Perceived Statistics Self-Efficacy, Research Anxiety, and Research Confidence of Mathematics Pre-Service Teachers in One State University in the Philippines

**Ericka Paula Jane Capistrano Romero, Marjorie Mendoza Laguerta, &
Rose Reyes Andrade**

College of Teacher Education, Laguna State Polytechnic University, Philippines

*Corresponding email: rose.andrade@lspu.edu.ph

Abstract: Perceived Statistics Self-Efficacy, Research Anxiety and Research Confidence of Mathematics Pre-Service Teachers in One State University in the Philippines. Objectives: This study aimed to investigate the relationship between statistics self-efficacy, research anxiety and research confidence. This research also determined whether statistics self-efficacy can predict research confidence. **Methods:** Purposive sampling method was used among 71 students who had previously taken statistics and research employing adapted questionnaires in data collection. **Findings:** Results revealed that statistics self-efficacy and research anxiety have a relationship with motivated behavior and statistical theory. Meanwhile, statistics self-efficacy and research confidence were found to be associated in terms of lecture behavior, use of information technology, motivated behavior, time management, and statistical theory. Furthermore, this study discovered that statistical theory and time management could predict respondents' research confidence. **Conclusion:** The findings imply that improving the statistics self-efficacy of prospective mathematics teachers is indispensable for mathematics research production.

Keywords: pre-service mathematics teachers, research anxiety, research confidence, statistics self-efficacy.

Abstrak: Persepsi Kemanjuran Diri Statistik, Kecemasan Riset, dan Keyakinan Riset Guru Prajabatan Matematika di Salah Satu Universitas Negeri di Filipina. Tujuan: Penelitian ini bertujuan untuk mengetahui hubungan antara efikasi diri statistik, kecemasan penelitian, dan kepercayaan diri penelitian. Penelitian ini juga menentukan apakah efikasi diri statistik dapat memprediksi keyakinan penelitian. Metode: Metode purposive sampling digunakan pada 71 siswa yang sebelumnya telah mengambil statistik dan penelitian menggunakan kuesioner yang disesuaikan dalam pengumpulan data. Temuan: Hasil mengungkapkan bahwa efikasi diri statistik dan kecemasan penelitian memiliki hubungan dengan perilaku termotivasi dan teori statistik. Sementara itu, efikasi diri statistik dan keyakinan penelitian ditemukan berhubungan dalam hal perilaku kuliah, penggunaan teknologi informasi, perilaku termotivasi, manajemen waktu, dan teori statistik. Selain itu, penelitian ini menemukan bahwa teori statistik dan manajemen waktu dapat memprediksi kepercayaan penelitian responden. Kesimpulan: Temuan ini menyiratkan bahwa peningkatan self-efficacy statistik calon guru matematika sangat diperlukan untuk produksi penelitian matematika.

Kata kunci: calon guru matematika, kecemasan penelitian, kepercayaan diri penelitian, efikasi diri statistik.

To cite this article:

■ INTRODUCTION

Currently, the world revolves around the accumulation of numerical and digital data. In daily life, statistics play a huge role as it is considered a science of variability and a technique to deal with the uncertainty that surrounds people (Li, 2016). Specifically, it is used to describe and forecast phenomena that require the collection of data. Statistics is a highly interdisciplinary field, with applications in almost every branch of science such as mathematics and research (University of California Irvine, 2022). Given that statistics is widely used, it is alarming that some individuals still show a lack of self-efficacy or confidence towards statistics (Retutas & Rubio, 2019).

Self-efficacy or confidence is described as the level of trust in one's capacity to carry out a task in achieving performance goals. Expectations of self-efficacy encourage an action, how much attention is placed on achieving a goal, and how much commitment will be placed to an activity despite failures and challenges, thus making self-efficacy a good predictor of performance (Loo & Choy, 2013). In statistics, self-efficacy is an individual's confidence in the capacity to execute statistical tests or reason statistically (Baloglu et al., 2017). According to Salim et al. (2018), Baloglu et al. (2017), and Ogbonnaya et al. (2019), statistics self-efficacy is one of the variables that greatly influences how students engage in statistics-related tasks such as research. Researchers who feel efficacious in statistics tend to be achievers in research methods and statistics.

Research is defined by Swindoll (2012) as the process of acquiring and examining data to maintain knowledge of a phenomenon under investigation. Research plays a vital role in everyday living as it is an instrument that enables the world to handle change in the way of life in line with society's needs and demands (Oguan et al., 2014; see also Shaukat et al., 2014). Moreover, it cannot be denied that doing research requires statistical skills. The data analysis portion of a research paper is crucial since it describes the data analysis methodologies that have been presented. Many students enrolled in research requirements have limited knowledge of statistics, thus making them unable to perform this task competently (Loewen et al., 2019). Consequently, this leads to research anxiety (Tasgin & Kaya, 2018).

Research anxiety is the fear of doing research-related tasks. Anxiety is a major factor in student's failure to complete their research and why they are having trouble with it. Some students may also procrastinate in completing research due to anxiety (Rezaei & Zamani-Miandashti, 2013). It is daunting to identify that research anxiety is the most common anxiety experienced in higher education (Ashrafi-riz et al., 2014). Rezaei and Zamani-Miandashti (2013) mentioned that students who experience higher levels of research anxiety have lower research self-efficacy and vice versa.

The importance and usefulness of undergraduate students' self-efficacy in research training have been demonstrated in studies (Rezaei & Zamani-Mindashti, 2013). Research self-efficacy (or confidence, as mentioned by Hemmings, 2012) is the perception of a person as to the level at which he or she is capable of doing particular research tasks. According to Livinti et al. (2021), the adoption of the idea of confidence in the field of research is one of the best indicators of effective research participation.

The Philippines is being outnumbered by neighboring countries in research participation and production. According to the British Council (2015), 2.2% of the world's scholarly publications were shared by Southeast Asia. In 2013, among the seven countries in Southeast Asia, the Philippines ranked fifth in research production and citations. In terms of educational research performance, the Philippines is currently surpassed by Indonesia, which placed sixth in

1996 but first in 2021 in terms of research production (Guido & Orleans, 2020). Moreover, the Philippines has no institution that displays particular strength in mathematics research compared to other countries in Southeast Asia that have at least 1 institution (British Council, 2015). According to Wilson and Mack (2014), pre-service teachers' declining levels of mathematical research threaten to establish a cycle of declining mathematics and science activities in educational institutions. Based on the literature above, it is clear that among Southeast Asian nations, the Philippines has the lowest performance in research production, which affects mathematics research publications.

Performance in research is determined by research anxiety (Brunila & Valero, 2017). According to Tasgin and Kaya (2018), one of the reasons researchers feel anxious about research is due to fear and perceptions of statistics. In addition, less research anxiety is observed in pre-service teachers who have a positive attitude toward statistics. However, many pre-service mathematics teachers are hesitant towards statistics because they believe that they do not comprehend the principles (Lovett & Lee, 2017; see also Mustam, et al., 2015; Hannigan et al., 2013). According to Baloglu et al. (2017), attitudes and confidence toward research methods and statistics could significantly predict the confidence and effort of an individual conducting research.

This research is anchored on Bandura's (1997) self-efficacy theory. This theory determines the behavior of an individual based on his/her perception of his/her abilities. Bandura (1997) stated that self-efficacy is the perception of the ability to fulfill the actions necessary to achieve specific goals. This theory also explains how the perception of an individual may cause anxiety. Anxiety is caused by a lack of self-efficacy in acting overtly as well as a lack of self-efficacy in controlling frightening thoughts. This means that self-efficacy is linked to the anxiety that a person experiences.

This study also used the concepts of statistics self-efficacy competencies by Lane et al. (2002), research proposal writing components by Onwegbuzie (1996), and research confidence factors by Bieschke et al. (1996).

Lane et al. (2002) developed a statistics self-efficacy measure. The competencies were identified by the respondent's perceived important variables. The competencies yielded six themes, which are described as follows: (1) lecture behavior – the efficacy to focus during statistics discussion; (2) using information technology – the efficacy to utilize technology in statistics; (3) motivated behavior – the efficacy to be motivated in statistics; (4) time management – the efficacy to organize time in accomplishing statistical tasks; (5) statistical theory – the efficacy to understand and utilize statistical concepts; and (6) general competencies – the competencies that affect self-efficacy in statistics but do not fall under other factors, which include being patient, being able to do data collection and being collaborative in statistical tasks.

As per Edward Lee Thorndike's Law of Readiness, anxiety is developed when a learner is forced to confront ideas without prior conditioning. This implies that learning only happens when the learner is prepared to learn the concepts (EduGyan, 2017). This supports the idea that unpreparedness is one of the factors that may determine annoyance toward research. Onwegbuzie (1996) described the components of the research proposal writing process as follows: (1) library anxiety – the anxiety in utilizing libraries; (2) statistics anxiety – the fear of doing statistical tasks in research; (3) composition anxiety – anxiety in writing research; and (4) research process anxiety – the fear of accomplishing tasks in research. Furthermore, provisions of compelling evidence that composing a research proposal induces anxiety in individuals

were also emphasized, therefore, making these components indicators of research anxiety as well.

Research anxiety has been linked to research confidence. Bieschke et al. (1996) developed an instrument designed to measure a person's confidence in accomplishing research-related tasks. Early tasks, conceptualization, and implementation were determined to be significant predictors of research confidence while the factor presenting the results is not found to be a significant predictor. Bieschke et. al (1996) described the components of research confidence as follows: (1) early tasks – confidence to create new research idea; (2) conceptualization – confidence to organize ideas about a research concept; and (3) implementation – confidence to implement and analyze the results of research.

This study is similar to Tasgin and Kaya (2018), who claim that a negative correlation exists between statistics attitude and research anxiety. This is also parallel to the studies of Razavi et al. (2017) and Rezaei and Miandashti (2013), who suggested that post-graduate students with high research anxiety have low research confidence. The study of Li (2012) is also linked to this study, where confidence in research methodology and statistics is directly proportionate to confidence in conducting research. Moreover, since pre-service teachers have moderate self-efficacy in statistics (Mustam et al., 2020), researchers wonder whether the same holds true for pre-service mathematics teachers given that they are more exposed to statistics.

Given these pieces of literature, they suggest that statistics self-efficacy can be linked with research anxiety and research confidence. Investigating these variables serves as an initial step towards improving the performance of the Philippines in mathematics education research.

Hence, the focus of the study includes the independent variable, which is statistics self-efficacy, and the dependent variables, which

are research anxiety and research confidence. Under statistics self-efficacy are lecture behavior, using information technology, motivated behavior, time management, statistical theory, and general competencies. On the other hand, the components of research anxiety are library anxiety, statistics anxiety, composition anxiety, and research process anxiety. Finally, research confidence is investigated using the terms early tasks, conceptualization, and implementation.

This study examined the relationship between statistics self-efficacy towards research anxiety and research confidence. This study also explained how statistics self-efficacy can predict research confidence.

■ METHODS

Participants

This study employed non-probability sampling, specifically purposive sampling in choosing the respondents. The respondents were from one state university in the Philippines. The second-year, third-year and fourth-year students of Bachelor of Secondary Education, Major in Mathematics students were chosen since they have already taken statistics subject and research. There are 13 second-year respondents, 27 third-year respondents and 31 fourth-year respondents. The total respondents to this study are 71.

Research Design and Procedures

This study used a descriptive correlational design to characterize the respondents' perceived levels of statistics self-efficacy, research anxiety, and research confidence (Loeb et al.,2017) and to examine if an increase or decrease in statistics self-efficacy will correspond to an increase or decrease in research anxiety and research confidence (Tan, 2014).

The researchers secured permission to conduct this study on the state university's administration and the respondents.

Respondents were ensured that the data was subject to confidentiality. Code names were used in the data analysis to protect the identity of the respondents.

Since the questionnaires that were utilized in this study were adapted from existing questionnaires, the instruments were validated from the 4th week of March to the 1st week of April 2022. After ensuring the quality of the instrument, the researchers administered pilot testing on the 2nd week of April; 2022. This research was implemented on the 3rd to 4th week of April; 2022, where researchers disseminated the questionnaires through Google Forms. Analysis and treatment of the data were done in May, 2022. After the collection of data, the following statistical measures and tests were applied to address specific study problems.

Instruments

The researchers utilized adapted research instruments from Lane et al.'s (2002) Statistics Self-Efficacy Measure, Onwuegbuzie's (2003) Research Anxiety Rating Scale and Research Self-Efficacy Scale constructed by Bieschke et al. (1996). The adapted instruments underwent validation and test reliability. Pilot testing revealed acceptable to excellent reliability for lecture behavior (α=.664), using information technology (α=.636), motivated behavior (α=.788), time management (α=.816), statistical theory (α=.879), general competencies (α=.860), library anxiety ($á$=.885), statistics anxiety (α=.939), composition anxiety (α=.851), research process anxiety (α=.902), early tasks($á$=.823), conceptualization (α=.953) and implementation (α=.937).

Data Analysis

The mean and standard deviation were used to analyze the respondents' perceived statistics self-efficacy, research anxiety, and research confidence. Cited in Table 1 is the legend utilized to interpret the perceived statistics self-efficacy, research anxiety, and research confidence of mathematics pre-service teachers.

Table 1. Basis for the interpretation of statistics self-efficacy, research anxiety and research confidence

Score	General Interpretation	Statistics Self-Efficacy Interpretation	Research Anxiety Interpretation	Research Confidence Interpretation
1.00 - 1.49	Strongly Disagree	Not Efficacious at All	Not Anxious at All	Not Confident at All
1.50 - 2.49	Disagree	Lowly Efficacious	Lowly Anxious	Lowly Confident
2.50 - 3.49	Agree	Efficacious	Anxious	Confident
3.50 - 4.00	Strongly Agree	Highly Efficacious	Highly Anxious	Highly Confident

On the other hand, Kolmogorov-Smirnov test was employed to assess whether the data is normally distributed to analyze the relationship between statistics self-efficacy and research anxiety, and statistics self-efficacy and research confidence. Pearson Product Moment Correlation was used since the data were approximately normal to determine if a significant relationship existed between the independent and dependent variables. Moreover, multiple linear regression was utilized to analyze whether statistics self-efficacy could predict research anxiety and research confidence.

■ **RESULTS AND DISCUSSION**

Table 2 displays the perceived self-efficacy of mathematics pre-service teachers. The first indicator described the lecture behavior with an

Table 2. Perceived statistics self-efficacy

Indicators	Mean	SD	Verbal Interpretation
lecture behavior	3.22	0.47	Efficacious
using information technology	3.06	0.45	Efficacious
motivated behavior	3.39	0.46	Efficacious
time management	3.18	0.54	Efficacious
statistical theory	3.22	0.41	Efficacious
general competencies	3.29	0.06	Efficacious

overall mean of 3.22 and an overall standard deviation of 0.47. This component is interpreted as "efficacious". This result demonstrates that the respondents were efficacious in paying attention during statistics class despite having distractions. Digging deeper, respondents knew how to comprehend statistical concepts as mathematics major. As a result, this helps to create or improve self-efficacy by reinforcing individual beliefs and demonstrating mastery. According to Li and Lerner (2013), great focus and positive emotions inside the classroom will likely serve a crucial role in the student's educational experience, and that fuels a student's perception of self-efficacy. The behavior of students during lecture discussions leads to self-efficacy which could result in having an interest in mathematics (Viljaranta et al., 2014).

The second indicator shows the perception of the respondents towards self-efficacy in statistics in terms of using information technology, with an overall mean of 3.06 and an overall standard deviation of 0.45. This component is interpreted as "efficacious". This suggests that pre-service mathematics teachers are efficacious in utilizing technology to accomplish tasks in statistics. Technology makes the process of interpreting data easier. Hence, integrating it to complete statistical tasks boosts confidence. According to Poliak (2019), technology is an efficient instrument for providing individuals with the tools needed to comprehend statistical concepts and ideas. Given that the use of technology in statistics is integrated into all of the respondents' statistics-related subjects, the respondents still perceive themselves as efficacious instead of highly efficacious due to some challenges. In this regard, the use of Excel, SPSS, and other statistical applications requires the use of a laptop. During the start of online classes amidst the pandemic, several students were observed to post fund-raising projects aimed at purchasing laptops due to a lack of sources. As per Flores et al. (2017), the availability of resources and self-efficacy influence how teachers efficaciously utilize technology in their tasks.

Indicator 3 illustrates how pre-service mathematics teachers perceive statistics self-efficacy in terms of motivated behavior. This component has an overall mean of 3.39 and a standard deviation of 0.46, indicating that the respondents perceive themselves as motivated to accomplish statistical tasks. Pre-service mathematics teachers were found to be confident in studying statistics. Mundia and Metussin (2019) demonstrated that students who believe in their own abilities are motivated to study strategically.

Table 2 also shows the perceived statistics self-efficacy in terms of time management. This component has a 3.18 overall mean and a 0.54 overall standard deviation, implying "efficacious". This entails that the respondents are efficacious in statistics by having the initiative to organize time effectively to accomplish statistical tasks. Pre-service mathematics teachers show confidence by creating schedules for statistics-related activities. As per Maloney et al. (2013), students who believe to have good time management skills consider themselves efficient in doing tasks.

Indicator 5 presents the respondents' assessed self-efficacy in statistics in terms of statistical theory with an overall mean of 3.22 and a standard deviation of 0.41. This component is interpreted as "efficacious". The respondents are efficacious in utilizing and comprehending statistical concepts. Since the respondents were mathematics majors, prior knowledge of mathematics aided them in understanding statistical concepts. As mentioned by Chiesi and Bruno (2021) and Sese et al. (2015), mathematical background predicts an individual's confidence in the use and application of statistics. Besides the fact that the respondents are mathematics majors, there are several statistics concepts and subjects that were encountered by them during junior and senior high school. Considering that higher education mathematics students have several statistics subjects; it is expected that they are highly efficacious towards statistics. Even though this finding is unexpected, it is congruent with Wilson and Mack (2014) and Mustam et al. (2020) where pre-service teachers have an average understanding of statistics making them confident in applying statistical information.

Finally, the respondents' perceived statistical self-efficacy in terms of general competency has an overall mean of 3.29, with a standard deviation of 0.06, and is interpreted as "efficacious". This states that respondents were confident in collecting information, remaining patient, and collaborating with others in completing statistical tasks, considering that all indicators were also regarded as "efficacious". These attitudes reveal the efficacy of the respondents in statistics subjects. These findings were supported by Rosli et al. (2017), where positive statistics attitudes were present among students. A positive attitude influences the students to be patient, confident, and willing to work with others while accomplishing a task.

Table 3. Perceived research anxiety

Indicators	Mean	SD	Verbal Interpretation
library anxiety	2.40	0.69	Lowly Anxious
statistics anxiety	2.50	0.67	Anxious
composition anxiety	2.76	0.66	Anxious
research process anxiety	2.82	0.68	Anxious

Table 3 depicts mathematics pre-service teachers' perceived research anxiety in terms of library anxiety, statistics anxiety, composition anxiety, and research process anxiety.

Pre-service mathematics teachers believe that lack of skills to access information in online libraries is evident. Moreover, library anxiety has an overall mean of 2.40 and is the only component of research anxiety interpreted as "lowly anxious". This implies that respondents were lowly anxious about using online libraries. Prospective mathematics teachers were somewhat afraid to utilize online libraries to find useful information in making research. This result is contrary to Popoopla and Olajide (2021) and McPherson (2015), where most undergraduate students experience high levels of library anxiety.

Table 3 also displays mathematics pre-service teachers' perceived statistics anxiety, with an overall mean of 2.50 and an overall standard deviation of 0.67, which is interpreted as "anxious". This implies that the respondents are anxious about accomplishing statistical tasks in research. Pre-service mathematics teachers were afraid to perform statistical tasks inappropriately. Although the result is consistent with Yusuf et al. (2019) that statistical anxiety exists among pre-service mathematics teachers, particularly in terms of studying and putting it into practice, this result is unexpected since the respondents were

found to be efficacious in statistics. It contradicts McGrath et al. (2015), where statistics self-efficacy is negatively related to statistics anxiety. This means that if the respondents were efficacious in statistics, then they would be less anxious about it.

Indicator 3 illustrates mathematics pre-service teachers' perceived research anxiety in terms of composition anxiety with an overall mean of 2.76 and an overall standard deviation of 0.66, which is interpreted as "anxious". This reveals that the pre-service mathematics teachers were anxious about writing research. It is evident that respondents experienced numerous symptoms of anxiety while composing their study. This conclusion is in line with Ho (2015) that students experience research composition anxiety. Kara (2013) explained that students who suggest having writing anxiety are not used to writing occasionally. Since the respondents of this study were mathematics majors, their chosen field of specialization does not require frequent composition of written outputs, making them anxious about writing.

Finally, table 3 shows mathematics pre-service teachers' perceived research anxiety in terms of research process anxiety. This component has an overall mean of 2.82 and an overall standard deviation of 0.68, indicating "anxious". This implies that the respondents were anxious about the process of accomplishing research. Pre-service mathematics teachers experience symptoms of anxiety, especially when faced with challenges. Cardwell et al. (2017) explained that typical research obstacles rapidly demotivate students, making them easily anxious about research.

As can be gleaned from table 4, the overall mean of mathematics pre-service teachers' research confidence in terms of early tasks is 3.05 and has an overall standard deviation of 0.39 which is interpreted as "confident". This finding implies that pre-service mathematics teachers are

Table 4. Perceived research confidence

Indicators	Mean	SD	Verbal Interpretation
early tasks	3.05	0.39	Confident
conceptualization	3.03	0.39	Confident
implementation	3.10	0.42	Confident

confident enough to develop a new research concept. The respondents believe to have satisfactory skills in generating fresh research ideas. One factor that can be attributed to this is that before pre-service mathematics teachers wrote research, the institution required the students to learn the basics of research in a whole semester. This allowed the students to have adequate time to develop new concepts and ideas to investigate in research. This is coherent with Finch et al. (2013) who observed that researchers were efficacious and competent in performing basic research activities such as identifying literature and generating new study ideas.

The respondents' perceived research confidence as to conceptualization has an overall standard deviation of 0.39 and is noted as "confident". Pre-service mathematics teachers were reported to be self-assured when working through chapters one to two of the research. The respondents are confident in formulating the concepts behind research ideas. Finch et al. (2013) have a contradicting result where researchers were found to have minimal confidence in developing study concepts for the research proposal. These researchers were interested but had no experience establishing research topics and were hesitant to create chapters one and two. On the other hand, the respondents of this study were confident in conceptualizing research ideas since they had already made several research projects as part of senior high school and college requirements. Furthermore, the respondents have a separate subject that emphasizes conceptualizing research before proceeding to implementation. That

subject focuses on establishing a gap in the literature, conceptualizing ideas, and writing the initial chapters of a study. Additionally, the presence and guidance of research advisers contribute to building concepts for new ideas to explore.

Table 4 also shows the outcomes of research confidence of mathematics pre-service teachers in terms of implementation. The overall mean is 3.10, with a standard deviation of 0.42. which is interpreted as "confident" while conducting research. Pre-service mathematics teachers perceive that they have sufficient skills to accomplish implementation tasks in their study. On the contrary, Finch et al. (2013) revealed that researchers were feeling little to no confidence in implementing research. Just like in conceptualizing, respondents have encountered some to no experience in implementing research. The results of this study revealed otherwise since pre-service mathematics teachers have already experienced conducting research. In addition, the respondents are the first three batches of K–12 students and have already encountered creating research as part of senior high school and even college requirements. More than that, the respondents were guided by experienced mathematics research advisers at their institution. Eighty-seven percent of the respondents' advisers have already published numerous research publications in reputable research index journals and have been cited by local and international authors. The expertise of research advisers has aided pre-service mathematics teachers in doing research.

Table 5 presents the relationship between statistics self-efficacy towards research anxiety and research confidence. It can be shown that statistics self-efficacy has a weak negative significant relationship with research anxiety in terms of motivated behavior (r=-0.269) and statistical theory (r=-0.239). This concludes that if pre-service mathematics teachers were

Table 5. Relationship of statistics self-efficacy, research anxiety and research confidence

Statistics Self-Efficacy	Research Anxiety	Research Confidence
lecture behavior	-0.089	0.503**
using information technology	-0.120	0.370**
motivated behavior	-0.269*	0.497**
time management	-0.155	0.552**
statistical theory	-0.239*	0.665**
general competencies	-0.093	0.195

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

efficacious towards motivation and knowledge in statistics, they would tend to have lower levels of research anxiety. On the other hand, statistics self-efficacy has no relationship with research anxiety in terms of lecture behavior, using information technology, time management, and general competencies. This shows that research anxiety is unrelated to how respondents are efficacious in behaving during the discussion, using technology, managing time, remaining patient, gathering data, and communicating with others throughout statistics tasks. This finding is not congruent with Tasgin and Kaya (2018), where it is found that there is an existing relationship between the teacher's research anxiety and their perception of statistics.

In terms of general competency, the table also shows that statistical self-efficacy is not significantly related to research confidence. The confidence of mathematics pre-service teachers in collecting data, being patient, and collaborating with others is unrelated to research confidence. Nevertheless, statistics self-efficacy has a

moderate positive significant relationship with research confidence in terms of lecture behavior (r=0.503), using information technology (=0.370), motivated behavior (r=0.497), and time management (r=0.552). In addition, there is a strong positive significant relationship in terms of statistical theory towards research confidence (r=0.665). The result suggests that pre-service mathematics teacher's statistical self-efficacy is directly linked to research confidence. This means that high level

This means that a high level of self-efficacy in statistics means high confidence in research. On the other hand, if a student is not efficacious in statistics, the student is more likely to be less confident in research making. The result of this study contradicts the findings of Cordova et al. (2014) that self-efficacy in prior knowledge may not be useful for conceptual change learning. That is, being knowledgeable about statistics does not guarantee that a student will have the same level of confidence in subjects that utilize statistical concepts like research.

Table 6 illustrates how statistics self-efficacy predicts research confidence. Regression analysis is applied to determine that the statistics self-efficacy in terms of statistical theory and time management significantly predict research confidence, $F(2, 68) = 30.970$, $p = 0.000$, $R^2 = 0.477$. That is, a one-unit change in the respondents' statistical theory and time management predicts a 0.465 and 0.158 unit change in research confidence, respectively.

This signifies that research confidence can be predicted if students are efficacious in statistics in terms of time management and statistical theory. Pre-service mathematics teachers who are confident in their ability to manage time while completing statistics-related tasks are similarly confident in research-making. The same holds true if the students are efficacious in applying statistical knowledge to statistical tasks. The relationship of statistical theory to research self-efficacy was backed by Gotch and French (2014).

Table 6. Test of prediction of statistics self-efficacy to research confidence

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.063	0.257		4.141	0.000
statistical theory	0.465	0.098	0.524	4.729	0.000
time management	0.158	0.075	0.232	2.098	0.040

Although limited, teachers' knowledge of a particular subject was related to perceiving confidence. This implies that teachers who have adequate statistical knowledge were confident in conducting research since statistical concepts are applied research. Furthermore, this is parallel to Behnam et al. (2014) that students who have better time management skills experienced higher self-efficacy as compared to those who were not. Likewise, those who have improved time management skills tend to have increased

confidence levels. Consequently, time management workshops can be utilized to improve the self-efficacy of students.

■ CONCLUSIONS

The main purpose of this study is to describe the respondents' perceived statistics self-efficacy, research anxiety, and research confidence. The results revealed that pre-service mathematics teachers perceive themselves to be efficacious towards statistics in terms of lecture behavior,

using information technology, motivated behavior, time management, statistical theory, and general competencies. In terms of research anxiety, respondents were slightly anxious about library anxiety but agreed to have statistics anxiety, composition anxiety, and research process anxiety. Moreover, pre-service mathematics teachers were confident in research in terms of early tasks, conceptualization, and implementation.

The study also revealed that there is a weak negative significant relationship between statistics self-efficacy and research anxiety in terms of motivated behavior and statistical theory. The number of respondents included in the study could be one of the variables that made most components of statistics self-efficacy not significantly related to research anxiety. Due to the pandemic, this study is solely limited to the second-year, third-year, and fourth-year mathematics prospective teachers in one state university in the Philippines. On the other hand, a strong positive significant relationship was found between statistics self-efficacy and research confidence in all terms except general competencies.

It was also shown in this study that statistics self-efficacy can also predict research confidence in terms of time management and statistical theory. With this, it is suggested that workshops and interventions may be employed to improve statistics self-efficacy which in turn would lessen research anxiety and enhance research confidence. Furthermore, this study discovered that statistics self-efficacy can predict research anxiety as to motivated behavior. However, given its numbers, further studies can be done to confirm the results.

■ REFERENCES

Ashrafi-Rizi, H., Zarmehr, F., Bahrami, S., Ghazavi-Khorasgani, Z., Kazempour, Z., & Shahrzadi, L. (2014). Study on research anxiety among faculty members of Isfahan university of medical sciences. Mater Sociomed, 26(6):356-9.

Baloglu, M., Abbassi, A., & Kesici, S. (2017). Multivariate relationships between statistics anxiety and motivational beliefs. Education, 137, 430–444.

Basco, L. M., & Han, S. (2016). Self-esteem, Motivation, and Anxiety of Korean University Students. Journal of Language Teaching and Research, Vol. 7, No. 6, pp. 1069-1078. DOI: http://dx.doi.org/10.17507/jltr.0706.02.

Bieschke, K. J., Bishop, R. M., & Garcia, V. L. (1996). The Utility of the Research Self-Efficacy Scale. Volume: 4 issue:1, pages: 59-75. https://doi.org/10.1177/106907279600400104.

British Council (2015). Research Performance in South-East Asia. https://www.britishcouoncil.org/education/he-science/knowledge-centre/partnerships-collaboration/research-performance-seaasia.

Brunila, K., & Valero, P. (2017). Anxiety and the making of research(ing) subjects in neoliberal academia Subjectivity. https://doi.org/10.1057/s41286-017-0043-9.

Cardwell, J. M., Magnier, K., Kinnison, T., Silva-Fletcher, A. (2017). Student experiences and perceptions of compulsory research projects: a veterinary perspective. Veterinary Record Open 4:e000243. doi:10.1136/vetreco-2017-000243.

Chiesi, F. & Bruno, F. (2021). Mean differences and individual changes in nursing students' attitudes towards statistics: the role of math background personality traits. Nurse Education in Practice, 52(2021) 103043. https://doi.org/10.1016/j.nepr.2021.103043.

Cordova, J. R., Sinatra, G. M., JOnes, S. H., Taasoobshirazi, G., & Lombardi, D.

(2014). Confidence in prior knowledge, self-efficacy, interest and prior knowledge: Influences on conceptual change. Contemporary Educational Psychology 39 (2014) 164–174. http://dx.doi.org/10.1016/j.cedpsych.2014.03.006.

Department of Education (2016). Department of education memo order nos. 291, s. 2008. Guidelines for the implementation of CSC resolution no.080096 on working hours for public school teachers.

Retrieved from EduGyan: http://www.edugyan.in/2017/03/edward-lee-thorndike-theory-of-learning.html

Finch, E., Cornwell, P., Ward, E. C., & McPhail, S. M. (2013). Factors influencing research engagement: research interest, confidence and experience in an Australian speech-language pathology workforce. BMC Health Services Research. doi:10.1186/1472-6963-13-144.

Flores, J. G., Santero, J. R. & Gordillo, J. J. T. (2017). Factors that explain the use of ICT in secondary-education classrooms: The role of teacher characteristics and school infrastracture. Computers in Human Behavior, 68 (2017) 441-449. https://dx.doi.org/10.1016/j.chb.2016.11.057

Guido, R. M. & Orleans, A. (2020). Philippine Research Productivity in Education Research: A Comparative Performance in Southeast Asia. 8, 76-90.

Hannigan, A., Gill, O. & Leavy, A.M. (2013). An investigation of prospective secondary Mathematics teachers' conceptual knowledge of and attitudes towards statistics. Journal of Mathematics Teacher Education, 16, 427-449.

Hemmings, B. (2012). Sources of research confidence for early career academics: A qualitative study. CSU Research Output, 0729-4360, Vol. 31, Issue 2, pages 171-184. http://researchoutput.csu.edu.au.

Ho, M. (2015). Exploring writing anxiety and self-efficacy among efl graduate students in taiwan. higher education studies; Vol. 6, No. 1; 2016 doi: 10.5539/hes.v6n1p24.

Lane, A. (2002). Development of a measure of self-efficacy specific to statistics courses in sport. Journal of Hospitality, Leisure, Sport and Tourism Education. 1(2), 47-56. doi:10.3794/johlste.12.17.

Loo, C. W. & Choy, J.L.F. (2013). Sources of self-efficacy influencing academic performance of engineering students. American Journal of Educational Research, 2013, Vol. 1, No. 3, 86-92. DOI:10.12691/education-1-3-4.

Kara, S. (2013). Writing anxiety: a case study on students' reasons for anxiety in writing classes. Anadolu Journal of Educational Sciences International (AJESI), 3(1), 103-111.

Li, L. (2016). The Statistics in Daily Life. International Conference on Sensor Network and Computer Engineering, 591-595. https://doi.org/10.2991/icsnce-16.2016.115.

Li, Y., & Lerner, R. M. (2013). Interrelations of behavioral, emotional, and cognitive school engagement in high school students. Journal of Youth and Adolescence, 42(1), 20-32.

Livinti, R. Gunnesh-Luca, G., & Iliescu, D., (2021). Research self-efficacy: a meta-analysis. Educational Psychologist, 56:3, 215-242. https://doi.org/10.1080/00461520.2021.1886103.

Loeb, S., Dynarski, S., McFarland, D., Reardon, S., & Reber, S. (2017). Descriptive analysis in education: a guide fo researchers.

Loewen, S., Gonulal, T., Isbell, D., Ballard, L., Crowther, D., Lim, J., & Tigchelaar, M. (2020). How knowledgeable are applied linguistics and SLA researchers about basic statistics?: data from north america and

europe. Studies in Second Language Acquisition, 42(4), 871-890. doi:10.1017/S0272263119000548

Lovett, J. N., & Lee, H. S. (2017). Making sense of data: Context matters.Mathematics Teaching in the Middle School, 21(6), 338-347.

Maloney, P., Dent, L. A., & Karp, T. (2013). A new method of assessing the effects of service-learning class on engineering graduate students. International Journal for Service learning in Engineering, Special Edition, pp.29-47, Fall 2013, ISSN 1555-9033.

McGrath, A. L., Ferns, A., Greiner, L., Wanamaker, K. & Brown, S. (2015). Reducing Anxiety and Increasing Self-efficacy within an Advanced Graduate Psychology Statistics Course. The Canadian Journal for the Scholarship of Teaching and Learning, 6 (1). http://dx.doi.org/10.5206/cjsotl-rcacea.2015.1.5.

McPherson, M. A. (2015). Library anxiety among university students: A survey. IFLA Journal, 41(4), 317-325. https://doi.org/10.1177/0340035215603993.

Mettassari, G. (2013). Self-Esteem, achievement motivation, self-efficacy and students' anxiety in speaking. ejournal.undiksha.id/index.php/JPP/article/view/2767/2328.

Mohammed, A. (2012). EFL effective factors: anxiety and motivation and their effect on Saudi college students' achievement. library.iated.org/view/MOHAMMED2011EFL.

Mundia, L., & Metussin, K. (2019). Exploring factors that improve mathematics achievement in Brunei. Studies in Educational Evaluation, 60, 214-222

Mustam, A. A., Adnan, M., Johnny, J., & Setambah, M. A. B. (2019). Attitude towards statistics among pre-service teachers of institute of teacher education.

Journal of Physics: Conference Series 1521 (2020) 032011 IOP Publishing. DOI: 10.1088/1742-6596/1521/3/032011.

Ogbonnaya, K. E., Okechi, B. C., & Nwankwo, B. C. (2019). Impact of statistics anxiety and self-efficacy on statistical performance of psychology students. Nigerian Journal of Social Psychology, Volume 2, No. 2.

Oguan, F.E. Jr. (2014). Attitude and anxiety towards research, its influence on the students' achievement in the course. Asian Journal of Management Sciences & Education, 3(4), 165-172.

Onwuegbuzie, J. (1996). Patterns of enrollment and achievement in research methodology courses. Manuscript submitted for publication.

Onwegbuzie, A. J. (2003). Development and score-validation of the research anxiety rating scale. International Journal of Research in Education Methodology, Vol.4, No.2. ISSN:2278-7690.

Poliak, C. (2019). The Use of Technology in statistics courses. american society for engineering education. 2019 ASEE Annual Conference & Exposition, DOI 10.18260/1-2—33435.

Putri, N. D. & Musdi, E. (2020). Analysis of students Initial mathematical communication skills in mathematics learning. Journal of Physics: Conference Series, 1554 (2020) 012064 doi:10.1088/1742-6596/1554/1/012064

Rasheed, R. A., Kamsim, A., & Abdullah, N. A. (2019). Challenges in the online component of blended learning: A systematic review. Elsevier Ltd. Computers & Education, 144, 103701. https://doi.org/10.1016/j.compedu.2019.103701.

Retutas, M., & Rubio (2019). Multivariate analysis on performance in statistics, self-efficacy and attitudes of senior high school

students. Journal of Research and Advances in Mathematics Education. Volume 6, Issue 4, pp. 352-367 p-ISSN: 2503-3697, e-ISSN: 2541-2590 10.23917/jramathedu.v6i4.14368.

Rezaei, M. & Zamani-Miandashti, N. (2013). The Relationship between Research Self-efficacy, Research Anxiety and Attitude toward Research: A Study of Agricultural Graduate Students. Journal of Educational and Instructional Studies in the World, 3(4), 69-78.

Robinson R.S. (2014) Purposive Sampling. In: Michalos A.C. (eds) Encyclopedia of Quality of Life and Well-Being Research. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-0753-5_2337.

Rosli, M. K., Maat, S. M., & Rosli, R. (2017). Students' attitude and anxiety towards statistics: a descriptive analysis. Research on Education and Psychology 1(1), 47-56, e-ISSN: 2602-3733.

Salazar, L. R. (2018). Examining the relationship between math self-efficacy and statistics motivation in the introductory business statistics course: Self-Compassion as a mediator. Decision Sciences Journal of Innovative Education, 16 (2), 140-160. https://doi.org/10.1111/dsji.12149

Salim, N. R., Gopal, K., & Ayub, A. F. M. (2018). The influence of statistics self-efficacy towards statistics engagement among undergraduate students. https://doi.org/10.1063/1.5041705

Salkind, N. J. & Frey, B. B. (2021). Statistics for people who (think they) hate statistics: Using Microsoft Excel (fifth edition). Sage Publications.

Seplaki, C. L., Agree, E. M., Weiss, C. O., Szanton, S. L., Bandeen-Rochee, K., & Fried, L. P. (2014). Assistive devices in context: Cross-sectional association between challenges in the home environment and use of assistive devices for mobility. The Gerontologist, Vol. 54, No. 4, 651–660 doi:10.1093/geront/gnt030

Sese, A., Jimenez, R., Montaño, J. J., & Palmer, A. (2015). Can attitudes towards statistics and statistics anxiety explain students' performance? Rev. Psicodidact. 20(2), 285-304. https://doi.org/10.1387/RevPsicodidact.13080.

Shaukat, S. (2014). Postgraduate students' attitudes towards research. Bulletin of Education and Research, 36(1), 111–122.

Smith, C. M., & Lauren, A. A. (2018). Peer influence, computer literacy skills and library anxiety of undergraduates in some South African universities. Journal of Education and information Technology, 1092), 120-135.

Swindoll, C. R. (2012). Quotable quotes. http://www.goodreads.com/quotes/-the-longest-i-live-the-more-i-realize-the-impact.

Tan, L. (2014). Correlational Study. In W. F. Thompson (Ed.), Music in the social and behavioral sciences: An encyclopedia (pp. 269-271). Thousand Oaks: SAGE Publications.

Taþgýn, A. & Kaya, Y. (2018). The Relationship between Preservice Teachers' Attitudes towards Statistics and Their Research Anxiety. International Journal of Assessment Tools in Education, 5 (4), 731-739. DOI: 10.21449/ijate.455177.

Viljaranta J., Tolvanen, A., Aunola, K. & Nurmi, J. (2014). The developmental dynamics between peer interest, self-concept of ability, and academic performance. Scandinavian Journal of Educational Research, 58(6), 734-756.

Wilson, R. & Mack, M. (2014) Declines in high school mathematics and science participation: Evidence of students'

and future teachers' disengagement with maths. International Journal of Innovation in Science and Mathematics Education 22(7):35-48.

Yusuf, Y., Suyitno, H., Sukestiyarno, Y. L., & Isnarto. (2019). The influence of statistical anxiety on statistic reasoning of pre-service mathematics teachers. Scientific Electronic Library Online, Bolema 33 (64). https://doi.org/10.1590/1980-4415v33ns64a12.