Lecturers Pedagogical Concepts in Reducing Student Anxiety in Statistics Courses

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ABSTRAK

Mahasiswa pascasarjana menunjukkan tingkat kecemasan yang tinggi dalam mempelajari Statistika; Kecemasan ini mempengaruhi apresiasi mereka terhadap mata kuliah statistika. Hal ini mendesak untuk diteliti karena terdapat perbedaan antara teori, harapan dan kenyataan di lapangan. Sehingga perlu dilakukan penelitian dengan tujuan untuk menganalisis perilaku pedagogi dosen Statistika yang tepat untuk mengurangi kecemasan mahasiswa pascasarjana. Metode penelitian yang digunakan adalah pendekatan studi kasus deskriptif yang dijalin ke dalam desain penjelasan sekuensial. Subjek penelitian adalah dosen dan mahasiswa pascasarjana. Data primer diperoleh dari 99 mahasiswa pascasarjana mengenai tingkat kecemasan mereka pada bidang Statistika dan pengalaman mereka terhadap perilaku pedagogi dosen. Selain itu, 12 mahasiswa pascasarjana diwawancarai tentang perilaku pedagogis mereka yang mengurangi kecemasan mereka dalam Statistik. Untuk melakukan triangulasi data primer, bukti penilaian praktik mengajar dosen diperoleh dari Direktorat Perencanaan Akademik dan Unit Penjaminan Mutu universitas. Hasil dan temuan bahwa terdapat 17 perilaku pedagogi dosen strategis pada perilaku umum (faktor afektif dan praktik pedagogi) dan pedagogi khusus (faktor kognitif) yang menurunkan kecemasan statistika mahasiswa pascasarjana dan meningkatkan sikap positif terhadap studi Statistika. Inilah kontribusi heuristik yang ditawarkan penelitian ini terhadap penerapan teori efisiensi pemrosesan. Oleh karena itu, pengenalan terhadap perilaku pedagogis tersebut dan keterbukaannya selama pengajaran Statistika akan sangat membantu dalam mengurangi tingkat kecemasan mahasiswa pascasarjana di bidang Statistika.

ABSTRACT

Graduate students show high levels of anxiety in studying Statistics; This anxiety affects their appreciation of statistics courses. This is urgent to research because there are differences between theory, expectations, and reality in the field. So, it is necessary to research to analyze the appropriate pedagogical behavior of Statistics teachers to reduce postgraduate student anxiety. The research method used is a descriptive case study approach woven into a sequential explanatory design. The research subjects were lecturers and postgraduate students. Primary data was obtained from 99 postgraduate students regarding their level of anxiety in the field of Statistics and their experiences with lecturers' pedagogical behavior. Additionally, 12 graduate students were interviewed about their pedagogical behaviors that reduced their anxiety in Statistics. To triangulate primary data, evidence of assessment of lecturers' teaching practices was obtained from the university's Directorate of Academic Planning and Quality Assurance Unit. The results and findings show that there are 17 strategic lecturer pedagogical behaviors in general behavior (affective factors and pedagogical practices) and specific pedagogy (cognitive factors) which reduce postgraduate students' statistics anxiety and increase positive attitudes towards statistics studies. This is the heuristic contribution that this research offers to the application of processing efficiency theory. Therefore, the introduction of these pedagogical behaviors and their openness during the teaching of Statistics will help reduce the anxiety level of graduate students in the field of Statistics.

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1. INTRODUCTION

At the higher education level, every student who wants to continue to a postgraduate program must complete a bachelor's degree from a university. It aims to broaden the depth of students' knowledge in a particular field and develop areas of expertise acquired at the undergraduate level (Colombo & Piva, 2020; Kelsey et al., 2020; Stuss et al., 2020). Entering students into postgraduate education programs to develop high levels of knowledge, understanding, analysis, and evaluation and to create new, innovative knowledge and to broaden students' academic abilities and engagement with research to help advance the course of society (Nowell et al., 2020; Perkmann et al., 2021; Uskov et al., 2015). It is hoped that universities can raise skilled manpower required in a country. In achieving all this, research is a formal field of study that is recognized by all education at the postgraduate level. Research is a way in the field of postgraduate education that equips students with the skills and knowledge necessary to encourage independent growth, creativity, and lifelong research. Therefore, "the nature and quality of research cannot be separated from the nature and quality of postgraduate education and future educational researchers"(Demiral & Çepni, 2018; Gümüş et al., 2020; Krishna, 2020). Therefore, it is not unusual that universities gain acceptance as respectable members of the global intellectual community through adherence to research credibility and capability standards.

The increasing high statistical anxiety among postgraduate students raises concerns across all universities in finding reliable ways in addressing the problem at hand. This paper argues that the pedagogical behaviors exhibited by statistics teachers at the universities and colleges during instructional periods should be analyzed and reported (Awan et al., 2021; Ma & Sun, 2020; Parlina et al., 2020; Thu et al., 2021); this is because available evidence points to the fact that classroom factors are significant contributors to postgraduate students' high level of statistical anxiety, and statistics teachers' poor attitude has been identified as a significant determinant of students' statistical anxiety, among other factors, such as mathematics phobia, disconnection to real life and poor instructional pace (Anderson & Secor, 2022; Mishra et al., 2020; Wen & Dubé, 2022). These factors question the pedagogical behaviors of statistics teachers. Previous study recommended an empirical investigation into the immediate pedagogical behavior's antecedent to students' statistical anxiety (Burić & Kim, 2020). Pedagogical behaviors, as gleaned are the characteristics and practices that teachers manifestly display during instructional sessions (Larsen et al., 2023; Tinh et al., 2021). Pedagogy is simply the nexus between teaching and learning and characteristics (teacher knowledge, patience, enthusiasm, methods of instruction, etc.) exhibited by teachers within the interaction of teaching and learning (de Oliveira et al., 2021; Gallardo, 2020; Lumbantoruan & Natalia, 2021).

This study takes a broader perspective in addressing statistics anxiety in undergraduate and graduate students rather than just focusing on teaching methods recommended by educators (Bolinski et al., 2020; Steinberger, 2020; Tindall & Curtis, 2020). In higher education, lecturers are the center of classroom interaction and they facilitate the learning process through a variety of pedagogical skills (Caviola et al., 2022; Elsalem et al., 2020). Therefore, an approach of profiling statistics lecturers' pedagogical behavior that precedes students' statistical anxiety might help to comprehensively document the appropriate characteristics that statistics lecturers should demonstrate during Statistics lessons to reduce, if not eliminate, the rise in students' statistical anxiety (Rahman, 2023; Spivey et al., 2020). Therefore, this paper focuses on postgraduate students' levels of statistics anxiety and their attitudes towards Statistics about their lecturers' pedagogical behavior with the ultimate aim of creating a profile of pedagogical behavior. The increasing statistical anxiety among students, both undergraduate and postgraduate students, seems to downplay the relevance of Statistics courses. For the past two decades, research efforts have been directed towards the development of strategies in addressing the problem. Approaches or strategies developed so far are both cognitive factors that are believed to reduce students' statistical anxiety (Rasouli et al., 2018; Teng et al., 2020). For example, in terms of the cognitive approaches utilized a one-minute paper strategy where students wrote on a paper the important concepts they learnt and indicated unanswered questions at the end of every instructional session (DeJarnette et al., 2020; Rasouli et al., 2018; Teng et al., 2020). This method was found to be effective in the reduction of undergraduate students' anxiety in Statistics. Previous study indicated that tapping students' cognitive abilities to increase engagement through intelligence-based, creative-based and practical-based instruction is an effective approach to reducing students' statistical anxiety (Perchtold-Stefan et al., 2024). Extant literature has documented numerous findings on non-cognitive approaches that helped to reduce students' statistical anxiety (Caviola et al., 2022; Steinberger, 2020).

Most of the non-cognitive approaches focused on teaching frameworks and learning approaches. For example examined the effectiveness of a specific teaching framework on students' anxiety and attitudes towards Statistics in a multivariate Statistics course (Malik & Ubaidillah, 2020). The framework

included teaching techniques such as the utilization of real-world examples, enthusiasm, humor and integration of theoretical knowledge and practical skills. Students had the opportunity to use data relevant to their theses. Consequently, a significant reduction was observed in their statistical anxiety. Other study confirmed that the integration of humor into instructional techniques enhances students' engagement and learning to reduce students' negative attitudes towards Statistics (Ramsay et al., 2020). Similarly, other study found that when humorous cartoons, statistical music videos, teachers' anecdotes concerning difficulties with Statistics and research on persistence in mathematics are used in a multifaceted teaching framework, students' statistical anxiety will be reduced. In addition to the use of humor (Dilekli & Tezci, 2020). Other study recommended the use of anonymous questions and reduced use of statistical formulas as well as teachers' behaviors such as exhibition of confidence and self-management of anxiety to reduce students' statistical anxiety (Abbas & Sherin, 2017). Also, found that the combination of application-oriented teaching methods with statistics teachers' concentration on students' anxiety in Statistics is an effective way of reducing their statistical anxiety.

Adopting the cooperative learning strategy (mixer) to teach factor analysis, previous study found that students' understanding was enhanced as they enjoyed the procedure (van Alten et al., 2020). Another study noted that graduate students' anxiety in Statistics was reduced as their instructors used approachable communicative behaviors to interact with them (Derakhshan et al., 2022). These approachable communicative behaviors are referred to as immediacy and it is defined as students' perception of instructors' nonverbal and verbal communication skills (Callingham & Watson, 2023; Henderson et al., 2020; A. I. Wang & Tahir, 2020). Other study found that poor communication between statistics teachers and students was the key factor for students' statistical anxiety (Berchiatti et al., 2020). So far, literature provides some good measures in addressing students' high statistical anxiety. The measures suggested are both cognitive - focusing on intellectual classroom activities and non-cognitive basically through the use of various teaching frameworks to boost students' interest and confidence in Statistics.

However, fundamental gaps must be filled to provide comprehensive measures to address the problem. A critical analysis of literature shows that most of the approaches adopted to dealing with students' statistical anxiety are through the use of some specific interventions rather than focusing on the pedagogical behaviors of statistics teachers that are antecedents to students' statistical anxiety (González-Valero et al., 2019; Kamińska et al., 2022; Ordóñez-Matamoros et al., 2020). For example, in the case of study a mixer was used to enhance students' understanding of only factor analysis; this approach appears to lack potency in addressing students' general anxiety in Statistics (Albagmi et al., 2022). This is because concerns are likely to be raised concerning other statistical topics without specific interventions. Also, the approach by other study appears to be effective, as it helped to improve students' interest and confidence but leaves out teacher characteristics which can negatively affect students' learning of Statistics (Brandmiller et al., 2020). Therefore other study recommended an empirical investigation into the immediate pedagogical behaviors antecedent to students' statistical anxiety from different contexts (Burić & Kim, 2020; Patricia Aguilera-Hermida, 2020). As a departure from previous studies, the current study focused on students' experiences and perspectives and investigated the pedagogical behaviors of their statistics teacher that are immediate antecedent to their (students) statistical anxiety and attitude towards Statistics.

This research is urgent to research because there are differences between theory, expectations, and reality in the field. The theory is that lecturers' mastery of statistics will reduce students' anxiety in pursuing higher education. It is hoped that lecturers who master statistics material can transform their knowledge to students and students are expected to be able to complete higher education through research and not experience obstacles in statistics. However, the reality in the field is that many students at undergraduate and postgraduate levels experience anxiety in statistics courses and quite a few experience obstacles in obtaining the desired degree because they are hindered in statistics which is needed in research and final assignments. The novelty of this study focus on appropriate pedagogical behavior of statistics teachers to reduce postgraduate student anxiety as well as the specific aim of the research to determine the level of anxiety of postgraduate students in studying Statistics courses, to analyze postgraduate students' attitudes towards Statistics, to see a statistically significant influence between postgraduate students' anxiety in Statistics subjects on their attitudes towards studying Statistics and to analyze the pedagogical behavior of lecturers in reducing the anxiety of postgraduate students in the field of Statistics.

2. METHOD

The method in this research is a case study with a sequential explanation design used in a case study strategy to help identify and classify the pedagogical behavior of statistics lecturers needed to

reduce students' statistical anxiety at the postgraduate level. Due to the gap between previous researchers regarding lecturer pedagogy in higher education, this research is different from before and this case study research carries out an in-depth and holistic exploration of the pedagogical behavior demonstrated by a statistics lecturer at the university level during the statistics course learning process and the statistics learning process. used as evidence in finding results and findings. A statistics lecturer at a university was studied as a case. To confirm that pedagogical behavior is an antecedent of low, medium, or high statistical anxiety of charging students, statistical (quantitative) anxiety data of consumption students was first collected. Afterward, documentary evidence and interviews were obtained to explain the observations made during the quantitative phase (Harrison et al., 2020).

The population is postgraduate students in the 2022/2023 academic year located at universities in Jakarta. The year taught statistical methods in educational research by the same university statistics lecturer. Each Statistics lecturer has gained six years of teaching experience in handling this subject and has helped improve student academic achievement in the field of Statistics; This encourages an examination of the pedagogical behavior demonstrated by students. Primary (via questionnaires and telephone interviews) and secondary (quality assessment reports) data were collected from lecturers through graduate students. Permission was obtained from the head of the Department who is responsible for programmers and the Directorate of Academic Planning and Quality Assurance, for the statistics lecturer's quality assessment report. Respondents and participants were guaranteed confidentiality and anonymity. In the quantitative and qualitative stages, 99 and 12 (12 produces the data saturation point) and postgraduate students respectively provided valid data.

Data collection technique. Data collection techniques using the Statistical Anxiety Rating Scale (STARS) developed by Cruise et al. (1985) were used to collect data about graduate students' anxieties and attitudes toward Statistics. STARS has gone through rigorous validation and revision. Recent validation suggests that the instrument although developed to measure statistics anxiety, also measures attitudes toward Statistics (Maric et al., 2023). Therefore, the three subscales first one is interpretation anxiety, text, and class anxiety, and students' fear of asking for help should be used to measure statistics anxiety, and the last three subscales – 'value of statistics', computing self-concept', and 'fear of statistics lecturers' should be used to measure attitudes towards Statistics. These recommendations were adhered to in this paper and further validation was carried out to suit the research context. Results of confirmatory factor analysis. An unstructured interview guide was used to collect qualitative data based on the quantitative findings (Flora, 2020; Kline & Walters, 2016). Table 1 presents the standardized weight, average variance extracted (AVE) and McDonald's omega.

Table 1. Anxiety Item Loading Statistics, AVE and Omega Estimates

Factors	Items	Loading	AVE	Omega
Statistic Anxiety				
Interpretation Anxiety	IA1	0.626	0.47	0.787
	IA2	0.602		
	IA3	0.844		
	IA4	0.649		
Test and Class Anxiety	TCA1	0.790	0.44	0.757
	TCA2	0.630		
	TCA3	0.499		
	TCA4	0.705		
Fear of Asking for Help	FAFH1	0.578	0.50	0.742
	FAFH2	0.818		
	FAFH3	0.708		
Attitude towards Anxiety				
Worth of Statistics	WS1	0.761	0.41	0.713
	WS2	0.689		
	WS3	0.418		
Computation Self-Concept	CSC1	0.602	0.64	0.875
	CSC2	0.828		
	CSC3	0.880		
	CSC4	0.858		
Fear of Statistics Teachers	FST1	0.865	0.40	0.622
	FST2	0.385		
	FST3	0.519		

Only one item (TCA3) under statistics anxiety and two items (WS3 and FST2) under attitude towards Statistics are below the threshold. Data analysis techniques in this research by looking for the mean and standard deviation are used to describe postgraduate students' statistical anxiety (exogenous variable) and attitudes towards statistics (endogenous variable). Structural equation modeling (SEM) through moment structure analysis (AMOS) is used to determine the relationship between the two variables mentioned above. Finally, qualitative data were analyzed inductively to identify pedagogical behaviors.

3. RESULT AND DISCUSSION

Result

The quantitative results are first presented after which the qualitative results are presented to provide possible explanations for the findings obtained during the quantitative phase of the study. The statistical anxiety of the students was first analyzed and the obtained results are presented in Table 2.

Table 2. Postgraduate Students' Level of Statistical Anxiety

Subscales	M	SD	Interpretation
Interpretation Anxiety	2.70	1.00	Moderate
Test and Class Anxiety	2.66	1.07	Moderate
Fear of Asking for Help	2.11	1.05	Low
Grand Mean/Standard Deviation	2.49	1.04	Low

Generally, the postgraduate students had a low level of statistical anxiety (M = 2.08, SD = 1.04). It appears that interpretation anxiety and test and class anxiety have the highest tendency to invoke anxious moments in postgraduate students during the study of Statistics. Hence, any practical ways of handling these two factors will help in drastically reducing postgraduate students' statistical anxiety to the barest level. Since data were gathered from students in three modes of study, there might be variations in terms of how they were handled and possibly affect their statistical anxiety. Hence, the influence of their mode of study on their statistical anxiety was examined and Table 3 presents the results.

Table 3. Influence of Students' Mode of Study on their Statistical Anxiety

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.117	2	0.559	0.820	0.443
Intercept	480.326	1	480.326	705.191	<0.001
StudyMode	1.117	2	0.559	0.820	0.443
Error	65.388	96	0.681		
Total	680.958	99			
Corrected Total	66.506	98			

Note: R Squared = 0.017 (Adjusted R Squared = -0.004); $p > 0.05$.

Base on Table 3, the univariate ANOVA model did not identify postgraduate students' mode of study as a significant factor to create any differences in their statistical anxiety. An examination of the R squared shows that modes of study accounted for a very small variation (0.017) in postgraduate students' statistical anxiety. The results appear to suggest that the observed low statistical anxiety depended on their teacher's pedagogical behaviors and not the different modes in which they were taught Statistics. A seeming reflection of the low statistical anxiety of the postgraduate students is presented in Table 4, which provides evidence of their attitudes towards the study of Statistics.

Table 4: Postgraduate Students' Attitude toward the Study of Statistics

Subscales	M	SD	Interpretation
Worth of Statistics	2.21	0.96	Positive
Computation Self-Concept	2.40	1.11	Positive
Fear of Statistics Teachers	1.62	0.78	Positive
Grand Mean/Standard Deviation	2.08	0.95	Positive

Scale Descriptors: 1.00-1.49 (highly positive), 1.50-2.49 (positive), 2.50-3.49 (moderate), 3.50-4.49 (negative), 4.50-5.00 (highly negative). Evidence in Table 4 indicates that the postgraduate students who exhibited a low level of statistical anxiety also demonstrated a positive perception to calculate statistics (M = 2.40, SD=1.11). They valued the worth of Statistics in postgraduate education (M = 2.21, SD = .96), hence, their positive attitude towards the study of Statistics. Therefore, an ostensible positive relationship is created between postgraduate students' statistical anxiety and attitude towards Statistics. A test of this observation was carried out through SEM using AMOS. Figure 3 presents the obtained structural model and Table 5 presents the detailed results.

Table 5. Postgraduate Students' Statistical Anxiety and Attitude towards Statistics

Path	B		BSE	CR	LLCI	ULCI	p
Constant	0.346		0.181	1.912	0.053	0.654	0.022
IA ---> ATT	0.248	0.312	0.085	2.918	0.151	0.499	0.009
TCA --->ATT	0.246	0.330	0.094	2.617	0.125	0.519	0.016
FAFHA ---> ATT	0.193	0.252	0.088	2.193	0.084	0.415	0.007

Base on Table 5, the path coefficient and the confidence interval for the exogenous and endogenous variables, thus postgraduate students' interpretation anxiety and attitude (B =0 .248, 95% CI [0.151, 0.499]), test and class anxiety and attitude (B = 0.246, 95% CI [0.125, 0.519]), fear of asking for help anxiety and attitude (B =0.193, 95% CI [0.084, 0.415) show that independently the statistics anxiety subscales have a significant effect on attitude towards Statistics. By inference, there is a positive relationship between postgraduate students' statistical anxiety and their attitude towards the study of Statistics. Thus, as their statistical anxiety reduces, a corresponding increasing positive attitude will be exhibited towards the study of Statistics. Consequently, a 51% change in postgraduate students' attitudes towards Statistics can be explained by their statistical anxiety; this effect is moderate. The low statistical anxiety exhibited by the postgraduate students was further analyzed from two data sources: evidence gathered from the DAPQA and interview data from the students. This was to identify the associated pedagogical behaviors exhibited during Statistics lessons. Table 6 presents the documentary evidence.

Table 6. Documentary Evidence of a University's Teacher Pedagogical Behaviors during Statistics Lessons

Core Areas	Subscales	Mean
	Course content based on outline provided	3.86
Course Content	Course Content likely to be covered	3.86
	Detailed course content	3.71
	Lecturer was regular	3.71
Attendance	Lecturer was punctual	3.86
	Lecturer stayed up to end of class	3.86
	Knowledge of the subject matter	3.71
	Well organized and systematic	3.86
	Effective communication	3.86
	Fully promote teaching and learning	3.86
	Encouraged independent study	3.86
Mode of Delivery	Encouraged students to analysis issues from different perspectives	3.71
	Accepted other viewpoints	3.86
	Made room for questions and answers	3.86
	Responses to questions were appropriate and informative	3.71
	Concerned with academic progress of students	3.71
	Graded assessments	4.00
Assessment	Graded assessments returned in good time	4.00
	Discussed graded assessments	4.00
Grand Mean		**3.83**

Base on Table 6, the results are reported as received from the DAPQA. The results covered quite a broader area of teacher pedagogical behaviors: right from the design of curriculum plans as reported in the area of statistical course outline to the assessment of students learning in the course. In all aspects, a display of very good performance was reported by the postgraduate students (regular students). As can be seen, assessment behaviors were significant in the list with the highest mean score (4.00). Assessments

were graded, returned and discussed with students in time to support their learning. The interview results give credence to the gathered documentary evidence presented next under identified pedagogical behaviors.

Discussion

The findings of this research are 17 important pedagogical behaviors that should be demonstrated by statistics lecturers to reduce graduate students' statistical anxiety and to foster a positive attitude toward the study of statistics. To ensure that their lecturers' pedagogical behavior was a direct antecedent of their statistics anxiety, their statistics anxiety was first examined and the study found that graduate students demonstrated low levels of statistics anxiety. These students are drawn from three learning modes (regular, sandwich, and distance education). However, their way of learning does not affect their statistics anxiety. The clear implication is that teacher educators play an important role in reducing students' statistical anxiety; this factor was noted as a major determinant of students' statistics anxiety. This finding is in line with previous findings that lecturers are the determinants of student success in statistics courses (Z. H. Wang et al., 2020; Jovanović et al., 2021; Almaiah & Alyoussef, 2019). Consequently, the expected outcome of positive students' attitudes towards Statistics was realized. These findings support the processing efficiency theory (Collet & Nakawa, 2022; Sahin & Yilmaz, 2020). The low level of students' statistical anxiety is reflected in the tendency for positive emotions (for example satisfaction and enthusiasm for studying Statistics) which results in a positive attitude toward learning Statistics. The SEM results confirm and conclude that there is a positive relationship between students' statistical anxiety and attitudes towards learning statistics. This means that students' low statistical anxiety results in a positive attitude towards learning statistics. It is theorized that low student statistics anxiety will result in a highly positive attitude towards learning Statistics. Heuristic contributions are made to the application of processing efficiency theory in overcoming students' statistical anxiety in the sense that cognitive factors, affective factors, and statistics teachers' pedagogical practices are direct strategies for reducing students' statistical anxiety.

The qualitative phase of the study linked the reported results to 17 general pedagogical behaviors (immediate antecedents) of their statistics lecturers. Five lecturer attributes, so that knowledge content in Statistics, practical statistics lessons, application of theoretical statistical knowledge, statistical problem solving, and critical explanation of technical statistical terminology are found and categorized in cognitive factors. The current research further argues that in addition to using a cognitive approach to engaging students to understand statistical concepts Statistics lecturers' content knowledge is essential in preventing possible confusion among undergraduate students during learning. Moreover, Statistics courses are notorious for having a lot of technical terminology that creates confusing problems for students. Therefore, students will appreciate statistics courses that critically explain technical terminology in statistics to prevent statistical anxiety. Affective factors identify four relevant lecturer attributes, namely interactive, funny, and lively lectures, teaching confidence, friendliness, and enthusiasm for teaching to reduce students' statistical anxiety. This finding is in line with previous research findings which stated that interactive lecturers can reduce students' anxiety in the learning process of statistics courses (Miller et al., 2019; Patricia Aguilera-Hermida, 2020; Hilliard et al., 2020). Confirmation of teacher humor is provided to strengthen existing literature. Lecturer self-confidence is also supported, as found in literature and friendliness, which shows the lecturer's abilities (Asare, 2023; Xie & Derakhshan, 2021). A factor that appears vaguely in the literature is the passion for teaching.

The final category is lecturers' pedagogical practices, which consist of eight attributes of an educator: organized and systematic delivery; student involvement; effective communication; encouragement of students, acceptance of views; punctuality and regularity; promotion of independent learning; and rapid assessment feedback and discussion. Although the existing literature categorically identifies student engagement (through the use of various active learning strategies) and communication attributes the rest are not conspicuously captured (Henrie et al., 2015; Setlight et al., 2023). Therefore, the current research projects that organized and systematic delivery of Statistics lessons are relevant for reducing students' statistical anxiety. Previously, poor communication between statistics students and students was known to increase statistics anxiety (Asare, 2023; Sharpe, 2013). This research found that assessment strategies can help reduce students' statistics anxiety. Evidence suggests that prompt feedback and discussion of assessment tasks are valued by graduate students. In summary, statistics pedagogical behavior is an important antecedent to students' statistical anxiety and attitudes toward the study of statistics. As a result, students tend to appreciate learning Statistics and show lower anxiety (considered functional anxiety) when 17 common pedagogical behaviors are demonstrated during Statistics teaching. It seems that general pedagogical behavior adds to specific pedagogical behavior in reducing the anxiety level of graduate students in the field of Statistics.

The implication of this research is to provide an overview for lecturers so that when teaching statistics courses, they pay attention to the factors that determine student success in studying statistics. Another implication of this research provides a complete picture that lecturers in teaching statistics courses pay attention to the methods and pedagogy used. appropriate in delivering statistical material to postgraduate students. The weakness of this research is that it did not find students' obstacles and difficulties in understanding statistics courses. This research does not fully understand what obstacles students face when studying statistics courses so feelings of anxiety often arise. This research is limited only to lecturer pedagogy. Suggestions, the learning process in Statistics courses should receive sufficient attention to maintain the credibility of universities and higher education institutions as members of the global intellectual community in developing students' innovative research and statistics skills. This will help the development of society through the advancement of systems, structures, and culture. Therefore, statistics lecturers must adopt a pluralistic teaching approach that embodies the cognitive factors, affective factors, as well as pedagogical practices necessary to support students' learning of Statistics in a non-threatening environment. In addition, the search for holistic antecedents of students' statistical anxiety can consider other supporting variables that are not direct factors of students' statistical anxiety in the classroom. This research recommends conducting the same research with a larger sample and finding the obstacles and difficulties of postgraduate students in studying statistics courses.

4. CONCLUSION

The anxiety of graduate students in statistics courses appears to be very complex and requires a multifaceted approach to overcoming the problem. Therefore, addressing graduate students' statistical anxiety by focusing on statistics lecturers' cognitive factors is a highly effective factor, and lecturers' pedagogical practices are recommended by the findings of this research to continue to be improved. If graduate students' statistical anxiety is cognitively developed and manifested through their emotions as posited by processing efficiency theory, then the above-mentioned pedagogical behaviors (cognitive factors, affective factors, and pedagogical practices) derived from graduate students' experiences with their statistical do seem highly credible. and is useful in reducing the statistical anxiety of graduate students. This is the heuristic contribution that this research offers to the application of processing efficiency theory.

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