Beyond Grades: Statistical Competence and its Determinants among Grade 12 Learners in Palawan, Philippines

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ABSTRACT

Statistics is a critical component of 21st–century learning, yet gaps remain between students' academic performance and their actual statistical understanding. This study examined the statistical competence of Grade 12 senior high school learners in selected secondary schools in Palawan and identified factors influencing their competence. A descriptive–correlational design was employed using a researcher–developed questionnaire administered to 154 learners from both academic and technical–vocational tracks. Descriptive statistics and Pearson's correlation were used to analyze the data. Findings revealed that although learners demonstrated outstanding academic performance in Statistics and Probability (M = 91.34), their overall statistical competence was only at a "competent" level (WM = 3.62), indicating a gap between procedural achievement and conceptual understanding. Learners showed stronger competence in computational domains, such as measures of central tendency, but lower competence in higher–order skills, including inferential statistics and bivariate analysis. Among the examined factors, student–related variables showed a significant relationship with statistical competence ($r = 0.398$, $p < .01$), while teacher– and parent–related factors were not significantly associated. Additionally, statistical competence was significantly related to academic performance and strand but not to sex. The findings highlight the central role of learner engagement and self–regulation in developing statistical competence. The study underscores the need for learner–centered, inquiry–based instructional approaches that promote higher–order thinking and conceptual understanding, particularly in geographically diverse and resource–constrained contexts such as Palawan.

Keywords: literacy, senior high school, statistical competency, academic track, TVL track

INTRODUCTION

Statistics plays a vital role in developing learners' ability to interpret data, make informed decisions, and engage in research–based inquiry. As part of the K to 12 curriculum, Statistics and Probability is designed to equip learners with essential competencies aligned with 21st–century skills, including critical thinking, problem–solving, and data literacy (Van Laar et al. 2020). These competencies are increasingly important in a data–driven society where individuals are expected to analyze and interpret information effectively (Yuniawatika 2018).

Competency–based education emphasizes mastery of skills and application of knowledge in real–world contexts (Curry and Docherty 2017). Within this framework, statistical competence extends beyond procedural knowledge to include interpretation, reasoning, and application. However, previous studies have shown that learners often demonstrate strong performance in computational tasks but struggle with higher–order statistical thinking, particularly in inferential reasoning and application (Bush et al. 2014; Jansen and Möller 2022).

In the Philippine context, research has highlighted challenges in students' understanding of statistical concepts despite satisfactory academic performance (Calma et al. 2022; Dumale and Gurat 2023; Gabio and Cajandig 2025). These findings suggest that performance–based assessments may not fully capture learners' conceptual understanding. Moreover, most studies have focused on general or urban contexts, with limited attention to geographically isolated areas such as Palawan.

Emerging evidence indicates that learners in Palawan face distinct educational challenges related to access, instructional resources, and learning environments (Perez et al. 2021; Villaruz et al. 2022; Saavedra 2025). These contextual factors may influence the development of higher–order competencies, including statistical reasoning. Additionally, while previous studies have identified student, teacher, and parent–related factors as influencing academic outcomes (Ashaari et al. 2011; Ismail et al. 2023; Naungayan et al. 2024), there remains limited localized evidence examining how these factors relate specifically to statistical competence.

Thus, this study investigates the statistical competence of Grade 12 learners in selected secondary schools in Palawan and examines the factors influencing their competence. Specifically, it aims to determine: (1) learners' demographic profile, (2) their level of statistical competence, and (3) the relationship between statistical competence and selected student, teacher, and parent–related factors.

METHODS

Research Design

This study employed a descriptive–correlational research design to examine statistical competence and its associated factors.

Locale and Participants

The study was conducted in three public secondary schools in Palawan. From a total population of 1,493 Grade 12 learners, 154 respondents were selected through random sampling.

Instrumentation

A researcher–developed questionnaire was used to collect data on statistical competence and influencing factors. The instrument demonstrated acceptable reliability with a Cronbach's alpha of 0.72 (Sweller et al. 2011).

Data Collection and Ethics

Permission was secured from school authorities, and informed consent was obtained from participants. Confidentiality and voluntary participation were ensured throughout the study.

Data Analysis

Descriptive statistics (mean and percentage) and Pearson's r correlation were used to analyze the data using SPSS.

RESULTS

Demographic Profile

As presented in Table 1, the majority of the respondents were female (53.25%), while 46.75% were male. Among the strands, ABM had the highest representation (24.68%), followed by HE (20.78%) and IA (16.88%). In terms of academic performance in Statistics and Probability, most respondents obtained an Outstanding rating (68.83%), with a mean grade of 91.34.

Table 1. Demographic profile of respondents (n = 154**).**

Category		Frequency (n)	Percentage (%)
Sex	Male	72	46.75
	Female	82	53.25
Strand	ABM	38	24.68
	STEM	19	12.34
	HUMSS	21	13.64
	GAS	7	4.55
	AFA	5	3.25
	HE	32	20.78
	IA	26	16.88
	ICT	6	3.90
Academic Performance	Outstanding (90–100)	106	68.83
	Very Satisfactory (85–89)	37	24.03
	Satisfactory (80–84)	11	7.14
	Mean Grade	91.34	Outstanding

Level of Statistical Competence

Table 2 presents the level of statistical competence of the respondents. The overall weighted mean was 3.62, described as Competent. The highest mean score was obtained in Measures of Central Tendency (WM = 4.00), followed by Probability and Non–Probability Sampling (WM = 3.94) and Frequency Distribution (WM = 3.86). The lowest mean scores were recorded in Bivariate Data Analysis (WM = 3.31), Strength of Relationship/Effect (WM = 3.31), and More than Two Population Means (WM = 3.32).

Table 2. Level of statistical competence of respondents. Legend: 4.21–5.00 = Highly Competent; 3.41–4.20 = Competent; 2.61–3.40 = Moderately Competent; 1.81–2.60 = Slightly Competent; 1.00–1.80 = Not Competent.

Indicator	WM	
Research variables and probability distributions	3.76	Competent
Random variables in real–life problems	3.79	Competent
Probability and non–probability sampling	3.94	Competent
Parameter and statistic	3.68	Competent
Frequency distribution	3.86	Competent
Measures of central tendency	4.00	Competent
Measures of dispersion	3.69	Competent
Hypothesis testing concepts	3.58	Competent
Solving hypothesis testing problems	3.53	Competent
Bivariate data analysis	3.31	Moderately Competent
Relationship between variables	3.62	Competent
Difference (one group)	3.46	Competent
Difference (two groups)	3.44	Competent
More than two population means	3.32	Moderately Competent
Strength of relationship/effect	3.31	Moderately Competent
Overall Weighted Mean	3.62	Competent

Factors Affecting Statistical Competence

Student–related factors were rated positively (WM = 4.08), particularly in engagement and information–seeking. Teacher–related factors received the highest ratings (WM = 4.43), while parent–related factors were also positively perceived (WM = 4.08) (Table 3).

Table 3. Factors Affecting Statistical Competence. Legend: 4.21–5.00 = Strongly Agree; 3.41–4.20 = Agree; 2.61–3.40 = Moderately Agree; 1.81–2.60 = Disagree; 1.00–1.80 = Strongly Disagree.

Factors	Weighted Mean	Interpretation
Student–Related Factors	4.08	Agree
Teacher–Related Factors	4.43	Strongly Agree
Parent–Related Factors	4.08	Agree

Relationship Between Statistical Competence and Profile Variables

Table 4 shows the relationship between statistical competence and selected profile variables. Statistical competence was significantly related to strand ($r = –0.296$, $p = .000$) and academic performance ($r = 0.351$, $p = .000$). No significant relationship was found between statistical competence and sex ($r = 0.141$, $p = .082$).

Table 4. Relationship Between Statistical Competence and Profile Variables. Significant at $p < .01$ (two–tailed). Note: **$p < .01$.

Variables	r–value	p–value	Interpretation	Decision
Sex	0.141	.082	Not Significant	Accept H_0
Strand	–0.296**	.000	Significant	Reject H_0
Academic Performance	0.351**	.000	Significant	Reject H_0

Relationship Between Statistical Competence and Identified Factors

As reflected in Table 5, student–related factors were significantly associated with statistical competence ($r = 0.398$, $p = .000$). Teacher–related factors ($r = 0.143$, $p = .077$) and parent–related factors ($r = 0.045$, $p = .584$) did not show significant relationships with statistical competence.

Table 5. Relationship Between Statistical Competence and Identified Factors. Significant at $p < .01$ (two–tailed). Note: **$p < .01$.

Variables	r–value	p–value	Interpretation	Decision
Student–Related Factors	0.398**	.000	Significant	Reject H_0
Teacher–Related Factors	0.143	.077	Not Significant	Accept H_0
Parent–Related Factors	0.045	.584	Not Significant	Accept H_0

DISCUSSION

The findings indicate a mismatch between learners' academic performance and their level of statistical competence. Although the respondents obtained outstanding grades in Statistics and Probability, their competence was generally limited to fundamental and computational aspects of statistics. Lower ratings were observed in areas that require analysis, interpretation, and application of statistical concepts. Similar observations have been

reported by Garfield and Ben–Zvi (2007) and Kandeel et al. (2025), who noted that students often perform well in routine calculations but encounter difficulties when asked to explain results, interpret relationships among variables, or apply statistical concepts to real–life situations. This suggests that high grades do not always reflect a strong understanding of statistical reasoning.

The results may be explained by the nature of classroom learning experiences. According to Piaget (1970) and Vygotsky (1978), learning becomes more meaningful when students actively construct knowledge through engagement, inquiry, and interaction with authentic tasks. When instruction focuses primarily on procedures and correct answers, learners may become proficient in computation but may not fully develop the ability to analyze, interpret, and use statistical information critically. As a result, students may perform well in examinations yet experience difficulties when conducting research, interpreting data, or making evidence–based decisions. This is particularly important because statistical literacy has become an essential skill in higher education, employment, and everyday life.

The significant relationship between student–related factors and statistical competence highlights the important role of learners themselves in the development of statistical understanding. Students who are motivated, actively engaged in learning activities, and willing to seek information appear more likely to develop stronger statistical competence. This finding supports earlier studies emphasizing the influence of learner attitudes, engagement, and self–directed learning on academic achievement (Ashaari et al. 2011; Moussa, 2023). The result suggests that improving statistical competence may require more than providing instructional resources; it also requires creating learning environments that encourage participation, curiosity, and responsibility for learning. Activities that involve investigation, collaboration, and problem–solving may help learners become more engaged with statistical concepts and improve their ability to apply what they have learned.

In contrast, teacher–related and parent–related factors did not show significant relationships with statistical competence. Although teachers and parents provide important academic support, learners ultimately determine how such support is translated into learning outcomes through their motivation, engagement, and self–regulatory behaviors. Previous studies have shown that student attitudes, self–efficacy, and active participation play a crucial role in academic achievement and skill development (Ashaari et al. 2011; Moussa 2023). Likewise, parental involvement contributes to learning opportunities, but its effects may vary depending on learners' responsiveness and engagement with academic tasks (Naungayan et al. 2024). These findings suggest that interventions aimed at improving statistical competence should complement support systems with strategies that strengthen learner engagement and independent learning.

The significant relationship between strand and statistical competence further suggests that variations in curricular exposure may contribute to differences in learners' statistical skills. Learners in strands that emphasize research, quantitative analysis, and problem–solving are likely to encounter more opportunities to apply statistical concepts in authentic contexts, thereby strengthening their understanding and confidence in using statistical tools. Previous studies have shown that meaningful learning experiences and opportunities for practical application contribute to the development of higher–order thinking and statistical competence (Piaget 1970; Vygotsky 1978; Kadusale et al. 2024). Similarly, educational experiences and learning environments have been found to shape learners' academic development and preparedness for analytical tasks (Perez et al. 2021). Consequently, providing equitable opportunities for data–driven learning across all strands may help promote stronger statistical competence among senior high school learners.

Overall, the findings show that strong academic performance alone does not guarantee a corresponding level of statistical competence. While learners generally perform well in Statistics and Probability, difficulties remain in competencies that require deeper understanding and application. Strengthening statistical competence therefore requires learning experiences that go beyond memorization and routine procedures. Greater emphasis on inquiry–based activities, real–world data analysis, and research–oriented tasks may help learners develop the analytical skills needed to interpret information, solve problems, and make informed decisions in an increasingly data–driven world.

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GENERATIVE AI STATEMENT

ChatGPT and other generative AI tools were not used to generate research data, conduct analyses, interpret findings, or draw conclusions. Such tools may have been used only for language editing and improving the clarity of the manuscript. The authors take full responsibility for the content of this paper.

ETHICAL CONSIDERATIONS

In this study, the researchers further explained to the respondents the purpose of the study, the confidentiality procedures and requested their signatures of consent. Responses were anonymized and assigned identification codes. Data were securely stored in a password–protected device accessible only to the researchers. The researchers ensured that no deception was involved in the conduct of the study.

DECLARATION OF COMPETING INTEREST

The author declares no competing interests.

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