha = 0.05$

Findings also show that there is no significant difference in the mathematics subject mastery of the control group before and after conventional mentoring ($t(17)=-0.93$, $p=0.36$). Therefore, H_{o3} failed to be rejected. The mean scores of the teaching interns who received conventional mentoring from their mathematics mentor based on the pre-test scores (Mean=30.39, SD=1.85) and post-test scores (Mean=30.94, SD=2.13) differed but not significantly. This slight increase in the mean from pre- to post- could just be attributed to the teaching interns' maturation in the course of four months of their internship phase. The negligible 0.65 increase in the mean could also be due to their teaching assignments that the researchers in this study can't control wherein the teaching interns were assigned to teach subjects other than mathematics leading to less interactions with their mathematics mentor and the subject matter itself.

However, there is a significant difference in the mathematics anxiety of the control group before and after the peer tutoring sessions ($t(17)=-2.83$, $p=0.01$). Therefore, H_{o4} is rejected. It can be noted that the control group's mathematics anxiety significantly increased after conventional mentoring (Mean=2.92, SD=0.60) than before conventional mentoring (Mean=2.58, SD=0.53), which is not the intended outcome. The teaching interns might have significant negative experiences during the teaching internship that could have caused an elevation in their mathematics anxiety level. They might have been tasked to teach difficult mathematics content, since as the grading periods go by, mathematics topics increase in their level of complexity with minimum supervision and guidance from their mentors. Or as mentioned above, they might have had less teaching assignments in mathematics making the subject altogether strange and foreign to them and their retention of mathematical concepts and skills becomes another area of concern.

DIFFERENCES IN THE PRE-POST MEAN GAIN/LOSS OF THE MATHEMATICS SUBJECT MASTERY AND ANXIETY LEVEL AFTER THE PEER TUTORING SESSIONS

The finding reveals that there is a significant difference in the pre-post mean gain of mathematics subject mastery of the experimental and control groups ($t(29)=4.04$, $p<0.05$). Therefore, H_{o5} is rejected. This means that the mean gain in subject mastery of the

experimental group after peer tutoring (Mean=5, SD=3.61) significantly differs with the mean gain in subject mastery of the control group (Mean=0.56, SD=2.53) who did not undergo said intervention. This is notable considering the number of items that the test has as well as the mathematical competencies being tested. The results show that peer tutoring has been effective in increasing the mathematics subject mastery of the BEEd teaching interns. These results contribute to the already strong research base that peer tutoring is a strategy that promotes academic development across ages, grade levels and subject areas, as demonstrated in the studies by Hott and Walker (2012), Arco-Tirado et al. (2020), and Alegre et al. (2020).

In addition to the finding above, Cohen's d was computed to determine the magnitude of the effect of peer tutoring. The effect size obtained was 1.4243, which reveals that the mean of the experimental group was at the 91.9th percentile of the control group. 0.8 is considered as a large effect size and 1.4243 is almost double the value; therefore, this shows that peer tutoring has greatly affected the subject mastery of the teaching interns.

In addition, there is also a significant difference in the pre-post mean gain/loss of mathematics anxiety level of the experimental and control groups ($t(29)=-2.54$, $p=0.02$). The experimental group had a mean loss (Mean=-0.27, SD=0.83) in their mathematics anxiety level as opposed to the mean gain of the control group (Mean=0.35, SD=0.52). However, these results can't sufficiently support the conclusion that peer tutoring decreased the mathematics anxiety level of the teaching interns, since the difference between the mean gain/loss of the experimental and control groups can be attributed to the significant increase in the mathematics anxiety of the teaching interns who didn't go through peer tutoring (as shown in Table 2) due to factors beyond the scope of this research such as, but not limited to, the increasing level of difficulty of the mathematics topics as the school year progresses, nature and number of teaching assignments, transfer of the participants to off campus, etc. According to Spencer (2006), the levels of self-confidence and self-efficacy go up with peer tutoring but as to what levels of self-confidence and self-efficacy are needed to reduce mathematics anxiety significantly is yet to be known.

TABLE 3. Differences in the pre-post mean gain/loss of the control and experimental groups

| Scores | Experimental Group (n = 13) | | Control Group (n = 18) | | Independent Samples t-test (Welch's test) | | |
|-------------|--------------------------------|------|---------------------------|------|--|----|---------|
| | Mean | SD | Mean | SD | t | df | p-value |
| Grade 6 MAT | 5 | 3.61 | 0.56 | 2.53 | 4.04 | 29 | *0.00 |
| RMARS | -0.27 | 0.83 | 0.35 | 0.52 | -2.54 | 29 | *0.02 |

*significant at $\alpha = 0.05$

CORRELATION BETWEEN BEEd TEACHING INTERNS' MATHEMATICS SUBJECT MASTERY AND ANXIETY LEVEL

Table 4 shows the computed Pearson Product Moment Correlation Coefficients to determine the relationship between subject mastery of the teaching interns and anxiety. The findings reveal that there is a non-significant, negative weak correlation between subject mastery and mathematics anxiety level of the teaching interns in the pre-tests ($r=-0.16$, $p=0.39$). Therefore, H_{o7} failed to be rejected. There is also nonsignificant, very weak association between subject mastery and mathematics anxiety level in the post-tests ($r=-0.05$, $p=0.79$). Therefore, H_{o8} has failed to be rejected. The two scatterplots (Figure 2 and Figure 3) summarize the results.

The nonsignificant results could be attributed to the small sample size ($n=31$). The negative correlation

between subject mastery and mathematics anxiety of the teaching interns means that as subject mastery increases, their anxiety level decreases and vice versa. These are reflective of the findings of Luttenberger, Wimmer and Paechter (2018) that while a significant relationship exists between math anxiety and math performance among primary and secondary education students in varying sizes, such correlation studies among university students have yielded ambiguous results. The results on the strength of the correlation though substantiate a finding of another research that "there is a negative weak relationship between math anxiety and scholastic performance" (Eslit 2018) with subject mastery considered a component of scholastic or academic performance. But even with the anxiety reduction strategies utilized by the teacher education students at a higher degree, academic performance is not affected (Eslit 2018).

TABLE 4. Correlation between the Grade 6 MAT and the RMARS scores

| | RMARS (Pre-Test) | p-value | RMARS (Post-Test) | p-value |
|-------------------------|------------------|---------|-------------------|---------|
| Grade 6 MAT (Pre-Test) | $r = -0.16$ | 0.39 | | |
| Grade 6 MAT (Post-Test) | | | $r = -0.05$ | 0.79 |

*significant at $\alpha = 0.05$

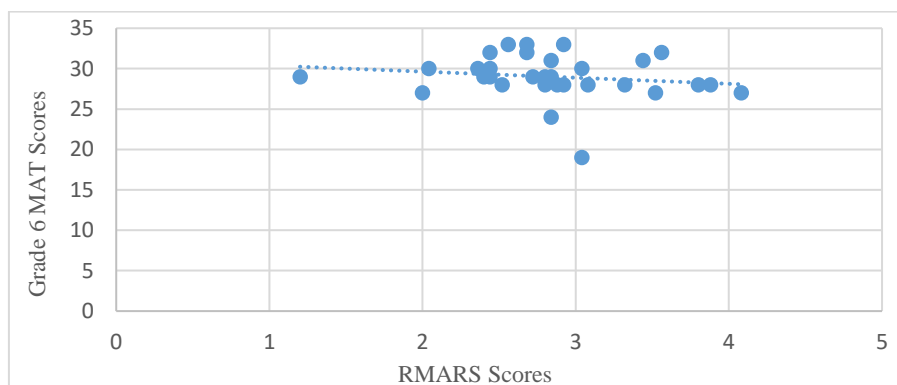


FIGURE 2. Scatter Plot of Pre-test Scores in the Grade 6 MAT and RMARS

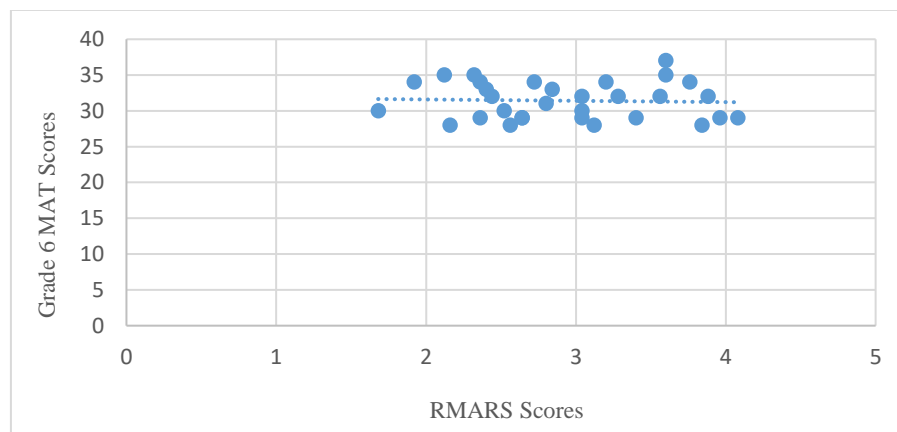


FIGURE 3. Scatter Plot of Post-test Scores in the Grade 6 MAT and RMARS

LINEAR REGRESSION MODEL: SUBJECT MASTERY AS A
FUNCTION OF MATHEMATICS ANXIETY

The ANOVA results indicate that the simple regression model $y = -0.185x + 31.961$, where y = subject mastery and x = mathematics anxiety level, is insignificant ($F(1,29) = 0.061$, $p = 0.807$, $R^2 = 0.002$). Therefore, H_0 is failed to be rejected. This shows that mathematics anxiety is an insignificant predictor of subject mastery in mathematics among the teaching interns. These results corroborate with the non-significant correlation between subject mastery and mathematics anxiety as shown in Table 4.

From the findings, it can be observed that a teaching interns' mathematics anxiety level is not related with his/her mastery of the said subject and vice versa. This negates the research findings of Zhang, Zhao and Kong (2019) that there is a significant negative math anxiety-math performance correlation. However, the observation of this study may relate with Felman's (2018) argument that anxiety evokes the "fight-or-flight" response. Such response gears up individuals to physically face or flee any potential threats to safety. Hence, in this study, a teaching intern with mathematics anxiety may either face his/her fear of

mathematics upfront by finding ways to learn the subject and even master it, or stay away from it altogether by not having to deal with it at all costs. This could be a reason why mathematics anxiety level has no bearing on subject mastery as the number of teaching interns who responded with "fight" might have balanced out with those who responded with "flight".

This implies that apart from exploring ways to reduce mathematics anxiety among teaching interns, there is a need to determine beforehand how these interns have responded to their anxiety in mathematics whether by "fight" or "flight". In a study of Finlayson (2014), 70 pre-service teachers revealed having experienced math anxiety and shared how they have overcome this through personal strategies with support from family as a strategy common to them all. This shows the necessity to provide more attention to those teaching interns who lack the personal strategies and support to overcome anxiety since they will seemingly benefit more from the anxiety reduction interventions. Continuous support, encouragement and motivation will be provided to the mathematically anxious teachers to enable them to face mathematics head on.

TABLE 5. Regression Statistics

| <i>Regression Statistics</i> | |
|------------------------------|--------------|
| Multiple R | 0.045809189 |
| R Square | 0.002098482 |
| Adjusted R Square | -0.032311915 |
| Standard Error | 2.646541299 |
| Observations | 31 |

TABLE 6. Analysis of Variance (ANOVA)

| | <i>df</i> | <i>SS</i> | <i>MS</i> | <i>F</i> | <i>Significance F</i> |
|------------|-----------|-------------|-----------|----------|-----------------------|
| Regression | 1 | 0.427142577 | 0.427143 | 0.060984 | 0.806687351 |
| Residual | 29 | 203.1212445 | 7.004181 | | |
| Total | 30 | 203.5483871 | | | |

TABLE 7. Coefficients

| | <i>Coefficients</i> | <i>Standard Error</i> | <i>T Stat</i> | <i>P-value</i> | <i>Lower 95%</i> | <i>Upper 95%</i> | <i>Lower 95.0%</i> | <i>Upper 95.0%</i> |
|--------------|---------------------|-----------------------|---------------|----------------|------------------|------------------|--------------------|--------------------|
| Intercept | 31.96121298 | 2.245103843 | 14.23596 | 1.28E-14 | 27.36946005 | 36.55296591 | 27.36946005 | 36.55296591 |
| X Variable 1 | 0.184832773 | 0.74846453 | -0.24695 | 0.806687 | -1.715614616 | 1.345949069 | -1.715614616 | 1.345949069 |

CONCLUSION

This study determined the effects of peer tutoring on the mathematics subject mastery and anxiety level of the Bachelor of Elementary Education (BEd) teaching interns. Findings revealed that peer tutoring had been significantly effective in increasing the mathematics subject mastery of the BEd teaching interns, but not significantly effective for reducing mathematics anxiety. Moreover, the correlation

between subject mastery and mathematics anxiety of the teaching interns were insignificant, and that mathematics anxiety is an insignificant predictor of subject mastery in mathematics. In conclusion, the peer tutoring of BEd Mathematics teaching interns to BEd General Education teaching interns is an effective and practical intervention in improving mathematics subject mastery. This implies that a peer tutoring program can be beneficial in equipping general education prospective teachers with sufficient content

knowledge and confidence to teach mathematics. With the study results showing that peer tutoring has potential in improving the subject mastery of teaching interns in mathematics, the researchers recommend further research on a functional peer tutoring process. The findings have also shown the insignificant relationship between subject mastery and math anxiety among the teaching interns contrary to most math anxiety-math performance correlation studies. Thus, the researchers recommend that research be done to determine whether or not the teaching interns have utilized personal strategies to cope with their math anxiety and to improve their subject mastery. The researchers also recognize that the present study was limited to Mathematics as the content subject and was constrained by time. Hence, they recommend for research on peer tutoring for the other subject areas and for longer time duration when conducting the peer tutoring sessions among the teaching interns.

ACKNOWLEDGMENTS

The authors wish to acknowledge the BEE and BSED Mathematics student interns who participated in this study, the Center for Research and Development of the Cebu Normal University for their motivation and unwavering support and the Cebu Normal University for generously funding this research endeavor.

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Submitted: 25 July 2019
Reviewed: 6 March 2020
Accepted: 18 October 2020
Published: 30 November 2020