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## Aim & Scope

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The CMU Journal of Science is a peer-reviewed multidisciplinary journal published annually by Central Mindanao University, Musuan, Maramag, Bukidnon, Philippines. This official scientific journal of the University is accredited by the Philippine Commission on Higher Education (CHED) as category B. It publishes quality research articles, perspectives, review articles, and technical notes of researchers in the fields of natural science, engineering, social science, and mathematics from local, national, and international contributors.

## Editorial Policy

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CMU Journal of Science

The CMU Journal of Science (CMUJS) is a multidisciplinary peer-reviewed scientific journal published annually by Central Mindanao University, University Town, Musuan, Bukidnon, Philippines.

All submitted manuscripts are reviewed and evaluated by the Editorial Board to determine whether these manuscripts are publishable or not. To be accepted, articles must satisfy all of the following criteria.

1. The manuscript has not been published by any journal;
2. The manuscript is recommended for publication by a minimum of two peer-reviewers;
3. The manuscript has passed the plagiarism detection test with a score of at least 85% for originality not more than 15% similarity index); and,
4. The manuscript has passed the grammar checker software.

The CMUJS adopts a double-blind peer-review process before the papers are published to ensure the quality of the publication and to avoid plagiarism.

The Editor-in-Chief, upon consultation with the Editorial Board, assigns a manuscript to at least two reviewers.

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the manuscript, the full paper will be sent to them.

After the review process, each reviewer will return the reviewed manuscript and the Assessment Form indicating his/her recommendation. A manuscript recommended for deferment of publication will be considered if the comments by reviewers are complied. Otherwise, it will be rejected.

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The manuscript should be written in good English (American or British usage is accepted, but not a mixture of these). A soft copy of the paper must be submitted in one file only. This would be emailed to [journalofscience@cmu.edu.ph](mailto:journalofscience@cmu.edu.ph). Paper size is A4 (8.25 x 11.69), with an inch margin on all sides. Font style is Times New Roman, Font size is 12. The paper should be double-spaced; with about 4,000-6,000 words in single column format, inclusive of tables and figures. Manuscripts should be encoded in Microsoft Word (at least Word 2007) and Excel (for graphs and tables). Articles encoded using other softwares (Corel, LaTeX, Photoshop, etc.) may be accepted after consultation with the publication staff. Photos, maps, graphs, charts, and other illustrations shall be labeled as Figures, tables and matrices, as Tables. These should be appropriately numbered and labeled based on their order or presentation. Figure titles shall be written below the figure whereas, table titles shall be on top of the table matrix.

## Introduction To The Issue

CMU Journal of Science on its 23rd Volume continues to publish quality research outputs in the field of natural and social sciences from local, national, and international contributors. This year, on behalf of CMU Journal of Science Publication and Editorial Board, it is my profound pleasure to introduce Natural Sciences Issue (2) of 2019. I want to take this opportunity to express my sincere gratitude to the authors, section editors, publication board members, invited peer reviewers from various academe, and administrators who contributed their time and expertise for the success of CMUJS Natural Science publication.

The articles presented in this second issue of Volume 23 focuses on Natural Science with a perspective article about Food Security amid the COVID-19 pandemic. Specifically, it covers topics on Physico-Chemical Properties of the Fish Pond Water in CMU, Bukidnon, Philippines; Fish Abundance and Physico-chemical Properties of Matingao River and Marbel River, Mount Apo Natural Park, Mindanao, Philippines; Growth and Profitability of Broilers with Vermimeal on Ration Under Two Management; Saluyot (*Corchorus olitorius* L.) Leaves as Acoustic Gel for Ultrasound Imaging; Computational Modeling and Simulation of Linear Accelerator Performance for General Radiotherapy and; Eggshells as Alternative Shielding Material Against Diagnostic X-rays.

CMU Journal of Science aims to annually publish quality research outputs across all disciplines regardless of its perceived impact. We hope these peer-reviewed articles will provide notable development and practical usefulness to every researcher and readers.

CMUJS will continue to help researchers, teachers, students, and other individuals through the dissemination and publication of scholarly articles. We are looking forward and more than grateful for receiving research articles and respond to the needs of the contributors.



EINSTINE M. OPISO  
The Editor-in-Chief



## Living Conditions and Academic Performance of Students Occupying Boarding Houses in Northern Mindanao

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### ABSTRACT

Learners' academic performance is affected by a multifaceted array of aspects. This paper focused on the effects of the boarding houses' environment on the educational performance of 279 students of Central Mindanao University from SY 2015-2016. Data concerning the students' demographic profile, academic performance, and characteristics of their boarding houses were collected using a semi-structured questionnaire. They were evaluated statistically using mean, frequency counts, percentage, and Pearson Product Moment Correlation statistical tools. Statistical outcomes showed that more than half of the respondents were below 18 years old, females, enrolled in a BS degree in Agriculture, and single. Regarding religion, Catholics composed the majority of the respondents. The monthly allowance varies according to the parent's income, as the majority were academic scholars with grades below 2.20 and 2.19 for the school's two semesters. All variables relating to the features of the boarding houses were rated as satisfactory based on rental rate, health and sanitation, facilities, accessibility, safety and security, and policies implemented. Moreover, the study found that gender and scholarship type were significantly related to academic performance. Government and private institutions can use the identified factors as the basis for educational program planning and implementation to support the learners' academic performance.

*Keywords:* Academic performance, boarding houses, demographic profile, living conditions, Mindanao

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### INTRODUCTION

Boarding houses have rapidly increased due to the growing demand for student housing. These affordable accommodations attract most people who need temporary dwellings for various reasons. At Central Mindanao University, innumerable boarding houses have been constructed inside the campus, offering basic accommodation needs and particular services for a specific period to both secondary and college students who come from distant places. These students share privileges offered by boarding house operations with other students with various ethnic backgrounds, diverse academic interests, and different personalities. The abrupt transition from high school to college results in some challenges in adapting to new situations. Hence, students must adjust to living independently and face all the struggles they may encounter by themselves eventually. However, living in such a situation usually contributes gradually to the overall well-being of university students.

A student considers many aspects when choosing a boarding house to achieve a conducive environment for dwelling and learning. The majority of these students preferred those that are affordable and accessible to schools and other establishments. According to Malaga (2022), Circumstances in boarding houses set conditions that impact students' educational experiences. Navarez's (2017) research brought attention to the inadequate outcomes of surveys conducted on student housing facilities and accommodation in the Philippines. The study revealed that the living conditions of students fail to meet

the present requirements and expectations of residents in terms of a student housing facility that prioritizes learner-centered and quality-driven approaches. This includes promoting active and collaborative learning, facilitating meaningful interactions among students from diverse backgrounds and beliefs, and ensuring convenient access to community facilities and services that directly support the educational and social objectives of the university.

Despite the previous findings, there is a scarcity of local studies that specifically address the quality of living conditions in boarding houses in Mindanao, which propelled the researcher to conduct this study.

### Theoretical Framework

The present study is anchored in the theory of ecological psychology by Gibson and Gibson (2002). Ecological psychology is a theoretical framework that emphasizes the complex interactions between individuals and their environment and suggests that multiple levels of influence must be considered in understanding human development and behavior. This framework is based on the idea that individuals and their environment are interdependent and that individuals actively shape and are shaped by their environment. Ecological psychology considers the physical and social environment to be a

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dynamic and integrated system that influences individuals' behavior, development, and well-being.

In the context of the present study, ecological psychology is used to explore how multiple levels of influence of boarding houses, such as the rental rates, health and sanitation, housing facilities, accessibility to the university and public establishments, and safety and security policies of the house might impact students' academic performance.

Ecological psychology also emphasizes the importance of studying behavior in natural and meaningful contexts, and advocates for the use of methods that capture the complexity and dynamics of individuals' interactions with their environment. In the context of this study, ecological psychology could encourage researchers to use methods that allow for a comprehensive and nuanced understanding of the ways in which students' living conditions might impact their academic performance.

By using the ecological psychology framework, researchers could gain a more holistic understanding of the complex relationships between individuals and their environment, and how these relationships impact academic performance. This understanding can then be used to inform interventions and policies aimed at improving the living conditions and academic outcomes of students living in boarding houses in Northern Mindanao, Philippines.

### Research Questions

1. What is the demographic profile of the selected students from private and public boarding houses, in terms of:
  - a. Age;
  - b. Course and year;
  - c. Gender;
  - d. Marital status;
  - e. Religion
  - f. Monthly allowance; and
  - g. Parents' source of income?
2. What is the selected student's academic performance in terms of:
  - a. Scholarships;
  - b. General weighted average; and
  - c. Goals and attitudes?
3. What are the characteristics of the boarding houses in terms of:
  - a. Rental rates;
  - b. Health and sanitation;
  - c. Housing facilities;
  - d. Accessibility to university and public establishments;
  - e. Safety and security; and
  - f. Policies of boarding house?
4. Is there a significant relationship between demographic profile, features of boarding houses, and the student's academic performance?

### METHODOLOGY

The study used the descriptive design with survey questionnaires disseminated and filled out by

student lodgers. Structured interviews with landlords, landladies, and some of the chosen student-lodgers were also administered to countercheck the data gathered. Moreover, observations of building structures as well as the facilities of the boarding houses were conducted to collect supporting data.

This study was conducted at Central Mindanao University, with 279 university students from selected private and government boarding houses in Musuan, University Town, the heart of Bukidnon.

The study started by obtaining a list of student-lodgers from the university's different government and private boarding houses through random cluster sampling. Then, the researchers coordinated with the students in their selected subjects and their respective boarding house owners or operators. It was followed by distributing questionnaires to the student-boarders for the researcher to collect the necessary data. The accomplished questionnaires were then retrieved after three days and an in-depth interview with the chosen student-boarders and the operators of boarding houses followed, after which the data were organized for analysis. Visitation and observation of these boarding houses' facilities and structures were finally done to countercheck the data gathered.

A survey questionnaire consisting of statements was utilized in this study. The instrument went through clarity and refinement. The instrument consisted of three parts. Part I determined the demographic profile of the students. The second part inquired about the student's academic performances, and part III looked at the possible characteristics of the boarding houses of the respondents in CMU.

Descriptive statistics such as frequency counts, percentages, and means were used to describe the figures obtained from the first until the last part of the questionnaire using the checklist and a 5-point Likert scale. The researcher used Pearson Product Moment Correlation analysis to see if the profile of students and their living conditions in boarding houses in the university have a significant relationship with their academic performance.

### RESULTS AND DISCUSSION

#### Profile of the Respondents

Table 1 presents the personal profile of the respondents in terms of age. The use of frequency and percentage distribution was intended to give a little background of the study's respondents. Table 1 shows that three-fourths (75.0%) of the respondents were below 18, while those above the mean age comprised only one-fourth (25.0%) of the total respondents. The mean age is 18.67 years while the minimum and the maximum age are 16 and 25 years, respectively. It implies that more than the majority of the respondents were still considered dependent on their parents.

The courses taken by the respondents are all reflected in Table 2, which shows 15 different types of courses. It can be seen from the table that the majority (50.9%) of the respondents are taking Bachelor of Science



Table 1. Respondent's Age

CATEGORY (mean=18.67, min=16, max 25)	FREQUENCY	PERCENT
Below the mean	209	75.0
Above the mean	70	25.0
Total	279	100.0

Table 2. Respondent's Courses

CATEGORY	FREQUENCY	PERCENT
Bachelor of Science in Agriculture	142.0	50.9
Education	32.0	11.5
Hotel & Restaurant Management	28.0	10.0
Civil Engineering	17.0	6.1
BS Biology	15.0	5.4
Home Economics Education	11.0	3.9
FBM	8.0	2.9
Environmental Science	5.0	1.8
Agricultural Engineering	4.0	1.4
Doctor of Veterinary Medicine	3.0	1.1
Electrical Engineering	3.0	1.1
Food Technology	3.0	1.1
Information Technology	3.0	1.1
AB History	1.0	0.4
Total	279.0	100.0

Table 3. Respondent's Gender

CATEGORY	FREQUENCY	PERCENT
Male	88	31.5
Female	191	68.5
Total	279	100.0

in Agriculture. Those enrolled in Education and Hotel and Restaurant Management followed with 11.5% and 10.0%, respectively. It can also be noted that almost one-third (30%) of the population comprised the other courses offered in engineering, veterinary medicine, and forestry.

The participant's gender is outlined in Table 3. It can be seen that more than two-thirds (68.5%) of the respondents were females, while those who belong to the male category comprise the other almost one-third (31.5%). This result indicates that females still dominate the gender in colleges and universities.

On the other hand, Table 4 presents the respondent's marital status. As reflected in the table, almost all (98.9%) respondents were still single. Those who are schooling that are already married are only 1.1% of the total population. It means many students still believe in focusing on studying while obtaining a college education. It also shows that some students still value education despite being married already.

A study by Brilliantes et al. (2012), Jackson et al. (2019), and Kulkarni, Pathak, and Sharma (2013) found gender differences in the academic performance of male and female students. Findings showed that girls had a

higher mean academic achievement compared to boys. The same findings were seen by Parajuli and Parajuli (2017), who found that female Nepalese students surpass their male counterparts due to a culturally-laden context where girls are given more attention and sympathy than boys. On the contrary, the study of Adigun et al. (2015) revealed that male students in Nigeria performed marginally better than female students, although the difference was not statistically significant. Additionally, their better performance was shown to be more evident in the private schools, which have the best results of male academic performance in the region.

On the other hand, another profile of the respondents investigated in this study was their religion, which was reflected in Table 5. It can be noted in the table that Catholics still dominated the Philippine religion, with almost four-fifths (78.1%) of the respondents. Evangelicals followed with 5.7%. The least proportion were those practicing Seventh-day Adventists (5.0%), Born Again (2.9%), Iglesia ni Cristo (1.8%), Jehovah's Witnesses (0.4%), and Pentecostals (2.2%) Christians.

Table 6 presents the monthly allowance received by the respondents from their parents or guardians. As can be gleaned from the table, almost two-fifths (38.0%)



Table 4. Respondent's Marital Status

CATEGORY)	FREQUENCY	PERCENT
Single	276	98.9
Married	3	1.1
Total	279	100.0

Table 5. Respondent's Religion

CATEGORY	FREQUENCY	PERCENT
Catholics	218	78.1
Baptists	14	5.0
SDA	11	3.9
Born Again	8	2.9
Iglesia ni Cristo	5	1.8
Pentecostal	6	2.2
Jehova's Witness	1	0.4
Evangelicals	16	5.7
Total	279	100.0

Table 6. Respondent's Allowance Every Month

CATEGORY (mean=2,709.85, min = 500,max=9000)	FREQUENCY	PERCENT
1000 and below	38	13.6
1001 to 2000	106	38.0
2001 to 3000	63	22.6
3001 to 4000	37	13.3
4001 to 5000	28	10.0
5000 and above	7	2.5
Total	279	100.0

of the respondents received a monthly allowance that ranges from 1001 to 2000. Those who received a monthly allowance of 2001 to 3000, 1000 and below and 3001 to 4000 followed with 22.6%, 13.6%, and 13.3%, respectively. Only 2.5% of respondents received a monthly allowance of 5000 and above. The minimum monthly allowance received was 500 pesos, while the maximum was 9000. The average monthly allowance was 2,709.85.

Table 7 presents the sources of income of the respondent's family, who come from different places in Mindanao. As shown in the table, most (44.8%) of the respondent's family comes from farming. Employment comes next with 28.3%, followed by those whose income comes from businesses other than farming (i.e. sari-sari store, buy and sell, and the like) with 24.0%. Those respondents supported by parents working abroad or OFW accounted for the least proportion, with 2.9% of the respondents.

#### Academic Performance of the Respondents

The respondent's academic performance was subdivided into categories, which include their scholarships and general weighted average in two semesters.

Table 8 presents the type of scholarships the respondents have while studying at Central Mindanao University. The scholarships were divided into two

categories- the academic and non-academic types.

As presented in Table 8, most (35.8%) of the respondents were supported by their parents in their college education, followed by those who were college scholars and grant-in-aid with 31.5% and 24.0%. Non-academic scholars, such as those students with athletic skills and singing talents, comprise only 7.5% of the respondents. In contrast, those university scholars comprised the least proportion, with 1.1% of the respondents.

Scholarships are considered an overarching piece of the puzzle that makes up a solid foundation in assisting students seeking to complete a degree. According to Graziosi et al. (2020), the financial necessity and other academic requirements that can impede a student from concentrating on their studies are solved by scholarships, allowing scholars more time for their studies. The same findings were also seen by Page, Kehoe, Castleman, and Sahadewo (2017) who discovered that selected scholars were more likely to graduate with honors than those who are not scholars.

As shown in Table 9, the mean grade was 2.20 and 2.19 for the first and second semesters, respectively. More than the majority of the respondents, both in the first and second semesters, were below the mean grade with 54.0% and 52.0%, respectively. It means that the respondents

Table 7. Family's Source of Income

CATEGORY	FREQUENCY	PERCENT
Farming	125	44.8
Employment	79	28.3
Overseas Filipino Worker	8	2.9
Businesses other than Farming	67	24.0
Total	279	100.0

Table 8. Respondent's Type of Scholarships

CATEGORY	FREQUENCY	PERCENT
Academic Scholars	179	64.2
a. University	3	1.1
b. Grant-in-Aid	67	24.0
c. College	88	31.5
Non-Academic Scholars	100	35.8
Total	279	100.0

Table 9. Respondent's Average in the First and Second Semesters

CATEGORY (mean = 2.20, min = 1.26, max = 3)	FREQUENCY	PERCENT
I-First semester		
Below the Mean	151	54.0
Above the Mean	128	46.0
Total	279	100.0
CATEGORY (mean = 2.19, min = 1.41, max = 3.0)	FREQUENCY	PERCENT
II – Second semester		
Below the Mean	144	52.0
Above the Mean	135	48.0
Total	279	100.0

were getting good grades. It can be attributed to the fact that more than most of the students were scholars compared to only 35.8% who were not. Those with an average grade above the mean of 2.20 and 2.19 comprised 46.0% and 48.0%, respectively, for the first and second semesters.

#### Various Characteristics of the Boarding Houses

As presented in Table 10, the rental rates of boarding houses were rated by students as "satisfactory," with a mean of 2.68. It implies that the rental of boarding houses was just a reasonable 41 to 60% of the time.

As indicated in Table 11 on health and sanitation, all indicators were rated as satisfactory, with an overall mean of 2.73. It implies that occupants of boarding houses' cleanliness (2.68), maintenance (2.74), and waste disposal were practiced 41 to 60% of the time.

Table 12 presents the housing facilities of boarding houses at CMU. As shown from the table, all facilities were rated "satisfactory," with an overall mean of 2.58.

The top five indicators which were rated the highest were lighting (2.73), receiving area (2.66), bedroom arrangement (2.60) study area (2.58), and comfort room (2.57). Other amenities include a bathroom (2.52), laundry

area (2.56), kitchen (2.56), dining area (2.52), and the lowest rating of "fair" ventilation (2.50).

It can be noted in Table 13 that in terms of accessibility of the student boarding houses, they rated it as satisfactory, with an overall mean of 2.73. It means that about 41 to 60% of the time, the boarding houses were accessible to water, electricity, a waiting shed, a hospital, and a church. The highest ratings among the indicators were electricity, with 2.93, followed by hospital and water, with 2.77 and 2.73, respectively. Accessibility for the waiting shed and market each has a 2.68 mean rating. The lowest rating was on accessibility to church, with 2.61.

Table 14 presents the safety and security of boarding houses. As shown in the Table, all the safety and security indicators have a descriptive rating of satisfactory. Firefighting facilities were rated the highest with 2.86, followed by curfew policy and first aid box with 2.76 and 2.67, respectively. The lowest rating was on gate and fences, with 2.56, which can be attributed to the fact that only a few of the boarding house has defined fences and gates based on the ocular survey the researchers conducted.

Generally, the rating of security and safety is 2.71, which means satisfactory and implies that security and safety good practices were done by the boarding houses

41 to 60% of the time.

As seen from Table 15, all the policy indicators on boarding houses were rated satisfactory with an overall mean of 2.66. It implies that implementation (2.53), monitoring (2.54), and sanction (2.92) good practices were done 41 to 60% of the time.

## Relationship Between Demographic Factors, Features of the Boarding Houses, and Academic Performance

Table 16 presents the relationship between the demographic factors, features of boarding houses, and students' academic performance.

Based on the correlation analysis, there is

Table 10. Boarding House's Rental Rate

INDICATOR	MEAN	DESCRIPTIVE RATING
Reasonable	2.68	Satisfactory

Legend:

4.51 – 5.00	Excellent	81 to 100% of the time
3.51 – 4.50	Very Satisfactory	61 to 80% of the time
2.51 – 3.50	Satisfactory	41 to 60% of the time
1.51 – 2.50	Fair	11 to 40% of the time
1.00 – 1.50	Needs Improvement	1 to 20% of the time

Table 11. Boarding House's Health and Sanitation

INDICATOR	MEAN	DESCRIPTIVE RATING
Cleanliness	2.68	Satisfactory
Maintenance	2.74	Satisfactory
Waste Disposal	2.78	Satisfactory
MEAN	2.73	Satisfactory

Legend:

4.51 – 5.00	Excellent	81 to 100% of the time
3.51 – 4.50	Very Satisfactory	61 to 80% of the time
2.51 – 3.50	Satisfactory	41 to 60% of the time
1.51 – 2.50	Fair	11 to 40% of the time
1.00 – 1.50	Needs Improvement	1 to 20% of the time

Table 12. Boarding House Facilities

INDICATOR	MEAN	DESCRIPTIVE RATING
Receiving Area	2.66	Satisfactory
Bedroom Arrangement	2.60	Satisfactory
Study Area	2.58	Satisfactory
Lighting	2.73	Satisfactory
Comfort Room	2.57	Satisfactory
Kitchen	2.56	Satisfactory
Laundry Area	2.56	Satisfactory
Bath Room	2.53	Satisfactory
Dining Area	2.52	Satisfactory
Ventilation	2.50	Fair
MEAN	2.58	Satisfactory

Legend:

4.51 – 5.00	Excellent	81 to 100% of the time
3.51 – 4.50	Very Satisfactory	61 to 80% of the time
2.51 – 3.50	Satisfactory	41 to 60% of the time
1.51 – 2.50	Fair	11 to 40% of the time
1.00 – 1.50	Needs Improvement	1 to 20% of the time



Table 13. Boarding house's accessibility

INDICATOR	MEAN	DESCRIPTIVE RATING
Water	2.73	Satisfactory
Electricity	2.93	Satisfactory
Waiting Shed	2.68	Satisfactory
Market	2.68	Satisfactory
Hospital	2.77	Satisfactory
Church	2.61	Satisfactory
MEAN	2.73	Satisfactory

Legend:

4.51 – 5.00	Excellent	81 to 100% of the time
3.51 – 4.50	Very Satisfactory	61 to 80% of the time
2.51 – 3.50	Satisfactory	41 to 60% of the time
1.51 – 2.50	Fair	11 to 40% of the time
1.00 – 1.50	Needs Improvement	1 to 20% of the time

Table 14. Boarding House's Safety and Security

INDICATOR	MEAN	DESCRIPTIVE RATING
Gate and Fences	2.56	Satisfactory
Fire Fighting Facilities	2.86	Satisfactory
First Aid Box	2.67	Satisfactory
Curfew Policy	2.76	Satisfactory
MEAN	2.71	Satisfactory

Legend:

4.51 – 5.00	Excellent	81 to 100% of the time
3.51 – 4.50	Very Satisfactory	61 to 80% of the time
2.51 – 3.50	Satisfactory	41 to 60% of the time
1.51 – 2.50	Fair	11 to 40% of the time
1.00 – 1.50	Needs Improvement	1 to 20% of the time

Table 15. Boarding House Policies

INDICATOR	MEAN	DESCRIPTIVE RATING
Implementation	2.53	Satisfactory
Monitoring	2.54	Satisfactory
Sanction	2.92	Satisfactory
MEAN	2.66	Satisfactory

Legend:

4.51 – 5.00	Excellent	81 to 100% of the time
3.51 – 4.50	Very Satisfactory	61 to 80% of the time
2.51 – 3.50	Satisfactory	41 to 60% of the time
1.51 – 2.50	Fair	11 to 40% of the time
1.00 – 1.50	Needs Improvement	1 to 20% of the time

no statistically significant relationship between the student's demographic profile and their academic performance. Based on the result, it is evident that a student's demographic profile does not necessarily determine their academic performance. Though family background and characteristics may play a role in shaping a student's upbringing, the result has shown that these factors do not directly impact a student's inherent cognitive level. Thus, the researcher believes it is essential to focus on the individual

rather than solely relying on their demographic profile to assess their academic potential.

The same findings were seen by Baker et al. (2011) and Reardon et al. (2019, who both confirmed that family background and neighborhood characteristics have little to no effect on students' inherent cognitive level and academic performance in school. Their studies suggest that external factors such as socioeconomic status, race, or ethnicity may

Table 16. Correlation Analysis Between Independent and Dependent Variables

Independent Variable	Dependent Variable: Academic Performance		
	Correlation Coefficient	p-value	Interpretation
Demographic Profile	.068	0.260	Not Significant
Characteristics of Boarding Houses	.806*	0.000	Highly Significant

influence access to resources and opportunities, which can impact academic performance, but they do not directly affect a student's innate cognitive ability.

On the contrary, the findings of El Refae, Kaba, and Eletter (2021) found that students' attributes, experiences, and family backgrounds impact academic performance. Factors such as parental education level, income, and involvement in their child's education can impact a student's academic performance. For example, students from families with higher socioeconomic status may have access to more resources and opportunities, such as tutoring or extracurricular activities, that could positively impact their academic performance.

Meanwhile, the characteristics of boarding houses were found to have a high significant relationship with the student's academic performance. The findings suggest that the quality of the boarding house where a student resides can significantly impact their academic performance. Therefore, providing access to quality boarding houses that offer supportive and conducive learning environments can be an effective intervention for improving students' academic performance. Similarly, boarding houses that provide social and emotional support, such as counseling services and mentorship programs, can also positively affect students' academic performance by reducing stress and enhancing well-being.

The results support the findings of Oladele, Ogunyemi, and Omonijo (2016) found that students living in better quality boarding houses had higher academic performance compared to those living in poor quality boarding houses. Specifically, the study found that boarding houses with adequate resources, such as adequate study materials, and a good quality living environment, positively impacted students' academic performance. Similarly, Martin et al. (2021) found

that boarding students have higher academic achievement compared to day students. Even after controlling for various individual and school-level factors, the researchers found that boarding students showed better academic outcomes. The study suggested that the boarding school environment, which includes characteristics such as residential facilities, access to academic resources, and a supportive social environment, may contribute to higher academic achievement among students. These factors can create an environment that is conducive to learning, with fewer distractions and more opportunities for students to focus on their studies.

With a comprehensive understanding of these results on the relationship of boarding houses and academic performance, could be used to inform and guide educators on how to best support their students. By having a comprehensive understanding of these results, educators can take steps to ensure that students have access to the necessary resources and support systems that can help them perform better academically.

## CONCLUSIONS

Generally, the occupants of boarding houses are below 18 years of age, female, taking up Bachelor of Science in Agriculture and single. They practiced Catholicism's who received 1001 to 2000 monthly allowance from their parents who are mostly farmers. They were academic scholars who maintain grades below 2.20 and 2.19 for the first semester and second semesters, respectively.

All of the variables related to the features of boarding houses were rated "satisfactory" namely rental rate, health and sanitation, housing facilities, accessibility, safety and security, and policy of boarding houses.

Results of the correlation analysis

revealed that there is no significant relationship between the student's demographic profile and academic performance, while a highly significant relationship was found between the characteristics of the boarding houses and the student's academic performance.

## RECOMMENDATIONS

Schools could ensure that boarding houses are clean, safe, and equipped with the necessary resources, such as study spaces and libraries, to create an environment conducive to learning. The schools may also provide students with academic and emotional support, such as tutoring, counseling, or mentorship programs, to help them overcome any challenges they may face in their academic and personal lives.

Teachers should develop strong relationships with their students and take time to understand their individual needs and challenges. This can help create a more supportive and collaborative learning environment that can improve student academic performance.

Boarding houses should encourage a healthy social environment that fosters positive relationships among students. This can help reduce feelings of loneliness or isolation, and create a sense of community that can support students in their academic pursuits.

Overall, having a better understanding of the relationship between boarding houses and academic performance can help educators create a more supportive and effective learning environment for their students. By providing students with the necessary support and resources, educators can help their students excel academically and achieve their full potential.

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**Growth Response of Totted Lettuce (*Lactuca sativa* L.)  
Using Rabbit Manure + *Trichoderma*-based Bio-organic Fertilizer**

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**ABSTRACT**

The study investigated the growth response of looseleaf lettuce (*Lactuca sativa* Linn.) applied with bio-organic fertilizer (BOF) consisting of rabbit manure and *Trichoderma spp.* produced under aerobic conditions. Composting process was done within 60 days. Complete randomized design was used for 5 treatments based on the volume of BOF applied. BOF material was analyzed for its total NPK, pH, moisture content, organic matter, total organic carbon, and C:N ratio. Through fertilizer analysis, the total N of the BOF material was found to be 0.94%, total P was 1.87%, and total K was 0.20%. When BOF was applied to the lettuce seedlings in different levels, T4 provided the optimal growth for final plant height ( $26.248 \pm 0.81$  cm,  $p < 0.05$ ), total number of leaves ( $8.20 \pm 0.15$  cm,  $p < 0.05$ ), longest leaf ( $19.93 \pm 0.15$  cm,  $p < 0.05$ ), width of longest leaf ( $13.88 \pm 0.15$  cm,  $p < 0.05$ ) and leaf diameter ( $51.38 \pm 0.21$  cm,  $p < 0.05$ ) compared with plants dressed with inorganic fertilizer. The treatment with applied BOF obtained a significant total leaf yield per pot with T4 ( $1532.50 \pm 1.75$  g,  $p < 0.05$ ) having the highest yield. Based on the findings of the present study, the high growth response of lettuce may be attributed to the potential synergistic relationship between *Trichoderma spp.* and rabbit manure. Furthermore, the results support the effectiveness of *Trichoderma spp.* in enhancing the soil's macronutrient profile post-application.

**Keywords:** Bio-organic fertilizer, composting, lettuce, rabbit manure, *Trichoderma*

**INTRODUCTION**

Lettuce, known to be an upland crop, has been produced in lowland areas nowadays in many parts of the world due to its high demand and economic importance (Santos-Filho et al., 2009). Market demand for this leafy vegetable is in an upward trend during the last decade (FAOSTAT, 2016) with 27mt of global production. Likewise, the Philippines has also observed a 3.1% increase in the production of lettuce from 3.81mt in 2015 to 4.30mt in 2019 (PSA Crop Statistics, 2020).

Alongside the surge in demand for lettuce and other leafy crops, a great deal of interest in recent years is rising in improving healthy compounds and antioxidants present in vegetables and fruits while decreasing the inputs required to produce them, and reducing environmental hazards of production system without jeopardizing yield or impacting growers negatively (Stefanelli et al., 2010). With the cumulative adverse effects of prolonged use of inorganic fertilizers, organic farming has emerged as a promising alternative in meeting growing demands for a healthy food supply, continuing sustainability, increasing soil microbial diversity and fertility, and alleviating environmental pollution in general (Postma-Blaauw et al., 2012; Sharma et al., 2012).

In recent decades, the use of biofertilizers specifically in organic farming has provided numerous benefits in the agricultural crop production systems (Singh et al., 2016). A biofertilizer is a substance that contains living microorganisms that upon application directly onto

the soil, inhabit the rhizosphere or the interior of the plants and thus, stimulate plant growth by increasing the supply of nutrients to the host plant, improving the availability of plant nutrients, and enhances the soil quality (Malusa & Vassilev 2014; Medina, 2010; Singh et al., 2016). The term "biofertilizer" is interchangeable with "bio-organic fertilizer" (BOF), the key difference is that BOF is a processed inoculated compost from any organic material that has undergone rapid decomposition by the introduction of homogeneous microbial inoculants (Philippine Coconut Authority, 2016).

Animal manure is arguably the most common source of compost and biofertilizers in agriculture (Hubbe et al., 2010). In the Philippines, one particular organic waste that is gaining attention as a viable component for composting is rabbit manure. Currently, the rabbit industry in the Philippines is growing since the Department of Agriculture is continuously promoting it as an alternative to pork (Go, 2020). The Bureau of Animal Industry under the Department of Agriculture is continuously supporting the growing meat-type rabbit industry in many parts of the country and conducting researches on the economic feasibility of the rabbit industry (Bejarin, 2021).

Considering the growth of the rabbit industry, it is predictable that rabbit manure volume in numerous

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farms will eventually increase thereby needing proper agricultural waste management in the future. One rabbit can produce around 28.8 kg of manure in its entire lifespan (Xu et al., 2005) and the amount of nutrients it contains is higher than many other animals' manure. One ton of rabbit manure holds 100.9 kg superphosphate (SSP), 17.85 kg sulfuric acid potassium, and 108.5 kg ammonium sulfate (Anon, 1998).

However, the high nutrient and water content of rabbit manure makes it unsuitable for direct use fertilizer as it could lead to water contamination and soil pollution in long-term practice (Hao & Chang, 2003). Conversion of rabbit manure to a valuable organic fertilizer could contribute to effective yet inexpensive, and eco-friendly agricultural productivity.

The application of *Trichoderma* species in agriculture and environmental conservation is documented in several works of literature (Chaparro et al., 2011; Contreras Cornejo et al., 2009; Hoitink et al., 2006). Numerous *Trichoderma* species are applied as biofungicides and biofertilizers to agricultural soils to augment crop growth (Lee et al., 2016). The *Trichoderma* species has also been known as a bio-control agent due to its ability to compete for space and nutrients and produces toxins against various soil-borne pathogens (Zainuddin & Faridah, 2008). This study examines the growth response and leaf yield of potted lettuce applied with different levels of rabbit manure-based BOF in lowland production.

## METHODOLOGY

### *Composting Set-up and Process*

A pot experiment was conducted in a net house at the agricultural production area of Bulacan Agricultural State College (15°04'47" N, 120°56'53" E), Bulacan Province, Philippines from November 2020 to February 2021. A week-old rabbit manure was collected in Alagao, San Ildefonso, Bulacan Province, and was composted in a compost bed applied with pure homogenous *Trichoderma* spp. in powder form (BioQuick, UPLB-NIMBB, Philippines). Carbonized rice hull was added in a 3:1 ratio as a bulking agent. Composting was done under aerobic conditions for 60 days with compost turning conducted every 7 days. The BOF was harvested after 60 days and the quality was evaluated based on smell (no offensive smell), ambient temperature (27-33°C), color (dark brown to dark), and texture (slightly grainy to fine).

Complete randomized design was used for the pot trial with 200 looseleaf lettuce seedlings. Each pot was filled with 3 kg of soil from the experiment site. The experiment consisted of 5 treatments in 4 replications. Treatments were: (T1) recommended rate based on soil test kit (STK) analysis - Urea (46-0-0) and Duofos Phosphate (0-22-0); (T2) 200g BOF application; (T3) 400g BOF application; (T4) 600g BOF application and (T5) negative control. Fertilizer application was carried out as basal application on the day of transplanting and 14 days after transplanting (DAT).  
Growth Response Parameters' Measurement

Plant height was measured from the swollen hypocotyl at ground level to the tip or apex of the

longest leaf on 14DAT and 25DAT. Total number of leaves was counted manually per plant for each treatment and replication every week until day of harvest. Leaf length was measured from the leaf blade to the leaf apex and was carried out on the shortest leaf and longest leaf in each treatment. Leaf width was measured on both sides of leaf margins having the broadest arches. Leaf blades are not straightened or flattened out due to the nature of lettuce's leaf margin (lobate to sinuate to incised) which is prone to breakage. The leaf diameter was obtained by measuring the entire leaf blade without straightening or flattening the entire leaf. All leaf measurements were conducted weekly, while root length was assessed by measuring the tap root on the day of harvest. Lettuce plants harvested in all treatments and replications were weighed individually from the roots until the apex of the longest leaf. Total yield was obtained by adding all the fresh weights from roots to shoots of individual plants in each treatment in all replications.

### *Fertilizer Analysis*

The final BOF material was analyzed for total NPK, pH, moisture content, total organic Carbon (TOC), organic matter, and C/N ratio. TN was determined through Kjeldahl method in which 0.1 g sample of sieved composite BOF was weighed and added with reagent, 0.3 g of Se, plus 3 mL of concentrated sulfuric acid in a Kjeldahl flask and digested until pistachio green. The digested sample was distilled for 5 min until the turquoise color was achieved followed by titration with hydrochloric acid (HCl) until the color changed to brick red. TP was quantified using the Vanadomolybdate method (Hoffman, 1964) and determination was carried out by UV-visible spectrophotometry. TK was measured by flame atomic emission spectrometry (FAES) method using an atomic absorption spectrometer in air-acetylene flame in pure standard solutions on emission wavelengths for potassium (Raspoor et al., 2009).

pH was quantified through the potentiometric method while moisture content was measured using gravimetric method (Sartorius Quintix, Japan). Concentration of TOC was determined based on titrimetric Walkley-Black method (1934) by adding 10 and 20 mL of potassium dichromate (K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>) solution and sulfuric acid (H<sub>2</sub>SO<sub>4</sub>), respectively, to the weighed BOF sample 0.5-1 g in a block digester tube, pre-heated then cooled. The solution was titrated with ferrous ammonium sulfate solution until a color change from greenish cast to dark green or brown was reached. The amount of K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> expended during the chemical reaction indicated the TOC content of the BOF material. Total organic matter was determined by computation once TOC was determined using the formula: Organic matter (%) = TOC (%) x 1.72. Likewise, the C/N ratio was obtained by computation with the formula: C:N = Total Carbon/Total Nitrogen.

### *Soil Analysis*

Soil pH was determined using 1:1 soil: water potentiometric method. OM and OC used Walkley-Black Method using 1g of air-dried soil sample. Phosphorous was measured via Olsen Method (1954), potassium using ammonium acetate extraction method at pH 7.0, and Kjeldahl method for nitrogen (AOAC International, 2005). Soil analysis was conducted before and after the



application of BOF.

### Statistical Analysis

Data gathered were submitted to Shapiro-Wilk test for normality and Levene's Test for homogeneity of variance, followed by an f-test using one-way ANOVA on STAR v.2.0.1 (IRRI, 2012) and repeated measures ANOVA on SPSS v25. Significant differences among treatments were further analyzed by multiple pairwise comparison using Tukey HSD ( $p < 0.05$ ). Paired T-test was used to analyze the significant difference between pre-and post-application of fertilizer on the soil,  $p < 0.05$ .

## RESULTS AND DISCUSSION

### BOF Composition

The MC of BOF found to be at 46.87% (Table 1) was higher than the MC of pure animal manure such as goat, cattle, and rabbit and organic materials like sawdust and rice hull used in several studies (Islas-Valdez et al., 2017; Kim et al., 2016; Chowdhury et al., 2014; Gomez-Brandon et al., 2013) which utilized fertilizers from animal manure and organic wastes. The pH value is another important parameter that could influence compost's effects on its microbial and chemical activity (Anon, 2002), especially in the bioconversion of macro and micronutrients. The pH (6.46) result fell into the same pH range of swine, cattle, and chicken manure containing antibiotics that dissipated during prolonged composting of 171 days Zhang et al. (2018). In contrast, the pH reported in this study was relatively lower than the pH (7.57) of rabbit manure subject to continuous feeding vermicomposting system by *Eisenia fetida* (Gomez-Brandon et al., 2013). But as described by Pan et al. (2012) microbial activity could enhance the likelihood of attaining an optimum pH range of 5.5–9.0; while the composting process is most effective and regarded ideal at pH values between 6.0 and 8.0 (Akond et al., 2016). Nonetheless, Haruta et al. (2005) stated that a pH value of 6.7-9.0 supports good microbial activity during composting. Considering these findings, it can be construed that the pH of BOF in this report exhibited suitability for microbial activity and the effectivity of the compost in enhancing soil fertility.

NPK plays a major role in the metabolic activities as well as the growth and development of plants. Nitrogen is an important building block of amino acids, nucleic acids, and chlorophyll. More importantly, it plays a critical regulator role in protein synthesis, carbon, and amino acid metabolism (Kulcheski et al., 2015). Phosphorous

is another essential macronutrient necessary for plant growth and propagation, involved in energy metabolism, and corresponds to about 0.2% of the dry weight of plants (Kuo & Chiou, 2011). Meanwhile, potassium is vital for metabolic adjustment during plant development and reproduction, yield, and responses to biotic and abiotic stresses (Bose et al., 2014).

Due to the significant roles of NPK in crop cultivation, their concentrations in many types of biofertilizers are constantly assessed. As presented in Table 2, different composting processes and composting raw materials may result in varied NPK contents of organic fertilizers. The type of bulking agents, composting time, mixing ratios of raw materials, and microorganisms used may also contribute to the final NPK of the final compost product as observed in this paper and other literature.

Although the BOF product of this study had the lowest TK, it had the second highest TP given its short decomposition period (Table 2). This may be attributed to the presence of *Trichoderma* strains which could increase phosphatase activity during composting process (Kapri & Tewari 2010). Meanwhile, the relatively low total N (0.94) and low C: N (8:1) displayed (Table 1), suggested that the BOF produced may still be undergoing maturation stage. A low concentration of N which is below 3% indicated that bioconversion of N may not have been fully completed or may have resulted in net N released as ammonia during composting (Chowdhury et al., 2013).

It was observed in several scientific reports that the incorporation of beneficial microorganisms such as *Trichoderma* spp., *Azotobacter* spp., and *Aspergillus* spp. in composting yield significant results in improving the quality of compost, especially the macronutrients NPK which are taken up by plants in large concentrations through root zones (Siddiquee et al., 2017; Singh & Sharma et al., 2002). We supposed that the NPK levels in this report are fairly comparable to other types of compost material produced organically.

The OM (12.83%) (Table 1) was considered higher compared to pure cattle (3.57%), swine (3.47%), poultry (3.08%), and green manure (decomposed plants) (3.23%), as reported by Adekiya et al. (2020) in which the different manures underwent complete composting. On the other hand, the OM level in this study was relatively lower than the OM reported in the study of Das et al. (2017) of composted cattle manure (CCM) and composted swine

Table 1. Physicochemical parameters of the BOF made from rabbit manure-*Trichoderma* spp.

Parameter	Result
Moisture content (MC) %	46.87
pH	6.46
Total Nitrogen (N) %	0.94
Total Phosphorous (P <sub>2</sub> O <sub>5</sub> ) %	1.87
Total Potassium (K <sub>2</sub> O) %	0.20
Total Organic Carbon (OC) %	7.46
Total Organic Matter (OM) %	12.83
Carbon/Nitrogen Ratio (C: N)	8:1

Organic Fertilizer Type	Composting Time (days)	N (%)	P (%)	K (%)	Reference
Rabbit manure (dry weight)	<30	1.01	0.54	1.95	Adekiya et al., 2020
Cattle manure vermicompost	175	1.60	0.01	0.21	Hernandez et al., 2010
Carabao manure vermicompost	60	1.21	1.06	0.38	Tejada et al., 2019
Wheat straw+ <i>T. harzianum</i> + <i>Aspergillus niger</i> + <i>Azotobacter chroococcum</i>	30	0.98	0.19	0.55	Singh & Sharma, 2002
Empty fruit bunches + <i>Trichoderma</i> spp.	30	0.91	2.13	6.68	Siddiquee et al., 2017
Rabbit manure + <i>Trichoderma</i> spp.	60	0.94	1.87	0.20	This study

manure (CSM) mixed with urea. Das et al. (2017) showed an OM level of above 18%, while the TOC of CCM is at 21% and 19% for CSM.

Likewise, the relatively low OM reported in this study corresponded to a low TOC (7.46%) result as organic matter is the source of organic and inorganic carbon found largely in carbonate materials (Sherrod et al., 2019) thus, with low OM it is highly likely that OC concentration will also be truncated.

One of the contributing factors to this result was the mixing ratio of the rabbit manure and bulking agent used (carbonized rice hull). One of the primary functions of bulking agents is to provide carbon and energy source for microorganisms in the decomposition process (Adhikari et al., 2009). Thus, adding biodegradable carbon materials could enhance the initial C/N ratio of the compost mixture including abridged N losses. Goyal et al. (2005) also suggested that the type and quality of the bulking agent used during composting, in which supplementing organic materials characterized by more recalcitrant carbon, can reduce the degradation of the OM and augment the humification of the final compost. As demonstrated in the study of Zhao et al. (2020) the utilization of manure as compost in soil increased the quality of soil by improving soil organic matter levels and the soil enzymes needed for carbon sequestration as well as the soil organic carbon.

Based on these findings, it is proposed that the supplementation of organic material like compost and bio-organic fertilizer is more beneficial to maintaining soil fertility production than a single or double application of inorganic fertilizer. From this study, it appears that the

rabbit manure-*Trichoderma* as bio-organic fertilizer has the potential to either be utilized as organic fertilizer or organic soil conditioner as it is as viable as vermicompost and green manure.

#### *Changes in the Soil Characteristics*

At crop harvest and post-application of BOF, soil parameters mentioned (Table 3) showed improvement to some extent. Except for soil pH, all soil parameters analyzed increased despite the BOF's low to medium macronutrient profile. On the other hand, the observed decrease in soil pH as seen in Table 3 could be due to the continuous decomposing activity of *Trichoderma* spp. where its released hydrolytic enzymes that have low pH may affect soil pH (Silva et al., 2012). The reports of Contreras Cornejo et al. (2013) also established the soil acidifying property of *Trichoderma* when applied in soil and promote plant growth by synthesizing siderophores, phosphate solubilizing enzymes, and phytohormones (Doni et al., 2014). And based on the optimum increase in the P content of the soil (62.36%) applied with BOF, there is a strong suggestion that these phosphate solubilizing enzymes contributed to the P upsurge of the BOF-treated soil making the soluble P form readily available for plants (Kamal et al., 2018).

The increased K and N availability in the soil were also attributed to the solubilizing enzymes and production of organic acids, such as fumaric acids, gluconic acids, and citric acids which then allow solubilization of potassium, phosphate, nitrogen, and other micronutrients (Eslahi et al., 2021)

#### *Growth Response of Lettuce on BOF*

Table 3. Changes in soil parameters before and after BOF application

Soil Parameter	Soil without BOF applied	Soil after BOF application	% Increase (+)/ Decrease (-)
pH	7.28	6.77*	-7
Organic Carbon (OC), %	2.31	2.52*	9.10
Organic Matter (OM), %	3.97	4.34*	9.30
Phosphorous (P), ppm	443.81	720.60*	62.36
Potassium (K), cmol/kg	1.20	1.67*	39.20
Total Nitrogen (N), %	0.20	0.34*	70

\* $p < 0.05$  through paired T-test

Table 4. Measurement of the growth response of lettuce under different BOF treatments

Growth parameter	T1	T2	T3	T4	T5
Plant height (cm)	20.90±0.81 <sup>b</sup>	23.21±0.81 <sup>c</sup>	24.58±0.81 <sup>d</sup>	26.25±0.81 <sup>e</sup>	17.20±0.81 <sup>a</sup>
Total Number of leaves	5.97±0.15 <sup>b</sup>	7.05±0.15 <sup>c</sup>	7.73±0.15 <sup>d</sup>	8.20±0.15 <sup>e</sup>	5.53±0.15 <sup>a</sup>
Leaf length (shortest) (cm)	3.97±0.15 <sup>b</sup>	4.06±0.15 <sup>c</sup>	5.46±0.15 <sup>d</sup>	7.46±0.15 <sup>e</sup>	3.36±0.15 <sup>a</sup>
Leaf length (longest) (cm)	14.70±0.15 <sup>b</sup>	17.2±0.15 <sup>c</sup>	18.62±0.15 <sup>d</sup>	19.93±0.15 <sup>e</sup>	12.70±0.15 <sup>a</sup>
Leaf width (narrowest) (cm)	2.15±0.18 <sup>a</sup>	2.2±0.18 <sup>a</sup>	3.37±0.18 <sup>b</sup>	4.89±0.18 <sup>c</sup>	1.73±0.18 <sup>a</sup>
Leaf width broadest (cm)	10.00±0.15 <sup>b</sup>	11.23±0.15 <sup>c</sup>	12.42±0.15 <sup>d</sup>	13.88±0.15 <sup>e</sup>	6.95±0.15 <sup>a</sup>
Lf diameter (shortest leaf)	11.05±0.27 <sup>b</sup>	12.5±0.27 <sup>c</sup>	16.7±0.27 <sup>d</sup>	20.06±0.27 <sup>e</sup>	8.52±0.27 <sup>a</sup>
Lf diameter (longest leaf) (cm)	39.92±0.21 <sup>b</sup>	44.56±0.21 <sup>c</sup>	47.60±0.21 <sup>d</sup>	51.38±0.21 <sup>e</sup>	32.27±0.21 <sup>a</sup>
Root length (cm)	6.33±0.12 <sup>a</sup>	6.35±0.12 <sup>a</sup>	6.53±0.12 <sup>bc</sup>	6.68±0.12 <sup>cd</sup>	6.30±0.12 <sup>ab</sup>
Fresh weight (g)	100.25±1.75 <sup>b</sup>	109.75±1.75 <sup>c</sup>	129.50±1.75 <sup>d</sup>	147.75±1.75 <sup>e</sup>	82.00±1.75 <sup>a</sup>
Total yield (g)	995.50±1.75 <sup>b</sup>	1102.50±1.75 <sup>c</sup>	1295.00±1.75 <sup>d</sup>	1532.50±1.75 <sup>e</sup>	820.00±1.75 <sup>a</sup>

Values are means of 4 replicates ± standard errors. Means with different letters within a row are significantly different ( $p < 0.05$ ) by Tukey HSD. (T1 – Recommended inorganic fertilizer; T2 – 200g of Bio-organic fertilizer (BOF); T3 – 400g of BOF; T4 600g of BOF; T5 – Negative control).

The effect of treatments on all the components observed in the growth response showed significant results (Table 4). The components include plant height, the total number of leaves, length, width, and diameter of the shortest and longest leaf, root length, fresh weight of the individual plant, and total yield. As displayed in Table 4, T4 showed the highest statistical significance in all observed parameters.

Growth and development of the lettuce was highest in T4 where BOF application was 600g per pot. The yield on T4 had the longest and widest leaves, highest number of leaves, longer roots, the tallest, and also had the highest yield. In terms of yield, T4 was 32.15% more than the yield of T1 which was the recommended rate inorganic fertilizer. In addition, the T4 yield was also 15.50% more than the total yield of T3 where BOF application was 400g per pot. T3 and T2 which are also BOF treatments in 400g and 200g applications respectively were also observed to perform better than the inorganic fertilizer. Also, T3 (6.53±0.12) and T4 (6.68±0.12) have comparable results in root length. These results countered the Hernandez et al. (2010) in which the use of composted cattle manure and vermicomposted cattle manure obtained lower yield in weight (g) compared to urea upon the cultivation of lettuce.

One possible reason for the reported result in this study was explained by Nieto-Jacobo et al. (2017) in their investigation of the ability of *Trichoderma* spp. to produce indole-3 acetic acid (IAA) a type of auxin which is a plant hormone and microbial volatile organic compounds such as sesquiterpenes, alcohols, ketones, lactones, esters, thioalcohols, thioesters and cyclohexenes (Schenkel, 2015) which both promote plant growth and development specifically lateral root formation. Plant growth stimulation by *Trichoderma* spp. has been widely reported as these fungi can increase uptake of nutrients, hasten the rate of photosynthesis and carbohydrate metabolism, and phytohormone synthesis in many horticultural crops (Anith, 2011; Cubillos-Hinojosa et al., 2009; Graveyard et al., 2007).

Rabbit manure as investigated by Islas-Valdez et al. (2017) also contained high concentrations of auxins (44.75 mg L<sup>-1</sup>), gibberellins (828.86 mg L<sup>-1</sup>) and humic acids (537.88 mg L<sup>-1</sup>). These are phytohormones that promote embryonic development of plants, seed germination, cell elongation, root and stem tropisms, plant metabolism, and acceleration of nutrient uptake (Jindo et al., 2020; Canellas & Olivares, 2017; Balzan et al., 2014). Experiments of Ikrarwati et al. (2021) supported the current findings when they reported the application of rabbit manure in ultisol soil, increased its fertility, and resulted in significant yield in onion. A study by Wardany and Anjarwati (2020) demonstrated that liquid fertilizer for rabbit manure is more effective at increasing the numbers of lettuce leaves compared to liquid goat manure.

There is a great potential that the synergistic interaction of rabbit manure and *Trichoderma* spp. resulted in the statistically significant growth response of lettuce. From these presented findings, we associate the significant growth performance and development of lettuce with the synergism of phytohormones present in the rabbit manure and solubilizing activity as well as organic compound production of *Trichoderma* spp. in the soil.

## CONCLUSION AND RECOMMENDATION

To the best of the researchers' knowledge, this is the first local report on the synergistic effect of rabbit manure and *Trichoderma* spp. as bioorganic fertilizer on the growth response of looseleaf lettuce under pot trial. The effectivity of the BOF treatments was found to be significantly higher than the use of inorganic fertilizer in many plant growth parameters with T4 (600 g BOF application) as the best treatment for plant height, leaf length, leaf width, number of leaves, root length, fresh weight and total yield. It should also be noted that in-depth investigations are necessary to further establish the macro and micronutrient profile of the BOF and how it affects the nutrient uptake of the crops. Overall, we recommend further studies and validations of the present findings using other varieties of lettuce.

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## Performance of Physical Education First Year Students in Physical Fitness

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### ABSTRACT

This study investigated the effect of Physical Education 32 Fitness Exercises activities of the CMU first-year students during the Second Semester School Year 2018-2019. The focus of this study was on physical fitness status of the students using Physical Fitness Tests. The results revealed that the physical fitness level of the students has significantly improved, as this was shown in the health-related fitness test with an overall mean of 2.80 based on the conducted pre-test, while the result on the post-test manifested an overall mean of 3.06. The skill-related fitness pre-test, obtained a mean score of 2.79 compared to post-test that had 3.33. This means that physical exercise and physical education-related activities helped improve the physical fitness condition of the respondents. Physical Education subject, particularly Physical Education 32, was effective in terms of health-related and skill-related parameters. This was after engaging in the various exercises' activity, found in the outcomes-based syllabus, there was a significant increase in the number of participants who were able to reach the high competence level of fitness. It also proved that the physical fitness test under the Physical Fitness battery of test could determine the physical fitness performance of the students.

*Keywords:* PE 32, Physical Fitness, CMU First-Year Students

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### INTRODUCTION

The school is the conducive environment for students to exhibit their physical activity as suggested by the World Health Organization, demonstrating such activities means adopting a healthy lifestyle. The physical activity opportunities of students in the out-of-school environments are gradually decreasing. In this case, physical education classes in schools can present essential opportunities for students. For this reason, one of the most up-to-date goals of physical education teachers is to encourage students to be physically active. The physical fitness level of all students must be above a certain threshold whether they are part of a sports team. Physical fitness involves endurance, strength, power, speed, balance, agility, and flexibility, appropriate measurement methods should be used in the measurement and evaluation process. Quinn (2019), emphasized that some government agency uses the field measurements to monitor their personnel's physical fitness assessment for Army combat readiness test, is comprised of a series of exercises that help evaluate overall health and physical status. Some of which are intended for medical purposes. While in schools with physical education teachers play a vital role in assessing their students' physical fitness and basic motor competencies. Although, many tests are designed to assess a single aspect of physical fitness, it is crucial to combine tests that will provide a comprehensive measurement of students' (Ulupinar and Ozbay, 2020).

Furthermore, Rizal, & Gunawan. (2019) stated that Physical Education is an important subject of doing

the various exercise activities. Physical Education subjects in school aim at helping students to understand how to maintain fitness and develop muscle strength, improve cardiovascular health, and adopt a healthy lifestyle. Moreover, Walton-Fisette and Wuest (2015) stated that Physical fitness is the ability of the body's systems to function efficiently and effectively. They also added that health fitness is important for all individuals throughout their lifespan.

The Physical Education 32 (Fitness Exercises) instructors administered the physical fitness components test at the beginning of the semester to classify the fitness status of the individual students and at the same time provide baseline information. The first part of the testing sessions provides the students an idea of their fitness levels at the start of the semester and established their physical exercises aside from their regular activities in the Physical Education class schedule.

The pre-test and post-test were two phases of the physical fitness test. The pre-test was done at the beginning of the school semester to determine the fitness status of the students. On the contrary, the post-test was administered three weeks before the final examination schedule. The fitness testing was necessary for many reasons. The baseline idea of the fitness levels at the start

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of the school year was provided by the pre-test. There was already a significant comparison made prior to this. The instructors of physical education classified the students' performance in order to attain appropriate individual activity recommendations.

To identify the possible significance and the result between the pre-test and post-test performances of the students within the duration, PE 32 assigned instructors regularly monitored the actual activities involved in the said course. There were students with buddy and group consultations to assure proper and honest recording for Personal Physical Fitness Form (PPF).

The conduct of the Physical fitness testing should be used as an educational tool that helps students gain knowledge and understanding about physical fitness and its benefits. It should not be conducted as an isolated event. When physical fitness tests were used as a meaningful assessment, and students were taught about the physical fitness components, they were more likely to understand the value of a physically active lifestyle and more engage in regular physical activities (Eastham, 2018).

### *Conceptual Framework*

The physical fitness has a multidimensional structure and can be assessed through its different components: body composition, cardiorespiratory fitness, musculoskeletal fitness, motor fitness, and flexibility. There are more than fifteen health-related physical fitness test batteries which are used worldwide. The physical fitness assessment of children and adolescents presents us with vital information which can be utilized to maintain and improve student's health. Therefore, it is of importance for schools to implement health-related physical fitness test batteries which are in accordance with the age of the participants and best reflect the relationship between physical fitness and their health (Kolimechkov, 2017).

The physical fitness implies not only the acquisition of physical skills but it also the condition that helps a person look better, think better, digest better, enjoy more, feel better and more confident, too. It is a quality of life. A physically fit person carries out daily duties and responsibilities successfully and still have enough physical reserves to enjoy his social, civic, cultural, and recreational interests. In this unit, you will find the different physical fitness tests to determine your fitness. Supplemental activities are also included to answer your weaknesses. Physical Fitness Testing is a necessary activity because it will give us information on the status of the overall physical fitness. The test should be administered at least twice a year, the pre-test at the beginning of the school year. The results of these tests will provide information whether the Physical Education Program in general, can help the students achieve desirable levels of physical fitness. The lists include measurement of the overall physical fitness that include health-related and performance-related fitness (Imbalife, Understanding the Importance of Physical Fitness).

The respondents' physical fitness status was tested in the different physical fitness test activities such

as 50-meter sprint (Speed), long jump (power), sit-up (strength), push-up (power), shuttle-run (agility), sit and reach (flexibility) and 12 -minutes run (endurance). The physical fitness of the participants was generally impressive based on the CHED Norm of Physical Fitness. The test of measuring physical fitness level showed different results among the groups. the average set by the groups of students was generally equivalent to or higher that the CHED standards. This means that the TIP PE students could meet or even surpass CHED standards (Giron 2008).

Physical Education 32 as a course is a conducive setting that requires young students to enroll in the first two academic year's equivalent to four consecutive semesters. It has specific course activities that encourage psychomotor learning, development in monitoring assessment, health promotion, and attainment of physical fitness. As a course it helps students to establish and maintain their physical fitness.

The Department of Education implemented Memorandum Order No. 58, series of 1990 on the Guidelines and Standards for Collegiate Service Physical Education Program that presented its objectives emphasizing the integration of the improvement and maintenance of students' physical fitness.

The President's Council of Fitness and Sports in the United State of America was established on July 16, 1956. After the issuance of Executive Order 10673, this council has been continuously operating its programs. The program's highlights include the raise of standards and level of physical fitness of people. The nationwide campaign reached many education areas that strive to accomplish the following: 1) To improve programs of Physical Education with increased emphasis on physical fitness, 2) To increase the state of the physical fitness and sports program leaders and supervisors, 3) To increase the number of school personnel during physical education work, 4) To conduct a regional clinic in physical fitness, and 5) To inform the public and develop its interest in Physical Education through advertising this in social media (President's Council on Physical Fitness & Sports The First 50 Years: 1956-2006).

The Republic Act No. 5708 is known as the School Physical Education and Sports development Act of 1969. This reinforces the school's physical fitness and sports development program. This was followed by a Memorandum Order by the Department of Education and Culture in February 1971, which mandates the schools to integrate with Physical Education the school sports and physical fitness program where it should remain as part of the basic education curriculum and shall be undertaken by the Department of Education. Physical fitness program must be given from childhood to adulthood. Furthermore, there are four phases that are needed to be developed in five years. These phases are: 1) Physical Fitness Testing, 2) Curriculum Development, 3) Staff Development; and 4) Provision of Facilities and Equipment. One of the primary concerns of schools, colleges, and universities is to make young citizens aware of these all-important programs to improve and maintain their physical fitness conditions (Republic Act No. 5708, 1969). In addition,



Physical Education teachers select activities to help students develop and improve their fitness levels. These also integrate skill-related fitness components. The role of the teachers of Physical Education subjects assess the fitness levels of their students. Regularly, the fitness tests are conducted at the beginning and end of the school year or semester. The fitness status of students in the area and the physical education teachers may use fitness scores to determine the program's success (Shimon, 2011).

The physical education teachers should administer the physical fitness test which is done at least twice a year. Pre-test is conducted at the beginning of the school year and post-test is done before the school year ends. The conduct of pre-test and post-test provides information whether the Physical Education program helps the students achieve optimum physical fitness levels for their benefit (Guidangen, 2016).

It has been observed that conducting a regular period of classes two hours a week for physical activity encouraged students to participate and engage at least 40 minutes per actual session with quality physical education programmed processes to improve the fitness level. There are different combinations of physical activities through the Central Mindanao University-approved course syllabus of 2018, specifically, PE 32, with a descriptive title of Fitness Exercises, containing the various physical movements. Further, these movements enhanced individual fitness status in core stability, strength, and mobility. These also include goal-setting exercise progression and regression and periodic assessments to develop various fitness components. The students are properly guided in performing the proper execution of the actual exercises.

Physical fitness tests include specific test protocols that students must practice before test administration. To determine the individual physical fitness performance of the students, the pre-post-test Physical Fitness Battery of Tests (PFT) was administered to categorize their health-related and skill-related competencies while selecting what

other components they may need to improve (Physical Education Department Curriculum, 2018).

The Physical Fitness testing is a means for teaching students how to set goals for improving their health. This assessment is flexible enough that it can accommodate many different types of tests in the various areas of fitness (cardiorespiratory endurance, muscular strength, muscular endurance, flexibility and body composition and nutrition) since teachers use a wide variety of fitness tests. However, you may want to use this as a template or guide for creating a more specific assessment of your own. It is very important that goals be specific and measurable and customizing a form allows you to make it more meaningful for the tests you use (Gorwitz, 2012).

The study aimed to examine Health-Related fitness components and Skills-Related fitness components variables. The study believed that variables have influence each other. Furthermore, it attempted to describe the pre-test and post-test mean performance of each fitness component and identify the significant difference between before and after tests.

More explicit presentation of the study concept, a schematic model shows how different variables are interrelated with the physical fitness pre-test and post-test.

The study aimed to examine Health-Related fitness components and Skills-Related fitness components variables. The study believed that variables influence each other. Furthermore, it attempted to describe the pre-test and post-test mean performance of each fitness component and identify the significant difference between before and after tests. Hence, this study was anchored on Campbell and Stanley's (1963) One-Group Pretest-posttest model.

A one-group pretest–posttest design is a type of research design that is most often utilized by behavioral

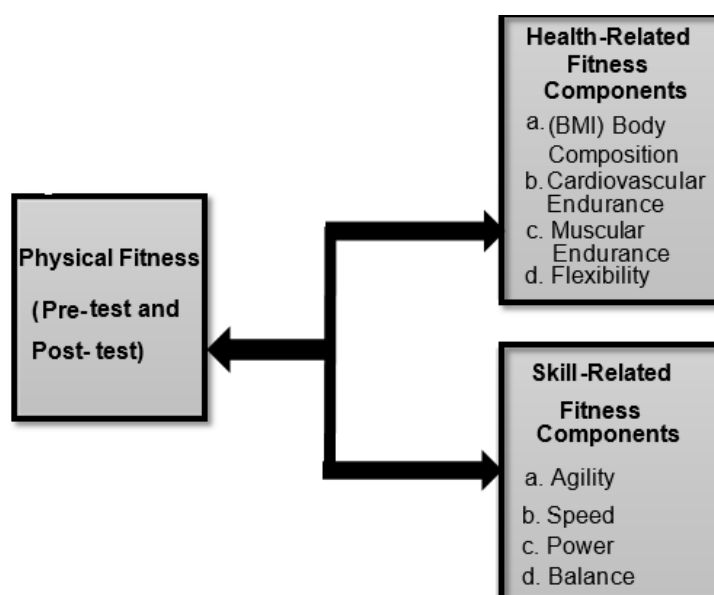


Figure 1. Conceptual Framework: Relationship Between Health-Related Fitness Components and Skill-Related Fitness Components.

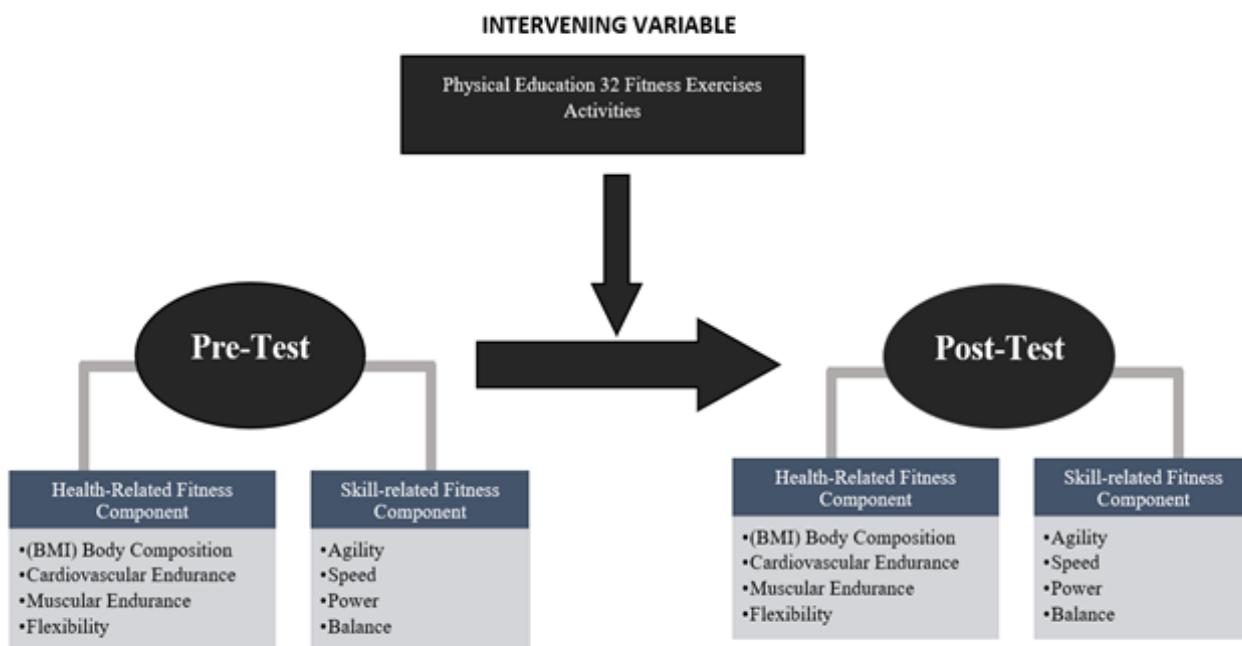


Figure 2. Theoretical Framework: One-group Pretest-Posttest Model Integration

researchers to determine the effect of a treatment or intervention on a given sample. This research design is characterized by two features. The first feature is the use of a single group of participants (i.e., a one-group design). This feature denotes that all participants are part of a single condition—meaning all participants are given the same treatments and assessments. The second feature is a linear ordering that requires the assessment of a dependent variable before and after treatment is implemented (i.e., a pretest–posttest design). Within pretest–posttest research designs, the effect of a treatment is determined by calculating the difference between the first assessment of the participants and the post-assessments of the participants after the intervention/treatment. (Cranmer, 2017)

This study integrates Campbell and Stanley’s (1963) One-group Pretest-Posttest Model as a framework that presents a pretest, followed by an intervention/treatment, and then a post-test where the difference between the Pre-test and Post-test is explained by the intervening variable – the causal link between other variables.

Physical Education 32 Fitness Exercises activities served as the intervention/treatment the researcher used for the first-year students at Central Mindanao University in this study. This was employed to identify the changes in the post-test scores after performing the exercise activities.

Operationally, four hypotheses were examined in this study:

Hypothesis 1: The post-test scores based on the health-related components are significantly higher than the pre-test scores.

Hypothesis 2: The post-test scores based on the skill-related components are significantly higher than the pre-test scores.

Hypothesis 3: There is a significant difference between the pre-test and post-test performances of the students on their fitness/health profile

Hypothesis 4: There is a significant relationship between health-related components and skill-related components in terms of pre-test and post-test.

### Objectives

The study aimed to examine the physical fitness of the first-year students in the second semester of the school year 2018 to 2019 at Central Mindanao University and to investigate the impact of the Physical Education 32 Fitness Exercises activities as the intervention in physical exercise activity.

Specifically, this research attempts to answer the following questions:

1. Describe the pre-test and post-test mean performance of the students’ fitness/health profile in terms of the following variables:
  - a. Health-Related Components
  - b. Skill-Related Components;
2. Identify the significant difference between the pre-test and post-test, and;
3. Determine the significant relationship between the Health-related and skill-related components.

### METHODOLOGY

The researcher used the non-experimental quantitative research utilizing descriptive correlation technique, which involved finding directions and extent relationship between two variables. Using non-experimental quantitative, however, non-manipulability-free factors require further review in Education. The said technique was very instrumental in the study because

the researcher aimed to find out whether exercise motivation significantly influences the physical fitness of the respondents. The researcher conducted the study in Central Mindanao University, University Town, Musuan, Maramag, 8710 Bukidnon, Philippines. Among the 1,200 first-year student population, 232 respondents were chosen from 33 sections. Using the stratified sampling from each class section. The Slovin's formula of random sampling had employed with a maximum of 5 percent per section to identify the representative per section in Physical Education 32 Fitness Exercises course, offered Second Semester, School Year 2018-2019.

A combination of the Physical Fitness Test Manual based in the existing DepEd PPFT manual by Mequi (2014) cited by Llego (2019) were used as a guide and instruments in this study. The Department of Education Philippine Physical Fitness Test (PPFT) Manual in 2015 is the guide in executing different tests. The manual contains a set of measures that can determine the student's fitness level.

The researcher sent a letter to the University President to seek approval to conduct the study. The approval was needed before the data were collected from the respected faculty members of the Department of Physical Education. The issuance of Data Privacy Statement and the Institution Ethical Research Committee Board certificates were requested to protect the credibility of this work responsibly and for the confidentiality of the used documents. Finally, the study used Mean, Pearson (r), and Regression statistical tools to analyze the data.

## RESULTS AND DISCUSSIONS

This section presents the data gathered, a thorough discussion, interpretation, and implication of the study's findings. This also describes the level of the students' fitness health profile such as skill-related fitness components and health-related fitness components. Also, this section presents the significant difference of the students' performance in the pre-test and post-test.

Table 1.1 reveals the level of mean of the students' performance in fitness/health profile in terms of health-related components. Further, the data compares the results of the pre-test and post-test. The pre-test obtained an overall mean of 2.80 which means that the level of the respondent's health-related component is moderate. The

overall results of mean of the post-test reveal an increase from 2.80 to 3.06. The body composition obtained 4.19 mean score in the pre-test. This means that which means that the health-related component of the respondents was high. Before the study was conducted, and during the post-test, the mean overall score has increased to 4.20 with a descriptive level of very high which means that the Physical Exercise subject was compelling in terms of improving the health-related component of the students in terms of body composition. This means that the students of this generation are conscious and are motivated to improve their body figures.

Secondly, the overall mean performance of the students 'cardiovascular endurance during the pre-test is 1.25, with a descriptive level of very low, while in the post-test, the mean overall score has increased to 1.48 with the same descriptive level of very low, which means that there is only a slight improvement on the students' performance, where students do not always engage in the aerobic exercises in the classroom setting but only during university functions and occasions like, Founding Anniversary, Palaro and Physical Education/Siglakas Club Day.

Thirdly, in the pre-test, muscular endurance shows the result of a mean overall score of 1.92, while in the post-test, it has a mean overall score of 2.35 with the same descriptive status of low. It means that there is only a slight improvement in the student's status of muscular endurance. One of the reasons perhaps is students nowadays do not carry heavy books and notebooks anymore in attending their classes; instead, they are only having light gadgets. Carrying this much weight every day can bring detrimental health effects (Dong, 2016). Muscles that lack muscular endurance tire easily and limit the amount of work. This is the part of the body that needs to be improved. Lastly, in the pre-test, the flexibility overall mean of score is 3.85 with the descriptive level of high. During the post-test, the flexibility is 4.22 with the descriptive level of very high, which reveals a significant difference between the pre-test and post-test. The reasons for the improvement of the flexibility skill of the students are stretching and physical fitness activities, and doing actual exercises before and after class.

It can be noted that in the pre-test, the highest mean is 4.19 in body composition, followed by flexibility

Table 1.1 Level of Pre-Test and Post-Test Mean Performance of the Students' Fitness/Health Profile in Terms of Health-Related Components

Indicator	Pre-Test			Post-Test		
	SD	Mean	Descriptive Level	SD	Mean	Descriptive Level
Body Composition	1.04	4.19	High	1.03	4.20	Very High
Cardiovascular Endurance	0.71	1.25	Very Low	0.94	1.48	Very Low
Muscular Endurance	0.63	1.92	Low	0.83	2.35	Low
Flexibility	0.82	3.85	High	0.70	4.22	Very High
Overall	0.45	2.80	Moderate	0.49	3.06	Moderate

Table 1.2 Level of Pre-Test and Post-Test Mean Performance on the Fitness/Health Profile of Students in Terms of Skill-Related Components

Indicator	Pre-Test			Post-Test		
	SD	Mean	Descriptive Level	SD	Mean	Descriptive Level
Agility	0.75	1.99	Low	0.89	2.53	Low
Speed	0.86	3.06	Moderate	0.82	3.52	High
Power	0.77	3.35	Moderate	0.78	3.63	High
Balance	1.37	2.76	Moderate	1.32	3.64	High
Overall	0.56	2.79	Moderate	0.58	3.33	Moderate

with a high mean of 3.85, muscular endurance with an average mean of 1.92 and, lastly cardiovascular endurance with an average of 1.25. The highest mean in the post-test is 4.22 in flexibility, followed by body composition with the mean of 4.20, muscular endurance with an average mean of 2.35, and cardiovascular endurance of 1.48, respectively. The fitness program of the students was only attained during their Physical Education classes, with still insufficient time intended for their physical conditioning after Physical Education class, and sometimes, classes were suspended for some holidays and university events. The short duration of Physical education classes a semester would not be enough to show significant improvement especially that the students are focuses on the use of technology for both personal and academic purposes. Further, some online games are at one corner which will make them engaged with so little time for actual physical activities. The mean value of both pre-test and post-test increased. This means that there is a positive effect on the physical and health conditions of the students. Physical Education classes contributed so much in the positive effect.

Table 1.2 the fitness profile of the first-year students in Skill-Related Components shows that the pre-test obtains an overall mean of 2.79, with a moderate qualitative description, which means that the activity related to physical fitness occasionally manifests. In the post-test, the results of the overall mean revealed an increase in mean scores from 2.79 to 3.33. The result reveals that, during the pre-test, agility has a mean score of 1.99 with a descriptive level of low. Furthermore, the overall mean score of agility in the post-test has increased to 2.53, with a descriptive level of low which means that the agility performance of the students is not applied in their daily routine. The activity is an Illinois Run where not all can perform and exert effort to gain the skill. The students have many events in their regular workload in academics and extracurricular activities, these have been observed to exhibit inadequate sleep caused by decreased body movement and lack of alertness to perform agility skills. Hence, they have fewer activities related to Illinois runs. Secondly, during pre-test, speed gets an overall mean of 3.06 with a descriptive level of moderate. On the other hand, the overall mean score of speed has increased to 3.52, with the descriptive level of high. It means that running with acceleration is very common and is mainly applied to the daily routine of the students. Thirdly, during

pre-test, the power test results to an overall mean score of 3.35 with a descriptive level of moderate compared to the post-test overall mean score of 3.63 with a descriptive level of high. It means that the students habitually perform the power of legs and arms in their daily activities. Lastly, in the pre-test, the balance overall mean score is 2.76 with the descriptive level of moderate, and in the post-test, the balance overall mean score is 3.64 with the descriptive level of high. The results mean that balance skill is applied to the performance of the students while at school and home.

Furthermore, the highest mean in the pre-test is 3.35 in power, which means that the average population of the sample students manifests explosive body movement, followed by the speed with an average mean of 3.06, balance with an average mean of 2.76, and lastly, agility with an average of 1.99. The result reveals that in the post-test, balance gets the highest mean score of 3.63, speed with an average mean of 3.52, and finally, agility with an average of 2.53. On the post-test, all the mean scores in Table 1.1 and Table 1.2 (Level of pre-test and post-test mean performance of the students' fitness/health profile in terms of skill-related components) are elevated. As shown in Table 1.1, the post-test yields an overall mean of 3.06 compared to 2.80 over the pre-test but still fell in the same category of moderate. Similarly, in Table 1.2, the post-test yields an overall mean of 3.33 compared to 2.79 over the pre-test but still belonged to the same category of moderate. Therefore, The Physical Education classes contributed the improvement and increased students' speed, power, and balance performances. In addition, the mean value of agility has increased from 1.99 to 2.53, before and after. Generally, the improvement is not fully attained.

Table 2 shows the result of the paired sample t-test and the differences between the pre-test and post-test scores. The result reveals that the body composition was at 0.180, indicating that it is not highly significant at 0.01 level. It means that there is no significant difference between the pre-test and post-test in body composition. Thus, it manifests that Physical Education classes of one semester are considered the inadequate length of period to change the body composition of all the respondents and to consider the students' rare participation in the physical exercises with their daily activities concentrating



Table 2 The significant difference between the pre-test and post-test performances of the students' on their fitness/health profile was determined using paired sample t-test.

Indicator	Sig. (2-tailed)
Body Composition	0.180
Cardiovascular Endurance	0.002**
Muscular Endurance	0.000**
Flexibility	0.000**
Agility	0.000**
Speed	0.000**
Power	0.000**
Balance	0.000**

Significant Difference Between the Pre-Test and Post-Test Indicators

Legend: \*\* = highly significant at 0.01 level

the academic performance than to enjoy performing physical activities with friends. It can be observed that the cardiovascular indicator is at 0.002\*\* significant level, indicating high significance. Hence, significant difference is noted between the pre-test and post-test cardiovascular indicators. Muscular, flexibility, agility, speed, and power indicators are at 0.000\*\*, which means that it is highly significant at 0.01 level and significant difference is depicted between the pre-test and post-test indicators. Based on the data, the balance indicator is at 0.0000\*\* significant level, indicating it is highly significant. In conclusion, there is a significant difference between the pre-test and post-test balance indicators.

The majority of the indicators are proven to have a highly significant difference between the pre-test and post-test at 0.01 level except for the body composition indicator. The significant relationship between health-related components and skill-related components.

Table 3 shows a significant relationship between the skill-related components and health-related components of the physical fitness test. Hence, the skill-related components of the physical fitness test affect the health-related components of the students and vice versa. These further imply that the physical fitness of the first-year students in Central Mindanao University significantly differs from pre-test to post-test. Moreover, the physical fitness of first-year students after the post-test has differed significantly compared to the results during the pre-test. It can be concluded that there is a significant difference found in the physical fitness of first-year students after participating in the class exercises and activities.

Findings confirm with the study of Latorre et al. (2018) that the attitudes and performance of the students in the pre-test and post-test will increase when they were

exposed to Physical Fitness Test as interventions.

The results of the study of Bastug (2018) confirm that physical fitness interventions like dancing exercises and physical fitness tests could significantly enhance the physical fitness performance of the students.

Similarly, with the study conducted by Greco et al. (2019), the results also confirmed that a maintained physical fitness test could promote substantial gains in the flexibility of the lower body, static balance, explosive leg power, and general motor coordination. The study of Kolimechkov (2017) concluded that the physical fitness assessment of children and adolescents presents us with vital information that can be used to maintain and improve the health of the children. In short, it is important for schools to implement a set of health-related physical fitness test and that can fit with the age of the participants and can better reflect the relationship between physical fitness and health at the same time.

In relation to the statement above, significant findings from different researches on physical fitness were among the most frequently sought forms of assessment in this study. Based on the results, physical fitness was viewed mainly as a quantitative change and enhanced learning is considered an improvement in the acquisition of the given activity to be performed by one group or group of students in the Physical Education course for their physical fitness performance assessment. Professional fitness facilitators prescribe an exercise program with specified training principles with the frequency, intensity, time or duration, and type of exercises. These variables are needed in constructing an exercise prescription or program for an individual (Wuest & Bucher, 2014). To attain and maintain a fitness level of individual, must exercise regularly with the threshold in training workouts to achieve optimal results.

Table 3. Significant Relationship between Health-Related Components and Skill-Related Components in Terms of Pre-Test and Post-Test

Pre-test	Skill-Related components	Post-test	Skill-Related components
Health-Related components	.202** .000	Health-Related components	.278** .000

Legend: \*\* = highly significant at 0.01 level

Physical exercise within the fitness level target zone is necessary.

Furthermore, results conform to the study as cited by Kuehn (2019), where he said that the post-test score should be higher than the pre-test score to prove that the student performance progresses at a notable and positive levels.

## CONCLUSIONS

The results reveal that the students' body mass index (BMI) and flexibility performance levels improved from high to very high and moderate to high level, respectively. At the same time, there was no improvement in both cardiovascular endurance and muscular endurance performance level of very low and low, respectively. It can be gleaned that the overall description of health-related fitness components was a moderate performance in the pre-test and the post-test.

The speed, power, balances improved after the post-test in which the descriptive performance level was described to be moderate to high performance. However, the agility remained at a low level from the pre-test to the post-test. The overall performance of skill-related fitness components was moderate in pre-assessment and post-assessment. Significant differences were seen between the pre-test and post-test results of the following: cardiovascular endurance, muscular endurance, flexibility, agility, power, and balance, which was opposite to the body composition with no significant difference.

The implementation of CMU Physical Education instructional system design worked effectively, especially in terms of Physical Fitness, as shown in the mean scores in the actual tests. The instructional objectives were entirely accomplished, these can be observed from the increase of the skills learned by the students from the tested physical fitness components.

## RECOMMENDATIONS

Based on the stated conclusions, it is recommended that Physical Education teachers may encourage the students to be more physically active. The physical fitness level activities not only in their Physical education classes but also in their free time.

Physical Education students may improve and maintain their physical fitness level by regularly engaging in fitness exercises wherein they can associate their skill-related and health-related performances. The study employing Physical Fitness Test (PFT) introduced by Dr. Aparicio H. Mequi and Fitness Battery of Tests recently recommended by the Commission on Higher Education, may be conducted. Every semester, more factors and variables in the test batteries may be closely examined.

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## Grade 9 Students' Performance in English of the University of San Carlos-North Campus

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### ABSTRACT

Many teachers have conveyed discontentment with the literacy achievement shown by many students. The English area teachers of the university decided to address this deficiency with the on-going implementation of the remedial program in the elementary. In senior high school and tertiary levels, the risks are high. Teachers then expect learners to use diverse texts in order to answer; to form an analysis, to make experiments and to do research. It is not shocking that there are multiple communicative shortcomings at the secondary and tertiary levels. Difficulties which were minor, controllable or partially disregarded now become major concerns. This study was conducted to find out the English performance of the Grade 9 students of the University of San Carlos North Campus in terms of the three components: written works, quarterly assessments, and performance tasks. It also sought to determine the factors that affect the English performance of students. As an output of this study, a curriculum map was designed for English classroom use. This study used qualitative and quantitative methods. The teacher-made test, as an instrument, was adapted from the study of Murcia, Belando, Silveira (2015) and Magno & Bunagan (2009). Fifty students and two teachers in Grade 9 answered the survey questionnaires. The results revealed that the English performance of the Grade 9 students was above average and the top factors that impacted their performance were teacher's personality, teacher's communication skill, assessment, and teaching strategies. Through analysis, students' English performance was significantly influenced by how the teachers treat them and how they deliver the lessons. Teachers need to reflect on the factors which assist and deter the academic performance of the child. To better prepare classroom activities, a well-prepared curriculum map was found to enrich instruction delivery among teachers and augment learning potentials among students. Since this research has discovered the gaps on giving the assessments, and most influential factors that affect their academic English performance, this curriculum map was designed to address all these findings.

*Keywords:* English, factors, performance tasks, quarterly assessments students' performance, written works

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### INTRODUCTION

Many significant changes have been made to the way teachers teach in classrooms. It is due to the new skills challenge for the 21st century. Learning in the 21st century refers to the abilities and innovations that will allow learners to excel in an environment that continuously requires teamwork, strategic thought, imagination, and communication. According to Escobar (2019), how and why to learn is essential and far more significant than what or who to learn from. At this time, learners ought to approach lifelong learning with a versatile mind. As reported by Cabigon (2015), the community, academics, private and non-governmental sectors urged that the Philippines needs to enhance English learning and teaching and develops critical skill necessary for the industry. He added that this was an ingenuity that could probably reinforce the decisive advantage of the Philippines in some parts of the world, especially with ASEAN economic integration.

Language proficiency in English is strongly linked to academic success, according to Racca and Lasaten (2016). It was noted that language functions play a substantial role in logical and analytical thought. They added that the more exposed students are to using the language, the more effective their reasoning can be. As

a result, the better students know and apply it, the more they can do well in their academic subjects.

Past study indicates that students who fall behind in the development of reading and writing in the early years face significant problems in pursuing schooling in the later years as texts become more complex (Myrberg, 2007). It is not shocking that there are multiple communicative shortcomings at the secondary and tertiary levels. Difficulties that were minor, controllable, or partially disregarded now become significant concerns.

According to Strauss (2017), many scholars have observed that several students are unable to compose complete sentences with good grammar and clarity, to structure their writing efficiently, and to defend their views with pieces of evidence. He also clarifies that in their writing, students sometimes do not know how to study or how to paraphrase the language of others. Unable of mastering the foundations' skills in four or six years, they are now entering the job market with insufficient English

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skills. In the Philippines, the English language is highly valued because it offers social mobility especially jobs within and outside the country.

Today, a great challenge for teachers is adapting students' learning needs to an ever-changing environment. According to Ghavifekr, Afshari, Siraj, and Bin Abdul Razak (2013), "As a result of the complexity and dynamic features of educational change, the fundamental concern for the effective application of the transition, is "in what way" they can manage change in a productive and deliberate manner" (p. 333). To best serve the changing and evolving demands of their students, teachers need to review school learning, educational strategies, and evaluation. Curriculum design should center on the ultimate aim of enhancing English teaching and learning for all students.

This endeavor aimed to design a curriculum map to provide authentic practice, appropriate learning experiences for the students, and give more opportunities to use the English language. By refocusing efforts on the teacher as a curriculum designer, learners will be equipped to effectively express themselves with ease and confidence in both oral and written ways. This study is intended to enhance the English programs and curriculum of the University of San Carlos-North Campus. Varied and stimulating classroom activities can transform students' passivity and boredom into active involvement and genuine interest. This study is an effective means of getting first-hand tacit knowledge on which this English language endeavor works best.

### Statement of the Problem

This study assessed the English performance of Grade 9 students of the University of San Carlos-North Campus to design a curriculum map for the first and second quarters of the next academic years.

1. What is the students' performance in terms of:
  - 1.1 written work
  - 1.2 quarterly assessment
  - 1.3 performance task
2. What factors have contributed to the student's performance in the identified areas?
  - 2.1 assessment
  - 2.2 content or flow of the lessons
  - 2.3 ICT utilization
  - 2.4 language exposure
  - 2.5 strategies
  - 2.6 teacher's communication skill
  - 2.7 teacher's personality
  - 2.8 teacher's preparation

### LITERATURE REVIEW

English as a medium of thought and means of communication never stays static. It has to be dynamic, constantly changing to meet current times and demands. Much of the momentum of language teaching today can be seen as a reaction to a need which teachers have long been aware of Newmark (1966) articulated that it is a dilemma of the students who may be structurally competent but cannot effectively communicate. In a preliminary phase, it

is vital that language teachers study the language learners carefully and develop language plans and language teaching materials that meet their needs.

According to Medalle (2003), in deciding what is best for language teaching, the question WHO? (Who are the students?) precedes WHAT? (What kind of learning resources do they need?), then these two determine HOW? (How can I provide optimal learning?) To cover these queries, the fundamental roles of a teacher according to the Private Education Assistance Committee (PEAC) are very critical: As a designer, the teacher must put together the different elements of the learning plan according to standards; as an assessor, he/she must provide feedback regarding student progress and achievement; and as a facilitator, he/she must guide students in their inquiry and transfer.

Nevertheless, successful and efficient teaching does not just take place instantly; it is created by diligent planning of the methods of learning. The collection of bits and pieces of data is not what there is to education. The acquisition of information is at the bottom part of the learning style continuum. For higher levels of thought and for learning that is relevant and long-lasting, the outcomes of the research recommend using a program in which the four macro skills can be learned in an integrated manner (Depdiknas, 2006).

Recently, the curriculum has altered as it still does. Thus, the development of the language curriculum has evolved. The curriculum is critical in education. It serves as a road map for educators to recognize students' knowledge and skills. It is a framework of scaffolded principles, content, and practices structured to improve the awareness, skills and competencies of learners. The program is a collection of plans, content, instructional resources, and learning experiences aimed at a particular purpose (Depdiknas, 2006). Designing a curriculum is a "how-to-do-it" practice, which is said to be a writing activity that can be used as a method of collecting, ordering, texting, reviewing and editing ideas (Nation, 2010:1).

#### *Students' Performance*

**Written Work.** It attempts to evaluate the interpretation of ideas and the implementation of skills by learners. It means that students are able in written form to communicate acquired abilities and concepts. It is highly advised that items be distributed around the dimensions of the cognitive function in lengthy quizzes / assessments. According to Catapano (2009), written work is a powerful assessment tool to let students write down their own responses to questions and compose their own unique answers to show understanding.

**Quarterly Assessment.** It measures the skills, principles and beliefs that have been learned in the quarter. This is given through objective tests, performance based assessment or their combination. Similarly, it is given once at the end of the quarter. According to Faustos (2019) quarterly test lets students provide themselves a pat on their shoulder, and a score guide to do better, and tweak things which need adjustments. In the same way, it gives

students, teachers and parents an opportunity to identify the changes they need to make in order to get through the subject.

**Performance Task (PT).** This section gives students opportunities to exhibit their learned competencies and skills. It allows learners the ability to communicate their learning in suitable and varied means. In multiple ways, it promotes student inquiry, information integration, comprehension, and skills. In this respect, learners may develop or produce products or do performance-based tasks. It is also possible to view written output in this kind. Also, it needs to be given several times during the quarter. Loyola (2016) said that performance tasks is given much weight compared to other components because it gives an idea on the abilities and skills that learners manifest with reference to the content standards. Furthermore, PT guarantees application of knowledge, skills and attitudes which are depicted through creating, innovating or collaborating with others.

### *Factors Contributing to Students' Performance*

Several research were undertaken to analyze the influences that can affect the academic success of students. While the position of all factors that contribute effectively to academic performance is not commonly defined, the researcher concentrates on internal factors in classrooms. According to Harb and Shaarawi (2006), the capability of the learners in English has a significant effect on students' academic performance. Good English communicators are more capable of completing their studies.

Several influences affect the quality of students' achievement (Waters & Marzano, 2006). Many variables should be weighed to assess the factors influencing the quality of student performance. Identifying the factors that contribute directly to the consistency of academic success is a rigorous task because learners belong to various backgrounds. This complexity is as dynamic as it has been in the Philippine's culture. In the light of these studies, the researcher conducted this to analyze the impacts of various influences on the English performance among Grade 9 students of the University of San Carlos North Campus.

### *Second Language Acquisition*

An SLA expert, Stephen Krashen, has rendered significant works to the language learning method, the concepts of which have become "a research source of second language acquisition ideas" (Lightbown & Spada, 2006, p.38). "The widespread use of conscious grammatical rules and tedious grammatical practice does not guarantee a strong getting hold of the language" (Krashen, 1987). Moreover, he emphasized that "Acquisition requires meaningful interaction using the target language not necessarily with how texts are delivered but with the messages they are expressing." (Krashen, 1987).

Krashen (2005) found that, on standardized examinations, students whose parents were educated score better than those whose parents were unschooled. Learned parents can interact more with their sons or daughters about assignments, concepts or events that are

learned in an institution. To put it another way, parents can take a big part in the education of their children (Fantuzzo & Tighe, 2000).

Ultimately, Krashen suggests that acquiring language is far more effective than learning language to obtain practical skills in a foreign language. According to Schutz (2018), good language teaching is not related to a packed course of standardized lessons focused on grammar ordering, translation or oral drilling, nor is it based on technical tools. Effective teaching is customized and is centered on the learners' needs.

### *Vyotsky's Zone of Proximal Development*

Lev Vygotsky (1896-1934) developed the zone of proximal development. He focused on social interaction in the creation of cognition (Vygotsky, 1978), and "making meaning" process.

He asserted that having sufficient assistance would provide the student enough "help" to achieve the task while still in the proximal development zone. According to him (unlike Piaget), social learning tends to come before creation. It is not possible to grasp human growth without regard to the social and cultural framework within which it is situated. This serves as the center of the assessment process for the K-12. This substantiates adequate evaluation, defined from controlled to autonomous presentation of information that will allow learners to use their learning in future situations.

In determining the success of children, Vygotsky found the adults around children's lives to be very important as those people will most likely be the ones to help the children learn (Silalahi, 2019).

### *Constructivist Theory*

Jerome Bruner's constructivist theory notes that learning is an ongoing mechanism in which learners, based on their present or previous experience, construct new ideas or concepts from interactions.

According to Ferlazzo and Sypniewski (2018), through past undertakings, students can build new concepts which can improve English language learning. Encouragement, assisting and allowing students to discover the main principles on their own are focused in this concept. Students are given opportunities, depending on their interests, to represent, assess their practice and identify intermediate skills to learn.

Kristinsdottir (2001) states that the main principle is communication between the learner and the instructor. In this theoretical sense, Socratic learning is proposed as the strongest mode of communication, as it helps the tutor to consciously note any research abilities displayed by the learner, their development, their frustrations, and form a rubric of their present learning state based on the exchange of ideas. Seeing that this idea takes and illustrates established facts, any teacher lesson plans, teacher worksheets, or tools can simply continuously develop the understanding of the learner for progression.

Under this philosophy of learning growth, Bruner is serious about vocabulary and how this effects reasoning. Identifying the variations in adult vocabulary and the language used by children is important to every child's development. They need time to improve not only their intellectual learning, but their vocabulary as well, with the child being younger. Teachers and parents alike are also urged to adopt the "scaffolding" engagement approach, which is a technique aimed at simplifying learning processes by taking smaller steps, all leading to the final result. In order to characterize the tutorial relationship between a teacher and a pupil "scaffolding" should be given. This helps maintain some dissatisfaction when keeping in mind what is important throughout the learning process.

Bruner's hypothesis indicates that teachers are very specific about the organization when assessing the research ability of the pupil, allowing the learner to reflect on the greater challenge at hand as well as the objectives, instead of being wrapped up in small information or grievances. They are urged to commend the efforts made by the learners when informing them, allowing them to concentrate on the related topics, and encouraging them to practice and rehearse what they have learned.

### Social Learning Theory

Albert Bandura posited the theory and emphasized that learning takes place by evaluation, imitation, and demonstration. The theory links behavioral and cognitive learning theories because of the concentration, memory, and motivation it incorporates. People learn by perceiving and mimicking. He indicated...

Interaction is important to language development. This is supported by Piaget's language concept which says that interaction enhances intellectual development is crucial to language learning. Language is inherently a social factor, according to Piaget (1969).

The purpose of classroom instruction is to develop the ability of learners to communicate through interaction using target language. The researcher now acknowledges, as quoted by Larcen-Freeman (2006), that instruction in grammar must be integrated into a communicative structure. The communicative challenge was suggested to provide learners with correct use of grammar. In addition, Celce-Murcia (2006) suggested to use strictly communicative tasks that nonetheless involve the understanding and development of grammar. It is then crucial to have a broad variety of tools and exposure in the classroom.

Not so long ago, pupils were seen as empty vessels in which the teacher spilled the day's lesson contents (Borich, 2000). Today's instruction is seen not simply as knowledge transfer, but rather as teacher interacting with learners. Students are given opportunities for multiple and creative ways to express themselves. Teachers take on the role of facilitator who leads training without being the primary source or transmitter of knowledge.

This study is also based on the Whole Language approach. In every learner there is still a need for more

training in using the language for practical purposes. Practice of language should be as close as possible to real communication. Reif and Heimburge (1996, cited in Medalle 2003) agreed that Whole Language is an interconnected approach that incorporates reading, writing, speaking, listening and allowing students to see links and derive meaning from good literature. His advocates (Goodman, 1980, Crafton, 1991 and Watson, 1987 among others) consider meaning to be paramount, and that students should be taught language from "whole to part" using authentic texts and activities through communication interaction.

Regardless of the diversity of immersive learning experiences, their goal remains to train students to use English in the world beyond the classroom. This is the world which, when lessons are over, focuses on preserving and improving their communicative skills. In the absence of native English speakers, the Internet now offers opportunities to interact with English-speaking peers on a variety of topics. Apart from prearranging exchanges, learners can also check for a wide range of information on World Wide Web sites. New electronics were bought across the world, making it easier for students to access the Internet. As England (1998, quoted in Medalla, 2003) hypothesized, schools are already dealing with the real world communication problems of the 21st century ... global concerns and complex problems will be addressed more effectively by people who can speak and write clearly to one another. English teachers will become more critical and accountable than ever before in their role in providing the skills needed to address these challenges.

In this period of disagreement and uneasiness regarding literacy, let teachers not lose sight that the pupil is the language learner and Chomsky (1965) diverted their attention to this perspective in no uncertain terms, thereby affecting teaching the language dramatically in the past. In the 1980s, the pattern has gained strength and has persisted today. In the language learning drama, learners are the key players, not the teachers. As Rivers (1987) acknowledged that children used literacy to make their mark in the world, from cave walls to computer screens, and create new opportunities for their lives. Teachers will certainly exercise great wisdom when they think as educators about what really matters to them. Learners and learning, not the newest principles, should be the subject of what they do in the classroom. Rivers stressed that it is the teacher's job to explore the springs of inspiration in individual students and channel it through course content, events in and out of the classroom, and learner-generated or at least learner-managed projects in the direction of further language acquisition.

## METHODOLOGY

### *Design*

This study utilized qualitative and quantitative methods that examined the students' academic performance for the first and second quarter of the Academic Year 2019-2020 and the factors that contributed to students' performance. In this work, the participants' grades of the three components such as written works, quarterly

assessments, and performance tasks were described. The assessed topics were identified and categorized based on the learning skills reflected in the curriculum map. On the other hand, the elements that shaped students' academic performance such as assessment, content or flow of the lessons, ICT utilization, language exposure, strategies and techniques, teacher's communication skill, teacher's personality, and teacher's preparation were recognized.

### *Environment*

The locale of this study is the University of San Carlos – North Campus at General Maxilom Avenue, Cebu City, Philippines. The institution is an associate of the Philippine Accrediting Association of Schools, Colleges and Universities (PAASCU) with Level II certification.

### *Participants*

The participants of the study were the two Grade 9 teachers and fifty Grade 9 students of the University of San Carlos North Campus of Academic Year 2019-2020. There were two English teachers handling the six sections of Grade 9 English classes. Only five sections were part of the study since one section comprised the homogeneous pilot group. To avoid bias, the pilot section was not asked to participate in this study. Voluntary response sampling was used. This technique was preferred because the students could not answer anymore the survey questionnaire physically, hence, the target random sampling did not happen. The questionnaire was given through online and only for those who volunteered to participate answered the survey. A sample size of ten students or 25% of the class population was involved with a total number of 50 participants all in all.

### *Instruments*

The participants' levels of academic performance were obtained through the students' scores for written works, quarterly assessments and performance tasks from the first and second grading periods. All the scores of the respondents were obtained from the class records of the English teachers.

This study utilized three main tools namely, the Evaluation of Teaching Performance Questionnaire by Murcia, Belando, Silveira (2015), Checklist for English Language Exposure by Magno and Bunagon (2009), and the interview guide for teachers.

The Teaching Performance Evaluation questionnaire consisted of 28 items grouped into seven factors: teacher's personality with two items (e.g. "My English teacher maintains an objective and respectful position with us."), teacher's communication skill with three items (e.g. "My English teacher has a good command of the contents of the course."), assessment with four items (e.g. "My English teacher applies the assessment criteria of the activities as established in the subject's curriculum"), strategies with eight items (e.g. "My English teacher organizes activities for us to actively participate in course assignments."), content organization and flow of the lesson with 3 items (e.g. "My English teacher presents the contents following

a clear and logical framework, highlighting the important aspects."), teacher preparation with five items ("My English teacher informs or orients us of the competencies we are expected to acquire.") and ICT utilization with two items (e.g. "My English teacher efficiently incorporates and employs ICTs."). The items were assessed using a 4-point Likert scale which varied from "Completely Agree (CA)" to "Completely Disagree (CD)." This questionnaire was quantified according to the following numerical values and descriptions: completely agree (4), agree (3), disagree (2); strongly disagree (1), beginning with the sentence "The English teacher ... for the student participants and I ... for the teacher participants."

The Checklist for English Language Exposure comprised 23 items grouped into four factors: home, friends, school & media (e.g. "I engage in activities where English is used.") The items were evaluated using a 4-point Likert Scale which ranged from the following numerical values and descriptions: completely agree (4), agree (3), disagree (2); strongly disagree (1). The four factors were computed and their mean scores were obtained.

The interview guide for teachers comprised eight questions all leading to answer their roles as teachers and the conducts they had undertaken to stimulate maximum learning. Similarly, the answers to the questionnaires were validated by the teacher respondent as proof of their actual experiences in the classroom. After the questionnaires had been answered, the researcher then forwarded them to two expert raters, one of whom holds a Masteral degree and is currently a Senior High School English coordinator and the other one is a doctoral student and teacher in one of Cebu's finest universities.

### *Research Procedures*

The researcher made prior arrangements with the Basic Education Principal to conduct the study in the department. A formal communication of request or transmittal letter was personally submitted to the principal. After which, the researcher made an arrangement with the Psychometrician for the schedule of the administration of the test through the help of one English teacher of the university. The choice of respondents was facilitated through volunteer response sampling.

The Grade 9 students were invited to participate in the research study. Parents of these respondents were informed and a letter was sent for their consent. The researcher explained the purpose of the study as well as its relevance to their child's academic performance. Similarly, the researcher explained the relevance of this study to students' academic endeavor. With the use of Genyo e-learning, a learning management system, the respondents answered the survey questionnaire. For the interview, the researcher asked the teacher participant for an appointment with him. During the meeting via online, the significance of the study was explained and the respondents were made to understand further that the study was not about criticizing his teaching performance; rather, on evaluating the skills and competencies learned by the students.



To answer the first research question on students' English academic performance according to written work, quarterly assessment, and performance task, the t-test for single sample was employed. Furthermore, to answer the second research question on the factors that contributed to students' performance based on teachers' teaching performance as well as the students' language exposure, the adapted questionnaires for both students and teachers were used. A corresponding weight value was given to the score of each item. To analyze the result, descriptive counterparts or verbal explanations were also provided.

## RESULTS AND DISCUSSION

This section discusses, analyzes, and interprets the data obtained from selected Grade 9 students by assessing the English academic performance of the students and the factors affecting their performance.

**Students' English Academic Performance.** Academic performance is essential across all levels of education. This is an essential requirement to determine students' progress from one grade level to another. At the minimum, English academic performance is crucial in the K-12 program. How the performance is assessed is as vital as what has been set. DepEd's policy on assessment and grading (DepEd, 2015) states that classroom assessment is intended to help students perform well academically.

Table 1 conveys the students' performance in the written work of the Grade 9 students in English for the first and second quarters of the academic year 2019-2020.

As depicted in Table 1, the students' performance in written works, is above average. Looking at the Standard Deviation (SD), the result is above ten, and it is considered as above- average performance. Since written exams were given as summative assessments, students may have grasped what had been taught by the teachers. However, the result does not equate with that of the diagnostic test of the Center for Educational Management (CEM) examination, which was given to these students in general. The test performance of the test takers was average primarily, few were above average, and a little was moving towards average. With teachers' efforts and students' cooperation and engagement, their performance may have improved. Besides, teachers gave reteaching, provided consultations, and would not proceed to the next lesson unless learning goals were met.

In relation to the result of the respondents' English academic performance, it may be noted that learners were able to learn the lessons covered. In the study of Astodello

(2007), she showed that his English classes for the third-year have issues with their written English where some cannot express themselves even in basic sentences. Most of the third year students of Tabuk City National High School have to build and master their non-verbal English skills in meaningful clues, proper usage and grammar, word construction, and correct use of punctuations (Adora, 2013).

Also, in the study conducted by Cheng & Qi (2006), the overall performance of a group of Chinese test-takers was average or above average compared with the whole population of 2004 MELAB (Michigan English Language Achievement Battery) test-takers. This result may be partly due to the fact that the English curriculum, textbooks, and testing systems in China attach importance to grammatical knowledge rather than to communicative competence (Cheng & Qi, 2006; Li, 1990). They reveal that many national and regional exams in China are lacking continuous and systematic research regarding test qualities. This feature has impacted on the Chinese test takers who have a great deal of experience with multiple choice items and have received much input in linguistic knowledge but less in pragmatic knowledge (Cheng & Qi, 2006).

With this result, there is an impression that the Grade 9 learners may have been infused more with knowledge type of test or items which measure lower-order thinking skills. In addition, there is also a tendency that the competencies tested during the training do not correlate with the expected skills to be acquired for the particular grade level.

### Written Works

These are summative assessments that require a measure of written accomplishment once the instruction has ended. Primarily, responses consist of resources that are printed. Conversely, it may also be an item, a happening, or an experience. The learning assessment is carried out in writing (pencil & paper test) and incorporates various types of questions such as open-ended (construction), closed (choice), and semi-closed questions.

Table 2 presents the topics, learning competencies and English skills evaluated in written works of the Grade 9 English classes for the first and second quarters of the academic year 2019-2020.

As gleaned from Table 2, it shows that most of the topics evaluated for the first two quarters mainly were on literature. This is not surprising, considering that literature has brought numerous benefits to students. Literature is

Table 1. Students' Performance in English  
N = 50

Group	H.M. <sup>a</sup>	A.M.	S.D.	Test Statistics		Qualitative Description
				Computed t-value	Computed p-value at $\alpha=0.05$	
Written Works	93.00	127.76	16.48	14.92*	< 0.00001	Above Average

Table 2. Topics, Competencies, and Skills Assessed in Written Works

Topics	Competencies	Language Arts Domains
Anglo-American Literature	<ul style="list-style-type: none"> <li>• Share prior knowledge about a topic</li> <li>• Examine literature as a form of self-discovery.</li> <li>• Create a link between the present text and the text read previously.</li> <li>• Draw generalizations of the viewed/presented content and assumptions</li> <li>• Make a stand on the text that was heard</li> </ul>	<ul style="list-style-type: none"> <li>• Reading Comprehension</li> <li>• Literature</li> <li>• Listening Comprehension</li> <li>• Viewing Comprehension</li> <li>• Writing</li> </ul>
Identifying Character Traits	<ul style="list-style-type: none"> <li>• Identify how a character trait helps shape a person.</li> <li>• Provide vocabulary or phrases suitable for a particular situation.</li> </ul>	<ul style="list-style-type: none"> <li>• Literature</li> <li>• Vocabulary Development</li> </ul>
Tone, Mood	<ul style="list-style-type: none"> <li>• Infer feelings and intentions in the viewed content.</li> <li>• Identify the tone, mood, and purpose of the author.</li> </ul>	<ul style="list-style-type: none"> <li>• Viewing Comprehension</li> <li>• Literature</li> </ul>
Normal & Inverted Word Order	<ul style="list-style-type: none"> <li>• Use the standard and reversed word order in creative writing</li> <li>• Write normal and inverted sentences</li> </ul>	<ul style="list-style-type: none"> <li>• Grammar Awareness</li> <li>• Writing</li> </ul>
Punctuations and Capitalizations	<ul style="list-style-type: none"> <li>• Use good punctuation marks and capitalization to express importance.</li> <li>• Write an application letter observing correct punctuations and capitalizations</li> <li>• Infer concepts, emotions, and intentions in the viewed content</li> </ul>	<ul style="list-style-type: none"> <li>• Grammar Awareness</li> <li>• Writing and Composition</li> <li>• Viewing Comprehension</li> </ul>
Interjections	<ul style="list-style-type: none"> <li>• Use interjections to convey meaning</li> </ul>	Grammar Awareness
Poetry and Figures of Speech	<ul style="list-style-type: none"> <li>• Distinguish the features present in poetry and prose</li> <li>• Identify the distinguishing features of notable Anglo-American sonnets, dramatic poetry, and vignettes.</li> <li>• Compose forms of literary writing</li> </ul>	<ul style="list-style-type: none"> <li>• Literature</li> <li>• Literature</li> <li>• Writing and Composition</li> </ul>
If Conditionals	<ul style="list-style-type: none"> <li>• Agree or disagree with the ideas presented in the material viewed</li> <li>• Use conditionals in expressing arguments</li> <li>• Formulate sentences using If Conditionals</li> </ul>	<ul style="list-style-type: none"> <li>• Viewing Comprehension</li> <li>• Grammar Awareness</li> <li>• Writing and Composition</li> </ul>
Elements of Narrative: Theme & Conflict	<ul style="list-style-type: none"> <li>• Analyze literature to value other persons and their particular situations in life.</li> <li>• Explain how the genre-wide aspects relate to a specific literary collection theme</li> </ul>	<ul style="list-style-type: none"> <li>• Literature</li> <li>• Writing</li> </ul>
Literary Images	<ul style="list-style-type: none"> <li>• Make inferences and conclude from what was said</li> </ul>	<ul style="list-style-type: none"> <li>• Literature</li> </ul>

considered a good lens to view the world. Also, it provides a window into various aspects of life, gives a mirror to examine people's views, offers a reflecting pool of ideas, and enables to connect to different generations. Studying literature academically, also lets students develop their writing skills, expand their vocabulary and enhance other English skills (Importance of Studying Literature, 2012). While vocabulary development is less assessed in this component, oral language fluency is never gauged. It could be noted, however, that it is written work that is measured here, not oral presentations. Meanwhile, writing was used to assess almost all topics. Even then, composition writing

was limited as it required sufficient input time from the teacher to deliver feedback.

Concerning the type of test used, primarily multiple-choice items, identification, and fill-in-the-blanks were employed. These types of tests were commonly using short-term questions that require short responses and small cognitive demands; thus, requiring students to generate basic information or evidence. It is therefore suggested that open-ended tests must be used more than short response test to evaluate more on sound reasoning, such as critical thinking, interpretation, or analysis.

Table 1. Students' Performance Tasks Level in English  
N = 50

Group	H.M. <sup>a</sup>	A.M.	S.D.	Test Statistics		
				Computed t-value	Computed p-value at $\alpha=0.05$	Qualitative Description
Performance Tasks	88.00	137.98	16.52	21.40*	< 0.00001	Above Average

As depicted in Table 3, the standard deviation is above 10. This means that the English performance of the students is above average. When English teachers were asked what, and how they gave performance tasks to students, they said they gave varied, engaging and meaningful activities. These activities had tapped into real-life circumstances and could equip them for future use. Vis-à-vis the test types used, they were authentic and fit for their age.

**Performance Tasks.** These are realistic exercises requiring learners to show their capabilities to execute the learned skills. This type of learning is aimed at helping the learners gain and apply understanding, exercise skills, and improve individual and group working conditions (Kelly, 2019). As evaluations become open and responses to the students become intricate, scoring becomes harder. Several techniques have been made to measure challenging student works, using holistic and analytic approaches. In some instances, students are evaluated on their performance; in some cases, they are assessed based on a finished product or oral presentation.

Table 4 presents the topic coverage, learning competencies, and English skills evaluated as the performance tasks of the Grade 9 English classes for the first and second quarters of academic year 2019-2020.

The data indicate that most of the topics assessed were focusing the skill on oral language and fluency. The main reason is not to overlap the evaluation of the competencies among the three components. Also, a performance matrix was provided to lay down scaffolding activities before the major performance tasks.

The skills required to demonstrate in performance tasks varied. Specific tasks asked students to demonstrate their capabilities directly (e.g., extemporaneous speaking). Other tasks presented situations requiring students to consider how to employ their learning in an unknown context (e.g., deciphering out why the author wrote such a poem).

Most of the tasks assigned were performed by the group. When activities are carried out by the group, various drawbacks could be identified. This is one of the dilemmas of scoring. That is why both individual and group scoring have to be well-formulated through rubrics.

As shown in Table 5, the standard deviation is above ten which indicates that students' English academic

performance is above average. In this type of summative assessment, recall, comprehension, and reasoning were emphasized. The English teachers confirmed that the highest percentage of the total number of items were under recall. They realized that giving so much knowledge type of test determines only the low-level cognitive development. Giving more reasoning type of test is much more beneficial to students as it evaluates a higher-order thinking process.

**Quarterly Assessment.** DepEd Order No. 8 s 2015 laid down a policy for the curriculum on classroom assessment. It is clear that the classroom evaluation has to be based on the curriculum structure and the curriculum guide for every discipline as such, language dimensions should be expressed in both teaching and assessment. The quarterly assessment determines the learner's progress at the end of each unit by comparing it to a specific standard. Multiple-choice and reasoning were the types of tests used. For multiple choice, learners assimilated the correct response, which ensured an 'objective' scoring. In the course of planning and writing, students answer the given question through analyzing, comprehending and explaining in reference to facts (Andersson & Beveridge, 2007). Scoring is challenging for this type of test. Therefore, rubrics were carefully designed to rate essays.

Table 6 shows the topic coverage, learning competencies, and English skills assessed in the quarterly assessments of the Grade 9 English classes for the first and second quarters of the academic year 2019-2020.

Comparing the topics and competencies assessed with the competencies reflected in the curriculum map, all the competencies for the first and second quarters were covered from the English 9 curriculum map. In addition, other skills like listening, viewing, and oral language were not included in the skills being measured in the periodical test. Since the other language arts domains were assessed already in the other components, only three were taken into consideration, namely, literature, grammar awareness, and writing and composition.

To comprehend the level of understanding in the quarterly assessment, cognitive process dimensions were utilized, which included low and high order thinking skills. Some test items designed were, however, under lower order thinking abilities, such as the items under recall. Other items were developed under high-order reasoning. According to North (2014), a language-based test should develop the higher-level thinking skills of the test takers. In addition, Sullivan (2011) suggested that to avoid

Table 4  
Topics, Competencies, and Skills Assessed in Performance Tasks

Topics	Competencies	Language Arts Domains
Dialogue about USC School Objectives	<ul style="list-style-type: none"> <li>Exhibit appropriate verbal and nonverbal behavior in a given speech context</li> <li>Use proper English sound production</li> </ul>	<ul style="list-style-type: none"> <li>Oral Language and Fluency</li> </ul>
Speech Choir about the History of English	<ul style="list-style-type: none"> <li>Use the correct pitch, juncture, stress, intonation, rate of speech, volume, and projection when writing and delivering poetry and prose like in speech choirs.</li> </ul>	<ul style="list-style-type: none"> <li>Oral Language and Fluency</li> <li>Writing and Composition</li> </ul>
Documentary about Environmental Issues and Effects on Health	<ul style="list-style-type: none"> <li>Use normal and inverted word order</li> <li>Observe proper stopping and pausing according to the punctuations used.</li> <li>Use the necessary prosodic voice characteristics in the documentary</li> </ul>	<ul style="list-style-type: none"> <li>Grammar Awareness</li> <li>Oral Language and Fluency</li> <li>Writing and Composition</li> </ul>
Extemporaneous Speaking/ Daily Routine	<ul style="list-style-type: none"> <li>Use principles of effective speech delivery focusing on voice, delivery, stage presence, facial expressions, body movements &amp; gestures and rapport with the audience</li> <li>Give suitable communicative styles for different circumstances</li> </ul>	<ul style="list-style-type: none"> <li>Oral Language and Fluency</li> <li>Oral Language and Fluency</li> </ul>
Sonnet Critique Analysis	<ul style="list-style-type: none"> <li>Use principles of effective speech writing focused on logical organization &amp; grammatical correctness</li> </ul>	<ul style="list-style-type: none"> <li>Writing and Composition</li> <li>Grammar Awareness</li> </ul>

Table 5  
Students' Quarterly Assessments Level of Performance in English  
N = 50

Group	H.M. <sup>a</sup>	A.M.	S.D.	Test Statistics		
				Computed <i>t</i> -value	Computed p-value at $\alpha=0.05$	Qualitative Description
Quarterly Assessments	70.00	83.20	14.74	6.33*	< 0.00001	Above Average

considering the item test, which measures the specific level of understanding as a receptive form of test, teachers should create an item under higher order thinking skills.

#### Factors Contributing to Students' English Academic Performance

Teachers are powerful agents. Without them,

school is considered a body without spirit, a skeleton without flesh, and a shadow without substance. In the lives of learners, teachers play significant roles. They are significant factors in their educational formation. In addition to their responsibility to teach students, teachers help shape values and form character. Indeed, effective teachers can contribute to students' success far beyond classroom walls. Besides, instructional methods have a



Table 6  
Topics, Competencies, and Skills Assessed in Quarterly Assessment

Topics	Competencies	Language Arts Domains
History of English	Identify Concepts on the history of English	Literature
Literary Selections	Give the central theme, lessons, main idea, and concepts about Beowulf, King Arthur, and the Pardoner's Tale	Literature
Tone & Mood	Determine the tone and mood of the selections	Literature
Punctuations and Capitalizations	Recognize sentences that show correct punctuation marks and capitalization Write a paragraph observing proper punctuations, and capitalizations.	Grammar Awareness Writing and composition
Normal and Inverted Sentences	Identify and invert Natural to Inverted Sentences	Grammar Awareness
If Conditionals	Identify and use conditionals correctly in sentences	Grammar Awareness
Figures of Speech	Distinguish the features present in prose and poetry	Literature
Literary Concepts	Decide the subject matter, pictures, feelings, mood, sound, methodology, and intent of the author	Literature
Literary Argumentation	Restate, share opinion, find pieces of evidence, formulate claims and warrants, and synthesize	Writing and Composition

direct effect on the success of students as teachers are the individuals they trust, and they obey much of the inputs they get from their teachers. Canto-Herrera, & Salazar-Carballo (2010) explained the substantial correlation identified between the "delegator" model of teaching and the students' academic achievement.

Figure 1 summarizes the factors that contribute to the English performance of the Grade 9 students in the first and second quarters of Academic Year 2019-2020.

The illustrative graph above shows the summary of mean values for the factors contributing to students' English academic performance. The teachers' communication and personality are the top factors that mark the English performance of students. Their mean value is 3.73. This is not surprising because students love to imitate the behavior and mannerism of the teachers.

**Teacher's Communication Skill.** Communication skills are a crucial requirement in the learning phase and teaching. The teacher communicates more instructions orally both inside and outside the classroom. If there is poor communication skill, it may disable the learning process and their career mobility. Teachers' communication skill is very crucial to students. To be able to communicate effectively is a crucial life skill and should not be underestimated, especially among teachers. The saying "One cannot give what one does not have" applies to this principle. An English teacher must be an excellent communicator to motivate students to be effective communicators themselves. Literature explicitly suggests that educators are the ones who set the stage for learning practices (Allen & Valette, 1997; Quist, 2000). English teachers must have the best

communicative skills because teaching is communication.

**Teacher's Personality.** Students tend to learn more when they are comfortable with the teacher. Studies suggest that self-esteem rises when students felt secure and valued. Moreover, learners would be driven to take part in the learning when learners are motivated to learn, there is a higher chance that they will succeed in their goals. In the same way, Gardner (2006) recorded those motivated students can do and know better. Correspondingly, of all school services, the most critical determinant of student success is good teachers.

Good academic performance is closely linked to teachers' personality, communication skills, assessment, and instructional techniques, as well as their readiness for dealing with different learners. These top factors are further confirmed by the Grade 9 teachers. They say that these influences have always been primary weapons of teachers in teaching. Therefore, retaining effective teachers should be one of the most critical agenda for school administrators.

**Assessment.** The second factor that impacts their English academic performance is an assessment, with the mean value of 3.61. Classroom assessment received a great deal of attention due on its effect to learning relative to national tests (Guskey, 2003). Students believed that if the assessment is prepared well, educators will have guidance in assisting them to meet the learning objectives.

**Methods, Strategies and Techniques.** The third top factor that contributes to student's English performance are methods, strategies, and techniques, with 3.6 as the

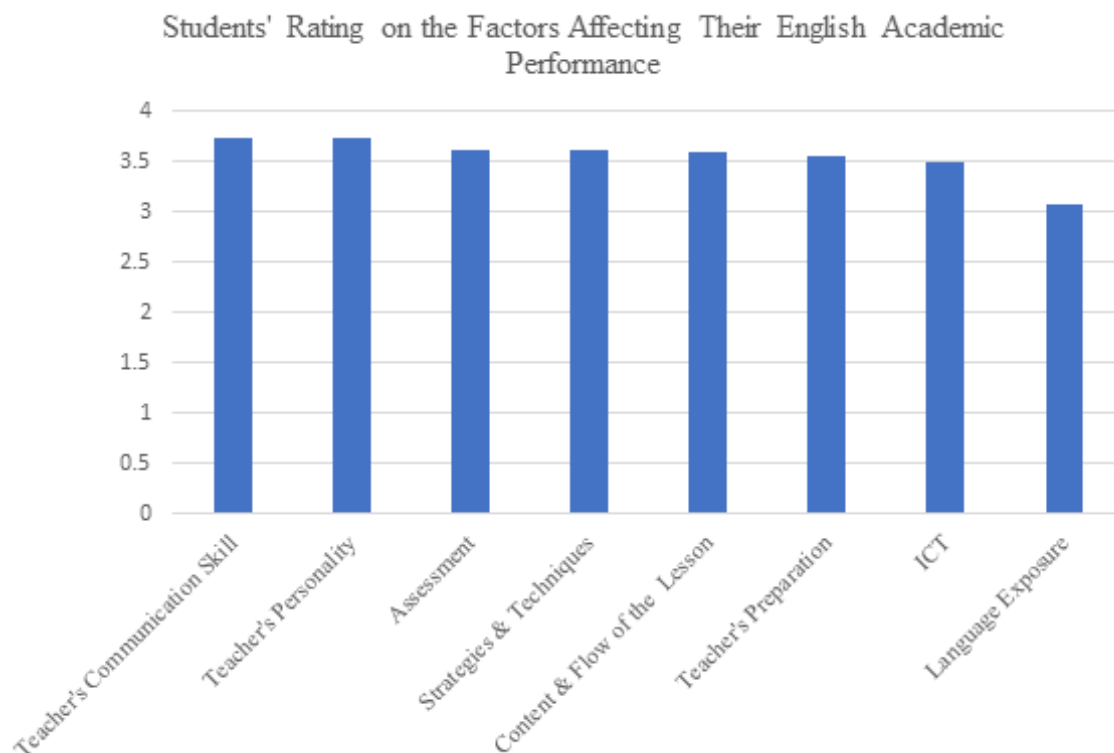


Figure 1. Factors Affecting the Students' Academic Performance

mean value. The teaching approach is a comprehensive plan that includes structure, educational goals, and techniques needed to be implemented (Issac, 2010). Learning approaches should be developed consistently so that learners will advance various techniques by the time they leave school (Friedrich & Mandl, 2006). Giving meaningful tasks is imperative, mainly when they are engaged in practical, valuable, and significant activities. Content and Flow of the Lesson. Teachers need different skills and attitudes to help their students obtain high outcomes. Teaching involves a range of talents and abilities so that teachers can deliberately blend to deliver the most meaningful experience possible.

**Teacher Preparation.** As per the stated findings, teachers' careful planning of the lesson and design of the curriculum need to be given much importance, especially during in-service training or before the academic year starts. This is to ensure that the curriculum is well-developed. As emphasized by Resch and Schrittmesser (2021) "Service-Learning stands out as a teaching approach that connects theory and practice." Therefore, the school should strictly implement on this.

**ICT Utilization.** The research by Aduwa-Ogiegbaen and Iyamu (2006) looked at causes in Nigeria's six geopolitical zones that are responsible for the low level of second-language English teaching in public secondary schools. To answer a questionnaire, three thousand senior high school students were questioned. Results have shown that English language teachers frequently neglect modern teaching tools and various teaching methods in their English lessons. Furthermore, results exposed that students' academic performance was tremendously affected by the inability of the teacher to adapt to the changing time.

**Language Exposure.** The lowest among the factors that influence students' English academic achievement is language exposure, which has a mean value of 3.08. From the results, an improvement is needed on the English exposure of the students which can help develop their academic performance indirectly. According to Moshia (2014), students are intensely learning English in response to potential aspirations, career progress, and job opportunities. The occasional use of English among students at school and at home, poor teaching and learning circumstances, and poverty were factors leading to the low performance in English, as revealed in the study. One important factor which is influencing the students' English academic performance is presented in Table 7.

Applying the assessment criteria of the activities and providing clear goals and assessment method in the curriculum were the top in rank with a mean value of 3.66 and the accessibility of the teacher in terms of monitoring students' progress with 3.55 mean value was the last in rank.

Assessment is a crucial part of studying as it helps students to see how they are progressing in class, and to assess whether or not they grasp content from the course. Assessment can be an effective tool in inspiring them. Aware of doing poorly, they could start working harder. In standardized content assessments, Stevens et al. (2000) concluded that language proficiency tests is much needed to measure students' academic language abilities.

Table 8 presents the factors of the teachers' mastery of the content and flow of the lesson that affect the Grade 9 students' English academic performance.

The table provides a general picture of the

Table 7  
Factors of Assessment Affecting Students' English Performance

Items	Mean	Rank
My English teacher applies the assessment criteria of the activities as established in the subject's curriculum.	3.66	1
My English teacher provides clear information about objectives, bibliography, consultations, contents, and assessment methods in the subject's curriculum.	3.66	1
My English teacher adequately attends to the consultations requested	3.58	2
My English teacher is easily accessible (consultations, e-mails, etc.).	3.55	3

Table 8  
Factors of Teachers' Content and Flow of the Lesson Affecting Students' English Performance

Items	Mean	Rank
My English teacher presents the contents following a clear and logical framework, highlighting the important aspects.	3.71	1
My English teacher allows us to organize and distribute part of the assignments to be performed in the course.	3.65	2
My English teacher presents the minimum content of his/her subject matter, tailored to the students' knowledge.	3.42	3

participants' experience in the way the lessons are taught. Presenting the content systematically ranks first with mean value of 3.71. While presenting the minimum content of the subject matter has the mean value of 3.42.

Table 9 reveals the result of the Information and Communications Technology utilization in the teaching-learning process in English 9 classes.

Table 9 presents the mean values of 3.51 and 3.41 for the utilization of ICT in the lesson. Comparatively, the respondents rate using e-learning resources to facilitate learning is higher than effectively incorporating and employing ICT in the lesson. Such result proves that

although the English teachers use ICT in their discussions and activities, they still need to efficiently and appropriately integrate technology in teaching. Powerpoint presentation in this time and age is not anymore similar with the transfer of texts from manila paper to powerpoint slides. It has to be more than that as students nowadays are digital natives. Teachers must be adept with ICT utilization so as not to be left behind by the challenge of the present time.

Table 10 features the factors that are affecting the Grade 9 students' language exposure in their English academic performance.

As reflected in the table, the top factor that influences students' language exposure is media (Mean=3.38). Media

Table 9  
Factors of ICT Utilization Affecting Students' English Performance

Items	Mean	Rank
My English teacher uses e-learning resources that facilitate learning.	3.51	1
My English teacher efficiently incorporates and employs ICTs (Information and Communication Technologies)	3.47	2

Table 10  
Factors of Language Exposure Affecting Students English Performance

Items	Mean	Rank
Media	3.38	1
School	3.30	2
Friends	2.89	3
Home	2.78	4

Table 11

## Factors of Teaching Methods and Strategies Affecting Students' English Performance

Items	Mean	Rank
My English teacher allows and encourages our participation.	3.80	1
My English teacher encourages our interest and our motivation to learn.	3.63	2
My English teacher organizes activities for us to actively participate in course assignments.	3.63	2
My English teacher facilitates student-student and student-professor interaction.	3.61	3
My English teacher promotes teamwork.	3.59	4
My English teacher provides us with scientific information that allows us to gain a better and deeper understanding of the subject matter.	3.54	5
My English teacher relates the teachings to the professional environment.	3.49	6
My English teacher promotes individual work	3.47	7

Table 12

## Factors of Teachers' Communication Skill Affecting Students' English Performance

Items	Mean	Rank
My English teacher attends and responds clearly to questions asked in class.	3.76	1
My English teacher interacts satisfactorily with us.	3.73	2
My English teacher has a good command of the contents of the course.	3.69	3

provides ample language opportunities through the use of any reading materials, film, internet, etc., and activities that improve English skills. Media entertains pupils and helps them to learn English both inside and outside the school (Tafari, 2009:1). In order to be competent and become effective communicator, teacher's goal must be to help expose students practice the language in both academics and concrete life experiences (Ellis, 2006). A research undertaken by Ortega (2011), he revealed that media exposure of Icelanders to English is significantly greater than their Spanish counterparts. Fjällström (2010) reflected connotatively on this finding when she concluded: 'Public broadcasting plays a significant role in information sharing; hence, they are obviously more open to English while listening to radio. The least influencer on the English language exposure among the Grade 9 students in English is Home (Mean=2.78).

Lamb et al. (2006) offered a summary of the key elements and strategies that influence the academic performance or outcomes of migrant students. Jurkovic (2010) exposed that general linguistic capacity had a substantial positive impact on the achievement of test scores. Nevertheless, metacognitive strategies were the only one of the models of language learner strategies that had a statistically important effect on the scores of the assessments.

Table 11 presents the specific factors under teaching methods, strategies, and techniques contributing to the English academic performance of the Grade 9 students during the first and second quarter of academic year 2019-2020.

Concerning methods, strategies and techniques, table 11 shows that engaging activities that promote

participation was ranked as the first factor relating to teacher's use of strategies (Mean=3.80). On the other hand, promoting individual work was ranked the last (Mean=3.47). The findings indicate that teachers need to continue utilizing teaching strategies that cater students' needs, that make content relevant to them, that relate lessons to real world situations, that give opportunity to integrate values and strategies to create meaningful learning experience.

The teaching - learning process mandates two engaged and dedicated classroom participants, the teacher and the learner. Vuzo (2010) conveyed, "In order to create conceptual and realistic experiences that shape the substance and type of the target subject, teachers and students collaborate together through interactions." Conversely, this condition is not commonly true in all subjects in junior or senior high schools, because the lecture method governs the process resulting to idle learning "(p.18). Once Cummings (2002) said, "Hearing is forgetting, seeing is remembering, and doing is learning."

Table 12 depicts the factors on the teachers' communication skill that affect the Grade 9 students' English academic performance.

The table shows the factors with reference to the communication skills of the teachers. Responding clearly to questions is ranked first with 3.76 as its mean value and using good command of the content ranks the last with 3.69 mean value. In order to teach students how to become critical and logical in contact through the use of English, teachers need to be competent enough to use the language efficiently.

Table 13 presents the factors of the teachers'



Table 13  
Factors of Teachers' Personality Affecting Students' English Performance

Items	Mean	Rank
My English teacher maintains an objective and respectful position with us.	3.76	1
Home My English teacher fosters research and a critical spirit in us	3.70	2

Table 14  
Factors of Teacher's Preparation Affecting Students English Performance

Items	Mean	Rank
My English teacher informs or orients us of the competencies we are expected to acquire.	3.60	1
My English teacher provides initial and final overviews of the session and/or subject in class.	3.60	1
My English teacher establishes the curriculum with a certain amount of flexibility for a better class dynamic.	3.60	1
My English teacher designs the content and develops the course to promote the acquisition of professional competencies.	3.57	2
My English teacher designs and relates the classroom content to real world situation.	3.50	3
My English teacher interweaves the content of the subject matter with other courses.	3.42	4

personality or attitude which affect the Grade 9 students' English academic performance.

Table 13 shows the ranking factors of the personality or attitude of teachers which impact the English academic performance of the students. Maintaining a good rapport and respectful position with students (Mean=3.76) is higher than fostering research and critical spirit with students (Mean=3.70).

The entire personality of a teacher is a reflection of students' thinking. As Palm Leo said "You can't train children to act better by making them feel bad. When students feel better, they act better." The example reflects the belief that students would learn more if teachers inspired them to learn. When students love their teacher, chances are they learn more from them. Their teaching style motivates students to learn. Research shows clearly that qualities of teachers are among the factors which lead to poor performance among students (Harmer, 2003; Mosh, 2004). In particular, longitudinal tests have demonstrated that if early childhood years do not have the proper basis for learning, then no new intervention at a later stage would be necessary to attain the maximum potential of the child (Quist, 2000).

Table 14 reveals the factors concerning teacher preparation affecting the English academic performance of Grade 9 students during the first and second quarter of Academic Year 2019-2020.

Table 14 presents the outcome for the factors relating to teacher preparation. As per the ranking of all factors, orientation on the competencies, giving overviews of the meetings and establishing the curriculum (Mean=3.60)

were on the top while interweaving the content of the subject comes last in the ranking (Mean=3.42).

Cummings observed that learning in which learners are engaged gives rise to far more productive participation. In other words, English success banks on teachers' instructional repertoire. Quist (2000) emphasized that effective language training and quality of learning are directly linked to educators' expertise, content understanding and appropriate use of strategies fit to students' needs and abilities.

### Proceedings in the English Classroom

To identify the proceedings of the teaching-learning process inside the classroom, an interview was conducted to the Grade 9 English teacher. Boyce and Neale (2006) described interview as a method that includes performing detailed discussions with few participants in order to examine their views on a given concept, program or circumstance. It includes posing open-ended questions in order to converse with respondents.

The method aimed to seek the opinions and the experiences of the teacher in his teaching of the subject. In this research, the semi-structured interview was utilized and was conducted via google meet. The interviewer asked six questions about the conduct of teaching in the classroom. During the interview, supplementary questions were also asked to explain and/or broaden the points further. The questions were about the interviewee's role as a teacher, the challenges experienced as an English teacher, ways on maximizing student learning and assessment, ways on improving the quality of assessment for written works, performance tasks and quarterly assessments, the factors

that impact students' English performance and goals for good student outcomes.

### *Teacher's Role*

When the teacher was interviewed about his position as a teacher, the following comments were made.

*"...I am a teacher who facilitates the learning of the students in preparing whatever fundamental subjects or courses that they are going through English 9 that's being a facilitator, to implement all the strategies. Also, I am a curriculum designer, I design a specific and contextual curriculum based on the data that is presented to me by the psychometrician and of course with the experiences that we have had the previous years. We are going to incorporate the curriculum that we are making. As a designer, we have to really be adept with the things that our students would want to learn and of course, the objectives that are set by the Department of Education. The last is the role being an assessor. This is giving feedback such as in summative and formative assessments to the Grade 9 students especially in literature and English."*

The teacher emphasized that in the classroom, instructors have a crucial duty to play in students' lives. The three major roles mentioned were as a facilitator, as a curriculum designer and as an assessor. As a facilitator, effective teaching strategies were recommended to cater the different student learning styles and intelligences. As a designer, data from the psychometrician and the standards set by the Department of Education were needed to be considered. This would also be completed with the university's Vision and Mission. Acting as an assessor, the teacher provides suggestions, corrects and grades the level of difficulty within a task. This is necessary as students expect strong signals of their degree of progress from teachers and whether they are doing it right or not. Thereupon, learners should have a good understanding of the requirements for progress at each point of the task.

### *Challenges Encountered as an English Teacher*

At this point, the teacher was asked about the major challenges he encountered in teaching English to Grade 9 students. The following was his answer.

*"...One challenge that I had encountered over the years is the fact that we cannot relate sometimes to the book and the culture that we are reading because it's American in a way. For the standard American English, there are things or symbols in there that may not be parallel with the things we have here in the Philippines but I that is one challenge that we teachers in English 9 would focus on especially that in designing our own strategies because that's one way to compare and contrast...The schema theory of learning, we cannot give students the things that they do not know about. As teachers, we are not really immersed to the cultural concept of the Americans and the English people."*

The challenge cited by the teacher was more

on understanding other cultures that are related to understanding the literary history of the places. According to the teacher, it was challenging to hone cultural literacy because teachers were not immersed with the cultural operations of the Americans and the English people as the Grade 9 English curriculum highlights the Anglo-American Literature. Nevertheless, with books and internet, teachers were still able to cope with it. The teacher suggested that in order to keep up with the educational challenge of the time, teachers needed to re-educate, re-calibrate, re-tool and refine ways of teaching.

### *Maximizing English Learning in the Classroom*

To identify the proceedings and the actual experiences in the classroom, the teacher was asked about the ways on how he maximized the learning of English in his classes. The answer to the question was the following.

*"You have to let them do cooperative learning... It is a very complex form of academic content that the students have to experience in every class especially English. Because the discussion in there is authentic, I mean it's real and you can inject something that may lead to values integration and to real life situation or current events in your discussion in cooperative learning strategy."*

The instructor stressed the importance of cooperative learning because it offers opportunities for the use of language in contexts of life. By being not only a provider of instructional materials, but also a master curator of learning materials, teachers should design efficient and productive learning experiences for the continuous engagement of students. The teaching methods that teachers use will have a huge influence on students' success in English. Instructional methods should be selected carefully to meet the learners' needs.

### *Learning and Assessment in the New Normal*

Each teacher knows the value of preparing appropriate learning and assessment tools. In this section, the teacher was asked about what he considered in designing learning and assessment in the new normal. The following was his answer.

*"We consider the learning cycle, wherein we are going to design our contextualized curriculum, we are going to strategize the way that the students would be learning digitally. And we are going to assess this with reasoning skills. For what we reason? We would be managing our own, we would be relearning as well as a teacher..."*

The faculty believed that having a program that is contextualized to the learners' interests and the ways they might learn better is very essential. The teacher highlighted the importance of evaluating the reasoning capability of the students.

Educators need to design assessments and learn about their goals and expectations. Teachers need to think that in times of remote study, constant feedbacking on

student's learning will help them focus on their strengths. Also by leveraging online learning tools on subjects and making learning playlists or menus, students will be primed for an enjoyable learning process.

#### V. Ways to Improve Written Works, Quarterly Assessments and Performance Tasks

Assessment is a very important part in student's learning. It is used to educate and strengthen classroom activities and promote learning outcomes. In this part, the teacher was asked about the ways on how the summative assessment components could be improved. The following was his reply.

*"... In the periodical exams, I can say that we have to do away with so much knowledge questions and comprehension questions because we can do that in our scaffolded assessment all throughout the quarter. In the periodical exams, we have to focus on the reasoning skills, say, one essay test could be a summative test for all the quarters in English if that's possible.*

*I think our written work factor in school is already fine. It's good already. With the percentage, with the kind of activities that we give especially the formal themes and formative quizzes, it's for me the most appropriate written work combination.*

*For performance tasks...we have to strengthen the use of rubrics especially the analytic rubric because that's one way to assess, and gauge the students' competencies all throughout the unit or quarter. With the way, how we present the Performance Task in the school especially for English, I am very glad that we are doing very good with that. The activities are varied, the assessment types are authentic and the scenarios really tapped with the real life situations and it can be very useful for the students when the time comes that they would be using them."*

The teacher emphasized that higher order thinking questions must be formulated more instead of knowledge and comprehension questions. This is due to the fact that HOTS provides sound reasoning and promotes long term learning. On the other hand, if test items are mainly forms of information and comprehension, only short-term learning might be measured. According to the teacher, the written work component was assessed correctly since writing activities and formative assessments were also utilized as practice or drill towards learning the English language. For performance tasks, the use of rubrics was stressed out to assess the student's performance effectively. When it comes to how performance tasks were assessed, the Grade 9 teachers gave varied, authentic and meaningful activities.

#### VI. Factors that Impact Students' English Performance

Learning English entails several factors that can pose impact on the method of learning. The factors were believed to have a close relationship with the English performance of students. To determine these elements, the teacher was asked about the most influential factors that affect students' English academic performance. This was his reaction.

*"First, the curriculum that we plan in the first part of the year or during Inset. The core of it all is coming from the teacher, coming from the power competencies or whatever curriculum guide that we follow...We are going to merge them together in order to create a power competency... Second is teacher's expertise. After the curriculum, you will have to do all things or our roles in order for the curriculum to be realized. Third is assessments and feedback. That's very important. I've learned from my lessons in my master's class, about the second language acquisition negative feedback where we are going to create the feedback in a manner that the students would try to redefine his /her response in a very immediate manner..."*

A well-crafted program acts as a guide to make sure academic offerings are on the right track. In the interview, the teacher pointed out that the curriculum is the primary factor that contributes to the learning of the students. Second is the teacher's expertise. Expertise in teaching involves having a repertoire of ways at one's disposal to manage teaching, and then learning how to select and apply what is suitable from the repertoire. Teaching expertise may refer to instructional, management, planning and motivational skills which are very crucial to teaching. Third most influential factor is assessment and feedback. These are integral aspects of the evaluation process for they have huge influence on student learning and have been one of the most effective moderators to promote achievement.

### CONCLUSIONS

The English academic performance of Grade 9 students in USC-NC is described as Above Average in the three summative assessment components namely; written work, performance task, and quarterly assessment. Through analysis, students' English performance was greatly influenced on the ways how the teachers treat them and deliver the lessons.

This study concluded that good English communication ability and commendable personality among teachers were the greatest indicators affecting the quality of students' performances. Assessment was the next significant predictor for students' performance. Learners valued what were evaluated and how these assessments were conducted. Teachers need to carefully review the assessment process to allow both students and parents learn how standards are being realized. The result of this study suggests that it is important to understand how summative assessment components are to be measured and recorded in the light of the benchmarks and standards of the school. The third feature that inclined students' academic success is teaching strategies and techniques. The constant challenge that language teachers face is how to actively involve their learners in a variety of activities in the classroom. There is no best strategy to be used in class. In the same way, teachers' creativity and resourcefulness to apply the approaches which fit to the students' learning styles are much needed.

The key aspect for the teachers to determine the

top factors is to consider them in designing a curriculum and eventually teach their students effectively so that they can display high quality results in their academics. To accomplish this goal, educators must recognize the value of quality teaching so as to produce quality learning. Teachers need to better reflect on the factors which assist and deter the educational development of the child. Comprehensive understanding of the elements is important. However, it takes ample means and long periods for instructors to first define all these variables and then schedule the teaching activities and techniques in the classroom. It is for this purpose that the curriculum map is developed so that teachers can create an instructional plan to ensure that learners have the opportunity to achieve their full learning and performance potential.

### RECOMMENDATIONS

Students are expected to involve in the activities offered by the teachers. These planned activities were found to optimize their learning ability. When engaged in relevant, exciting, and meaningful activities, students let down their psychological defenses, thus lowering the anxiety level in the classroom.

English teachers are highly encouraged to review, implement, evaluate and design the curriculum map. A well-prepared curriculum map was found to enrich instruction delivery among teachers and augment learning potentials among students. When planned and designed carefully, it becomes more student-centered rather than teacher-centered and the emphasis is more on learning from an activity rather than on the activity itself. Nonetheless, the needs of the students must always be at the forefront of their thinking. This way, teachers are empowered to improve or modify their work.

School administrators must constantly look to review, improve, and refine ways for quality supervision on teaching and learning. Now is the time to develop and use judiciously the curriculum map available to educators. Administrators should constantly supervise the teaching-learning process and the teachers implement, modify, or design the curriculum map appropriate in their teaching context. In doing so, they will be able to reach and teach diverse learners and provide for their holistic performance with meaningful, complex tasks in response to the increasingly challenging environments.

It is suggested that future research on the alignment and implementation of curriculum maps across the subjects and within the grade level be made to help establish educational equity and improve overall student achievement. A study on teacher-made evaluation activities and instruments is also recommended.

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## Gender-Based Destination Models in Case of A 2013 Flood Evacuation in Quezon City, Metro Manila, Philippines

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### ABSTRACT

Evacuation is a way to reduce disaster risks. Evacuation destination choice is essential in modeling and planning for logistical arrangements in future evacuations. In this study, exogenous variables that determine the destination choice of households were identified. Households in selected areas in Quezon City, Philippines were selected since they are highly vulnerable in the event of urban flooding. Gender-based discrete choice models for the whole evacuating households were developed. The resulting exogenous variables include income, source of warning, distance traveled from their house to their chosen destination, and length of stay in the selected destination. For male evacuees, determinants are the number of house floors, source of warning, and duration of stay in the choice of destination, while for female evacuees, factors are the type of work and house materials. This study provides valuable insights for government to plan for more effective evacuations. At the individual and household level, it gives insights to understand their decisions and increase self or household evacuation compliance. This can be a basis for more effective evacuation logistical arrangements for future flood evacuations.

*Keywords:* Evacuation behavior, destination type, flood emergency, evacuation planning

### INTRODUCTION

Natural and anthropogenic disasters are severe environmental disruptions that cause death, destroy infrastructure, damage ecosystems, weaken the economy, and interrupt human activities (Iheukwumere et al., 2020). Natural disasters range from earthquakes, volcanic eruptions, tsunamis, hurricanes, tornadoes, floods, droughts, landslides, and subsidence to asteroid impacts (Tulane University, 2018). Flood events are the most common disasters. In 2018, there were 127 cases of floods recorded with 2879 fatalities (CRED, 2019). On the other hand, 49% of the 396 total natural disasters in 2019 are flood cases (CRED, 2020).

An average of 20 typhoons enter the Philippine area of responsibility every year, of which five are destructive (ADRC, 2019). One of the five destructive typhoons that struck the country in 2009 is Ketsana (locally known as Ondoy). The typhoon left 140 people dead and 450,000 people displaced to shelters (UNOCHA, 2009). Additionally, the typhoon Quinta, super typhoon Rolly, tropical storm Tonyo, and typhoon Ulysses which all arrived in the country in November 2020, left Filipinos in a devastating situation. The continuous rain caused dams all over Luzon to reach their capacity contributing to more floods. The locals compared the disaster brought by Ulysses to worse than Ondoy (Servallos & Cabrera, 2020).

Natural disasters cannot be prevented. However, the potential loss and damage that disaster causes can be mitigated. The ability of humans to cope with the impact of disasters can be increased through capacity building to reduce existing vulnerabilities (Jeronen, 2020).

Evacuation can be done by the government before a disaster to reduce bodily injuries and deaths. To prevent losses, modeling household evacuation is either done sequentially or simultaneously. A widely used sequential modeling includes stay/evacuate, followed by departure timing, destination choice, and route choice (Pel et al. 2012). The decisions vary depending on the household socio-demographics and social networks, among others (Abhishek et al., 2019).

One of the decisions that a household make is choosing where they go during an emergency event. Evacuation destination is the location a household will go to when they leave their home due to an impending hazard. Studies in evacuation destination type choice have been increasing recently. However, much of these studies focused on developed countries where culture, capacity, and resources affecting households' response to evacuation orders differ from developing countries. Additionally, there is also a need to further investigate evacuation destinations due to floods as evacuation is considered hazard-specific. Understanding evacuation travel behavior in the context of floods in developing countries, such as the Philippines, is still appropriate and timely.

This study is another effort to examine exogenous variables that contribute to a better understanding of evacuation destination type choice of households.

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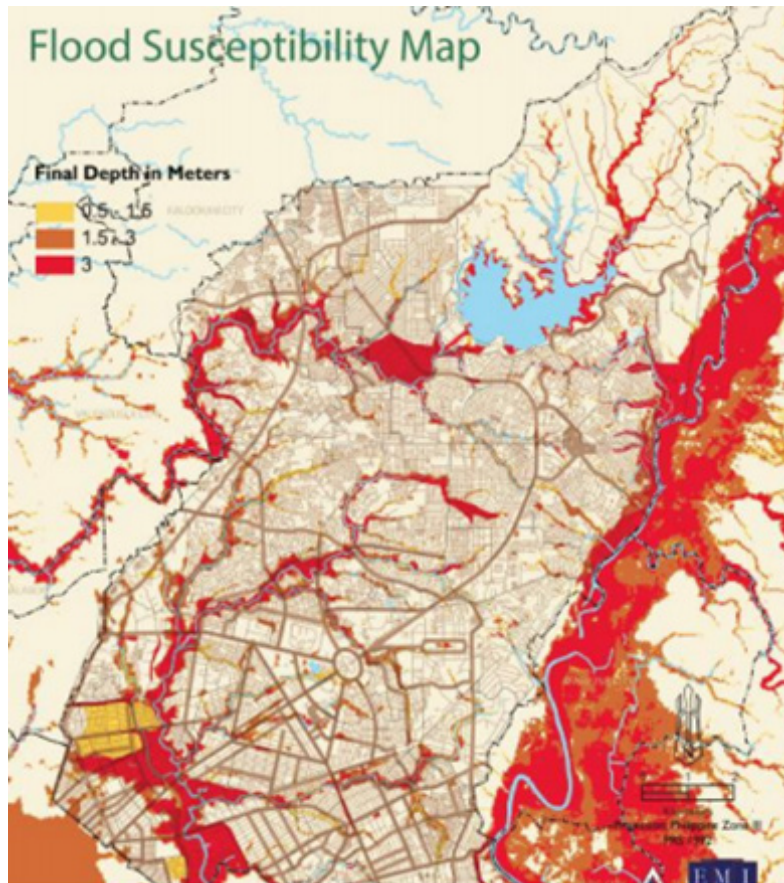


Figure 1. Flood Susceptibility Map of Quezon City Showing High Flood Risk Areas  
Source: Quezon City Government Official Website

Further segmenting the decision based on the gender of the household heads is done. The logit models were used to analyze the data collected from the selected sites. The findings in this current study are essential for the government of Quezon City. It is envisioned to provide valuable insights into the behavioral factors that can be a basis for planning a more effective evacuation in the future.

## REVIEW OF LITERATURE

### Evacuation Destination Choice

Evacuation destination is increasingly gaining interest in recent evacuation studies. Evacuation destination can be the ultimate destination, that is the place where evacuees remain until they decide to go back home. Evacuation destination can also be the proximate destination, or a temporary place to stay, before moving to another place at a later time. Studies found that destination types include hotels and motels, public evacuation centers, rented apartments, and family/friends' houses (e.g., Sadri et al., 2013; Yin et al., 2014; Lindell et al., 2011; Wu et al., 2012; Lim et al., 2016). Wilmot et al. (2008), in their study on modeling destination choice for the hurricane, considered friends/relatives, hotels/motels, and public shelters as model outcomes. Friends'/relatives' houses are widely preferred destination choices followed by hotels/motels. This is also true to Cuellar et al. (2009), Lindell et al. (2011) and Wu et al. (2012). This might be so, as these studies were all done in the context of developed countries. Results might be different in the context of developing,

and least developed countries as the socio-demographic characteristics in communities vary widely.

### Exogenous Variables of Evacuation Destination Type Choice

The destination type choice of households during an evacuation is outlined here. The exogenous variables that explain evacuation destination include socio-demographic and economic variables as well as factors related to the hazard and evacuation-specific ones. A study in 2019 shows that evacuation destination choice is determined by different factors like distance, accommodation space, and facilities of cyclone shelters (Parvin et al., 2019). Also, factors such as the average evacuation time, allocation of safe areas, the level of trust in authorities, modes of evacuation, and the volume of traffic heavily affect the choice of destination (Nagarajan et al., 2021). The information and transparency during disaster response, as rumors shaped many individuals' evacuation behavior in areas facing little or no damage. Also, governance capacity, those areas with a budget and good resource management, well-provided with plans on shelter allocation, show higher evacuation rates (Fraser et al. 2021). Further, factors like social networks, recommended location by authorities, and economic factors (e.g., Do 2019) also affect the choice of destinations.

Furthermore, socio-demographic characteristics of evacuees such as gender, educational level, household income, housing type, the presence of seniors ad small children, evacuation warning from local government,

marital status, and the number of household members, in addition to some destination-related factors, significantly affect evacuation destination choice (e.g. Wu et al., 2012; Abad et al., 2018; Golshani et al., 2018; Mostafizi et al., 2019; Alam et al., 2021; Lim et al., 2021). Additionally, the presence of flood equipment/materials, the distance of residence from the source of hazard, the distance traveled to the destination, and related costs and duration, are also linked to the decision-making (e.g. Lim et al. 2016). Travel behavior change also depends on employment type, possession of driver's license, ownership of the vehicle, and household characteristics (Abad et al., 2018).

## METHODOLOGY

### Data Collection and Study Area

The data utilized for analysis of gender-based evacuation destination choice was gathered from Quezon City, Metro Manila, Philippines. Considered the largest city in the Metro Manila area, Quezon City is prone to flooding (Figure 1). As of 2013, the City has a population of 2.68 million (Quezon City Planning and Division Office, 2013). The context of the data collected in 2013 was the flood experience of people due to the typhoon Trami in August 2013. When the typhoon entered the Philippine area of responsibility, the Marikina River, located in the eastern boundary of Quezon City, reached a critical height of 19 meters. When this happened, authorities enforced evacuation in affected areas. This resulted in thousands of households leaving their homes. Flood levels reached the rooftop of houses to 3-story buildings. Out of 643,281 households severely affected during the flood event, about 9,000 families went to designated evacuation shelters (Social Services Development Department, SSDD 2013). Affected areas in the City are barangays Bagong Silangan, Roxas, Sto. Domingo, and Toro. Face to face survey was done in these areas. The data collection procedure discussed in Lim et al. (2016) was employed.

The survey questionnaire consists of 3 sections including flood evacuation-related information, flood hazard information, and the characteristics of the respondents. The first section allowed the respondents to share their information such as their age, gender, monthly household income, type of work, vehicle ownership, number of household members, the presence of senior citizens, small children and pets, length of stay in the residence, homeownership status, house material, and floor levels. The second part of the survey form elicited information about the evacuation experience of households during the 2013 flood. The data elicited include the flood level, length of flooding, and damage level in the house. The source of warning was also elicited. Also, the household evacuation decision (whether they evacuated or not), the evacuation type (partial or full evacuation), departure timing (before the flood, or during floodwaters reaching the homes), and the destination type choice, were obtained. Additional evacuation details such as past flood experience, and the presence of flood equipment, were also asked from the respondents. Section 3 elicited comments and suggestions for better evacuation situations in the future.

At the beginning of the interview process, the

researchers oriented the respondents to the study objectives, the scope, and questions to be asked, as well as the data privacy. Before the consent of the respondents was ensured, the researchers mentioned that data privacy indicates that personal information gathered will be kept confidential. Of the 740 household interviews that were completed, Bagong Silangan, Bahay Toro, Sto. Domingo, and Roxas, consisted of 340, 150, 142, and 108, respectively. After data collection, the raw data were encoded in the excel file. Data was validated and cross-checked. Also, missing information was excluded from the data analysis. Then, the data was coded to the requirement of the statistical tool utilized for analysis.

### Discrete Choice Method of Analysis

The discrete choice model framework, particularly the logit model, was utilized for data analysis. Discrete choice models postulate that decision-makers face a set of choices among mutually exclusive ones (Wong et al. 2020). When they decide, they choose the alternative that gives the maximum benefit. Households that evacuated during the 2013 flood have two choice alternatives, including evacuation center/church/seminary, and friends'/relatives' home. With these alternatives, the binary logit model was used. The independent variables assessed for significance in the destination type choice, include initially all the variables that were collected. Then, variables included in the model were selected using the backward stepwise elimination of variables.

The utility functions for the destination type choice in this study are shown in Equations 1 and 2, for any household,  $r$ , evacuating to evacuation center/church/seminary,  $e$ , or friends'/relatives' home,  $f$ , respectively. In these equations  $\beta C_{er}$  and  $\beta C_{fr}$  are vectors of parameters for estimation. While  $\lambda K_{er}$  and  $\lambda K_{fr}$  are vectors of the independent variables that affect households' destination choice.  $\beta$ , and  $\lambda$  are vectors of coefficients to be estimated for  $C$  and  $K$ , respectively. These are estimated using the maximum likelihood estimation method, with the log-likelihood function shown in equation 5.  $\epsilon$  are terms for consideration of differences in preferences in the choice of the type of destination.

$$D_{er} = \beta C_{er} + \lambda K_{er} + \epsilon_{er} \quad (1)$$

$$D_{fr} = \beta C_{fr} + \lambda K_{fr} + \epsilon_{fr} \quad (2)$$

The probability,  $P$  that households choose to go to either of evacuation center/church/seminary,  $e$ , or friends/relatives' homes,  $f$  is denoted by  $P_{er}$  and  $P_{fr}$  respectively, as shown in Equations 3 and 4.

$$P_{er} = \frac{e^{\beta C_{er} + \lambda K_{er}}}{e^{\beta C_{er} + \lambda K_{er}} + e^{\beta C_{fr} + \lambda K_{fr}}} \quad (3)$$

$$P_{fr} = \frac{e^{\beta C_{fr} + \lambda K_{fr}}}{e^{\beta C_{er} + \lambda K_{er}} + e^{\beta C_{fr} + \lambda K_{fr}}} \quad (4)$$

$R$  is designated as the household number and  $J$  is the number of alternative evacuation destination type choices available to the households.



$$LL = \sum_{j=1}^J \sum_{r=1}^R \log(P_{er}) \log(P_{fr}) \quad (5)$$

To assess the significance of the variables in the binary logit, the t-statistics were used. The nearer the value to 0, the more significant the variable becomes. Model fit is assessed using pseudo R<sup>2</sup>.

### Summary of Data Utilized

Table 1 shows the description and frequency of the variables collected and utilized for analysis of the effect of gender in choosing the destination type. As shown in Table 1, the descriptive statistics indicate that among the respondents, most are more than 50 years old (30.75%). This is followed by respondents who are between 20-30 years old, 31-40 years old, as well as those that are within 41-50 years old, consisting of 16.77%, 29.03%, and 23.44% of the total respondents, respectively. Also, 289 of all respondents (62.15%) went to the evacuation center/church/seminary, while 176 (37.85%) of them went to their family/friends' house. Among the 381 respondents, mostly 71.65% (273) male, and 71.43% (60) female, went to evacuation center/church/seminary. Table 1 details the data information on all the other independent variables used for analysis in this study.

Three binary logit models were estimated and calibrated to investigate the effect of gender on the evacuation behavior of households. Model 1 is estimated using the full data. Model 2 is estimated using the male respondent data only. While Model 3, was estimated using the female respondents' information. Table 2 details the intercorrelation matrix among all the variables for the 3 Models. These contain the variables that were initially seen to affect the choice of male and female respondents using the various models established. The correlation matrix shows the possible variables that are significant to the evacuation destination choice for the different models. Model 1 indicates that type of work ( $r = -0.124$ ), income ( $r = 0.131$ ), source of warning ( $r = -0.141$ ), duration of stay in the destination choice ( $r = -0.122$ ), and distance traveled to destination ( $r = -0.208$ ), are significantly correlated with evacuation destination choice. While Model 2 indicates the number of house floors ( $r = 0.135$ ), distance traveled ( $r = -0.136$ ), distance traveled to the destination ( $r = -0.183$ ), and source of warning ( $r = -0.209$ ), are significantly correlated with the destination type choice. Lastly, the type of work ( $r = 0.315$ ), distance traveled ( $r = -0.339$ ), flood level ( $r = 0.293$ ), and type of house materials ( $r = -0.291$ ), are correlated with evacuation destination type choice.

### Significant Variables in the Logit Model Estimation

The destination of evacuation centers/churches/seminaries was the basis for model parameter estimation. The models show less than a 0.05 level of significance, indicating that a relationship exists between the independent and dependent variables. Model 1, 2, and 3, area under the curve (AUC) values are 0.681, 0.687, and 0.813, respectively. This indicates that the models have acceptable levels of discrimination. The model pseudo-R<sup>2</sup>

for models, 1, 2, and 3, are 0.082, 0.072, and 0.215, respectively. Table 3 shows the parameter estimation of models 1, 2, and 3.

### Model 1: All Respondents

Model 1 shows that significant variables to destination choice, include the distance traveled to the destination, duration of stay in the destination, monthly income, and the source of warning. Households with income within PHP 1,000-5,000 ( $b = 0.373$ ) will probably go to the evacuation centers/church/seminary. This might be because relief goods and food donations from the government and private institutions are provided to the evacuation center/church/seminary. Basic goods such as food and water were provided by the governments, individuals, and organizations, for free. Household heads receiving evacuation from other sources aside from barangay or government officials are less likely to evacuate to the evacuation centers ( $b = -0.961$ ). This result implies that it is more reliable for households if the warning comes from officials. Thus, reflecting the high level of trust in authorities. Also, households will less likely to go to evacuation centers if their distance is 200 m away from their current location. This is indicated by its coefficient  $b = -0.387$ . The negative coefficient of the duration of stay of households in a destination choice ( $b = -0.589$ ) indicates that if they will stay for 1-2 days in that destination, they are more likely to leave the evacuation centers. This finding might be drawn from their past experiences in staying in the centers.

### Model 2: Male Respondents

Distance traveled to the destination, the source of warning, and the number of house floors, are the exogenous variables that describe Model 2. The coefficient of the source of warning ( $b = -0.898$ ) suggests that if the warning comes from officials, they tend to go to evacuation centers. They indicated that evacuation orders from authorities and officials tend to affect evacuees' decision to stay in evacuation shelters. Also, the negative coefficient of the distance to the destination ( $b = -0.475$ ) indicates that if households travel 200 meters, they are less likely to go to evacuation centers. The result complements the findings of Nagarajan et al. (2021), and Mostafizi et al. (2019), as they found out the location of the shelter and how far it is from the centroid, significantly affect the percentage of people who evacuate to shelters. Moreover, the number of house floors with a positive coefficient ( $b = 0.632$ ) shows that households with only one house floor during a flood disaster have a higher probability evacuate to evacuation centers.

### Model 3: Female Respondents

For Model 3, the result shows that the house type of materials, and the type of work, are significant variables. The positive coefficient of the type of work ( $b = 1.516$ ), indicates that if the household head has full-time work, the household has a high probability of staying in the evacuation centers/church/seminary. While the type of house materials ( $b = -1.236$ ) suggests that if a household's house is made of concrete material, the household is less

Table 1. Descriptive summary of variables used in the analysis of destination choice based on gender

Variables	Classifications	All		Male		Female	
		f	%	f	%	f	%
Destination Decision (DDEC)	Evacuation center, church and seminary	289	62.15	273	71.65	60	71.43
	Friends'/relatives' house	176	37.85	108	28.35	24	28.57
Marital Status (MAR)	Single	96	20.65	25	6.56	71	84.52
	Married	369	79.35	356	93.44	13	15.48
Educational Attainment (EDUC)	Primary/Elem	109	23.44	88	23.10	21	25.00
	High School	249	53.55	204	53.54	45	53.57
	College/Diploma	72	15.48	59	15.49	13	15.48
	Others (Graduate)	35	7.53	30	7.87	5	5.95
Type of Work of the respondent (TWORK)	Full-time	156	33.55	129	33.86	27	32.14
	Part-time	309	66.45	252	66.14	57	67.86
The number of household members (MEM)	1- 4 members	181	38.92	141	37.01	40	47.62
	> 4 members	284	61.08	240	62.99	44	52.38
Age of the respondent (AGE)	20-30 years old	78	16.77	66	17.32	12	14.29
	31-40 years old	135	29.03	125	32.81	10	11.90
	41-50 years old	109	23.44	97	25.46	12	14.29
	>50 years old	143	30.75	93	24.41	50	59.52
Monthly Income of the respondent (INCOME)	1,000-5,000 PHP	143	30.75	105	27.56	38	45.24
	5001-10,000 PHP	222	47.74	196	51.44	26	30.95
	>10,000 PHP	100	21.51	80	21.00	20	23.81
Presence of Children (PCHILD)	No child	160	34.41	120	31.50	40	47.62
	Have children	305	65.59	261	68.50	44	52.38
Presence of senior citizen (PSEN)	No senior	410	88.17	343	90.03	67	79.76
	Senior is present	55	11.83	38	9.97	17	20.24
House material (HMAT)	Concrete	260	55.91	214	56.17	46	54.76
	Wood and concrete	205	44.09	167	43.83	38	45.24
House Ownership (HOWN)	Owned	114	24.52	93	24.41	21	25.00
	Rented	351	75.48	288	75.59	63	75.00
Number of house floors (FLOOR)	1 floor	284	61.08	242	63.52	42	50.00
	>1 floor	181	38.92	139	36.48	42	50.00
Number of years living in (YLIVE)	<10 years	137	29.46	116	30.45	21	25.00
	10-20 years	177	38.06	148	38.85	29	34.52
	>20 years	151	32.47	117	30.71	34	40.48
Number of vehicles (VEH)	No vehicle	398	85.59	323	84.78	75	89.29
	With vehicle	67	14.41	58	15.22	9	10.71
Damage (DAM)	No damage	125	26.88	109	28.61	16	19.05
	Damage/severely	340	73.12	272	71.39	68	80.95
Flood level (FLEVEL)	<1 meter	111	23.87	97	25.46	14	16.67
	≥ 1 meter	354	79.13	284	74.54	70	83.33
Source of flood warning (SWARN)	Other sources	199	42.80	155	40.68	44	52.38
	Officials	266	57.20	226	59.32	40	47.62
Cost of evacuation (ECOST)	No cost	341	73.33	281	73.75	60	71.43
	With cost	124	26.67	100	26.25	24	28.57
Duration in the evacuation choice (DUR)	1-2 days	379	81.51	306	80.31	73	86.90
	3-4 days	77	16.56	67	17.95	10	11.90
	>4 days	9	1.94	8	2.10	1	1.19
Presence of flood Equipment (EQUIP)	No equipment	404	86.88	330	86.61	74	88.10
	With equipment	61	13.12	51	13.39	10	11.90

Previous flood experience (EXP)	No experience	11	2.37	10	2.62	1	1.19
	With experience	454	97.63	371	97.38	83	98.81
Distance travelled to destination (EDIST)	< 200 meters	111	23.87	94	24.67	17	20.24
	200 – 400 meters	44	9.46	35	9.19	9	10.71
	>400 meters	310	66.67	252	66.14	58	69.05
Distance (DIST)	≤ 10 meters	283	60.86	221	58.01	62	73.81
	10-20 meters	39	8.39	35	9.19	4	4.76
	21-30 meters	26	5.59	21	5.51	5	5.95
	>30 meters	117	25.16	104	27.30	13	15.48

Table 2. Variables and their Correlation in Terms of Destination Type Choice Based on Gender

Exogenous Variables	Evacuation Destination (DDEC)		
	All	Male	Female
Type of Work of the respondent (TWORK)	0.124*	-	0.315*
Monthly Income of the respondent (INCOM)	0.131*	-	-
Number of house floors (FLOOR)	-	0.135*	-
House material (HMAT)	-	-	-0.291*
Distance (DIST)	-	-0.136*	-0.339*
Flood level (FLEVEL)	-	-	0.293*
Source of flood warning (SWARN)	-0.141*	-0.209*	-
Duration in the evacuation choice (DUR)	-0.122*	-	-
Distance travelled to destination (EDIST)	-0.208*	-0.183*	-

\*significant at 95%

Table 3. Results of the model parameter estimation for gender-based models compared to the model with the complete data

Parameters	Coefficient,b		
	All	Male	Female
TWORK indicator variable (1 for part-time, 0 for full time)	-	-	1.516
INCOM indicator variable (2 for > PHP 10,000, 1 for PHP 5001-10,000, 0 for PHP 1-5,000)	0.373	-	-
HMAT indicator variable (1 for wood and concrete, 0 for concrete)	-	-	-1.236
FLOOR indicator variable (1 for >1 floor, 0 for 1 floor)	-	0.632	-
SWARN indicator variable (1 officials, 0 for other sources)	-0.961	-0.898	-
EDIST indicator variable (2 for >400 m, 1 for 200-400 m, 0 for <200 m)	-0.387	-	-
DUR indicator variable (2 for >4 days, 1 for 3-4 days, 0 for 1-2 days)	-0.589	0.475	-
Constant	0.694	0.954	0.021
Number of Observations	465	381	84
LR chi <sup>2</sup> (4)	52.53	37.96	24.19
Prob > chi <sup>2</sup>	0.0000	0.0000	0.0001
Pseudo R <sup>2</sup>	0.082	0.072	0.215
CCR base rate	52.95%	59.37%	59.18%
CCR	77.78%	73.75%	80.95%
AUC	0.681	0.687	0.813

## SUMMARY AND CONCLUSIONS

To be better prepared for future flood events, the evacuation behavior of people needs to be understood. Understanding how households decide on the type of destination is an important subject that government officials need to know. Results from this can be a valuable factor to incorporate in evacuation plans. Such results can be used in the traffic simulation model and are necessary for the accurate assessment of network congestion and delay (Cheng et al. 2008). This study investigated whether the included independent variables affect evacuee behavior. The data used for analysis was gathered from households in Quezon City, Metro Manila, Philippines. The context of evacuation is due to a flood event in 2013. The correlation matrix was first analyzed to identify potential factors to be included in the logit models. Then, three binary logit models were estimated utilizing the whole data and the data from male and female respondents.

Results of variables significant to Model 1 indicate more that can be important in the decision-making of both male and female respondents. In general, significant variables found in Model 1 include distance traveled to the destination, duration of stay in the destination, income, and the source of warning. Households with an income within PHP 1,000-5,000, regardless of being male or female, will probably go to the evacuation centers/church/seminary. Most of the respondents located in high-risk flood areas have low to medium income levels. Also, household heads who received evacuation warnings from barangay officials are more likely to comply to go to the evacuation center/church/seminary. Households experience floods almost every year and most of them have past flood evacuation experience. This indicates their level of trust in the barangay officials which supports previous findings (e.g., Lim et al. 2016; Golshani et al. 2018; Lim et al. 2021). Also, households are less likely to go to an evacuation center/church/seminary if their distance is at least 200 m away from their current location, or longer than that. Households prefer to go to nearby destinations. This finding also supports past studies that found longer distances traveled are less chosen by the evacuees (e.g., Nagarajan et al. 2021; Mostafazi et al. 2019). The duration of stay of households in a destination indicates that if they will stay for 1-2 days in that destination, households are more likely to leave the evacuation centers according to past experiences.

Findings in Model 2 show that duration of stay in the destination, the source of warning, and the number of house floors, affect destination type choice. The source of warning suggests that if the warning comes from officials, they tend to go to an evacuation center/church/seminary. Similar to findings in model 1, this shows the compliance

likely to go to evacuation centers/church/seminary. This finding is similar to that of earlier studies. Households with wood as a housing type have a higher probability of going to the evacuation shelter first (e.g. Damera et al. 2019; Golshani et al. 2018). However, these are in cases of a hurricane and no-notice disasters.

### Model Internal Validation

To internally validate the three models estimated, the likelihood ratio (LR) test was employed. This was done to statistically test the model specification validity. For each model, the complete data were divided randomly into two subsamples. The whole data utilized to estimate the logit model is divided randomly into two subgroups with the same number of subsamples. The subsamples are indicated as ss1 and ss2 in equation 6. These two subsamples were used to estimate separate models to obtain the value of LL for each subsample. The LR (Equation 6) is then calculated to test the null hypothesis. The null hypothesis postulates that there is "no significant difference between the LR at the convergence of the model estimation results with the use of the whole data and the model estimated using the subsamples, respectively. The LL for models 1, 2, and 3 were calculated separately according to the entire data and subsamples of data utilized for each model.

$$LR_{full,male\ or\ female} = -2[LL(\beta_{full,male\ or\ female}) - LL(\beta_{ss1,male\ or\ female}) - LL(\beta_{ss2,male\ or\ female})] \quad (6)$$

In equation 6, the variables mean  $LL(\beta_{full,male\ or\ female})$ ,  $LL(\beta_{ss1,male\ or\ female})$ , and  $LL(\beta_{ss2,male\ or\ female})$  are the log-likelihood at the convergence of the model estimated with the use of the entire data and the subsamples, respectively. Table 4 provides the details of the calculated values. For the first model using the combined data of male and female household heads, calculated values of the LL for the full data, and 2 subsamples are -281.025, -118.107, and -105.893, respectively. Calculating the LR gives the value of 114.05 with degrees of freedom equal to 4. Since the critical value of  $\chi$  for a 5% level of significance and degrees of freedom equal to 4,  $\chi^2_{0.05, 4}$ , is equal to 9.488, the model validity is established. For the  $LL(\beta_{Male})$ ,  $LL(\beta_{ss1})$ , and  $LL(\beta_{ss2})$ , the values of the complete data and the split samples are -231.087, -99.537, and -117.820, respectively. The value of LR is 27.46 with degrees of freedom equal to 3. Since the critical value of  $\chi$  for a 5% level of significance and degrees of freedom equal to 3,  $\chi^2_{0.05, 3}$ , is equal to 7.815, the validity of the model is also established. Moreover, for  $LL(\beta_{Female})$ ,  $LL(\beta_{ss1})$ , and  $LL(\beta_{ss2})$ , the values of the whole data and the split samples are -24.815, -26.217, and -16.779 respectively. The value of LR is 30.75 with degrees of freedom equal to 2. Since the critical value of  $\chi$  for a 5% level of significance  $\chi^2_{0.05, 2}$ , is equal to 5.991, the validity of the model is also established.

Table 4. Values of the LL for Full Data and Sub Samples for the 3 Logit Models of Destination Type Choice

LL Values	Model 1 (Combined Male & Female Data)	Model 2 (Male Data)	Model 3 (Female data)
$\beta_{full\ data}$	-281.025	-231.087	-24.815
$\beta_{ss1}$	-118.107	-99.537	-26.217
$\beta_{ss2}$	-105.893	-117.820	-16.779



of households located in high-risk areas. Male household heads put importance on the warning they get from their authorities. Also, those with only one house floor are more likely to go to an evacuation center/church/seminary. Logically, these are the priorities to be evacuated as they do not have a choice. Male household heads also are less likely to stay in an evacuation center/church/seminary with a longer duration of stays. This is evidently due to the concerns that male heads indicated concerning their home and properties. They are concerned about the looting and security of their homes. Unlike the result in Model 3, female heads, when having a house material made of wood or half-concrete, likely go to evacuation centers/church/seminary. They do not put importance on the duration of stay in the evacuation centers/church/seminary or the number of floors the house have. This is in addition to the type of work of female heads, having full-time work, having a high probability to stay in the evacuation centers/church/seminary. This may be related to the female heads concerned for the family members when the home is flooded. They are more secure leaving their family members in an evacuation center/church/seminary while going to work.

Outputs of this study can help identify demand for evacuation centers, allocate evacuees in each evacuation center to reduce evacuation time, and effectively manage available resources when evacuating people at risk. Also, the findings in this study are important for government officials in charge of developing evacuation plans. Although findings in this study provide insights that can be helpful to evacuation planners, future studies are still needed to validate the logit models estimated here during an actual evacuation. Also, analyzing the transferability of the models to other areas in the Philippines that are flood-prone, can be a subject for future studies.

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## Nutrient Intakes of School-Age Children in Selected Schools in Davao City, Philippines

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### ABSTRACT

Adequate nutrition during childhood is vital for proper growth and development. However, nutrient intakes of Filipino school-age children are shown to be inadequate. This study assessed the nutrient intakes among school-age children from districts with the highest malnutrition rate in Davao City, Philippines. Using 3-day food records, dietary intake data were collected from a representative sample of 165 schoolchildren (aged 10-12 years) from six public schools in Poblacion, Paquibato, and Marilog districts. The nutrient intakes were calculated from the indicated food quantities, and the USDA food composition table was used as the primary database. These were compared with the 2015 Philippine Dietary Reference Intake values. Intake of total energy (102.56%), protein (165.11%), and some micronutrients reached the required amounts. On the other hand, inadequacies in several nutrients were identified: lipid intake was 49.01% of the recommended level, carbohydrate at 91.68%, dietary fiber at 53.16%, vitamin C at 54.98%, folate at 67.69%, vitamin E at 43.48%, vitamin D (IU) at 89.20%, calcium at 48.93%, and iron at 53.70%. Excess intakes of sodium (683.07%) and vitamin B12 (520.74%) were also reported. These findings suggest the need for targeted intervention programs that address nutrient inadequacies among Filipino school-age children.

*Keywords:* macronutrient intake, micronutrient intake, nutrient inadequacy, school-age children, 3-day food record

### INTRODUCTION

The inadequacy of nutrient intakes is of increasing public health concern. According to UNICEF (2020), the undernutrition of children has been attributed to nearly half of all child deaths globally. UNICEF (2023) reports that many school-age children do not consume nutritious and balanced diets. The insufficiencies in nutrients among children have been well documented, with pronounced prevalence in Southeast Asia (Fiorentino et al., 2016; Caswell et al., 2018; Campos Ponce et al., 2019; Magee & Mccann, 2019). In low- and middle-income countries, the consumption of nutrient-rich foods such as fruits, vegetables, and animal products among school-age children remains low.

Likewise, urbanization heightened the incidence of nutritional inadequacies due to consumption of foods from convenience and fast foods that are high in glycemic indexes, fats, and sugars (Fiorentino et al., 2016; Caswell et al., 2018). Moreover, rising access to fast foods and processed foods influence the preferences of Filipino school-age children (Siy Van et al., 2021) that may contribute to the high prevalence of inadequate intakes was highest for iron, calcium, vitamin C, folate, zinc, and total fat (Denney et al., 2018). As a result, one of the consequences is suboptimal cognitive development, which hinders development into healthy and productive adults (Denney et al., 2018; Wieringa et al., 2019). The programs associated with addressing these inadequacies are often

focused on only one or a few micronutrients. With the absence of a national protocol and guidelines to address chronic malnutrition (Garg et al., 2016), there is a greater need for a holistic approach to developing nutrition-specific interventions to address these deficiencies (Wieringa et al., 2019). Nonetheless, some efforts have focused on national policy and government scale-up and the development of nutrient-rich food products (Garg et al., 2016; Soriano et al., 2020). For instance, Davao City was the first to implement the Act for Salt Iodization Nationwide Law (Davao City Information Office, 2018). Effective food fortification strategies for children will help deliver significant nutrients.

In a few studies, most of the nutrient-deficient schoolchildren and adolescents came from poor families and rural areas (Angeles-Agdeppa et al., 2019a; Angeles-Agdeppa et al., 2019b; Mak et al., 2019). In the 2018 Expanded National Nutrition Survey (ENNS) conducted by the Food and Nutrition Research Institute [FNRI], undernutrition was still more prevalent among children in rural areas. In contrast, overweight/obesity was more prevalent among children in urban areas (FNRI, 2020b). In a recent report of the FNRI (2020a), it was found that the prevalence of stunting and overweight/obesity was higher

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among school-age children in Davao City (25.7% and 14.5%, respectively) compared to the respective national average prevalence of 24.6% and 11.6% (Davao City Agriculturist Office, 2016). Underweight and stunting were more prevalent among school-age children from poor areas in Davao City. However, research on the nutrient intake of school-age children in the Philippines is scarce.

This study aimed to determine the nutrient intakes of school-age children from districts with the highest malnutrition rate in Davao City, Philippines. Areas with the highest incidence of malnutrition were selected because the study seeks to recommend interventions targeting specific nutrient inadequacies among malnourished children. These particular districts generally have higher unemployment rates and numbers of identified poor children, contributing to the poor nutrient intakes and malnutrition status, as presented in the 2018 ENNS where inadequacies were more prevalent among children from the poorest households (FNRI, 2020a). Hence, the results of this study target to fine-tune the dietary recommendations and policies for school-age children in these poverty-stricken areas. Therefore, the data will help design policy interventions on nutrition education and school feeding programs in primary schools. Furthermore, the findings can direct government agencies and research institutions to develop food-based recommendations and public health strategies to address the issue of nutrient inadequacies among school-age children in Davao City, Philippines.

## METHODOLOGY

### *Study Population*

The study selected school-age children, specifically fifth-grade students aged 10-12 years, in six primary schools in Davao City, Philippines. According to data obtained from the Davao City Agriculturist Office (2016) and Davao City Planning and Development Office (2016), the top three administrative districts with the highest malnutrition rate in their respective legislative districts were Poblacion (5.16%), an urban area, and Paquibato (13.41%) and Marilog (7.95%), which are rural areas. The number of identified poor children aged 9-12 years old in Marilog, Paquibato, and Poblacion districts comprised 13.7%, 10.9%, and 7.8%, respectively, of the total number of poor children surveyed (Department of Social Welfare and Development, 2016). The highest number of identified poor children at 1,370 was under the Marilog district. These districts were selected because the results of this study target to fine-tune the dietary recommendations and policies for school-age children in these poverty-stricken areas. From each of the three districts, two primary schools were randomly selected. These schools include Kapitan Tomas Monteverde Sr. Elementary School and Teodoro Palma Gil Elementary School in Poblacion District, Paradise Embac Elementary School, and A.L. Navarro Elementary School in Paquibato District, and Salaysay Elementary School and Marilog Central Elementary School in Marilog District. With the assistance of the school principal and the fifth-grade head adviser, one section from each participating school was identified through random selection. A total representative sample of 165 students who had undergone the vegetable gardening curriculum

was selected. According to the central limit theorem, as the sample size becomes sufficiently large ( $n \geq 30$ ), the sample distribution approaches normality and thus statistical inferences become reliable (Lehmann, 1999; Kwak & Kim, 2017). The sample size was calculated using power analysis with the following specifications: effect size = 0.3, alpha error = 0.05, and power = 0.95. The minimum total sample size is 122, and the higher sample size used in the study increases the reliability of inferences as shown in a similar study (Calumba et al., 2023). Moreover, school-based feeding and gardening programs were prohibited during the project implementation to avoid bias, specifically to ensure that the food consumed was prepared and/or bought by the household.

### *Data Collection*

Household socio-demographic data including age, sex, educational attainment, and household size were collected using a pre-tested questionnaire administered to the parents/legal guardians of the child. All questionnaires were translated into the local dialect. The study was conducted following the Declaration of Helsinki (World Medical Association, 2018). The research objective was thoroughly explained, and written informed consent was obtained from the parents/guardians of the participating children prior to the data collection conducted from 2017 to 2018. Data were appropriately managed to ensure privacy and anonymity.

The dietary intake information was collected using the 3-day food record. This method was recently reported to be superior to the gold standard 7-day dietary assessment as it provides comparable results and can save time and cost (Chandrashekarappa et al., 2020). It has been commonly used in practical settings and is reported to be an acceptable dietary assessment tool (Yang et al., 2010) and standard for the validation of a developed food frequency questionnaire (Morel et al., 2018). The researchers and teachers from the participating schools explained the questionnaire to the parents/guardians with emphasis on proper measuring units, and the parent/guardian accompanying the child was asked to record all foods and drinks consumed by the child for the past three days during breakfast, lunch, dinner, and snacks. The respondents were asked to indicate the amount consumed using food utensils (e.g., measuring cups for rice; number of pieces for bread, individual fruits and vegetables, eggs, hotdogs, and root crops; number of packs for noodles, juice, and powdered milk; amount in kilograms for meat; number of spoons for powdered food products; and number of cans/bottles for canned goods and soft drinks and other beverages). Emphasis was placed on providing sufficient information to estimate the portion sizes. Food description details such as added ingredients were collected for each food recalled. The questionnaires were brought home, while some participants answered the survey during face-to-face meetings. The elderly respondents were assisted in answering the survey questions. Upon retrieving the questionnaires from the respondents, the answers were validated by the team.

### *Data Analysis*

A descriptive analysis was carried out in this study.



The most consumed foods of the participating school-age children were identified. They were classified into various food groups: meats/poultry/fish products, grains and grain products, eggs and milk products, vegetables, fruits, and sweetened beverages. The frequency of intake of the top twenty most consumed foods was also recorded. This refers to the number of times a specific food was consumed by 165 schoolchildren over three days.

The observed nutrient intakes were calculated from the 3-day food record using the food composition tables developed by the United States Department of Agriculture (USDA) (2019) as the primary database since it is more comprehensive and widely accepted globally, as well as the PhilFACT from the FNRI (2015) for specific food items not found in the USDA database. Each food intake was calculated for energy (kcal), protein (g), lipid (g), carbohydrate by difference (g), dietary fiber (g), vitamin C, thiamin, riboflavin, niacin, vitamin B6, folate, vitamin B12, vitamin A (retinol activity equivalent or RAE), vitamin A (IU), vitamin E, vitamin D (IU), and vitamin K, calcium, iron, magnesium, phosphorus, potassium, sodium, and zinc, wherein all vitamins and minerals were calculated in mg. The mean macronutrient and micronutrient intakes were obtained and plotted in Microsoft Excel. Nutrient intake data were assessed against the 2015 Philippine Dietary Reference Intake Recommended Energy/Nutrient Intake (REI/RNI) values. From this, the nutrient inadequacies and excessive intakes were determined from the % nutrient intake as follows, where 100% signifies adequate intake.

$$\% \text{ Nutrient intake} = \left( \frac{\text{Average nutrient intake}}{\text{Recommended nutrient intake}} \right) \times 100 \quad (1)$$

## RESULTS AND DISCUSSION

### Household Characteristics

The socio-demographic characteristics of

the 165 participating households are shown in Table 1. The respondents who answered this part of the questionnaire were either household heads or guardians of schoolchildren aged 10-12 years old. The majority of the interviewed household representatives were below 40 years old (53%) and predominantly female (76%) because their husbands were at work and some were stay-at-home mothers. Among the interviewed households, almost half had a college-level education. Also, the majority of the households had at least 5 members.

### Commonly Consumed Foods

The most consumed food items are listed in Table 2, while the top twenty foods consumed in the largest quantities are presented in Table 3. Rice, which was identified as the most consumed food and the primary carbohydrate source in the diet of school-age children, is a staple in the Philippines (Lapada, 2019). Meanwhile, protein intake is primarily sourced from consuming fresh meat (fish, chicken, pork, and beef), processed meat products, eggs, and milk. In addition, several food items listed (e.g., powdered chocolate drink, canned sardines, hotdog, dried fish, noodles, and corned beef) are processed products. In general, processed foods pose a concern among consumers because of higher saturated fat, sugar, and salt (Petit et al., 2019; Bleiweiss-Sande et al., 2020). The consumption of highly processed food has also been associated with childhood obesity, especially among low-income children, and is also linked with lower dietary quality (Bleiweiss-Sande et al., 2020). The consumed fruit and vegetable are banana and eggplant, respectively. Although children consume a combination of green leafy vegetables (e.g., Malabar spinach or 'alugbati' and pechay), fruit, vegetables (e.g., eggplant and squash), and starchy vegetables (e.g., potato), the amount and variety of these in the diet are limited and is similar to the trend for fruits. According to the respondents, the food consumption of children is driven mainly by accessibility and convenience.

Table 1. Socio-demographic profile of parent/guardian of the school-age children (n=165).

Characteristics	%
<b>Age</b>	
Below 40 years old	53
40 to 49 years old	32
50 to 59 years old	11
Above 59 years old	4
<b>Sex</b>	
Male	24
Female	76
<b>Educational attainment</b>	
Elementary	16
High school	35
College	48
Others	1
<b>Household size</b>	
Less than 5 persons	39
At least 5 persons	61

Table 2. Commonly consumed foods by school-age children, 10-12 years old, in selected schools in Davao City based on the 3-day food record.

Food group	Most consumed food
Meats/Poultry/Fish Products	Fish, chicken, pork, beef, canned sardines, hot-dog, dried fish, corned beef, beef loaf
Grains and Grain Products	Rice, bread, noodles
Eggs and Milk Products	Eggs and milk (liquid, milk powder)
Vegetables	Eggplant, string beans, Malabar spinach, pechay, water convolvulus, squash, carrots, bottle gourd, sweet potato, potato
Fruits	Banana, apple, durian, mango, papaya
Sweetened Beverages	Powdered chocolate drink

Table 3. Frequency of intake of the top twenty most consumed foods of school-age children, 10-12 years old, in selected schools in Davao City based on 3-day food record (n=165).

Rank	Food	Frequency of intake in 3 days*	Mean frequency of intake per respondent per day
1	Rice	1326	2.7
2	Fish	383	0.8
3	Egg	253	0.5
4	Milk	201	0.4
5	Bread	170	0.3
6	Banana	160	0.3
7	Chicken	123	0.2
8	Eggplant	121	0.2
9	Powdered chocolate drink	116	0.2
10	Canned sardines	107	0.2
11	Pork	104	0.2
12	Hotdog	97	0.2
13	Dried fish	85	0.2
14	Beef	83	0.2
15	Noodles	77	0.2
16	String beans	49	0.1
17	Sweet potato	46	0.1
18	Corned beef	44	0.1
19	Malabar spinach	38	0.1
20	Pechay	37	0.1

\*Values are the number of times the food is consumed across the 165 children during a single 3-day food record.

### Macronutrient Intakes

In this study, a 3-day food record was used to estimate the nutrient intake of the participants. Data collection on nutrient intake through food records and questionnaires is more feasible than biomarkers which require laboratory analyses (Wieringa et al., 2019).

The mean energy and protein intake reached the required levels at 102.56%, and 165.11%, respectively. Most of the school-age children had insufficient lipid, carbohydrate, and dietary fiber intakes which met only 49.01%, 91.68%, and 53.16% of the recommended levels, respectively (Figure 1). The participants consume mostly protein-rich foods as listed in Tables 2 and 3, including

fresh meat (fish, chicken, pork, and beef), processed meat products, eggs, and milk. The limited consumption of fruits and vegetables may have contributed to the low dietary fiber intake, which can lead to poor digestive health and an increase in both blood glucose and cholesterol levels (Korczak et al., 2017). Households with more than five members, living in rural areas, and with poor income status are more commonly engaged in vegetable gardening and growing fruit-bearing trees (FNRI, 2020a). However, the present results show that the consumption of fiber-rich fruits and vegetables among school-age children was low despite the majority of the households having more than five family members, and the districts selected as contributing a total of 32.4% to the number of identified poor children in Davao City. Previous research identified

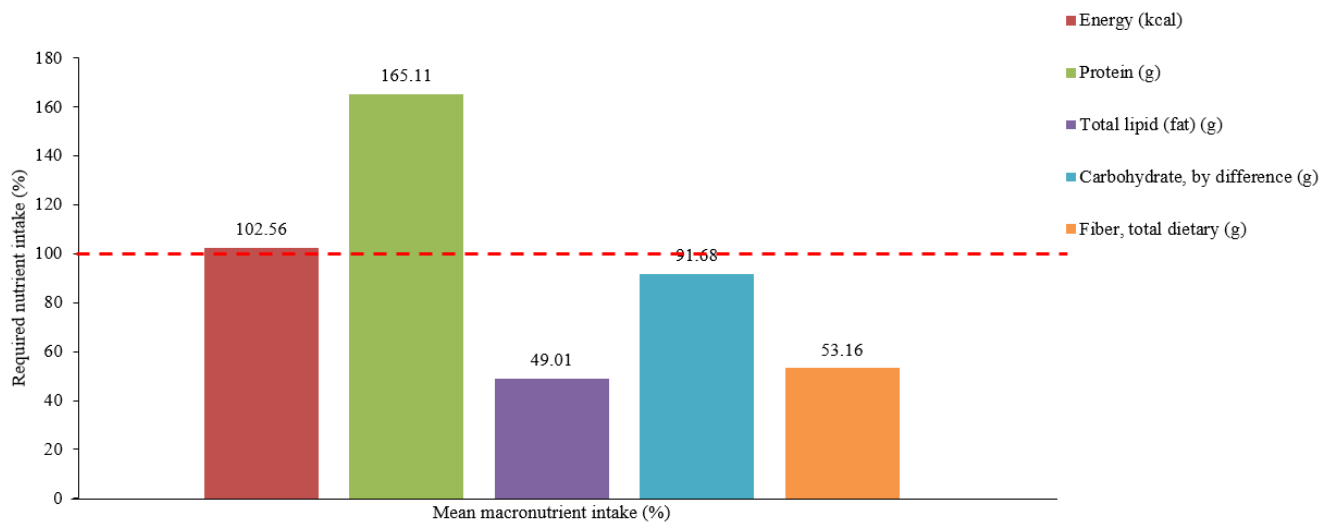


Figure 1. Mean energy and macronutrient intakes among school-age children, 10-12 years old in selected schools in Davao City based on 3-day food record.

\*The red dashed line denotes 100% adequacy. Data falling below the red broken line equate to the inadequacy of a certain nutrient, while just above or beyond the line signifies either sufficient or overconsumption of a nutrient.

affordability as a significant factor affecting the purchasing decisions of Filipino children while in school. Highly processed foods were found to be cheaper than healthier local alternatives sold in the school perimeter (Reeve et al., 2018). School-age children may be more exposed to fast food and convenience food (Bleiweiss-Sande et al., 2020). Moreover, lower consumption of vegetable food preparations was associated with a decline in income among fisher households in Davao Gulf, corresponding to higher consumption of processed food (Joquiño et al., 2021).

#### Micronutrient Intakes

The results demonstrated that school-age children were at the highest risk of inadequate intakes of vitamin C, folate, vitamin E, vitamin D (IU), calcium, and iron. The top three micronutrient inadequacies were iron (53.70%), calcium (48.93%), and vitamin E (43.48%). On the other hand, Figure 2 and Figure 3 report that children had very high intakes of sodium (683.07%) and vitamin B12 (520.74%).

The mean vitamin C intake was below the standard recommendations (54.98%). Vitamin C deficiency is common among populations with low fruit and vegetable intake (WHO & FAO, 2004). In the present study, the school-age children consumed very minimal amounts of these food groups (Table 3), which could be a contributing factor. Vitamin C is considered to have functional roles in the immune system and can help prevent respiratory infections in children from developing countries (Vorilhon et al., 2019). Vitamin C deficiency was more prevalent among Filipino schoolchildren in urban areas, suggesting a significant difference in the diet between urban and rural regions (Angeles-Agdeppa et al., 2019a).

School-age children from the present sample also

exhibited folate inadequacy with a mean intake of 67.69% of the recommendation. Some sources of folate include beans, nuts, and dark green leafy vegetables (Caswell et al., 2018), which are not abundantly consumed by the study population. The most consumed food, white rice, is low in folate (WHO & FAO, 2004). In the Philippines where rice is a staple and the consumption of legumes and green leafy vegetables are usually low, there is a higher chance of sustaining deficiencies in folate intakes (Allen, 2008). Similar to the trend for vitamin C, the inadequacy of folate was reported to be higher in urban areas (Angeles-Agdeppa et al., 2019a). Folate was previously shown to play a crucial role in preventing neural tube defects (Allen, 2008; Magee & Mccann, 2019). Also, poor folate status was associated with impaired memory and learning and poor cognitive performance among school-age children (Gupta et al., 2017).

Another nutrient inadequacy observed among children is vitamin E (43.48% intake compared to the recommended amount). Vitamin E is a major fat-soluble antioxidant obtained exclusively from the diet and is naturally present in plant-based diets and animal products. Vegetable oils are the primary dietary source of vitamin E and other foods where vitamin E is present include seeds and nuts, meat, and bread (WHO & FAO, 2004; Weber et al., 2019). Furthermore, vitamin E deficiency is primarily due to inconsistent dietary fat absorption and metabolism. Also, since vitamin E is lipid-soluble, its higher intakes are correlated with a lower incidence of cardiovascular diseases (WHO & FAO, 2004; Kemnic & Coleman, 2019).

Finally, vitamin D (IU) intakes were slightly insufficient in the study population with a mean value of 89.20%. Vitamin D is a fat-soluble vitamin referring to ergocalciferol (vitamin D2) and cholecalciferol (vitamin D3). Vitamin D in 1 µg is equivalent to 40 International Units (IU), which is used as the standard unit for Vitamin D

content in food products (Pludowski et al., 2018). Although vitamin D deficiency is an increasing public health concern, information on its prevalence in low-middle income countries is not widely available. In the Philippines, the vitamin D supply is primarily obtained from pelagic fishes, such as tuna (Cashman et al., 2019). The insufficient intake may be surprising as the children's fish consumption is relatively high. However, the most common fish species consumed by the participating children may not be high in vitamin D. Moreover, it is reported that vitamin D deficiency has adverse effects on bone metabolism and immune function (Pludowski et al., 2018). Aside from diet, skin exposure to sunlight can already provide daily vitamin D needs (WHO & FAO, 2004).

The calcium intake was only almost half (48.93%) of the recommended amount. Surprisingly, calcium intake is insufficient given that milk is the fourth most consumed food. Still, the high prices of milk and dairy products especially in urban areas may be a likely factor that can constrain its accessibility (Fiorentino et al., 2016; Angeles-Agdeppa et al., 2019a). In a recent study, the prevalence of calcium inadequacy among Filipino schoolchildren and adolescents was 92-94% (Angeles-Agdeppa et al., 2019a). Calcium, along with iron and zinc, is designated as a "problem nutrient" as deficiencies can cause severe issues in the growth and development of children (Goyena et al., 2019). Low dietary calcium has been associated with hypocalcemia and low bone mineral density (Fiorentino et al., 2016).

Insufficient iron intake was also highly prevalent in children with a mean value of 53.70% compared to the recommended levels. This poor intake was similar to previous studies on Filipino children (Denney et al., 2018; Angeles-Agdeppa et al., 2019a; Angeles-Agdeppa et al., 2019b; Goyena et al., 2019; Mak et al., 2019). Inadequacy of iron intake was also shown to be higher for 10-12 years old (Angeles-Agdeppa et al., 2019a), which is the age group in the current study. The poor intake of iron and the abovementioned calcium is common among Filipino children because of the low amount and diversity of foods that are rich in these nutrients (Mak et al., 2019). Leafy vegetables and other vegetables, largely indigenous ones, as well as fruits that have a high ascorbic acid content, help enhance the absorption of iron in the body. The low consumption of these foods, especially among poor households, puts them at a higher risk of iron deficiency (Hönicke et al., 2006). The 2018 ENNS describes the higher prevalence of anemia in children from poor households (FNRI, 2020b). Iron deficiency is the most common cause of anemia worldwide. Iron and calcium are also poorly absorbed by the body due to the excessive intake of phytate from grains, particularly rice (Table 3) (Bhargava, 2016). Studies have reported associations among iron deficiency, iron deficiency anemia, and poor cognitive development in children (WHO, 2017). Thus, insufficient iron intake may impair school attendance and performance. It is also a risk factor for poor vitamin A status (Fiorentino et al., 2016).

On the other hand, it was found that children have sufficient or high intake of the following micronutrients: thiamin (vitamin B1), riboflavin (vitamin B2), niacin, vitamin B6, vitamin B12, vitamin A, and vitamin K (Figure 2)

magnesium, phosphorus, potassium, sodium, zinc (Figure 3).

The excessive sodium intake (683.07%) obtained is comparable to a recent report indicating 893 mg sodium per day among Filipino schoolchildren aged 10-12 years (Angeles-Agdeppa et al., 2019a). As shown in the 3-day food record of the respondents, this high sodium intake can be attributed to the frequent consumption of processed and salty foods, such as canned sardines, dried fish, and noodles (Table 3). In a previous study, dried-salted sardine samples in the Philippines exceeded the recommended salt content for dried fish products (Simora et al., 2016). The high consumption of processed foods may be due to the geographical location of the respondents. Urban residents have easier access to manufactured foods and fast foods, which have higher sodium content, than rural residents (Mizéhoun-Adissoda et al., 2017; Siy Van et al., 2021). Moreover, as some of the respondents stated, the money they earn from selling harvested crops is used to buy rice and food products such as those mentioned above, which are relatively cheaper. Excess sodium intake has been widely associated with a higher risk of cardiovascular diseases (Petit et al., 2019) hence sodium intake during childhood needs to be regulated to prevent hypertension and other diseases in the life course (Leyvraz et al., 2018).

The mean intake of vitamin B12 was also beyond the recommended level, with the lowest and highest average values per school being 353.8 to 662.9%, respectively. Vitamin B12, which is necessary for cognitive development in children, is primarily obtained from animal-source foods (Venkatramanan et al., 2016). As shown in Table 3, the participating school-age children consumed many animal-based foods such as meat, fish, and poultry, contributing to the high intake of this vitamin. Moreover, early diagnosis of abnormally high vitamin B12 intakes is essential in preventing possible diseases (Andrès et al., 2013).

The observed nutrient inadequacies can be linked to the socioeconomic status of the three districts. Poblacion and Marilog districts had higher percentages of unemployed individuals at 13.7% and 13.5%, respectively, compared to the 12% city average. Also, the number of identified poor children aged 9-12 years old from the three participating districts reached 32.4% of the total number surveyed in Davao City in 2016. This information can be associated with one study showing how unemployment can increase the risk of malnutrition as employment is one of the social factors influencing human health (Sia et al., 2019). With accessibility and convenience identified as primarily influencing the food consumption of the school-age children, the high numbers of unemployed and identified poor children in the said districts and consequently poor socioeconomic status may have translated into low access to healthier food, affecting the children's nutrient intakes. This is especially common among poor households as 78.4% of the poor population in Davao City are food insecure. Also, food insecurity is more prevalent among households with more than five members (FNRI, 2020a), which is the case of 60% of the respondents in this study (Table 1). Lastly, despite the agricultural nature of the rural districts, this study shows that the children consumed



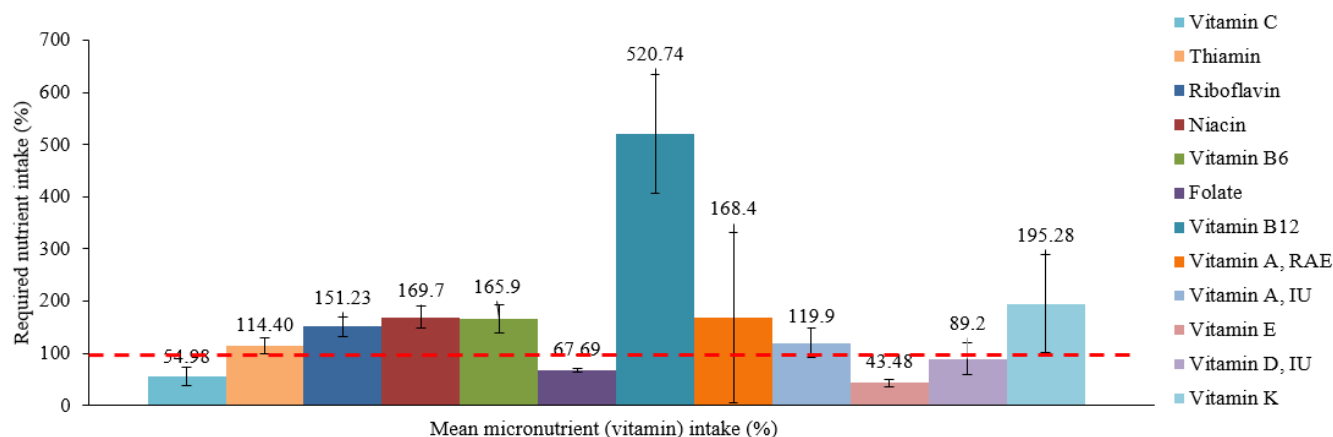


Figure 2. Mean micronutrient (vitamin) intakes among school-age children, 10-12 years old in selected schools in Davao City based on 3-day food record.

\*The red dashed line denotes 100% adequacy. Data falling below the red broken line equate to the inadequacy of a certain nutrient, while just within or beyond the line signifies either sufficient or overconsumption of a nutrient.

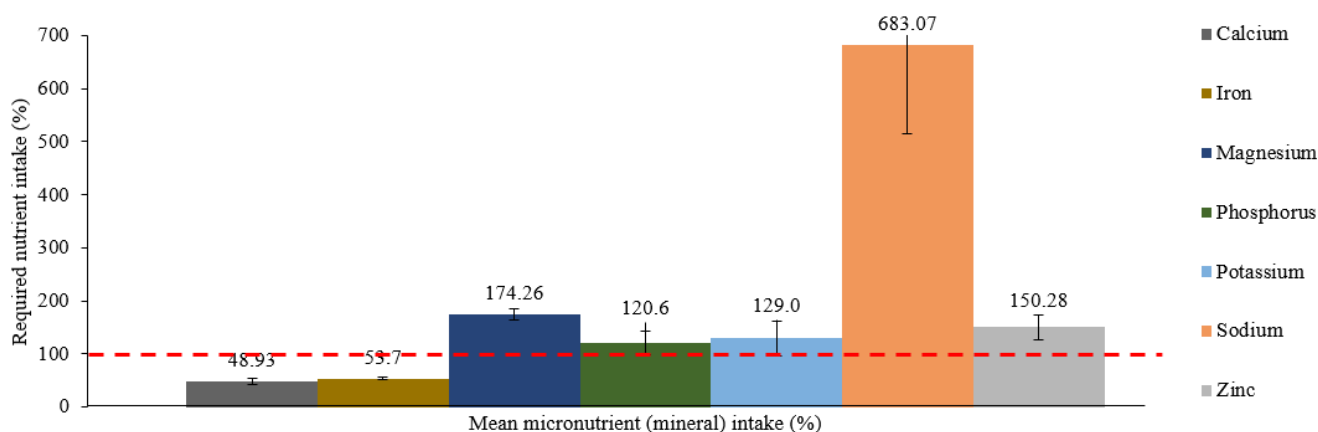


Figure 3. Mean micronutrient (mineral) intakes among school-age children in selected schools in Davao City based on 3-day food record.

\*The red dashed line denotes 100% adequacy. Data falling below the red broken line equate to the inadequacy of a certain nutrient, while just within or beyond the line signifies either sufficient or overconsumption of a nutrient.

several processed food products, which are reportedly more affordable than healthier food options in school (Reeve et al., 2018). Processed foods were increasingly consumed among Davao Gulf fishers' children from low-income households to substitute home-prepared meals (Jokuño et al., 2021).

This study has some limitations. The information presented was limited to the children's food intake declared by their parents or guardians. There may be other possible sources of nutrients that were not taken into account and under- or over-reporting could be plausible. Therefore, there is a likelihood of day-to-day variations in the food and nutrient intakes of the participants, including differences in weekday and weekend consumption, as the data describe only the short-term average. The results obtained were also analyzed using the USDA food composition tables, but the use of PhilFCT as the primary database must be considered in future studies. Further, future research

may focus on the transition in nutrition in the Philippine setting especially during a pandemic or when challenging environmental stressors are present. These efforts become more important during a health crisis where children are vulnerable, so their nutritional requirements must be met to prevent health disparities in the future.

## CONCLUSION AND RECOMMENDATION

The findings of this study show that the mean intake of lipid, carbohydrate, dietary fiber, vitamin C, folate, vitamin E, vitamin D (IU), calcium, and iron of school-age children from districts with the highest malnutrition rate in Davao City, Philippines, were below the recommended levels. As diet is a significant factor contributing to malnutrition, there is a stronger need for interventions to improve dietary practices (i.e., home gardening and consumption of indigenous fruits and vegetables) and consequently the nutritional status of Filipino children. This

study recommends increasing the awareness of the benefits of consuming a wide variety of food items among children, especially in marginalized areas. Further, the findings can be used to formulate and implement policies and programs that are more inclusive to improve the growth and health outcomes of school-age children in Davao City. A national but targeted food fortification program is recommended to address nutrient deficiencies, especially among children in low-income households. The present study highlights the need for broader and sustained support for home gardening, existing food fortification programs, nutrition education, research efforts, and other initiatives to improve the nutrition of school-age children, especially from areas with high malnutrition rates and poverty incidence.

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## Exploring the Therapeutic Potential of Nootropic Agent Noopept on Depression and Mood Disorders: An Investigative Analysis

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### ABSTRACT

This article aims to investigate the potential impact of noopept, a synthetic peptide and nootropic agent, on the treatment of depression and mood disorders. Despite a substantial body of research on noopept, the initial investigations focused predominantly on animal models. However, more recent research has investigated its efficacy in humans. Noopept has been shown to enhance acetylcholine signalling, increase the expression of brain-derived neurotrophic factor (BDNF) and nerve growth factor (NGF), protect against glutamate toxicity, and increase inhibitory neurotransmission in the brain. Depression is a common mental disorder characterised by low mood, altered sleep patterns, psychomotor retardation, cognitive sluggishness, and dysregulation of appetite and libido. Despite the fact that noopept is primarily investigated for its neuroprotective and cognitive-enhancing properties, its potential for treating depression and mood disorders remains unexplored. This article examines the potential therapeutic effects of noopept on depression and emphasises the need for additional research in this area.

*Keywords:* brain; cognitive psychology; depression; mood disorders; noopept

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### INTRODUCTION

According to Dagda et al. (2023), noopept is a synthetic peptide known to improve human and rodent memory, making it a nootropic agent. Nootropic agents are substances that improve cognitive abilities such as memory, creativity, and focus. The mechanism of action of Noopept is attributed to its antioxidant and anti-inflammatory properties, ability to inhibit the neurotoxicity of excessive calcium and glutamate, and capacity to enhance blood rheology. Ostrovkaya et al. (2007) demonstrated that noopept can aid spatial memory and increase immunoreactivity to A amyloid in a mouse model of Alzheimer's disease following olfactory bulbectomy. In addition, researchers have investigated the therapeutic potential of Noopept for cognitive impairment associated with neurodegenerative diseases such as Parkinson's disease (Anwar & Fathi, 2023; Uddin et al., 2019).

Cognitive enhancers or nootropics have acquired popularity in recent years, particularly in the technology and startup industries, according to Santos and Relajo-Howell (2020). These substances are believed to enhance cognitive abilities such as memory, creativity, and focus, giving consumers a competitive edge in the workplace. However, the use of nootropics is not limited to the workplace. Numerous people use these dietary supplements to enhance their academic performance, enhance their athletic abilities, and promote healthy ageing.

Caffeine, a stimulant found in coffee, tea, and other beverages, is one of the most popular and well-known nootropics. It is favoured for its ability to improve alertness and concentration, and many people rely on

it to increase their productivity. Other commonly used nootropics include omega-3 fatty acids, ginkgo biloba, and creatine, which have demonstrated positive effects on memory, focus, and cognitive flexibility. Although nootropics may appear to be a panacea for enhanced cognitive performance, it is essential to recognise that they are not a replacement for healthy lifestyle choices (Relajo-Howell, 2020). Appropriate rest, regular exercise, and a well-balanced diet are required for optimal cognitive function. Nootropics should be viewed as a supplement to these beneficial habits, not as a replacement.

It is important to note that while nootropics may offer potential benefits for cognitive enhancement, they should not be viewed as a complete solution for optimal brain health. Rather, they should be considered as a complementary tool to support a healthy lifestyle that includes sufficient sleep, regular exercise, and a balanced diet (Pilao et al., 2017). Moreover, the long-term effects of nootropics on brain health and cognitive function have not been fully studied, and therefore, caution should be exercised when using these supplements. While some studies have suggested that nootropics may have positive effects on neuroprotection and healthy ageing, more extensive research is needed to fully understand the potential risks and benefits of these supplements.

Additionally, the long-term implications of nootropics on brain health and cognitive function remain unclear. Although some research has indicated that

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nootropics may provide neuroprotective advantages and promote healthy ageing, further investigation is necessary to comprehensively assess the potential risks and benefits of these supplements. Despite the uncertainties surrounding nootropics, they have continued to pique the interest of individuals looking to enhance their cognitive abilities. This burgeoning interest has resulted in the creation of numerous new supplements and drugs, many of which make grandiose assertions about their efficacy. However, just like any other medication or supplement, caution is necessary when dealing with nootropics, and a healthcare professional's advice should be sought before use. Interactions with other drugs or supplements may occur, and certain nootropics may possess unknown risks or side effects (Relajo-Howell, 2021).

While nootropics may provide cognitive benefits, their long-term effects and potential hazards are still not fully understood. To appreciate the possible advantages and drawbacks of these substances, more research is required, and individuals should exercise caution and seek professional advice before using them. In the end, maintaining optimal cognitive function is best achieved through a healthy lifestyle that includes regular exercise, a well-balanced diet, and sufficient sleep. The use of nootropics as cognitive enhancers has grown in recent years, with many people seeking to boost their mental performance. While these supplements may provide some benefits, the potential long-term effects and risks associated with their use are not fully understood. More research is needed to understand how these substances affect the brain and whether they are safe for long-term use.

Experts caution that individuals should not rely solely on nootropics to improve their cognitive function. Instead, they recommend maintaining a healthy lifestyle that includes regular exercise, a balanced diet, and sufficient sleep. These lifestyle factors have been shown to have significant impacts on cognitive function, and they are also associated with other health benefits, such as improved mood and reduced risk of chronic diseases. Furthermore, it is essential to exercise caution when using nootropics, as the quality and safety of these products can vary widely. Consumers should only purchase from reputable sources and should be aware of the potential side effects and interactions with other medications they may be taking. Some of the most popular nootropics include caffeine, creatine, and omega-3 fatty acids. These substances have been shown to improve cognitive function in some studies, but more research is needed to fully understand their effects.

Noopept's prospective cognitive benefits have caught the attention of researchers and healthcare professionals. Extensive research has been conducted on the compound's mechanism of action, which is believed to involve regulating neurotransmitter systems associated with memory formation and controlling glutamate activity (Kondratenko et al., 2010). The substance's neuroprotective attributes, such as its antioxidant and anti-inflammatory properties, and its capacity to impede the neurotoxic effects of excessive calcium and glutamate, suggest its potential usefulness in various neurological disorders

(Dagda et al., 2023).

Various investigations have been conducted to examine the potential of noopept as a viable therapeutic agent for a wide spectrum of neurodegenerative disorders, which encompasses Alzheimer's and Parkinson's disease. Substantive research has demonstrated that noopept has the ability to enhance spatial memory and augment immunoreactivity to A $\beta$  amyloid in a murine model of Alzheimer's disease. This indicates that noopept has the potential to act as a therapeutic agent for cognitive impairment that is associated with this ailment (Ostrovskaya et al., 2007). Additionally, other investigations have suggested that noopept may also be efficacious in addressing cognitive impairment that is associated with Parkinson's disease (Anwar & Fathi, 2023; Uddin et al., 2019).

In addition to its potential therapeutic utility in treating neurodegenerative disorders, noopept has also been investigated for its ability to enhance cognitive function and improve memory capacity in healthy individuals. Extant research has indicated that noopept can augment learning and memory in both rats and humans and may also have the potential as a remedy for age-related cognitive decline (Ostrovskaya et al., 2014; Malykh & Sadaie, 2010).

Nevertheless, despite the promising results of these studies, it is important to bear in mind that further research is necessary to comprehensively understand the potential benefits and drawbacks of noopept as a therapeutic agent. It is imperative to determine the optimal dosage and duration of treatment, as well as the potential side effects and risks associated with its usage.

#### *Ongoing research*

The potential nootropic and neuroprotective effects of noopept have piqued the interest of researchers and medical professionals. The compound's potential to treat neurodegenerative disorders such as Alzheimer's and Parkinson's disease, as well as to improve cognitive function and memory in healthy individuals, has been investigated. While the growing body of evidence supporting the therapeutic potential of noopept is encouraging, additional research is necessary to completely understand the potential benefits and risks of using noopept as a therapeutic agent, including determining the optimal dosage and duration of treatment.

Despite its well-established effects on memory and neuroprotection, noopept's potential applications in the treatment of depression require further study. Depression is a complex mood disorder that affects millions of people worldwide, and it is typically treated with psychotherapy, pharmacotherapy, and other methods. However, traditional therapies for depression are not always effective for all patients, necessitating the development of new treatments. Existing research indicates that noopept may have potential as a complementary or alternative therapy for the treatment of depression. In one study, the effects of noopept and piracetam on depression were investigated using a cell-based model of habituation. Trofimov et al. (2005) found

that the combination of noopept and piracetam had a synergistic effect in diminishing depression in a cellular model. Other studies have also suggested that noopept may have a role in the treatment of depression; however, more research is required to establish its therapeutic utility in this context.

Depression is a significant global mental health concern, characterised by persistent feelings of melancholy, hopelessness, and fatigue, along with disturbed sleep, appetite, and sex drive. Psychotherapy, pharmacotherapy, behavioural rehabilitation, and electroconvulsive therapy are available to alleviate symptoms and enhance functionality (Alexopoulos, 2005; Blackburn et al., 2017; Ogwuche et al., 2020). In order to treat geriatric melancholy, underlying medical conditions must be treated or harmful medications must be discontinued. The potential of noopept as a novel antidepressant represents an intriguing opportunity for mental health professionals to broaden their patients' treatment options.

Although the effects of noopept on memory and neuroprotection are well-established, its potential application in the treatment of depression requires additional study. Since traditional treatments for depression are not effective for all patients, investigating the potential of noopept as a supplementary or alternative treatment may offer a promising new approach to managing depression and related mood disorders. To evaluate the safety and efficacy of noopept in humans and to ascertain the optimal dosage and treatment duration, additional research is required.

To determine the safety and efficacy of noopept in humans, including the appropriate dosage and duration of treatment, additional research is required. Despite promising results from animal studies, it is essential to determine whether these results can be replicated in humans. In addition, noopept's potential as an adjunct therapy for depression requires further investigation to optimise its integration with established therapeutic approaches.

As with any new treatment modality, noopept's safety and efficacy must be thoroughly evaluated prior to its pervasive use in the treatment of depression. The potential of Noopept as a novel antidepressant presents a promising opportunity to expand the range of available treatments. To ensure that the benefits of noopept outweigh any potential risks or side effects, circumspect research is required.

#### *A novel potential strategy*

Depression is a pervasive mental health disorder that profoundly affects the lives of millions of people around the globe. Antidepressant drugs, such as selective serotonin reuptake inhibitors (SSRIs), and cognitive-behavioral therapy (CBT) have been the mainstays of traditional approaches to depression treatment to date. The serotonin system of the brain is believed to play a crucial role in the development of depression, with the link between low serotonin levels and depression first proposed in the 1960s and gaining widespread attention

beginning in the 1990s in tandem with the advent of SSRIs (Moncrieff et al., 2022).

Nootropics, also known as "smart drugs", are supplements or drugs that are believed to enhance cognitive function, including memory, creativity, and motivation. While they are not approved by the FDA for medical use, many people use them to boost their productivity or cognitive performance. Noopept is a type of nootropic that has been touted as a potential treatment for depression. It is believed to work by increasing the production of brain-derived neurotrophic factor (BDNF), a protein that is involved in the growth and survival of neurons. Studies have shown that people with depression often have lower levels of BDNF in their brains. While noopept has shown promise in some preliminary studies, more research is needed to determine its safety and effectiveness as a treatment for depression. Mental health professionals caution that nootropics should not be used as a replacement for conventional antidepressants without first consulting with a qualified healthcare professional. It is also worth noting that nootropics are not regulated by the FDA, so the quality and safety of these products can vary widely. People who are considering taking nootropics should do their research and only purchase from reputable sources. Additionally, they should be aware of the potential side effects and interactions with other medications they may be taking.

Several studies have examined the efficacy of noopept in conjunction with other therapeutic agents, such as piracetam. One study, for instance, examined the effects of noopept and piracetam on the suppression of acetylcholine-induced currents in a cellular model of habituation. In a cellular model, the combination of noopept and piracetam was found to have a synergistic effect on depression (Pivoravov et al., 2020). Similar results have been found in other studies, suggesting that noopept may have therapeutic potential for depression.

Studies investigating the potential of noopept as a treatment for depression have yielded encouraging results, highlighting its potential as a novel therapeutic option. However, additional research is necessary to assess its safety and efficacy in humans and to determine the optimal treatment duration and dosage.

The potential of noopept as a novel antidepressant is an encouraging development in the field of mental health. It affords mental health professionals the opportunity to expand the treatment options for depressed patients, whether as a primary or supplementary treatment. In addition, noopept may provide an alternative for patients who do not respond to conventional antidepressants.

Although traditional treatments for depression continue to be effective for many patients, the use of nootropics such as noopept as an alternative or supplementary treatment for depression is a promising area for future investigation. Although additional research is required to ascertain its full potential as a treatment for depression (Gagani et al., 2016), the preliminary findings are encouraging and support the need for additional study in this area.

The potential of noopept as a novel antidepressant is an encouraging development in mental health. It provides a new avenue for mental health professionals to provide care, as it has the potential to expand the variety of available treatment options for patients with depression. In addition, noopept may be a viable alternative for patients who do not respond to conventional antidepressants. While additional research is required to fully comprehend its efficacy, the preliminary findings are encouraging and support the need for further study in this area. As research into noopept and other nootropics continues, innovative and effective treatments for depression may become available in the coming years.

#### *Noopept pathways of function and effects*

Previous scientific research has demonstrated that noopept influences multiple brain pathways. This is the first study to demonstrate the antiapoptotic effect of noopept against A $\beta$ -induced toxicity, demonstrating that noopept increases cell viability in differentiated PC12 cells subjected to A25–35. Pre-treatment with Noopept decreased the proportion of apoptotic cells and inhibited both early and late apoptotic events induced by A. These results are consistent with those obtained with this dipeptide in SH-SY5Y cells exposed to  $\alpha$ -synuclein amyloids' toxic effect. The study indicates that noopept has neuroprotective properties as well as the ability to increase mood-regulating neurotransmitters in the brain.

The results of previous scientific studies have suggested that noopept acts on various brain pathways, and the recent study demonstrates its antiapoptotic effect against A $\beta$ -induced toxicity, indicating its neuroprotective potential and mood-regulating ability. In addition, research by Ostrovskaya et al. (2008) revealed that noopept increases the mRNA expression of neurotrophic factors NGF and BDNF in the rat hippocampus, suggesting a role in neuronal restoration. These findings highlight the potential of noopept as a multifaceted tool in the treatment of various neuropsychiatric disorders, but more research is necessary to determine its full potential.

In their study, Ostrovskaya et al. (2008) examined the effects of noopept on the mRNA expression of the neurotrophic factors NGF and BDNF in the rat hippocampus. Acute administration of noopept increased mRNA expression of both neurotrophins in the hippocampus but not in the cerebral cortex, according to the study. (Ostrovskaya et al., 2008) Chronic administration of noopept caused a modest increase in BDNF expression in the cerebral cortex. Notably, protracted treatment with noopept did not result in the development of tolerance but rather enhanced the neurotrophic effect, which is likely to play a role in neuronal regeneration.

In additional research, the mechanism of action of noopept in the brain has been investigated. Using electrophysiological techniques, Razumovskaya et al. (2019) discovered that noopept increases the activity of NMDA receptors, which are essential for learning and memory processes. This indicates that noopept may enhance cognitive function by enhancing neuronal communication in the brain (Vorobyov et al., 2011). According to a

separate study, noopept modulates the activity of several neurotransmitters, including acetylcholine, dopamine, and serotonin, which are crucial for modulating mood and behaviour (Düzova et al., 2021). These results suggest that noopept may have a wide spectrum of effects on brain function and may be useful in the treatment of a variety of neuropsychiatric disorders.

Despite the fact that noopept has demonstrated promising results in preclinical studies, additional research is required to fully comprehend its therapeutic potential. To evaluate the safety and efficacy of noopept in humans and to determine the optimal dosage and treatment duration, clinical trials are required. Nonetheless, the results of this study provide vital insights into the potential of noopept as a treatment for neurodegenerative diseases and emphasise the need for continued research in this field.

Noopept has shown potential as a treatment for neurodegenerative diseases in preclinical studies. However, it is essential to note that preclinical studies are conducted using animals, and the results do not necessarily translate to humans. To evaluate the safety and efficacy of noopept in humans and to determine the optimal dosage and treatment duration, clinical trials are required.

The results of clinical trials will provide vital insights into the potential of noopept as a treatment for neurodegenerative diseases. Furthermore, these trials will help establish whether noopept is safe and effective for human consumption. The optimal dosage and duration of treatment will also be determined through these clinical trials.

While the results of preclinical studies are promising, it is important to remember that they do not guarantee the safety and efficacy of noopept in humans. Therefore, continued research is necessary to fully comprehend the therapeutic potential of noopept as a treatment for neurodegenerative diseases.

Existing research on the neuropharmacological effects of noopept and the underlying biology of depression suggests that noopept has the potential to serve as a novel antidepressant. However, given that the use of nootropics in this capacity is largely unexplored, the possibility of employing noopept as adjunctive therapy for the treatment of depression warrants further study.

Depression is a complex mood disorder characterised by, among other symptoms, persistent feelings of sorrow, hopelessness, and fatigue. Traditional treatments for depression, such as psychotherapy and pharmacotherapy, have been shown to be effective for many patients. However, not all individuals respond to these interventions, highlighting the need for alternative treatments (Blackburn et al., 2017; Ogwuche et al., 2020). The potential of noopept as a novel antidepressant agent represents an intriguing opportunity to broaden patients' treatment options.

The neuropharmacological effects of noopept are well-documented, and there is evidence that noopept has



a number of neuroprotective and neurotrophic effects. It has been demonstrated that noopept has antioxidant and anti-inflammatory properties, inhibits the neurotoxicity of excessive calcium and glutamate, and improves blood rheology (Dagda et al., 2023). In addition, noopept has been shown to modulate the activity of multiple neurotransmitter systems involved in memory formation and the regulation of glutamate, the brain's most important excitatory neurotransmitter (Kondratenko et al., 2010).

Recent research suggests that noopept may have the potential to be used as a primary or supplementary treatment for depression. Trofimov et al. (2005), for instance, investigated the effects of noopept and piracetam on the inhibition of the acetylcholine-induced current in a cell-based model of habituation. In a cellular model, the combination of noopept and piracetam was found to have a synergistic antidepressant effect. Other studies have also suggested that noopept may have a role in the treatment of depression, but more research is required to completely comprehend its therapeutic utility in this context.

Despite the promising potential of noopept as a novel antidepressant, additional research is required to evaluate the safety and efficacy of noopept in humans and to determine the optimal dosage and duration of treatment. In addition, additional research is required to determine noopept's potential as an adjunctive therapy for the treatment of depression. The use of nootropics in the treatment of depression is largely unexplored, and additional research is required to determine the possibility of employing these agents in this manner.

Existing research on the neuropharmacological effects of noopept and the underlying biology of depression suggests that noopept has the potential to serve as a novel antidepressant. To evaluate the safety and efficacy of noopept in humans and to ascertain the optimal dosage and treatment duration, additional research is required. In addition, more research is required to determine whether noopept could be used as adjunctive therapy for the treatment of depression, as the use of nootropics in this capacity remains largely unexplored. Overall, the potential for noopept to be utilised in the treatment of depression represents an intriguing opportunity to broaden patients' treatment options.

## CONCLUSION

The potential of noopept as a therapeutic agent for a variety of neurological and psychiatric disorders is a fascinating and rapidly expanding area of study. As described in this article, previous research has shown that noopept has neuroprotective, antiapoptotic, and antioxidant properties, as well as positive effects on neurotransmitters and brain regions involved in mood regulation and cognitive function.

The potential for noopept to treat depression and other mood disorders is a major focus of noopept research. According to animal studies, noopept may alleviate depressive symptoms by regulating neurotransmitter levels, reducing oxidative stress, and modulating neuroplasticity. In addition, encouraging results from

human clinical trials suggest that noopept may be a safe and effective treatment for depression.

As a potential treatment for depression and other mood disorders, noopept has generated interest in noopept research. Studies on animals indicate that noopept may alleviate depressive symptoms by regulating neurotransmitter levels, decreasing oxidative stress, and modulating neuroplasticity. The results of animal studies have prompted researchers to investigate the therapeutic potential of noopept for other mood disorders. The promising results of animal investigations have also resulted in clinical trials on humans. The encouraging results of these studies suggest that noopept may be a safe and efficacious treatment for depression. To determine the efficacy of noopept as a treatment for other mood disorders, however, more research is required. The potential for noopept to treat depression and other mood disorders is a major focus of noopept research. Animal studies and clinical trials on humans have yielded encouraging results, but additional research is required to fully comprehend the potential of noopept as a treatment for mood disorders.

The potential for noopept to improve cognitive function in healthy individuals and those with cognitive impairments is an additional area of noopept research interest. Studies have shown that noopept can enhance learning and memory by increasing the production of brain-derived neurotrophic factor (BDNF), an essential neuroplasticity-related protein. In addition, noopept has been shown to improve cognitive performance in patients with cognitive impairments such as Alzheimer's disease and traumatic brain injury.

Although the potential benefits of noopept are evident, further research is necessary to ascertain its safety and effectiveness in humans. Future research should focus on determining the optimal dosage and duration of noopept treatment, as well as assessing the possibility of adverse effects. In addition, additional clinical trials are required to confirm the efficacy of noopept as a treatment for neurological and psychiatric disorders.

Growing evidence supporting noopept's potential emphasises the need for additional research in this area. As our understanding of the mechanisms underlying noopept's brain effects advances, we may be able to develop more targeted and effective treatments for a range of neurological and psychiatric disorders. In addition, noopept's potential to enhance cognitive function in healthy individuals may have significant implications for enhancing academic and professional performance.

In conclusion, noopept is a promising new option for treating neurological and mental disorders. Despite the need for additional research, the growing body of evidence supporting its potential emphasises the importance of continuing research in this area. As our understanding of the mechanisms underlying noopept's effects improves, we may be able to devise more targeted and effective treatments for a variety of neurological and psychiatric disorders, thereby improving the lives of those who suffer from these conditions.

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## Development and Evaluation of "Acadi Math Made Easy" Board Game for Triangles and Quadrilaterals in Grade 4 Mathematics

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### ABSTRACT

The low scores of the National Achievement Test and the Trends in Mathematics and Science Study in 2019 proved a setback for the Philippines' mathematics education. Researchers developed a board game to aid fourth graders in improving problem-solving abilities involving the perimeter of quadrilaterals and triangles. The study utilized a developmental research design. Mathematics experts implemented a rating sheet the Department of Education provided to evaluate the game using three categories (Content, Other Findings and Additional Requirements for Manipulative) with passing scores of 30, 16, and 18. The means from scores specified by the four raters were 36.75, 14, and 22. While these results clarified there is insufficient points to meet one criterion, the project remains implementable with indicated adjustments. Furthermore, a gap exists in studying the interactive game's effectiveness in teaching mathematics due to limited onsite sessions. The researchers suggest future studies address this gap. In conclusion, the Acadi board game is a potential instructional material for Grade 4 mathematics, enhancing problem-solving skills.

*Keywords:* educational board game, manipulative instructional materials, quadrilaterals, routine and non-routine problems

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### INTRODUCTION

Mathematics plays a significant role in developing human thoughts and systematic intellectual procedures used in problem-solving. It assists people in being able to foresee, plan, choose, and suitably resolve each problem in everyday life (Musso et al., 2019). In the Philippines, mathematics under the "K to 12 Education Program" intends to instill "critical and problem-solving skills" among Filipino learners. (Department of Education, 2013a). However, mathematics education in the Philippines has long been facing a dilemma. Before the "K to 12 Education Curriculum" was instituted in 2013, the results of the National Achievement Test (NAT), a standardized test administered annually by DepEd, revealed the struggle of many Filipino mathematics learners at both elementary and high school levels (DepEd, 2013a).

The NAT results in mathematics for the school year (SY) 2011-2012 showed that learners in grades 3 and 6 and 4th-year high school scored low with mean percentage scores of 59.87, 66.47, and 46.37. (The National Achievement Test in the Philippines, 2013b). These were lower than the DepEd's required mean percentage score of at least 75. Unfortunately, further data regarding the NAT math performances after SY 2011-2012 were unavailable online. In 2018, the country also participated in the Programme for International Student Assessment (PISA) for the first time, garnering a score of 353 points in Mathematics which is significantly lower than the Organization for Economic Co-operation and Development (OECD) average of 489 points and was categorized to be lower than level 1 proficiency (DepEd, 2019). Additionally,

the Philippines was absent from the countries participating in the Trends in Mathematics and Science Study (TIMSS) in 2015 (Mullis et al., 2016). In the 2019 TIMSS the country is ranked last with a score of 297. The average TIMSS Scale Center Point is 500, indicating that The Philippines is sub-par in Grade 4 Mathematics. These scores, relative to the other participating countries, are "significantly lower." (Ina et al., 2019). Consequently, there is a need to assess and overcome the difficulties of students when it comes to Mathematics and develop certain activities that will enhance the performance of the learners in a manner in which students will have the ability to comprehend the curriculum's covered concepts and practice their skills in problem-solving interactively (Jolejole-Caube et al., 2019). Grade 4 mathematics, under the K to 12 Basic Education Curriculum, states that learners must be able to illustrate core concepts and skills covering numbers and numbers sense, in particular, numbers from 1 to 1,000, as well as four critical operations, ordinal numbers, money bills up to PHP 100, and fractions. In geometry, learners are also expected to learn about shapes, symmetry, and tessellations. Algebra trends, statistics, and probability are also subject to lessons taught in grade 4 to develop the critical and problem-solving skills of the learners. (DepEd, 2013a).

Study shows that engagement in educational games has an apparent positive effect on learning. (Hamari et al., 2016). Educational games are functional in the

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learning technique for students as these games encourage students to participate in decision-making circumstances. Previous studies suggest that this approach also generates motivation and interactivity, particularly in subjects with low motivation for the learners. Learning games can improve students' high-level skills by establishing an appealing learning environment, making learning engaging, and allowing students to gain knowledge by doing. (Zeng et al., 2020). A combination of cognitive, motivational, affective, and sociocultural perspectives is necessary for game design research to fully capture what games offer to learn (Homer & Kinzer, 2016).

As such, this research aims to develop an educational kit entitled "*Solving routine and non-routine problems in real-life situations involving perimeter of squares and rectangles, triangles, parallelograms, and trapezoids*" in Grade 4 mathematics. Furthermore, this research also aims to assess the efficiency of educational games involving interactivity among students in learning mathematics, as well as to improve students' analytical thinking skills with difficulty learning mathematics.

The researchers used the list of least mastered topics provided by the Caloocan city school division office to establish the educational kit. This area was selected because past studies showed that students struggle with math story problems (Khoerunnisa, 2021). Moreover, factors such as learners not being accustomed to working on non-routine problems, being in a hurry to read and understand the questions, and spending less time in solving the problems given are the reasons why students commit reading, comprehension, transformation, process skill, and writing errors in solving problems involving triangular and quadrilateral data among students (Asriyani et al., 2020).

In today's science and technology, mathematics plays a crucial part. A better foundation for the students will help them learn more complex mathematics. Schools that apply the proposed approach will train students better.

For the researchers, the study will help uncover areas in the educational process that other researchers could not explore. The scope of the research is to provide an instructional kit for Grade 4 mathematics students on the topic of "*solving regular and non-routine issues in real-life settings involving the perimeter of squares and rectangles, triangles, parallelograms, and trapezoids.*" The study does not cover topics in Grade 4 Mathematics other than those stated above. The study is also limited in using four evaluators to assess the educational kit.

## METHODOLOGY

### Research Setting

The students at Caloocan City Science High School conducted the study. Due to the quarantine restrictions at the time of the research project, this research was executed remotely in each of the researchers' houses with the supervision of the research advisers (fourth and fifth authors).

### Research Design

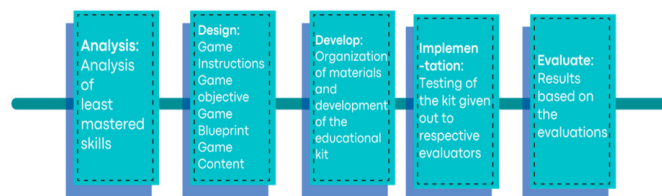


Figure 1. ADDIE Model

The study utilized a developmental research design. Developmental research has been defined as the systematic study of designing, developing, and evaluating instructional programs, processes, and products that must meet the criteria of internal consistency and effectiveness (Richey, 1994).

The ADDIE model was utilized to implement the study design. The analysis phase was used for the least mastered skills of grade 4 students in Mathematics. For the design phase, the game instructions, as well as its contents, were organized. The creation and development of materials of the educational kit were further administered. For the implementation, the kits were handed out to the evaluators to assess the materials, then the results were discussed in the evaluation phase. The statistical analysis that was used on the data gathered was descriptive analysis.

### Gathering and Analysis of Data on Least Mastered Topics of Grade 4 Learners in Math

The researchers requested a copy of the least mastered topics of Grade 4 students in Mathematics from the Schools Division Office of Caloocan City. The least mastered skills were identified through a quick survey given to teachers and taken from the error frequency for the 3rd and 4th quarter periodical test result. The received copy was then compared to the learning competencies from the Most Essential Learning Competencies (MELCs) of DepEd to determine the topic that will be used for the educational board game. Among the topics, "*solving routine and non-routine problems in real-life situations involving perimeter of squares and rectangles, triangles, parallelograms, and trapezoids*" was selected for the development of the board game.

### Design and Development of the Physical Kit

After analyzing the competencies and topics the grade 4 curriculum covered, the researchers developed the board game design and cards to be included in the Acadi Math Made Easy Board Game. Initially, a preliminary sketch was provided, demonstrating the plan for the design and layout of the manipulative, along with the mechanics of how the game can be played (Figure 2).

The problems in the cards were then formulated using sample problems from various worksheets and websites (Table 1) as guides. The layout of the board and cards was then done using Canva and Microsoft PowerPoint. The research advisers then checked the layouts and the content of the game.

After completing the revision and suggestions

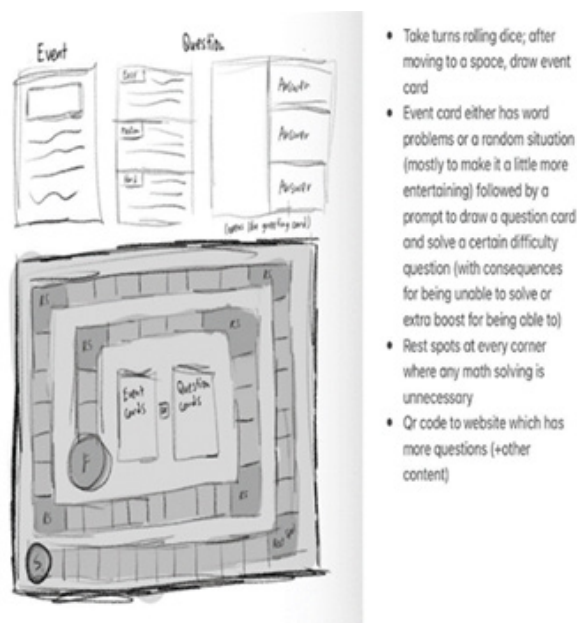


Figure 2. First draft of the board game

Table 1. Sample Problems used as guides in formulating the game cards

List of Sample Questions Written in Cards

1. When walking towards the bedroom, you notice the bed. You wanted to measure the bed before buying your sheets. After measuring, you found out that its length measures \_\_ (roll the dice one time and add 70) inches, and its width measures\_\_ (roll the dice one time and add 30) inches. What is its perimeter?
2. You decided to keep track of the distance that your mom walks when they cook in the kitchen. While cooking dinner, you counted that she walked around the kitchen a total of 5 times. If the kitchen measures\_\_ (roll the dice and add 100) inches in length and \_\_ (roll the dice and add 50) inches in width. What is the distance that she walked?
3. Your parents want to change the flooring of your playroom. The room has a length of \_\_ (roll the dice, add 5, and multiply by 3) feet and a width of \_\_ (roll the dice and multiply by 2) feet. What is the perimeter of the playroom floor?
4. You wanted to buy wood to make a picture frame for your photo. The picture is a \_\_ (roll the dice and add 10)" by \_\_ (roll the dice and 24)" rectangle. What is the total length of the wood strips you will need for your project?
5. A school project requires you to measure the perimeter of an object in your house. You decided to measure your television. After measuring, you found out that it measures \_\_ (roll the dice and add 25) by \_\_ (roll the dice and add 30) inches. What is the perimeter of the television?

Table 2. Worksheets and websites used as the basis for question formulation

List of Worksheets and Websites

Loudoun County Public Schools (n.d.). Unit 13 Homework: Area and Perimeter Word Problems [Homework Sheet]. Retrieved from <https://www.lcps.org>

Math-Aids.Com (n.d.). Dynamically Created Math Worksheets Retrieved from <https://www.math-aids.com/>

Education.com, Inc (n.d.). Perimeter Match [Worksheet]. Retrieved from <https://www.education.com/worksheet/article/perimeter-of-rectangle-2/>

Ask-math (n.d.). Perimeter of parallelogram. Retrieved from <https://www.ask-math.com/perimeter-of-parallelogram.html>

OnlineMathLearning.com (n.d.). Perimeter Word Problems: Examples from <https://www.onlinemath-learning.com/word-problems-perimeters-2.htm>



Figure 3. Final layout of the board game



Figure 4. Final layout of cards included in the game

made by the research advisers, the final layout of the board (Figure 3) shows a size of 15" by 15" printed on a Sintra board. The cards used in playing the board game were also printed. There are five event cards containing various instructions that players may draw and 25 question cards that the players are required to solve and compute to finish the game.

Furthermore, the gameplay of the board game was also finalized in this phase. The mechanics are as follows:

1. The Acadi board game is advised to be played by 2 or more players with 1 facilitator.
2. The board game represents an adventure with 30 steps. The player is required to draw a card for every step.
3. The question cards contain a word problem involving perimeters.
4. Read the instructions as a card is picked. Drawing a question card will require one to roll the dice to determine the values that will be used in solving.
5. Solve for the required values stated in the question

card.

6. For every correct answer, the player will take one step forward in the board until they reach the 30th step. When the answer is incorrect, it will be the other player's turn to pick a card.
7. Should there be a need for more cards, the players must shuffle the cards.

### Gameplay

1. The game starts with three players. Player 1(P1) and Player 2(P2) as the players and Player 3(P3) as the arbiter.
2. The P3 will have to shuffle the cards in the game, will also be the one to check the values for each question, and will also be required to check the answers provided by the players.
3. To determine who will be the first, the players will each roll the dice, and whoever gets the lowest number will start first.
4. Assuming a dice roll and P1 gets the lower number, P1 starts the game.

Table 3. Mean scores in Content and its sub-categories

Sub-category	Evaluator				Mean	SD	Interpretation
	1	2	3	4			
1. Functional Suitability	4	4	3	4	3.75	0.500	Satisfactory
2. Material has the potential to arouse interest of the target users.	4	4	4	4	4.00	0.000	Very Satisfactory
3. Facts are accurate.	3	3	3	4	3.25	0.500	Satisfactory
4. Information provided is up to date.	4	4	3	4	3.75	0.500	Satisfactory
5. Visuals are relevant to the text.	3	4	3	4	3.50	0.577	Satisfactory
6. Visuals are suitable to the age level and interests of the target user.	3	4	4	4	4.00	0.000	Satisfactory
7. Visuals are clear and adequately convey the message of the subject or topic.	3	4	3	4	3.50	0.577	Very Satisfactory
8. Typographic layout/design facilitates understanding of concepts presented.	3	4	3	4	3.50	0.577	Satisfactory
9. Size of the material is appropriate for use in school.	4	4	3	3	3.50	0.577	Satisfactory
10. Material is easy to use and durable	4	4	4	4	4.00	0.000	Very Satisfactory
Sum:	36	39	33	39			Satisfactory

5. The player's starting point is the house. To proceed to the next number, P1 will have to draw a card from P3. If P1 gets an event card, P1 will have to follow the instructions mentioned, but if P1 obtains a question card P1 has to roll the dice, and P3 will have to check the designated values depending on the number of the dice rolled.
6. If P1 could answer the question, P1 moves forward to the next tile. If P1 fails to answer the question, P1 will stay in the same place, and P1's turn is done, and it is time for the next player, P2.

### Evaluation of the Board Game

Four experts from the Math Departments of different schools evaluated the mathematical education board game to know if it would be suitable for grade 4 learners to provide aid to their learning style for mathematics. The educational board game was evaluated based on the Department of Education's Learning Resources Management and Development System standards. To achieve this, the instrument used in this study is the "Evaluation Rating Sheet for Charts, Posters, Drill / Flash Cards and Manipulatives" from the DepEd Guidelines and Processes for LRMS Assessment & Evaluation. The factors given in the evaluation sheet are as follows:

Factor A. Content refers to the concept and the layout of the material. The resource must score at least 30 points out of a maximum of 40 points. Failure to pass indicates that the contents of the material are inappropriate and/or the visuals were not suitable for the age levels of the targeted users.

Factor B refers to other findings in the material, such as conceptual and typographical errors. The resource must have a score of 16 to pass the criterion. Failure to pass indicates that the resource needs additional revision based on the errors that were pointed out by the evaluators. Factor C refers to the overall design of the material. A high score indicates that the material promotes innovative pedagogy.

### Statistical Analysis

Descriptive statistics were used by the researchers for the presentation of the data since the study is developmental research. The mean scores and standard deviations were computed for every sub-category, followed by the overall mean scores and standard deviations of the three categories. This statistical analysis was used to summarize and analyze the data that were collected. Furthermore, the researchers used an inter-rater reliability test to ensure that there was an agreement between the raters. The statistical test was performed with the help of SPSS, a free statistical data analysis tool.

## RESULTS AND DISCUSSION

According to Table 3, *functional suitability* had a mean of 3.75 with a standard deviation of 0.5 which indicates that the material is suitable for its function. The sub-category pertaining to *the material having the potential to arouse the interest of the target users* had a mean of 4 and a Standard Deviation of 0, meaning that the material could arouse users' interests. The sub-category stating that *facts are accurate* had a mean of 3.25 and a standard deviation of 0.5, indicating that the material



Table 4. Mean scores in Other Findings and its sub-categories

Subcategory	Evaluator				Mean	SD	Interpretation
	1	2	3	4			
1. Conceptual errors.	4	3	3	4	3.5	0.577	Present but very minor & must be fixed
2. Factual errors	4	3	3	4	3.5	0.577	Present but very minor & must be fixed
3. Grammatical and/or typographical errors.	4	3	3	4	3.5	0.577	Present but very minor & must be fixed
4. Other errors (i.e., computational errors, obsolete information, errors in the visuals, etc.)	4	4	4	4	4.0		
Sum:	16	13	13	16		0.000	Not Present
Mean of the Sum:	14.5						
Overall Mean:	3.625						
Overall Standard Deviation:	0.43275						

may have slight errors about the factual concepts in the problems. The *information provided, if it is up-to-date*, sub-category has a mean of 3.75 and a standard deviation of 0.5, meaning that the information is somewhat up to date. The relevance of the visuals to the text had a mean of 3.5 and a standard deviation of 0.577, indicating that the visual is relevant to the material's text. The sixth sub-category in Factor A had a mean of 4 and a standard deviation of 0, meaning that the material is user and child friendly. The *clarity and adequateness of conveying the message using the visuals* sub-category had a mean score of 3.5 and a standard deviation of 0.577, indicating that the visual's way of conveying the topics is somewhat clear.

Based on the evaluation results, it can be drawn that the developed board game covers the content that students need to study. This also implies that the developed board game is aligned with the selected most essential learning competency. Students enjoy the playful learning environment that board games offer, and they welcome board games as an entertaining way to learn. This is a significant result, especially for developing countries, as board games are inexpensive, interactive, and can make the students mentally and playfully active (Jordaan, 2018). Furthermore, games provide a fun, engaging, and challenging means of educating students at higher education institutions. (Hayhow et al., 2019).

Table 4 shows that the *conceptual errors* sub-category in Factor B showed a mean of 3.5 and a standard deviation of 0.577, indicating the need for revisions in some concepts in the material. The *factual errors* had a mean of 3.5 and a standard deviation of 0.577, indicating the need to check and revise for errors in the facts presented in the material.

The *grammatical and/or typographical errors* sub-category had a mean of 3.5 and a standard deviation of 0.577 indicating the need for editing in the grammar and the typography of the material. The fourth sub-category discusses the other errors presented in the material, With a mean score of 4 and a standard deviation of 0, the material showed no errors in the computational, obsolete

information, and others. Even though the overall mean score for this category was below the passing score, the evaluators gave a passing remark for the board game in this factor, provided that all necessary revisions in the manipulative will be accomplished. This implies that the developed board game will need only minimal revisions and can be used by teachers in teaching routine and non-routine problems in triangles and quadrilaterals.

Based on Table 5, sub-category 1 of Factor C indicates the presence of adequate support material with a mean score of 3.75 and a standard deviation of 0.5. It indicates that the manipulative has provided good support material. With a mean score of 3.5 and standard deviation of 0.577 in sub-category 2 of Factor C, the activities are summarized, and extension activities are provided. Sub-category 3 of Factor C, with a mean of 3.5 and standard deviation of 0.577, indicates the materials' support of innovative pedagogy. With a mean and standard deviation of 4 and 0, respectively, in sub-category 4, it shows that the manipulative is very safe to use. For sub-category 5, with a mean score of 3.75 and a standard deviation of 0.5, it indicates that the size and composition of the manipulative are suitable for the intended audience. With a mean of 3.5 and a standard deviation of 0.577 in sub-category 6, it indicates that the manipulative is compatible with the motor skills of the intended users.

Table 6 shows that the evaluators had an average score of 36.75 for the game's *content* which indicates a passing mark. Factor B, which refers to *other findings*, had an average score of 14 which indicates that the material requires specific revisions according to the errors pointed out by the evaluators. Factor C, the Additional Requirements for Manipulative, had a mean of 22 which indicates a passing mark. Given the interpretations based on the data gathered and the assessment accomplished by the evaluators, the Acadi Board Game was given the approval for possible use with the provision that necessary corrections and/or revisions will be made.

Table 7 presents the results of the inter-rater reliability analysis among the four raters. The Cronbach's

Table 5. Mean scores in Additional Requirements for Research Manipulative and its sub-categories

Subcategory	Evaluator				Mean	SD	Interpretation
	1	2	3	4			
1. Adequate support material is provided.	4	4	3	4	3.75	0.500	Satisfactory
2. Activities are summarized; extension activities are provided	4	3	3	4	3.5	0.577	Satisfactory
3. Suggested activities support innovative pedagogy.	3	4	3	4	3.5	0.577	Very Satisfactory
4. Manipulative is safe to use.	4	4	4	4	4	0.000	
5. The size and composition of the manipulative are appropriate for the intended audience.	4	4	4	3	3.75	0.500	Satisfactory
6. Suggested manual tasks within the activities are compatible within the motor skills of the intended users.	4	3	4	3	3.5	0.577	Satisfactory
Sum:	23	22	21	22			
Mean of the Sum:	22						
Overall Mean	3.667						
Overall SD:	0.455						

Table 6. Summary of mean scores for each category

	Mean	Standard Deviation	Interpretation
Factor A. Content	36.75	2.872	Passed
Factor B. Other Findings	14.00	2.449	Failed*
Factor C. Additional Requirements for Manipulative	22.00	0.816	Passed

\* In defiance of the Other Findings category to have a mean of 14.00 that is regarded as failed, reviewers of the board game have accorded a *passed* remark through the evaluation sheets, hence the approval for the use of the manipulative for academic purposes.

Table 7. Reliability Statistics

Cronbach's Alpha	N of items
.80	20

Alpha score for the performed statistical test was = 0.80. An alpha value of = 0.80 is considered an excellent alpha value (University of Virginia, 2015), indicating that the questionnaire is very reliable.

Table 8 shows the item-total statistics of the inter-rater reliability. The perceived values scale, with 20 items, was subjected to a reliability examination. Cronbach's alpha revealed that the questionnaire was reliable,  $\alpha = 0.80$ . The majority of the items seemed worth keeping, resulting in a drop in alpha if they were eliminated. The only exceptions were items 19 and 20, which raised the alpha to  $\alpha = 0.84$  and  $\alpha = 0.85$ , respectively. As a result, the removal of these items should be considered.

## CONCLUSION AND RECOMMENDATION

Following the revisions needed for the board game and the data provided, the researchers established that the *Acadi* board game could be an aid in helping students improve their skills in solving routine and non-routine problems in triangles and quadrilaterals in grade 4 mathematics. The game also provides easy instructions, which aid young learners to play the game easily. The educational board game can be fixed without difficulty in case of error.

For future researchers who will conduct a similar study, it is recommended to test out the board game to

Table 8. Item-Total Statistics

Questions	Scale Variance if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Functional Suitability	69.50	15.00	.95	.75
Material has the potential to arouse the interest of the target users.	69.25	18.92	NaN	.80
Facts are accurate.	70.00	16.67	.49	.78
Information is up to date	69.50	15.00	.95	.75
Visuals are relevant to the text	69.75	16.25	.50	.78
Visuals are suitable to the age level and interest if the target users	69.25	18.92	NaN	.80
Visuals are clear and adequately convey the message of the subject or topic	69.75	16.25	0.50	.78
Typographic design facilitates understanding of concepts presented	69.75	16.25	0.50	.78
Size is appropriated to use for school	69.75	17.58	.21	.80
Material is easy to use and durable	69.25	18.92	NaN	.80
Conceptual error	69.75	15.58	.66	.77
Factual errors	69.75	15.58	.66	.77
Grammatical errors	69.75	15.58	.66	.77
Other errors	69.25	18.92	NaN	.80
Adequate support material is provided	69.50	15.00	.95	.75
Activities are summarized; extension activities are provided	69.75	15.58	.66	.77
Suggested activities support innovative pedagogy	69.75	16.25	.50	.78
Manipulative is safe to use	69.25	18.92	NaN	.80
The size and the composition of the manipulative are appropriate for the intended target audience	69.50	21.67	-.64	.84
Suggested manual tasks within the activities are compatible within the activities are compatible within the motor skills of the intended users	69.75	22.25	-.67	.85

the learners to see the effects of this development on their learning. It is also advised to increase the number of evaluators to validate the educational game further. In addition, the researchers also recommend trying a different topic used in the board game.

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