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A JOURNAL DEVOTED TO DISCUSSION
AND INVESTIGATION IN THE HUMANITIES AND SCIENCES

SILLIMAN JOURNAL

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Editorial Notes

"The important thing is not to stop questioning.
Curiosity has its own reason for existing."
- **Albert Einstein**

When one is passionately curious, one finds many interesting things about nature and its people. Welcome to the second issue of Silliman Journal 2020. In this issue are six full-length articles inspired by explorations of human nature, learning, and nature.

The first article explores humans' spirituality and people's ability to bounce back after a tragedy. Rogen Ferdinand E. Alcantara seeks to determine the relationship between natural disaster survivors' spirituality and resilience.

The next article investigates the factors that affect the reading anxiety of students coming from a context where English enjoys a second language status. Kei Jullesse C. Quinal examines the students' level of reading anxiety and comprehension and determines whether their chosen strands influence these in senior high school.

Noting the importance of wellness in the teaching profession, Kenneth B. Pael examines senior high school teachers' personal health and wellness practices in a local school. Data from the study will be used to design a personal improvement plan for the teachers.

Following Pael's article is an assessment of the diversity of trees in the forest ecosystem of Mt. Tapulao in Zambales. Nina Arra DJ. Rivera and

Annie Melinda-Paz identify the trees found in the area to assess various aspects like their conversation status, economic use, endemism, etc. This evaluation is vital in managing the forest ecosystem, an important contributor to the area's natural and economic resources.

The fifth article is a perception study done by Annie Melinda Paz-Alberto, Oliva B. Parico, Roann P. Alberto, Carl Dionelle Ponce, and Daryl A. Juganas. Their article writes about fisherfolks' knowledge and perception of the changes happening in the coastal and fishery resources in four municipalities of Zambales.

The last article is a paper in the field of chemistry. Flora M. Yrad writes about modifying a dextrin methodology, simplifying the process and equipment for gold nanoparticle (AuNP), and reducing its reaction time.

In the notes section, John Edgar C. Rubio, Deo Mar E. Suasin, and I write about an innovation that we introduced in the Language Learning Center that contributes to our Intensive English Program students' learning process university students.

The cover art for this issue is "At the Bookstore" by artist and educator Rebecca M. de la Torre. It is a painting that depicts two loves of the artist: her mom and books.

Warlito S. Caturay Jr., PhD
Editor

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Spirituality and Resiliency among Natural Disaster Adult Survivors

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Silliman University, Dumaguete City

This study aimed to determine the relationship between spirituality and resiliency among natural disaster adult survivors covering selected communities in two provinces using a survey method where a continuing calamity response program was enforced in 2012 and 2013. The results revealed that most of the respondents have experienced high spiritual struggles and may have coped with trauma through negative coping. On the other hand, most of the respondents regarded their resiliency level as neutral, indicating ambivalence about their ability to cope and bounce back. The results also pointed out that there were no significant relationships between spirituality and resiliency among survivors. Spirituality is a highly internal and personal process regardless of one's physical condition and social needs, and it may or may not be directly related to resiliency. Nevertheless, the two disasters propelled the survivors to strive to make sense or continuously search for the meaning of their disaster experiences. With this, there is a need for balanced and holistic intervention and recovery programs for survivors to obtain a sense of optimal well-being, spiritual empowerment, and positive resiliency.

Keywords: Spirituality, resiliency, natural disasters, adult survivors, Negros Oriental, Bohol Province

INTRODUCTION

On December 17, 2011, Tropical Storm "Sendong" (international name Washi) slammed the Visayas and Mindanao areas, bringing powerful winds, heavy rain showers, and massive flooding, leaving many casualties

and thousands homeless. Then, on October 15, 2013, a 7.2 magnitude earthquake hit two Visayas provinces, leaving fatalities and displacement of families, the destruction of roads, school buildings, and other infrastructure.

In response to these tragic events, Silliman University, a private academic institution, organized the Community Care Program, later renamed the Continuing Calamity Response Program (CCRP), to assist the affected families and facilitate returning to normal life (Silliman University, 2014) and involving faculty, staff, students, alumni, government, and non-government organizations, to provide psycho-social care and assistance (Silliman University, 2013).

Indeed, no one who survived a disaster will be unaffected by this occurrence. Similar to other hazards, natural disasters such as severe storms and flooding can ensue emotional distress. Disasters threaten the person's sense of control and safety and can affect many aspects of life (State of New Jersey Department of Human Resource, 2013); living people homeless, with cost reaching billions (McMahon, 2011).

Catastrophes are significant, often sudden, and overwhelming events that will cause massive physical destruction, devastation, and disorganization. They include earthquakes, volcanic eruptions, killer floods and tsunamis, and other events caused by nature and environmental changes. The impact of catastrophic incidents on people and their communities goes much deeper than the physical destruction of roads, bridges, buildings, homes, and churches. It can cause overwhelming suffering among the people in the affected areas (Ladrido-Ignacio, 2011).

Therefore, in facilitating the transformation, it is necessary to focus on the survivors' inherent resilience and capacity to cope and recover. Likewise, assuring spiritual well-being is a critical issue to address in providing assistance and implementing intervention programs for survivors. For example, to determine how survivors' spiritual beliefs influence their ability to cope with loss and distress; to what extent people carry out their religious practices and find meaning in their distressful situation (Ladrido-Ignacio & Verzosa, 2011).

In these contexts, this study intended to determine the relationship between spirituality and resiliency among survivors of the 2011 Typhoon Sendong and the 2013 earthquake as a basis for continuing an evidence-based psycho-social program. This study would also like to know, in particular,

how spirituality is associated with survivors' ability to cope, as classified by gender, adult age group, educational attainment, place (barangay), and province.

Literature Review

Natural disasters such as earthquakes, floods, cyclones, and other hazards, affect approximately 200 million people each year. Ninety-eight percent of these disasters were absorbed by developing countries absorbed and accounted for tragically disaster-related deaths in 1991-2005. Low and middle-income countries suffer more severe and widespread degradation than rich countries. Moreover, older people and women are more affected. They are prone to health risks, isolation from families, lack of mobility, and nutrition losses. Also, natural disasters are disproportionately deadly for women (Poundrik, 2010).

Spirituality

Spirituality is a component of healing. Researchers have found the term challenging to quantify and concluded that spirituality is a complex and enigmatic concept. It is described as multifaceted specific to the spiritually lived experience of an individual (Kelly, 2012). Mattes (2005) also stated that:

> Spirituality is not a given doctrine, a belief system, or a set of rituals. Spirituality is not about correct or incorrect answers, structured approaches to prayer, or even holiness. Instead, spirituality is about questions, searching, discerning, meaning-making, and transcending. It is an essential element of who we are as human beings. Spirituality is the component of our humanness that draws us and pulls us out of ourselves in recognition that there is something that lies beyond us.
>
> Moreover, it is that force that motivates us and propels us forward, whether we consciously realize it or not. It becomes a companion to the very human process of making meaning out of one's lived experiences, thus enabling a person to have a greater awareness of one's gifts life has bestowed, the values one holds, and the insight into one's motivation (p. 3-4)

Furthermore, religion as a manifestation of one's spirituality is essential for how a community or society interacts, whether development or disaster. However, while identity elements such as gender, class, and ethnicity are essential information for humanitarian undertakings, religious belief is given little attention.

It is crucial to help survivors identify their positive coping strategies and realize that they have natural ways of dealing with the catastrophe that has struck them -- making the community's spiritual activities part of the reconstruction and rehabilitation efforts has yielded positive effects. There may also be skeptics, doubts, and possibly even questioning God's goodness in the face of the disaster, which is usually balanced because everyone shares this spirituality to cope. As a whole, the community shares this faith irrespective of religious affiliations. Spirituality gives survivors an intuitive sense of spirit, accepting this as part of life and imbues meaning (Ladrido-Ignacio, 2011).

Resiliency

The science of post-disaster psycho-social response is still emergent, but there is a thriving literary study on resilience interventions (Hechanova, Waelde, Docena, Alampay, Alianan, Flores, Ramos, & Melgar, 2015). Resilience as a conceptual model of healthy personality development has captured much research interest and its application to help overcome stress and adversities faced by people throughout their lives. Moreover, rebounding from difficulties, staying healthy, and leading successful lives, despite adverse circumstances and stressful life events characterize health-protective elements of resilience. Other resilience factors are disposition factors or temperament, personal abilities and strengths, and social support or environmental resources (Hiew & Matchett, 2002).

Furthermore, resilience is also a positive adaptation of a system during or following significant disturbances (Bauman, 2016). Finally, it is the capacity of those at risk to overcome and avoid long-term adverse outcomes (Duffy & Wong, 2003). In hazard research, resilience has been described as the ability to cope with disaster with nominal impact and impairment. It can contain the effects of disasters and recovery (Tejero, Futalan, Acedo, Casiño, & Regencia, 2016).

In another study, survivors have inherently displaying resilience despite

everything, a solid determination to resume a healthy life regardless of what happened (Confini, Carbonelli, Cecilia, & di Orio, 2014). Furthermore, the hazard research found that social support strongly influences the resiliency of the victims of a disaster, particularly from the family and relatives of the victims and the support from the government and the private and non-private organizations. Moreover, the comfort of family members and relatives became their source of strength during times of great crisis (Hechanova et al., 2015).

Faith has proven central to disaster how survivors make sense of and cope with catastrophe (Aten & Davis, 2018). In a post-disaster report, factors related to faith and religion have improved the capacity of survivors to be resilient (Wilkinson, 2015). Similarly, scholars confirm the positive correlations between spirituality and resilience for individuals who suffer from physical illness, death of a loved one, disasters, and other disease outbreaks (Roberto, Sellon, Cherry, Hunter-Jones & Winslow, 2020). Moreover, Ladrido-Ignacio (2011) states that spirituality allows resilience to come forth in times of crises and extreme life experiences. She further emphasized that spirituality is one coping mechanism among Filipinos when they manage the distress that stretches their endurance.

THEORETICAL FRAMEWORK

The study chose Biopsychosocial-Spiritual Orientation. The biopsychosocial systems theory illustrates the inter-playing of individual, family, and social processes.

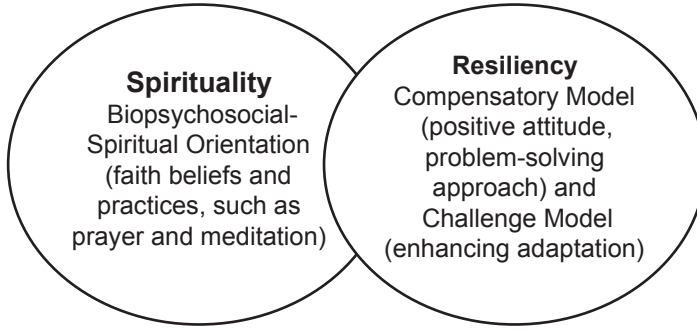

Figure 1. Summative theoretical frameworks of spirituality and resiliency

There is a profound influence of biological influence on medical and psychiatric conditions and psycho-social well-being. Moreover, applying the ecological perspective, the individual or family distress is understood and treated in a sociocultural context. This perspective allows us to look at emergencies of disaster or terrorism in a biopsychosocial context. It also enables us to imagine our interventions holistically, as events affect and are affected by multiple layers of experience. At the same time, it keeps us mindful of the role of individual development. Finally, it helps find solutions and contextualizes relative to family, community, and culture by incorporating the significant role of religion and spirituality in physiological and psycho-social distress and resilience (Walsh,2014).

On the other hand, considered in this study are the compensatory model and challenge model. The compensatory model proposes the compensatory factors that neutralize the negative impact of stress. Compensatory factors are characteristics of individuals and their environments, such as a positive attitude, a problem-solving approach to barriers, or spiritual beliefs. The challenge model views manageable stress as potentially enhancing adaptation because the individual learns from successfully meeting a challenge (Bauman, 2016).

All theoretical viewpoints that determine spirituality (faith beliefs and practices) and resiliency (attitudes, problem-solving approach to barriers) among persons in distress or emergencies are a complex interplay of distinct overlapping factors (Figure 1). Therefore, they are said to be interrelated and interdependent.

CONCEPTUAL FRAMEWORK

The conceptual framework (Figure 2) focuses on the link between spirituality and resiliency. More particularly, the left and right arrows between the columns indicate that survivors' spirituality consists of two forms of religious coping: positive coping and negative coping related to their resiliency or ability to bounce or recover from stressful situations. With this awareness, more cost-effective planning and balanced, sustainable post-disaster development can be initiated.

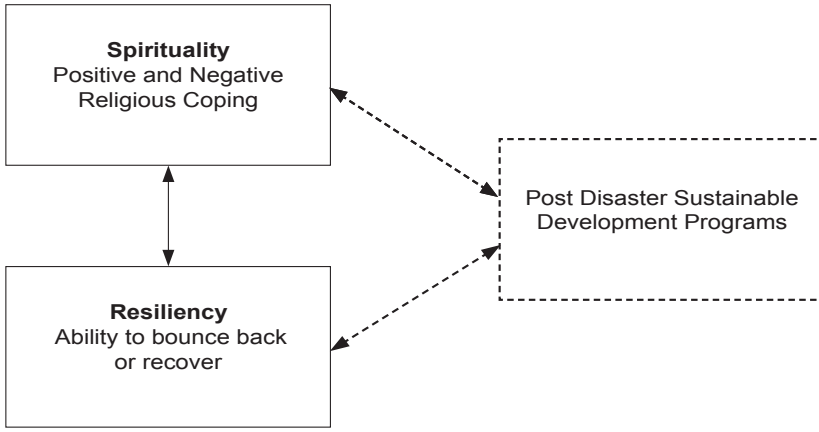

Figure 2. Association of perceived spirituality with the resiliency of adult survivors.

Communities strengthen the survivor's spirituality, and promote human capacities and community empowerment.

METHOD

Survey research was conducted covering selected communities in the provinces of Negros Oriental and Bohol, where the Silliman University Continuing Calamity Response Program (CCRP) was implemented in 2012 and 2013.

Participants

The participants of this study were adults who participated in the CCRP formed part of the target population, categorized by age groups of 20-39, 40-64, and 65 and older. The respondents came from six barangays in Negros Oriental hit by Tropical Storm Sendong: Junob, Dumaguete City; Tubtubon, Magatas, Sibulan; Campaclan, Poblacion, Sibulan; Caidiocan, Valencia; and Malaunay, Valencia, with a total of 213 respondents; and two United Church of Christ in the Philippines (UCCP) congregation in Bohol Province who were affected by the earthquake, namely Causwagan Norte, Catigbian and Badbad, Loon, with 103 respondents. Thus, there were 316 adult respondents.

Instruments

There were two instruments used during the data gathering. One is the Spirituality Religious Coping (Brief RCOPE) Assessment and the Brief Resilience Scale. The Brief RCOPE is an instrument that measures how one copes with significant trauma or adverse events in one's life. The Brief RCOPE, developed by Pargament, Feuille and Burdzy (2011) of the Department of Psychology, Bowling Green State University, Ohio, is a 14-item questionnaire that is a measure of religious coping in times of major stressful events. The other instrument is the Brief Resilience Scale (BRS) by Smith, Dalen, Wiggins, Tooley, Christopher, and Bernard (2008) of the Department of Psychology, University of New Mexico, Albuquerque, New Mexico. The BRS is a 6-item test designed to assess the ability to bounce back or recover from stress. Applied descriptive statistics was used to organize, describe and analyze the data obtained in this study. The Spearman rho coefficient correlation determined the significance of relationships.

Ethical Considerations

The respondents were given the option not to participate in the study. The willing participants had the option not to write their names or to withdraw participation at any time. The respondents were also assured that all information would be held in the strictest confidence. The respondents will signify their consent by affixing their name and signature on the respondent consent form. Only then were the questionnaires administered.

RESULTS

The data gathering was conducted between October and November in 2016, at three barangays in Sibulan (Campaclan, Magatas, and Tubtubon), two barangays in Valencia (Caidiocan and Malaunay), one barangay in Dumaguete (Junob), and two UCCP congregations in Bohol (in Badbad, Loon, and Causwagan Norte). The majority (77%) of participants were female, 69% were married, almost half (44.8%) belonging between ages 40-64 years, and 37.4 % completed high school.

Spirituality

The Brief RCOPE bears two global dimensions with two sub-scales measuring two religious coping methods—the positive coping and the negative coping. Positive coping is a movement toward religious resources in response to stress (Plante, 2009). Negative coping is considered "spiritual struggle," defined as "efforts to conserve or transform spirituality that has been threatened or harmed." The items in Brief RCOPE dealt with how a person copes with significant trauma or adverse events in his/her life and how religion played when dealing with perceived unfavorable event/s. For each assessment, a scoring formula results in the following ranges: low, moderate, or high. The rating of the seven times of negative coping is from 1 to 4. The respondents' Brief RCOPE frequency of scores (Table 1) shows the majority (73%) of respondents experiencing high spiritual struggle. Of the females who constitute 77% of the total respondents, about half reported high spiritual struggle, while only 16.14% of the total male sample experienced the same.

Table 1

Level of Spirituality among Respondents by Gender

Gender	Unspecified	High Spiritual Struggle	Moderate Spiritual Struggle	Low Spiritual Struggle	SD	$\underline{x}$
Female (n=244)	13 (4.11%)	181 (57.28%)	17 (5.38%)	33 (10.44%)	2.91	.92
Male ((n=72)	6 (1.90%)	51 (16.17%)	4 (1.27%)	11 (3.48%)	2.88	1.01
Total	19 (6.01%)	232 (73.42%)	21 (6.65%)	44 (13.92%)		

The respondents' Brief RCOPE frequency of scores classified by age group (Table 2) indicates that in the 20-39 age group (43.8% of the total respondents), 34.29% indicated a high spiritual struggle. In the 40-64 age group, 34.92% noted high spiritual struggle, and in the 65-89 age bracket, only 4.13% registered high spiritual struggle.

Table 2

Level Spirituality among Respondents by Age

Age	Unspecified	High Spiritual Struggle	Moderate Spiritual Struggle	Low Spiritual Struggle	SD	$\underline{x}$
20-39 (n=138)	6 (1.90%)	108 (34.29%)	8 (2.5%)	16 (5.08%)	2.98	.82
40-64 (n=148)	10 (3.17%)	110 (34.92%)	11 (3.49%)	17 (5.40%)	2.84	2.11
65-89 (n=24)	3 (.95%)	13 (4.13%)	2 (1.58%)	5 (1.58%)	2.11	2.64
Total	19 (6.03%)	231 (73.33%)	22 (6.67%)	44 (13.97%)		

Table 3

Level Spirituality among Respondents by Educational Attainment

Educational Attainment	Unspecified	High Spiritual Struggle	Moderate Spiritual Struggle	Low Spiritual Struggle	SD	$\underline{x}$
College (n=9)	2 (.63%)	37 (11.74%)	4 (1.27%)	6 (1.90%)	3.04	.50
High School (n=118)	8 (2.53%)	94 (29.84%)	7 (2.22)	9 (2.86%)	3.09	.59
Elementary (n=109)	0 (0%)	83 (26.35%)	6 (1.9%)	20 (6.35%)	3.14	.61
Vocational (n=17)	0 (0%)	9 (2.85%)	5 (1.59%)	3 (.95%)	3.09	.59
Not indicated (n=22)	0 (0%)	11 (3.49%)	4 (1.27%)	7 (2.225%)	2.92	.60
Total	10 (3.17%)	234 (74.28%)	27 (8.25%)	45 (14.29%)		

Table 4

Level of Spirituality among Respondents by Place

Educational Attainment	Unspecified	High Spiritual Struggle	Moderate Spiritual Struggle	Low Spiritual Struggle	SD	$\underline{x}$
Badbad (n=13)	1 (0.32%)	7 (2.22%)	2 (.63%)	3 (4.11%)	2.77	.93
Caidiocan (n=19)	0 (0.00%)	14 (4.43%)	1 (1.27%)	4 (2.27%)	2.95	.40

Campaclan (n=18)	0 (0.00%)	13 (4.11%)	1 (1.27%)	4 (2.27%)	3.06	.42
Causwagan (n=90)	3 (.95%)	66 (20.89%)	3 (.95%)	18 (5.70%)	2.83	.64
Junob (n=41)	5 (1.58%)	28 (8.86%)	3 (.95%)	5 (1.58%)	2.78	1.26
Magatas (n=27)	0 (0.00%)	25 (7.91%)	2 (.63%)	0 (0.00%)	3.59	.57
Malaunay (n=67)	4 (1.27%)	54 (17.09%)	5 (1.58%)	4 (1.27%)	3.01	.96
Tubtubon (n=41)	6 (1.90%)	25 (7.91%)	4 (1.27%)	6 (1.90%)	2.46	1.31
Total	19 (6%)	232 (73.43%)	21 (6.65%)	44 (13.92%)		
Province						
Bohol (n=103)	4 (1.27%)	73 (23.17)	5 (1.58%)	21 (6.65%)	2.83	.68
Negros Oriental (n=213)	15 (6.49%)	159 (74.70%)	16 (7.51%)	23 (10.80%)	2.93	1.04
Total	19 (6%)	232 (73.41%)	21 (6.67%)	44 (13.92%)		

Brief RCOPE frequency of scores as classified by educational attainment (Table 3), barangay (Table 4), and province (Table 4) are also likewise reported.

The Brief RCOPE results show that most respondents, whether classified by gender, age, educational attainment, or place, coped with significant trauma or adverse events in their lives through negative coping. In particular, the scores show much inclination toward high spiritual struggles where respondents indicated quite a bit or a great deal, specifically in items 8-14 where, for example, they "wondered whether God had abandoned" them or "they felt being punished by God" for their "lack of devotion," or they "questioned the power of God."

Moreover, these results indicate that most respondents experience spiritual discontentment that reflects underlying spiritual tensions and struggles within themselves, others, and the divine. As a result, their efforts to conserve or transform spirituality are threatened or harmed. Finally, these findings suggest that survivors were employing negative religious coping methods to counteract significant life stressors, crises, trauma, and life

transitions.

Resiliency

The Brief Resilience Scale was a 6-item test designed to assess the ability to bounce back or recover from stress. Items 1, 3, and 5 are positively worded and items 2, 4 and 6 are negatively worded. The BRS was scored by reverse coding items 2, 4, and 6 and finding the mean of the six items. To score, one adds the responses varying from 1-5 for all six items giving a range from 6-30, then divides the total sum by the total number of questions answered. The respondents answered on a scale from 1 to 5, from strongly disagree to strongly agree.

Table 5

Level of Resiliency among Respondents by Gender

Gender	n=316	x	SD	Interpretation
Female	244	3.12		Neutral
Male	72	3.10		Neutral
x		3.12	.38	Neutral

Table 6

Level of Resiliency among Respondents by Age

Age	n=316		SD	Interpretation
20-39	138	3.13	0.39	Neutral
40-64	148	3.10	0.41	Neutral
65-89	24	3.07	0.22	Neutral
		3.10		Neutral

Table 7

Level of Resiliency among Respondents by Educational Attainment

Educational Attainment	n=316		SD	Interpretation
College	9	3.29	0.65	Neutral
High School	118	3.12	0.59	Neutral
Elementary	109	3.11	0.68	Neutral
Vocational	17	3.23	0.74	Neutral
Not indicated	22	3.23	0.67	Neutral

		3.19		Neutral

Table 8

Level of Resiliency among Respondents by Place

Communities	n=316		SD	Interpretation
Badbad	13	3.22	0.37	Neutral
Caidiocan	19	3.10	0.32	Neutral
Campaclan	18	3.29	0.48	Neutral
Causwagan	90	3.10	0.29	Neutral
Junob	41	3.23	0.35	Neutral
Magatas	27	2.92	0.42	Neutral
Malaunay	67	3.16	0.38	Neutral
Tubtubon	41	3.03	0.47	Neutral
		3.12		Neutral
Province				
Bohol	103	3.11		Neutral
Negros Oriental	213	3.12		Neutral
		3.12	0.38	Neutral

Tables 5, 6, 7, and 8 show the participants' resiliency as classified by gender, age group, educational attainment, barangay, and province. In particular, both male and female respondents assessed their level of resiliency at neutral. Most respondents, regardless of age group and educational attainment, similarly regarded their level of resiliency as at the neutral level. Furthermore, irrespective of community, most assessed their level of resiliency at neutral. These results indicate a sense of ambivalence about their ability to bounce back or recover and possibly an uncertainty over whether they were coping positively or coping negatively from the experience of stressful events.

Relationship between Spirituality and Resiliency

Using the statistical tool Spearman Rho Correlation Coefficient, the relationships between spirituality and resiliency show negative or inverse, where the Spearman rho of .009 with the p-value of .874. The result suggests that the survivors' spirituality may or may not be related to their resiliency, and the survivors' level of resiliency or their ability to cope or bounce back and

may or may not be related to their perception of their spirituality.

DISCUSSION

Religious coping and adult survivors. This study revealed that most adult survivors, as classified by gender, age groups, educational attainment, and place, were experiencing high spiritual struggles. The results also indicate that most of the survivors used negative religious coping methods to cope with significant life stressors and deal with crisis, trauma, and transition. While the two critical events happened a few years ago, the findings suggest that most of the survivors were still experiencing spiritual discontentment, tensions, and struggles within themselves. The negative religious coping among the survivors may be related to the distress caused by the unimproved quality of life. The data further suggests how they viewed God's powers in light of the recent experiences of disasters. There seem to be feelings of being abandoned or being punished by God.

Religious coping, spiritual growth, and spiritual transformation. Nevertheless, as a contrasting perception, survivors may be expressing or experiencing spiritual growth and transformation. Their sufferings and emotional pains brought about by the two disasters may be deep and intense, causing them to experience high spiritual struggles, but this may be linked to survivors' spiritual growth and well-being. Hence, their struggles allowed them to understand more deeply the goodness of God and His saving grace, giving them the courage and endurance to face their "new realities" (Pergament, Feuille, & Burdzy, 2011).

Resiliency and adult survivors. The study also revealed that most survivors, as classified by gender, age, educational attainment, and place, viewed their level of resiliency as neutral. Conversely, there are probable reasons why the case respondents chose the neutral response option. As respondents recalled related facts and memories while answering the questionnaires, they realized they were not ready to face or deal with the negative feelings associated with the disasters. The results suggest that the respondents intentionally avoid choosing between the positive and negative emotions on the issues at hand because these issues no longer affect them. Another reason people tend to satisfy their response, especially when they are unmotivated. People also pick neutral options because of ambivalence. They may also be reluctant to voice an unpopular public opinion (Edwards & Smith, 2017).

Displaying resiliency despite everything. Nonetheless, the neutral response suggests that most survivors may not have achieved a complete transformation that focuses on the survivors' inherent resilience and capacity to cope and recover (Ladrido-Ignacio & Versoza, 2011). Still, the neutral response does not undermine survivors' ability to be resilient either. Smith, Dalen, Wiggins, and Bernard (2008) provided a clear distinction between "resilience" as "thriving" to move to a superior level of functioning after a stressful event. There is a semblance of survivors displaying resilience despite everything. A firm determination and a positive impulse to resume a healthy life regardless of what had happened (Confini, Carbonelli, Cecilia, & di Orio, 2014). At the very least, in the meantime, survivors were trying to move on and adapt to their present conditions.

Safe space to ventilate and validate emotions about God. Notwithstanding the survivors' spiritual state and their level of resiliency, survivors must be given a "safe space" to ventilate and validate their emotions during a crisis intervention setting, particularly on their uncomfortable feelings about God and their state of spirituality. Furthermore, they must be given a space to hone their resiliency skills, A safe space that will provide support, judgment-free, and respectful environment (Yee, 2019). These will ascertain not only a successful recovery but a meaningful recovery as well. Moreover, if given appropriate resources such as optimism, social support, and enhanced spirituality, this will facilitate them the attainment of optimum level functioning to enable them to sustain well-being and a sense of empowerment and take control over their situation (Ladrido-Ignacio, 2011).

Spirituality-Resiliency link. The result confirms the majority's inclination to negative religious coping. The two disasters may have propelled the survivors to strive to make sense or continuously search for the meaning of their disaster experiences. Spirituality is a highly internal and personal process regardless of an individual's physical, mental, and psychological conditions; it will remain intact. Thus, the negative relationship between spirituality and resiliency suggests that the level of spirituality among survivors may or not be related to their level of resiliency. Survivors may have adopted different coping approaches such as problem-solving skills, being optimistic about life, building personal confidence (Bauman, 2016), and managing strong positive emotions. Still, these may or may not be related to how they perceive their spirituality or spiritual struggles.

CONCLUSION AND RECOMMENDATIONS

Spiritual discontentment, tension, and threat. This study provides information on the levels of spirituality and resiliency among selected community survivors of the 2011 Tropical Storm Sendong in Negros Oriental and the 2013 7.2 magnitude earthquake in Bohol. The gathered data on the level of spirituality reveals that most survivors across gender, age groups, educational attainment, and place indicated negative religious coping among survivors. The results also pointed out discontentment and spiritual tension. Thus, affirming the interest of community psychology as it accounts for collective experiences among adult survivors and deepens understanding of the impact of natural disasters.

Adapting, bouncing back, and striving towards optimal living. The data on resiliency indicated that most of the survivors can adapt and bounce back and recover from their stressful circumstances; however, they were still striving towards an optimum level of functioning. Perhaps giving less attention to spiritual well-being and the capacity to be resilient were not fully achieved. These concerns raised are significant to developmental psychology, particularly on how adult survivors show their ability to bring about their spirituality and carry out their capacity to be resilient in the face of challenging and stressful situations and how they modify their life goals and meanings despite dire conditions and limited opportunities. The data also complements counseling psychology and psychotherapy applications, such as post-disaster interventions to promote safety, adaptation, and stability of survivors and enhance the core pastoral counseling disciplines, particularly in crisis response and disaster spiritual care, effective integration of faith-based psycho-social support.

Community spiritual care program. Based on the results, this study proposes establishing a community spiritual care program, a faith-based post-disaster intervention, and a recovery program that integrates the psycho-spiritual approach maximizing survivors' faith resources in coping and recovery. This approach endorses the collaboration of clergy, faith group leaders, and mental health professionals to assist individuals and communities in mitigating negative psychological consequences. It can be done by facilitating interpretation and positive spiritual responses to disasters. Ultimately, this program will provide the survivors with a safe space

to ventilate and validate their emotions during a crisis intervention setting, including their uncomfortable and unacceptable feelings about God and their state of spirituality.

Community capacity-building programs. It is also vital to implement a community capacity-building program as a follow-up intervention for disaster survivors to develop and strengthen their skills, abilities, processes, and resources that communities need to survive and support themselves over time utilizing interactive workshops and group process approaches. This program also aims to increase endurance and self-worth, sustain psychological well-being, and increase one's capacity to adapt and recover.

A need for a balanced and holistic recovery program to achieve sustainable development. Based on the data and findings of the study, some significant conclusions were drawn. First, the negative religious coping among survivors is related to distress caused by the unimproved quality of life; however, this may indicate spiritual growth and transformation that sustained them despite the wreckage and extreme life experiences. Second, the neutral responses of the majority suggest that survivors may not have achieved a complete transformation. Despite their living conditions, the survivors revealed trying to adapt, establishing a semblance of normalcy in the meantime. Third, good physical health, positive attitude, problem-solving and stress management skills, and related experiences were valuable to neutralize the negative impact of the disasters. With this, a balanced and holistic recovery program and intervention must be achieved for sustainable development to attain optimal well-being, spiritual empowerment, and positive resiliency.

Lessons from natural disasters survivors' spirituality and cultivating resilience amid COVID 19 pandemic. Goodman (2020) disclosed that psychologists' research shows why some people can find peace during the COVID-19 pandemic while others may be struggling with their faith. Religion and other expressions of spirituality have been helping people get through hard times. Goodman further explained that people's expression of faith has implications for their well-being and health. Although Christianity and other faith expressions teach that suffering exists, it also suggests that it has the power to be transformational and empowering. It produces perseverance, character, and, ultimately, hope, especially in this time of pandemic (Cornah, 2006). Cherry (2020) cited that looking back on the experiences of natural disasters and the fortitude of those who have survived natural disasters can

give us hope and help us cultivate resilience. She explains further that living resiliently during this pandemic means working through new challenges and coping with uncertainty.

Similarly, Chan (2020) justifies that the current pandemic is regarded as a biological disaster and can be better managed from a perspective of disaster management. Although the nature of the disaster and the management format differ, however, the concept and approach of management are similar. In like manner, post-disaster recovery and reconstruction should facilitate the patients to recover physically, psychologically, and socially (Chan, 2020). Thus, this re-iterates the study's proposal to establish a recovery program that integrates the psycho-spiritual approach maximizing survivors' faith resources in coping and recovery. Moreover, it emphasizes creating a virtual "safe space," an online space/platform created to provide an environment that encourages all people to share experiences, opinions, and views without fear or threat of political, economic, or personal harm (WorldYWCA, 2020).

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Grade 11 Students' English Language Reading Anxiety and its Relationship to Academic Strands and Reading Comprehension Level: Basis for Enhancement Program

Kei Jullesse C. Quinal

Comprehension, which is universally understood as the goal of reading and the penultimate "global reading skill," has been a prime source of inquiry and interest among scholars and experts. However, certain factors which may be caused by an individual's level in and perception of reading could make comprehension elusive. One of the many unearthed causative factors which could debilitate students' progress in reading comprehension is anxiety. This study examined the reading anxiety (RA), and reading comprehension (RC) levels of 164 Grade 11 STEAM, ABM, and HUMSS students from Silliman University enrolled in Reading and Writing Skills subject during the school year 2019-2020. Using an adaptation of Zoghi's English as Foreign Language Reading Inventory (EFLRAI) instrument and practice reading tests from the TOEFL® iBT Reading Practice Questions (2009), the study investigated whether students' academic strands influence their RA levels and whether or not a relationship exists between their RA and RC level.

Results revealed that all strands have a moderate level of RA and a satisfactory level in RC (STEAM-Intermediate level; ABM & HUMSS- High level). Data analysis also disclosed that there is no significant difference between students' academic strands and their RA level. Finally, RA and RC were found to have a significant positive relationship albeit a weak correlation. This suggests that anxiety does not always have a detrimental effect on students' RC, but it can be used to students' advantage. To address this, the researcher proposes a reading enhancement program to equip students with relevant reading strategies and activities that will normalize their anxiety levels.

Keywords: reading anxiety, reading comprehension, academic strands, reading enhancement program

INTRODUCTION

Reading is a vital skill that is considered by most to be the highway of progress and lifelong learning. Humans make sense and draw inferences from the different stimuli around the environment. Therefore, making sense and drawing inferences are inherent traits in each individual; these are traits or characteristics on which the nature and foundation of reading are built. For whatever purpose, whether it be for pleasure or information, reading ultimately serves as the "practical management of the world about us" (Jennings, 1965, as cited in Hermosa, 2002). It is also defined as "…a complex ability to extract or build meaning from a text" (Grabe, 2014, p.8). Other key terms which are inextricably linked to the definition of reading are experience, thought processes, ideas, background knowledge, and comprehension (Pang, Muaka, Bernhardt, & Kamil, 2003; Shoenbach, Cziko, Greenleaf, & Hurwitz, 2000). Thus, what makes reading sophisticated and complex as compared to other macroskills are its intricate processes. Making things more complex is the inevitable influence of the affective domain, specifically anxiety, on L2 (second language) learners when reading English academic texts.

Reading anxiety and other possible sources have not been thoroughly investigated in an ESL context, specifically in the Philippines. In this case, further exploration should be conducted since reading anxiety is relevant in ESL contexts. Furthermore, the current educational situation in the Philippines, particularly the Senior High program, can serve as another fertile ground for research concerning reading anxiety since it stratifies students according to academic strands and requires them to enroll in reading-related subjects. Thus, the present study investigated the relationship between Grade 11 students' academic strands, reading anxiety, and reading comprehension levels in Silliman University Senior High School, Dumaguete City, particularly in the core subject, *Reading and Writing Skills (RWS)*. The said subject was indispensable in determining students' reading anxiety level in English academic reading since it consists of activities (i.e., "critiquing a chosen sample of a particular pattern of development") and learning competencies (i.e., "distinguishing different patterns of organization") which were deemed potential triggers of reading anxiety.

Results from the analyses were then used as a basis for a reading enhancement program. Novel research ventures must use overall findings

to produce a program or enact specific pedagogical actions to improve the research environment in focus. The proposed enhancement program aimed to foreshorten Grade 11 ABM, HUMSS, and STEAM students' reading anxiety in their RWS classes and improve reading comprehension level by teaching them reading strategies, orienting them about textual genres, and equipping them with other essential skills (i.e., critical reading) needed for academic reading. Additionally, RWS teachers can use the results of this study as a guide in modifying the curriculum guide or recreating the activities in the said subject by targeting areas where anxiety is most induced, such as the texts/reading materials and the activities.

The following research questions were answered:

1. What are the reading anxiety levels of Grade 11 SUSHS from the different academic strands?
2. What is the reading comprehension level of Grade 11 SUSHS students?
3. Is there a significant difference between Grade 11 students' reading anxiety level and their academic strands?
4. Is there a significant relationship between Grade 11 students' reading anxiety level and their reading comprehension level?

HYPOTHESES

The following hypotheses were tested in the duration of the study:

H_{01}: There is no significant difference among Grade 11 students' reading anxiety and academic strands.

H_{02}: There is no significant relationship between Grade 11 students' reading anxiety level and reading comprehension level.

LITERATURE REVIEW RELATED LITERATURE

Effect of Reading Anxiety on Reading Comprehension

Reading problems are by default perceived as a burden or, even worse, a handicap. For this cause, teachers, parents, and researchers endeavor to determine the underlying causes that may have caused students to struggle during reading. Some studies that aimed to discover the nature of reading

anxiety and its correlation to reading comprehension revealed that research outcomes vary from time to time. Even then, research that would render different results compared to previous studies still poses pedagogical implications. Such was the study of Rajab et al. (2012). The researchers reported that reading anxiety does not always implicate low or poor reading performance/comprehension. They recruited 91 senior college students enrolled in either a science or non-science course.

In the Philippines, Cabansag (2013) explored the correspondence between gender, language, and reading anxiety, and reading comprehension. The study employed 65 BA English students who answered the FLCAS (Liu's version) and FLRAS questionnaire (Horwitz, Horwitz, & Cope, 1986). Data were analyzed using mean and standard deviation to get students' anxiety levels, t-test to determine the difference between genders, and Pearson Product Moment Correlation applied to recognize the relationships between variables. Reading anxiety levels, language classroom anxiety levels, and gender were independent of each other. This again conforms to Horwitz, Horwitz, and Cope (1986) and Kuru-Gonen's study (2009). Moreover, reading anxiety had no significant relationship to reading comprehension.

Mohammadpur and Ghafournia (2015) sought to continue past studies conducted by Hayati and Ghasemi (2008) and Jafarigohar and Behrooznia's (2012) investigative study on the interrelation between reading comprehension and reading anxiety levels in the Iranian context. The researchers, however, interchanged the order of data administration. First, students (BA General English) were asked to answer a TOEFL preparation test (Barron, 2010) consisting of 50 multiple-choice items. Students were then divided into high, intermediate, and low proficiency levels. Following the test was the answering of FLRAS. Finally, data from the two main sources were subjected to statistical analyses.

The analyses exhibited a significant negative correlation between students' anxiety and reading comprehension levels. In other words, participants from the low proficiency level are more vulnerable to reading anxiety. This result rendered invaluable pedagogical implications because language and reading teachers should find appropriate means to reduce students' apprehensions in second language reading. Doing so would entail a cardinal difference in students' performance inside and outside the classroom (p. 212).

Other studies, however, show that reading anxiety significantly affects reading comprehension, as in the case of Yi Tien's (2017) research. He examined 98 university-level EFL students' reading anxiety levels and their correlation to background variables such as gender and time allocated to reading English texts. Results indicated that the amount of time spent reading English texts has a significant relationship to the FLRA level. Although gender is independent of students' anxiety levels, t-test analysis still revealed that females tend to have higher anxieties than males. Moreover, the correlation between results from the reading proficiency test and anxiety levels was insignificant.

Presented were studies on reading anxiety in ESL/EFL contexts and factors affecting reading comprehension. Some studies pointed out that age, gender, or college course do not always have a negative effect on reading anxiety. However, inconclusive results between the variables mentioned above and their relationship to reading anxiety and reading comprehension still provide enough room for further investigation. More importantly, most studies previously discussed usually occurred in an EFL (English as a Foreign Language) context.

As previously mentioned, studies on L2 reading anxiety in the Philippines are at a disadvantage. The relationship between the said construct and other variables still needs further observation. That being the case, the present study seamed the following gaps in reading anxiety by applying three approaches or steps. First, the researcher employed a different set of participants, the reason being most studies on L2 reading anxiety usually employed tertiary level and junior high school students. Students from the Senior High School level, particularly Grade 11 students, were, therefore, investigated. Second, academic strands as an independent variable were investigated. Past studies have looked into the possible effect of tertiary students' course choice and whether it significantly influences their reading anxiety level. Choosing the said variable contextualized the study according to the current academic landscape of the Senior High Curriculum in the Philippines. More importantly, applying academic strands as an independent variable could help identify which group (ABM, HUMSS, STEAM) experiences anxiety the most and provide answers why they feel apprehension during Reading and Writing Skills (RWS) classes possibly brought about by the nature and complexity of the reading texts teachers provide and the preceding or succeeding tasks

that accompany a text as well as the overall learning environment. Third, the study utilized a different reading anxiety instrument. In this light, Zoghi's EFLRAI was utilized to test its validity further. Zoghi's EFLRAI instrument also helped specify whether anxiety is: a. reader specific (top-down anxiety) b. text specific (bottom-up anxiety) or c. context specific (classroom anxiety).

THEORETICAL FRAMEWORK

The theories used in this study were instrumental in anchoring the construct of reading anxiety and its relationship to learners' reading comprehension. Moreover, the theoretical underpinnings warranted that an individual's affective state could still surface even in cognitively demanding situations such as reading in the second language.

Theories were connected to the construct of reading acquisition and the act of reading in a second language. First, the Affective Filter Hypothesis provides a platform wherein the construct of anxiety can be hinged on. The L2 Reading Model was then attached to serve as a basis for the proposition that reading also involves the affective aspect. Second, reinforcing the assumption that anxiety can either have a debilitative or facilitative effect on the readers is the Processing Efficiency Theory. Since reading largely involves an individual's schemata or prior knowledge, the Schema Theory is appended to anchor the top-down and even the bottom-up processes of reading. The reading approaches, namely, bottom-up and top-down approaches, are also connected to the Schema Theory, both of which are huge contributors to the reading process.

METHODS

Research Design

The nature of this study reflects that of Nunan's (1995, p. 6) fourth type of mixed forms research design since it was non-experimental research that utilized quantitative data as the basis for statistical analyses (paradigm 6). Moreover, the mixed form as a research design is practical for this descriptive correlative study since the survey instrument used in gathering data contained a set of variables that contributed to three kinds of reading

anxieties (a. reader-bottom-up anxiety; b. text- top-down anxiety; and c. environment- classroom anxiety).

Research Environment

Since the researcher felt the need to contribute to the betterment of the university she was enrolled in for her master's degree course, the area investigated was Silliman University Senior High School (SUSHS).

SUSHS had a total population of 1,724 students, comprised of 852 students in the eleventh grade and 872 in the twelfth grade during the academic year 2019-2020. The school offers four academic tracks: Academic Career Track, Arts and Design Career Track, Sports Career Track, and Technical-Vocational-Livelihood Career Track. Strands offered under the academic track are Science Technology Engineering Agriculture and Mathematics (STEAM), Accountancy, Business and Management (ABM), and Humanities and Social Sciences (HUMSS).

Research Respondents

To make data gathering more facile, the researcher decided to determine the appropriate sample size of the study by class section. Slovin's formula with a 0.05 margin of error was applied to ascertain the number of sections in the study. The calculation yielded 11 sections out of 25. To have valid representation, the 11 sections were proportionately distributed across strands. Hence, eight sections were randomly selected from STEAM, two from ABM and one from HUMSS. The number of students in each section automatically became the final participants of the study. The eight sections from STEAM had 300 students, while the four sections under ABM had 72, and finally, one section from HUMSS had 31, yielding a total of 403 students. However, the unexpected suspension of classes and a week's worth of data gathering had to be canceled. Thus, the researcher was able to gather data from a final total of 164 students out of the supposedly 403 participants: Four sections composed of 120 students from STEAM participated, one section with 23 students from ABM, and one section from HUMSS with 21 students.

Research Instruments and Sources of Data

Zoghi's English Foreign Language Reading Anxiety Inventory

The EFLRAI is a 27-item scale designed by Zoghi (2012) to elicit probable and specific causes of students' anxiety. Each item corresponds with a 4-point Likert-format (1 totally disagree; 2 somewhat disagree; 3 somewhat agree, and 4 totally agree).

Questions are specially constructed to probe variables that directly cause reading anxiety. The survey has five variables: background and cultural knowledge, general reading ability, vocabulary, grammar, and teaching method. Background and cultural knowledge and general reading ability are distributed from items 1-7; vocabulary and grammar from items 8-21; and teaching method from items 22-27. The author of the EFLRAI categorized the variables mentioned above under three general factors: top-down anxiety (reader specific), bottom-up anxiety (text-specific), and classroom anxiety (context-specific). Thus, the possible range of scores for the EFLRAI is "from a low of 27 to a high of 108, with higher scores reflecting greater perceived reading anxiety" (Zoghi, 2012, p. 45).

TOEFL® Reading Practice Questions (2009)

Another source of data was students' reading comprehension scores. The test of comprehension adopted was the TOEFL® Reading Practice Questions (2009). The test is composed of three reading passages adopted from college textbooks. All passages cover various topics that fall under three main categories: historical, exposition, and argumentation. This ensures that the test will serve as an instrument to "…assess how well students can read the kind of writing used in an academic environment" (p. 37).

Each passage is followed with 12-14 questions in multiple-choice forms, insert text questions and prose summary questions. Insert text questions require students to choose which sentence fits best in a particular paragraph, whereas prose summary questions require test takers to select three among five sentences that express significant ideas from the passage. Multiple choice and insert text questions are worth one point, while prose summary questions

are worth two points. Thus, the highest score for the entire test is thirty (30) points.

E-mail Interview

The final source of data was that of students' reflections and insights from an e-mail interview instead of a Focus Group Discussion. Zhao (2009) points out that email interviews can be beneficial to researchers since they could help "obtain feedback in a short time" without having to transcribe answers (p.136).

DATA ANALYSIS

Data collected were analyzed using percentage, weighted and simple mean, Kruskal-Wallis (H) test, and Spearman's Rank Correlation Coefficient. The percentage was used to present the respondents' distribution in terms of their level of FL reading anxiety and reading comprehension scores. Weighted mean was also needed in determining their level of reading anxiety, while simple mean was used to arrive at students' RC levels. Kruskal-Wallis test, on the other hand, was utilized to ascertain the extent of association between the respondents' reading anxiety level and their academic strands. Moreover, Spearman's Rank Correlation Coefficient was used to determine whether a significant relationship exists between their RA and RC levels. The said tool is commonly used in the behavioral sciences to extract correlation between two predetermined variables. It was specifically used in this study since the data are not normally distributed and are in the ordinal level of measurement. In specifying the respondents' RA level, the following mean ranges were used as bases:

In determining the RC level of the respondents, scores were interpreted using the TOEFL® (2009) Performance Descriptors for reading.

Score	Reading Level
22-30	High
15-21	Intermediate
0-14	Low

Finally, responses from the e-mail interview were descriptively interpreted and subjected to Key Word Analysis. Words or phrases that directly relate to a specific type of RA were highlighted. For example, words related to top-down RA were highlighted yellow, blue for bottom-up RA, then green for classroom RA. The KWA was also used to determine which RA type is the most prevalent based on the word or phrase that recurred the most to validate the finding drawn from quantitative analysis regarding the RA type with the highest aggregate mean. To provide evidence on the descriptive interpretation, the researcher integrated the actual responses from the e-mail interview, succeeding the statistical analysis for each research question. Data from the interview gave substance to quantitative data and helped unearth other reading anxiety sources that have not been included in the survey.

LIMITATIONS

The researcher initially intended to gather data from 403 students under 11 sections equally distributed in the STEAM, ABM, and HUMSS strands as determined through sampling. However, due to the abrupt suspension of classes following the COVID-19 outbreak, a week's worth of data gathering had to be canceled. Thus, in totality, the researcher gathered data from 164 students out of 403 from six sections.

The researcher initially planned to administer a Focus Group Discussion (FGD) with 12 students randomly selected from the academic strands to triangulate the results. However, due to the outbreak of the virus, face-to-face interactions had to be canceled as well. Thus, the researcher resorted to an email interview.

RESULTS AND DISCUSSION

Reading Anxiety Levels of Grade 11 SUSHS Students

Students' reading anxiety levels were obtained using an adapted version of Zoghi's (2012) EFLRAI. All answers were subjected to statistical interpretation, particularly simple and weighted mean. The grand aggregate values for each academic strand disclosed that Grade 11 students had

a moderate level of anxiety. As has been construed, such a level does not necessarily pose a threat to students. Although relatively the same in anxiety level, there were specific areas in which strands almost or had reached a high anxiety level, particularly concerning vocabulary and grammar and classroom activities. The results from the Key Word Analysis also reflect neutrality in that some students are attested to not feeling anxious when reading English academic texts. More importantly, all three types of RA were manifested in the responses. It revealed that answers related to top-down RA have the least occurrences (six times). However, words and phrases explicitly indicating bottom-up and classroom RA have about the same number of occurrences (ten times). This result validates the finding that both (bottom-up and classroom) RA types are the most anxiety-inducing based on the answers from the ESLRAI.

Table 1

Reading Anxiety Level of Grade 11 SUSHS Students

Types of Reading Anxiety	Academic Strands					
	STEAM		ABM		HUMSS	
	$W\bar{X}$	VD	$W\bar{X}$	VD	$W\bar{X}$	VD
Top-Down						
Background and Cultural Knowledge	2.17	SwD	2.04	SwD	2.30	SwD
General Reading Ability	2.16	SwD	2.03	SwD	2.03	SwD
AGGREGATE MEAN	2.17	SwD	2.04	SwD	2.17	SwD
INTERPRETATION	Moderate Anxiety		Moderate Anxiety		Moderate Anxiety	
Bottom-Up						
Vocabulary	2.14	SwD	2.04	SwD	2.10	SwD
Grammar	2.29	SwD	2.47	SwD	2.41	SwD
AGGREGATE MEAN	2.22	SwD	2.26	SwD	2.26	SwD
INTERPRETATION	Moderate Anxiety		Moderate Anxiety		Moderate Anxiety	
Classroom	2.42	SwD	2.36	SwD	2.59	SwA
INTERPRETATION	Moderate Anxiety		High Anxiety		Moderate Anxiety	
GRAND MEAN	2.27	SwD	2.22	SwD	2.34	SwD
INTERPRETATION	Moderate Anxiety		Moderate Anxiety		Moderate Anxiety	

Reading Comprehension Level of Grade 11 SUSHS Students

To ascertain participants' reading comprehension levels, the same statistical calculations were applied as in the first research question and percentage and frequency count. The computation revealed that reading comprehension levels across strands were satisfactory. STEAM fell under the intermediate level, whereas ABM and HUMSS were categorized under the high level. Although the difference is small, the range description still shows that both strands belong to the two different reading comprehension levels. This signifies that all groups should be given further instruction in reading English texts to improve reading comprehension level and eventually reach the high reading level should teachers give a comprehension test or assessment. It also signifies that an enhancement program will be instrumental for all three strands.

Table 2
Reading Comprehension Level of Grade 11 SUSHS Students

Level	STEAM		HUMSS		ABM	
	Frequency	%	Frequency	%	Frequency	%
0-14 (Low)	19	15.83	4	19.05	4	17.39
15-21 (Intermediate)	51	42.50	5	23.81	6	26.09
22-30 (High)	50	41.67	12	57.14	13	56.52
Total	120	100.00	21	100.00	23	100.00
Mean Score	21	22	23			
Performance Description	INTERMEDIATE LEVEL		HIGH LEVEL		HIGH LEVEL	

Anderson (1991 cited by Alkialbi 2015, p.14) sees the importance of developing and enhancing L2 reading comprehension for both ESL and EFL students emphasizing the crux that "…with strengthened reading skills, ESL/EFL readers will make greater progress and attain greater development in all academic areas."

The researcher was also able to discover through the e-mail interview that most participants do not have enough declarative knowledge on reading strategies. When asked about what reading strategies they use to

mitigate reading anxiety, most of them answered the most common strategy: rereading, while some answers plainly show that their awareness of reading strategies is limited. Thus, a reading enhancement program can serve as a platform for students to be taught essential reading strategies that may eventually aid them in comprehending a text and even decrease their anxiety when tasked with reading materials that are a bit complex. Teachers should undoubtedly be ready to teach students with strategies most crucial for academic reading.

Table 3

Difference of Anxiety Levels among Academic Strands

Top-Down Reading Anxiety (Reader-specific)	H	P-value	Interpretation
Background and Cultural Knowledge	1.66	0.436	No significant difference
General Reading Ability	0.49	0.783	No significant difference
Bottom-up Reading Anxiety (Text-specific)			
Vocabulary	0.75	0.687	No significant difference
Grammar	3.03	0.220	No significant difference
Classroom Reading Anxiety (Teaching Method)	1.87	0.393	No significant difference
OVERALL	0.69	0.708	No significant difference

For the third research question, the Kruskal-Wallis test was used to determine if academic strands influenced anxiety levels. After comparing the aggregate mean values of each strand, the result reported having no significant difference between reading anxiety and academic strands. In other words, a student's academic strand has nothing to do with his/her reading anxiety level. That academic major did not directly cause reading anxiety was also revealed in Ru-Tsai and Yen-Lee (2018) and Rajab et al.'s, (2012) studies. The former study employed 202 Taiwanese college students who were pursuing either a science-related or non-science-related course.

Having no significant difference in the level of anxiety among the three groups of respondents (STEAM, HUMSS, ABM) signifies that anxiety is not significantly related to academic strand and that reading anxiety prevails regardless of students' majors or concentration.

Table 4

Relationship between Grade 11 Students' Reading Anxiety Level and Reading Comprehension Level

RA Type	Spearman rho	P-value	Interpretation
Top-Down RA			
Background and Cultural knowledge	0.12	0.12	Not significant
General reading ability	0.03	0.72	Not significant
Aggregate weighted mean	0.07	0.07	Not significant
Bottom-Up RA			
Vocabulary	0.07	0.38	Not significant
Grammar	0.21	0.01*	Significant
Aggregate weighted mean	0.15	0.06	Not significant
Classroom RA	0.20	0.01*	Significant
Grand weighted mean	0.16	0.04*	Significant

The fourth research question was answered using Spearman's Rank Correlation Coefficient to determine if reading comprehension and reading anxiety have a relationship.

Results indicate a significant positive relationship, albeit a weak one, between reading anxiety and reading comprehension. This postulates that when reading anxiety increases, reading comprehension is also likely to increase. In like manner, if reading anxiety decreases, reading comprehension is also likely to decrease. However, a weak correlation between the said variables indicates that students' anxiety levels have little to no impact on their reading comprehension level. It also means that their performance in the test cannot be entirely attributed to reading anxiety but that other factors yet to be known may have influenced their performance.

The correlational analysis facilitates anxiety that the aforementioned authors considered to be present in a learning situation. Macintyre and Gardner (1989, p. 252) mentioned that facilitative anxiety could be an "asset to students' performance." This concept is directly linked to Krashen's (1982)

affective filter hypothesis that is hinged on the beneficial or detrimental effect of anxiety in a learning condition. Krashen specifically suggested that teachers provide activities that will be motivating enough for students to engage in. Teaching methods and tasks that are too hard or too easy could either heighten a learner's anxiety or weaken his/her motivation to absorb new information. For anxiety to be facilitating, learners in all levels should be provided with i+1 tasks—familiar tasks but a little bit beyond the learner's current level.

Since there is a weak correlation between the variables, the result ultimately suggests that a sufficient amount of reading anxiety does not necessarily increase reading comprehension but could be a potential or influential factor. However, it would be safe to deduce that Grade 11 students of Silliman University Senior High School who participated in the study might comprehend texts better if a sufficient amount of pressure is placed alongside the task. Another interpretation that can be inferred is that reading anxiety has little to no effect on students' overall level of reading comprehension. This means that other internal or external factors contributed to students' reading performance—factors that still need to be investigated in future studies.

CONCLUSION

In conclusion, anxiety proved to be a force to be reckoned with inside *Reading and Writing Skills* subject for Grade 11 students and teachers of Silliman University. Both groups should determine to settle in the middle of the spectrum of reading anxiety (neither too high nor low). However, unless teachers continue giving texts that are stimulating, fostering a learner-friendly environment, and teaching reading strategies, anxiety will not remain at a moderate level and will be negatively related to reading comprehension. On a similar vein, students should also resolve to learn reading strategies on their own, take necessary risks during oral reading (Brown, 2001), read texts that are related to their academic strand, and use their anxiety as an ancillary to motivation and their desire to improve and enhance their skill in reading in the second language.

RECOMMENDED READING ENHANCEMENT PROGRAM FOR GRADE 11 STUDENTS OF SILLIMAN UNIVERSITY

One of the objectives of the present study is to devise a reading enhancement program that will be instrumental in decreasing anxiety and improving reading performance among Grade 11 students to establish their being "strategic readers" when reading English academic texts. Since the study's results revealed that students across strands have moderate levels of anxiety and no significant difference among academic strands' anxiety levels, the program was designed to address issues that are generally present in all three groups instead of designing a specific program for each. It consists of seven objectives (e.g., targeting the teaching of reading strategies, each of which has a set of activities or tasks for practical application). Objectives and activities were selected to target factors that prevalently triggered anxiety which emerged from students' survey answers. These factors are: reader-specific (e.g. inability to activate/insufficient prior knowledge), text-specific (e.g. unfamiliar vocabulary, complex grammatical systems) and classroom-specific (e.g. answering post-reading questions). The objectives and activities can be integrated into the lesson plans or existing teaching guides of RWS classes or considered as supplementary aids if the teacher perceives an alarming level of anxiety among students or if he/she sees the need to motivate students to participate actively and apply specific and relevant reading strategies which have been previously taught in the classroom. Applying the reading enhancement program can be done successively or intermittently depending on the teacher's assessment of his/her learners' performance. An example is briefly shown below:

On targeting Top-down RA caused by unfamiliar topics/titles

I. I. Learning/Reading Objective:

Activate one's prior knowledge by forming predictions before reading to establish students' interest.

I. II. Reading Strategies and Activities:

Pre: Previewing the text (title, headings, figures, etc.). Speculating author's purpose for writing. Ask and answer questions with peers about

their guesses as to what the text is about. Sharing one's knowledge/idea about the text (speed chatting).

During: Looking for or validating answers (confirming predictions) to questions given during the pre-reading activity.

Post: Connecting new and old information to establish what has been recently learned from the text. Creating a concept map.

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PROPOSED READING ENHANCEMENT PROGRAM

Program Title

Integration of Reading Strategies and Activities in Existing RWS Teaching Guides/ Lesson Plans.

Program Description

This reading enhancement program is based on the results of the study that explored the existence of reading anxiety and its relationship to Grade 11 students' reading comprehension level. It is focused on decreasing students' reading anxiety to a minimum and tolerable level so as to enhance comprehension when reading and accomplishing activities related to English academic texts. The program is composed of seven objectives and 17 tasks presented according to pre, during, and post reading activities which can be inculcated in RWS lesson plans by way of intervening whenever anxiety is roused due to specific activities/lessons, or as is deemed necessary by the teacher. The tasks selected will be invaluable in the teaching and application of reading strategies.

Goal

The program aims to build "strategic readers" (Grabe, 2014) who are adept with the different reading strategies that will boost their confidence when reading and comprehending complex English academic texts.

Student Learning Outcomes

- Draw on prior knowledge to better comprehend and infer the purpose of a reading passage.
- Recognize rhetorical forms using discourse/cohesive markers.
- Infer an unfamiliar word's definition using its surrounding context.
- Recognize grammatical word classes, tenses, and forms.
- Express one's literal and inferential comprehension with peers.

- Repair miscomprehension or maintain comprehension by referring to minor and major details provided in the text.

Objectives and activities adapted from the following references

Brown, H. D. (2001). *Teaching by principles: An interactive approach to language pedagogy.* Pearson Education.

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Results of the Study	Reading Objectives	Reading Strategies and Activities	Lesson/s applicable for the Reading Strategy/Activities (from SUSHS RWS Teaching Guide)
Top-Down Reading Anxiety (highest aggregate mean values across strands)			
1. Anxiety caused by unfamiliar topics / titles	Activate one's prior knowledge by forming predictions before reading to establish students' interest.	**Pre:** Previewing the text (title, headings, figures etc.). Speculating author's purpose for writing. Ask and answer questions with peers about their guesses as to what the text is about. Sharing one's knowledge/idea about the text (speed chatting). **During:** Looking for or validating answers (confirming predictions) to questions given during the pre-reading activity. **Post:** Connecting new and old information to establish what has been recently learned from the text. Creating a concept map.	• Reading and Thinking Strategies across Text Types (Content Standard: The learner realizes that information in a written text may be selected and organized to achieve a particular purpose.) • UNIT 2A: Critical Reading as Looking for Ways of Thinking (2B.1: Explicit and Implicit Claims in a Text.) • UNIT 2A: Critical Reading as Looking for Ways of Thinking (2A.2: Context of Text Development.) (Content Standard: The learner understands the relationship of a written text and the context in which it was developed.)
2. Anxiety caused by writing styles/rhetorical forms	Recognize rhetorical forms using discourse/ cohesive markers.	**Pre:** Skimming and scanning the text. Highlighting discourse and cohesive markers/key words that signal text structure. Discussing with peers as to what rhetorical form the text is written based on the markers. **During:** Marginal note-taking. Writing down the relevance of the discourse marker to a certain paragraph. **Post:** Generating a graphic organizer showing the organizational structure of the text (e.g. comparison-contrast) or demanding a critical or opinionated stance on the text information (i.e. if text is Persuasive, state/write whether or not you adhere to the message of the author.	

Bottom-Up Reading Anxiety (items with highest aggregate mean values across strands)			
1. Anxiety caused by unfamiliar vocabulary.	Infer an unfamiliar word's definition using its surrounding context.	**Pre:** Scanning the text for unfamiliar words. Writing down guesses for the words' definitions based on affixes (if there are). Alternative: Teacher provides a list of words then students make guesses as to which words will be relevant to the selected text. **During:** Creating a semantic map of the words listed in the pre-activity using context clues (the actual usage of the words in a sentence/paragraph). **Post:** Expanding the semantic map created in the previous activity or providing other contexts in which key vocabulary can be used.	• Reading and Thinking Strategies across Text Types (Content Standard: The learner realizes that information in a written text may be selected and organized to achieve a particular purpose.) • UNIT 2A: Critical Reading as Looking for Ways of Thinking (2B.1: Explicit and Implicit Claims in a Text.) • UNIT 2A: Critical Reading as Looking for Ways of Thinking (2A.2: Context of Text Development.) (Content Standard: The learner understands the relationship of a written text and the context in which it was developed.)
2. Anxiety caused by complex grammatical forms, tenses etc. (significant relationship with RC level)	Recognize grammatical word classes, tenses, and forms and its relevance to the text.	**Pre:** Brainstorming about what tenses/s and grammatical forms the text will have and discussing its purpose and relevance to the passage. **During:** Underlining complex or confusing grammatical forms and connect its usage to the purpose of the text (e.g. passive voice for relaying results in a study). **Post:** Connecting the grammatical form and the information it relayed in the text using any type of graphic organizer.	
Classroom Reading Anxiety (significant relationship with RC level)			
1. Anxiety caused by fear of making (literal, inferential, or pronunciation) mistakes.	Repair miscomprehension or maintain comprehension by referring to minor and major details provided in the text.	**Pre:** Identifying and establishing the purpose for reading. **During:** Connecting text to one's knowledge about the topic in order to establish text-reader relationship. Predicting questions which the teacher will probably raise. **Post:** Sharing with group mates one's understanding of the text and gathering information from others to validate or substantiate inferences.	• Reading and Thinking Strategies across Text Types • UNIT 2A: Critical Reading as Looking for Ways of Thinking (2B.1: Explicit and Implicit Claims in a Text.) • UNIT 2A: Critical Reading as Looking for Ways of Thinking (2A.2: Context of Text Development.) • UNIT 2B: Critical Reading as Reasoning (2B.2: Determining Textual Evidence.)
	Recognize grammatical word classes, tenses, and forms and its relevance to the text.	**During:** Annotating/marking significant areas in the text to easily recall/find answers so as to re-establish comprehension. **Post:** Summarizing the text in one's own words using a matrix and comparing it with a partner for sharing/exchanging of ideas.	

Personal Health and Wellness Practices of Negros Oriental High School Teachers

Kenneth B. Pael

The study aimed to determine the personal health and wellness practices of Negros Oriental High School teachers. The results of the study served as a basis for personal health improvement plans among the faculty. An adapted questionnaire was administered to 20 senior high school teachers. The findings of the study showed that as a group, the respondents have "good" physical functioning (mean = 78.75). Furthermore, the respondents also displayed "agreeable" responses to common health practices and behaviors (weighted mean = 2.84). The majority of the respondents also demonstrated adherence to good health practices.

Keywords: health, well-being, practices, behavior

INTRODUCTION

Being a school teacher is one of the most rewarding professions. Teaching has meaning, shapes perspectives, and is simply indispensable. Nonetheless, the complexity and intricacies of the teaching profession can also be challenging. These factors lead to teacher stress and may result in abandonment of the profession early in the service (Mafukata & Mudau, 2016). In congruence to this, researchers, administrators, and law-making bodies have become more invested in looking into the well-being of teachers (Collie et al., 2015). A body of research found a significant link

between teacher well-being and how this is connected to effective teaching and increased student motivation inside the classroom (Mccallum & Price, 2010). Teacher well-being is also connected to apparent well-being of their students. One potential area for building knowledge on teacher well-being is to assess their current health perceptions and health-related practices. This will highlight the common-day physical activities that teachers perform that may be affected by their overall well-being.

The construct of well-being has several definitions within the literature (Diener, Scollon & Lucas, 2009). In consonance with the recent developments, the researcher uses Tov's (2018) definition of well-being as "encompassing all how people experience and evaluate their lives positively." The importance of the holistic well-being of an individual is well-documented (United Nations Development Programme, 1990). In a more recent overview, there is a movement of advancing research on well-being and its relation to the workplace domain. Work-related well-being refers to how day-to-day activities and health practices among individuals impact their performance in the workplace. Concerning the present study, the researcher refers to it as teacher well-being. Domain-specific well-being can also be connected to other constructs such as work-related stress, health deterioration, and burnout (Harshana, 2018).

The present world health crisis has brought unprecedented challenges and has dramatically impacted the educational sector. In the Philippine context, the COVID-19 pandemic has resulted in the confinement of the community, the closure of business establishments, and the shift from face-to-face classes to distance learning (Tria, 2020). Facing this current situation, teachers are obligated to make adjustments in the workplace not only on the pedagogical approaches but also on their own physical and social restrictions, which could present a high stress level (Espino-Diaz et al., 2020). The year 2020 has seen a dramatic rise in the teachers' workload, from creating modules and supplementary materials, checking activity notebooks and performance tasks, and accomplishing ancillary duties. It can be noted that even before the arrival of COVID-19, teachers have already been susceptible to burnout (Dabrowski, 2020). The disruption of face-to-face classes has further heightened the stresses teachers face. As the Philippines continues to find its way around distance education, recognizing and sustaining the well-being of teachers should be a key priority. Therefore, more practical

information and guidance about personal health and wellness should be afforded to teachers during these challenging times. There is a need to build research centering on teacher well-being and self-care (Greenberg, Brown & Abenavoli, 2016; Pate, 2020). School administrators and leaders should pay attention to the teachers' physical and psychological health and wellness. With stronger support, teachers will be able to take an active role in protecting, preserving, and improving their health and well-being.

Gorsy, Panwar, and Kumar (2015) looked into the level of personal mental health among Indian schoolteachers. Employing the mental health index, the researchers found that gender differences exist among school teachers, with male teachers having more robust mental health than their female counterparts. Moreover, teachers stationed in urban areas have higher mental health than those in rural areas. In their review of literature, Australian researchers Acton and Glasgow (2015) found that teacher well-being is an integral part of professional development. Managing emotional labor and professional social networks is essential for teachers to retain and sustain themselves in the profession. Glazzard and Rose (2019) interviewed teachers from 10 primary schools in England. The research reported several factors that trigger work-related stresses. These are common during hectic times of the year, such as assessment periods, demands from extracurricular activities, and adjustments in the workplace environment.

Teacher well-being is often multifaceted and is affected by many factors. Within the school environment, teachers are primarily faced with these three factors: work stress (e.g., increased workload and other ancillary duties), organizational environment (e.g., interaction with colleagues and present school issues), and student-related challenges (e.g., student behavior and learning acquisition). Nonetheless, teacher well-being can be significantly influenced by their actions. Therefore, aside from the challenges posed by the teacher's immediate environment, the teacher's personal actions should not be overlooked as well. This would suggest that self-assessment on their health practices is needed to gauge their understanding of how these activities affect their well-being.

The study aimed to determine the personal health and wellness practices of Negros Oriental High School (NOHS) teachers. The results of the study served as a reference for implementing a positive health and wellness plan

among the teachers. Specifically, the study targeted to answer the following questions:

1. What is the mean self-rating of NOHS teachers regarding their current physical functioning?
2. How will the NOHS teachers respond to common health-related practices and behaviors?
3. What health-related practices do NOHS teachers perform?

Teacher well-being development demands active participation, involving cognitive stimulation, physical activities, social interactions, and a sense of connection to their environment. Taking ownership and responsibility for their actions is a positive attitude that may sustain teacher well-being.

METHODOLOGY

As the range of COVID-19 continues to impact the world, research on the implications of the shift in learning modality in schools on teachers' health and well-being has risen (Ferdig, 2020). The education profession is viewed as one of the most stressful professions globally (Bhuin, 2017). It cannot be denied that the teachers' well-being contributes to productivity and work satisfaction and extends to the student's well-being and academic achievement (Collie, 2015). Thus, the study looked into teachers' personal health and wellness practices under the new normal in education.

The respondents (n = 20) of the study were senior high school teachers from NOHS. The teachers were all employed for the school year 2020–2021. The mean age of the respondents is 41.25 years, with the range of 26 to 58. The average number of service years is eight, ranging from 2 to 30 years. Before administering the questionnaire, permission was asked from the school principal of NOHS–Senior High School Curriculum. A confidentiality agreement and informed consent for publication were also part of the survey instrument administered to the teachers. NOHS is the largest public secondary school in the province of Negros Oriental. Due to the ongoing community quarantine, the senior high school curriculum employs modular distance learning as the primary mode of learning in the current school year.

The study used a mixed method of qualitative and quantitative designs in interpreting and understanding the collected data. The researcher employed an adapted survey questionnaire from the RAND 36-Item Health Survey (Ware & Sherbourne, 1992) and Teacher Induction Module 2 (Department of Education, 2018). The four-part survey was used to determine the following: (1) teacher perception on current health and well-being, (2) activities that may impose physical limitations, (3) teacher perception on health-related practices and behaviors, and (4) health-related practices that teachers perform. The survey was conducted face-to-face, observing physical distancing and other health protocols. The collected data were tabulated and interpreted using item analysis, frequency and percentage, and total weighted mean. In addition, the respondents' written answers on performed health-related practices were interpreted through thematic analysis.

RESULTS AND DISCUSSIONS

The majority of the respondents (52.5%) rated their current health to be in "very good" condition, while five (25%) rated "excellent" and four (22.5%) rated "good" (Table 1). The self-perceived health status of the respondents showed a favorable health condition within the faculty. Concerning their health perception in comparison to one year ago, 10 (50%) expressed that they have the same health condition, while four (20%) believed to have improved health and six (30%) expressed that they have significantly improved health. This showed a positive trend in the overall health of the group. Moreover, 17 (85%) of the respondents viewed health as an essential factor in their well-being or life satisfaction. This denoted that the group had strong beliefs of the relationship between health and quality of life. Overall, based on the self-rating instrument, the respondents were in ideal condition to perform their roles and responsibilities as a teacher.

Table 1

General Health Perception of the Respondents

Statement	Frequency	Percentage
In general, would you say your health is		
Excellent	5	25
Very Good	11	52.5

Good	4	22.5
Fair	0	0
Poor	0	0
Compared to one year ago, how would you rate your health in general now?		
Much better now that one year ago	6	30
Somewhat better now that one year ago	4	20
About the same	10	50
Somewhat worse now than one year ago	0	0
Much worse now than one year ago	0	0
My health is an important factor that contributes to my holistic well-being (life satisfaction).		
I strongly agree	17	85
I agree	3	15
I disagree	0	0
I strongly agree	0	0

Self-perceived health status is an individual's interpretation of their health condition in connection to their daily life experiences. Their health perception could be influenced by their social, cultural, and historical upbringing (Folake, 2015). Thus, determining the factors that affect an individual's health perception is important. Perceptions of current health compared to previous health conditions serves as an outlook to understand human behavior and assess their needs. This provides an avenue to reflect health habits and situations that may have affected their current health (Kaya, 2019). Health and quality of life are two interlinked terms found in the literature (Karimi & Brazier, 2016). This proposed that health is considered a detrimental factor in the overall life satisfaction of an individual. Health monitoring practices among teachers should be normalized in schools. Monitoring approaches for physical activity and physical fitness are needed to be established as part of professional development. In light of the current health situation, teachers should be equipped with a stronger knowledge and understanding of health and wellness practices.

In the 10-item survey for the physical functioning of the respondents, the results showed that eight teachers (46%) were recorded to have an excellent physical condition, five (25%) with poor physical condition, five (25%) with very good, one (2%) with good, and one (2%) with fair (Table 2). It can be noted that among the five who registered with poor physical

functioning, three were in their fifties, and two were in their forties. Among the eight who registered with excellent physical functioning, five are in their late twenties and early thirties. The data showed a negative relationship between age and physical functioning. This suggested that the intensity of the activity declines with age. Overall, the mean physical functioning score of 78.75 suggested that the faculty had registered good physical functioning concerning common daily activities.

Nonetheless, the standard deviation of 20.6 denoted an apparent gap in the physical functioning abilities among the teachers. Physical activities have health benefits for people of all ages. Nonetheless, certain daily tasks are limited due to the body's current health condition. These limitations can be affected by several factors, but the data showed that age is the prevailing factor in the occurrence of these physical limitations (Watson et al., 2014).

Table 2

Level of Physical Functioning for Common Activities among NOHS Teachers

Score	Frequency	Percentage	Mean	SD
0–59	5	25	78.75	20.6
60–69	1	2		
70–79	1	2		
80–89	5	25		
90–100	8	46		

Score	Interpretation	Score	Interpretation
0–59	Poor	80–89	Very Good
60–69	Fair	90–100	Excellent
70–79	Good		

The rate of inactivity significantly increases with increasing age. Moreover, it is critical that to provide high-quality education to learners, schools must have high-quality teachers. The teacher's freedom from physical limitations is one factor relevant to a teacher's performance (Neeraj & Ahluwalia, 2019). Teaching is a mobile profession that requires movement inside and outside the classroom. Therefore, the limited physical functioning of teachers may affect the learning process.

Nonetheless, being an effective teacher is more than just having a healthy body. Low physical functioning levels can be considered a significant risk factor for professional achievement and development. The adverse effects of a sedentary lifestyle due to limited physical mobility and activity may be

translated into performance among teachers in accomplishing work-related functions. Aside from school functions, the personal activities of teachers are also affected by lower physical functioning, which results in other health concerns.

Regarding teacher perception of health-related practices and behaviors, the respondents showed favorable responses to statements with regard to diet and healthy food consumption, proper time management, and health-related behaviors (Table 3). The weighted mean of 3.25 for item 3 showed that the respondents emphasized on the importance of recreation time as a form of relaxation. This implied that teachers view having downtime as an excellent time-spending activity. Item 8 had a mean weight of 3.2, denoting that the teachers valued the urgency of finishing tasks on time. This could be that teachers have multiple functions, and finishing one task on time would allow them to accomplish other tasks. Mean weight of 3.1 for item 2 showed that the teacher also exhibited concern on adequate sleep as a factor that affects work performance. Sleep deprivation could have adverse effects on teachers' physical functioning and disposition (Yusuf et al., 2017). The respondents also displayed a positive response to maintaining a clean working space.

Table 3

Health Practices and Behaviors that May Be Applicable to Teachers' Personal Actions

Statements	Wgtd Mean	Description
1. Diet is a temporary thing. I'll do it next week after heavy work in school.	2.7	D
2. It is okay that I sleep at 12 midnight and will wake up at 3:00 AM to finish my work.	3.1	D
3. Time is gold. I do recreation if I have the time.*	3.25	SA
4. There are lots of paper works. Teaching is stressful.	2.25	A
5. I follow the "more fruits less fatty foods" rule.*	2.65	A
6. I drink coffee a lot; it makes me alive and energetic.	2.65	D
7. Cleaning my workplace is not a priority to me.	2.95	D
8. I believe and practice the saying "Do not do for tomorrow what you can do for today."*	3.2	A
9. I do stretching every two hours while working with my laptop.*	2.75	A

1. 10. I need my boss or someone to inspire me to accomplish my work on time.	2.9	D
Overall	2.84	

*The statements are interpreted oppositely from the weighted mean range as the ideal response should be scale 1.

Scale	Description	Weighted mean range
1	Strongly Agree	1.00–1.75
2	Agree	1.76–2.5
3	Disagree	2.51–3.25
4	Strongly Disagree	3.26–4.00

Nevertheless, the data showed that item 4 had a mean weight of 2.25, implying that the respondents showed low stress management processing as they viewed paperwork as a source of stress. Aside from classroom functions, teachers also need to prepare reports, documentation, and other work-related papers. Meeting deadlines and quality standards for these ancillary duties may trigger work-related stress among the teachers. Stress has been defined in various ways across different fields. Generally, stress is viewed as the interaction between the individual and the situation (Michie 2002). Stress is believed to undermine goal achievement, both for individuals and the organization. The workplace factors are significant sources of both demands and pressure causing stress.

Recreation gives relief from feelings of fatigue and tension. Long hours of work may lead to physical and mental fatigue and strain (Gulam, 2016). Leisure time is constructive activity. Recreation time is viewed as time-using, not time-consuming. Moreover, getting enough sleep is vital for mental and physical health and quality of life (American Thoracic Society, 2016). The quality and amount of sleep help in concentration, learning, reaction, decision-making, and memory recall and retention. Lack of adequate sleep is related to several medical conditions, such as diabetes, high blood pressure, stroke, weight gain, and kidney disease.

Concerning health-related practices, the majority of the respondents gave favorable answers (Table 4). The data showed that 16 of the 20 respondents displayed positive perceptions of the importance of proper diet and the quality of food they take. This would suggest a level of consciousness and awareness among the teachers in quantity and quality of food. The

teachers also exhibited positive knowledge of the importance of having quality food as part of their diet. Some respondents stated that dietary plans are part of their routines.

Meanwhile, time constraint was viewed as a major factor that hindered planning diets and negated healthy food choices. Moreover, 16 respondents showed positive views of choosing organic products in food preparation and consumption. The teachers had stated a deliberate choice of avoiding preservatives and lessening chemical intake from processed foods. Moreover, the teachers displayed a considerable awareness level on the health benefits of organic products. Sixteen respondents noted that an adequate amount of daily water intake is vital in maintaining good health. The benefits of adequate water consumption have been well-documented (Popkin, D'Anci & Rosenberg, 2010; Masot et al., 2020).

On the other hand, 9 of the 20 respondents showed unfavorable views on anger management. The teachers stated that excessive workload could trigger anger-related behaviors. Unideal workplace environments and relationship with other colleagues and superiors were commonly cited as the source of anger. Negative emotions in the workplace have observable effects on teacher performance (Hökkä, Vähäsantanen & Paloniemi, 2020).

Table 4

Health-related Practices Performed (or not) by Teachers and their Reasons

Practice	Yes	No	Reasons for (A) practicing or (B) not practicing
1. Do you make dietary changes slowly?	16	4	(A) diet plan is part of routine, need to boost immune system, current health situation, health conscious, to be physically fit, to promote self-discipline (B) time schedule, not a priority
2. Do you plan healthy meals in advance?	15	5	(A) for improved health, part of family practice, budgetary considerations, to have balanced food intake, weight gain conscious, to lower blood sugar (B) time constraints
3. Do you shop with a ready list based on your weekly meal plan?	12	8	(A) for easier preparations, to have balanced for intake, budgetary considerations, to avoid overspending, quick shopping

			(B) no time for planning, dependent on budget, not in charge of shopping, basing on buying experience
4. Do you buy more organic foods?	16	4	(A) for improved health, avoid preservatives, growing own organic food, to lessen chemical intake, part of family background, to lower blood sugar, healthy living
			(B) organic foods are costly, unavailability from place of residence
5. Do you drink a minimum of eight cups of water every day?	16	4	(A) for improved health, to rehydrate, to cleanse the body, following advice from expert, to discharge toxins
			(B) forgetting due to busy schedule
6. Do you do exercise every day?	15	5	(A) for sustained health, "keeps me moving," for personal health and the dogs
			(B) busy, work and home duties, other priorities
7. Do you often get angry?	9	11	(A) have ways of mood management, positive thinker, avoid stress, waste of time and energy, too many work load
			(B) tired, environmental factors, due to stress, easily irritated
8. Do you go out with friends?	15	5	(A) peace of mind, to relax, time for self, for socialization and fun, to relieve stress
			(B) busy, social distancing due to the pandemic
9. Do you give yourself time to recover from workouts?	13	7	(A) to energize myself, rest
			(B) busy, do not do workouts, not a habit
10. Do you take naps strategically?	16	4	(A) for improved health, to relax the mind and body, to refresh the mind, rest, to gain energy
			(B) "I don't take naps," not a habit, clash with chores

Morbidity and mortality are highly related to poor diets. Physical activity with poor diet results in an energy imbalance that contributes to increased weight or burnout (Centers for Disease Control and Prevention, 2011). A growing body of evidence showed that proper diet planning might reduce chronic diseases (Bergman & Brighenti, 2020). Moreover, in terms of health benefits, consumer exposure to pesticides associated with human disease is significantly reduced with an organic diet. Organic farming also

demonstrated lesser environmental impact than conventional chemical nutrient farming (American Academy of Pediatrics, 2012).

Nonetheless, the availability of organically grown produce is a vital component of consumer buying habits. Workplace-related anger is common because anger is common. However, the intensity of anger differs from one person to the next. The expression of anger of an individual may affect the workplace environment when it leads to confrontations and discord within the organization (Shahsavarani, 2016).

CONCLUSIONS AND RECOMMENDATIONS

The teachers' physical functioning was closely linked with age, a prevalent factor related to the respondent's perception of their health. The respondents demonstrated agreeable views on the common health-related behaviors and practices, considering the importance of recreational time as a way to combat fatigue. Paperworks and other ancillary duties have become a common source of stress among the teachers. Teachers should find proactive ways on how to balance complying with work-related documents in addition to their teaching load. Good health-related practices have been a part of the teachers' daily life.

Nonetheless, anger management is an avenue that needs further consideration. This may lead to positive expressions of anger to maintain constructive behavior in the workplace. A regular and predetermined self-evaluation on the teachers' personal health and wellness practices must be initiated. As part of the new normal, programs on stress and anger management should also be included in the school improvement plan.

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SILLIMAN

Assessment of the Diversity of Trees in Mt. Tapulao, Palauig, Zambales

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This study focused on the assessment of the current status of the diversity of trees present in Mt. Tapulao, Palauig, Zambales. The assessment was limited to the identification of the trees present in the area, their conservation status, endemism, functions, and economic uses. Assessment and evaluation of the anthropogenic threats that may have an effect on ecological integrity were also conducted. Quadrat method method was used in the assessment of trees, with two quadrats designated in each five stations. Results revealed 77 species of trees present in the area with a diversity value of 3.77 based on Shannon's Diversity Index. This value represents a very high diversity. Twenty three were identified at the species level, most of which were native to (57%) and endemic (43%) in the Philippines. The National List of Threatened Philippine Trees (DAO 2017-11) indicated that among the identified trees, six (6) species were under vulnerable conditions while some were endangered or critically endangered. According to the IUCN Red List, four (4) of the identified species were categorized as critically endangered, three (3) were vulnerable, two (2) were under the least concern category, and one (1) was an endangered species. Among the surveyed trees, majority were classified as forest trees (88.31%) while the rest were fruit trees (10.39%). Most (90.90%) of the fruit trees were utilized as a source of lumber for shelter.

The forest ecosystem of Mt. Tapulao is experiencing anthropogenic threats. It was determined that the major threats were road construction, wildlife hunting, soil erosion or silt runoff, and tourism areas or recreational areas. Meanwhile, mining, solid waste, ecotourism, and quarrying indicated moderate impacts. The passage of ordinances and programs that aim to protect, conserve, and manage Mt. Tapulao's resources played a key role in maintaining the biodiversity of the forest ecosystem. These ordinances and programs should be further

implemented and improved in order to fully protect and conserve the ecological integrity of Mt. Tapulao.

Keywords: Mt. Tapulao, biodiversity assessment, environmental degradation, forest ecosystem

INTRODUCTION

The complex geological history of the Philippines has resulted in an extraordinary wealth of biodiversity (Ambal et al., 2012). The country is considered as one of the 17 megadiversity countries, as it possesses 70 to 80 percent of global biodiversity. The Philippine rainforest harbors about 13,000 species of plants which comprise 5% of the world's total number of plant species (Balatibat, 2008). However, continued exploitation and destruction of natural resources have led to the depletion of the country's rich biodiversity. Without appropriate actions, further degradation of resources will continue and may eventually result in species extinction. Among the world's tropical regions, Southeast Asia is of particular conservation concern because it has the highest rate of habitat loss. Specifically, Southeast Asia has the highest relative rate of deforestation of a major tropical region; thus, it could lose three quarters of its original forests and up to 42% of its biodiversity by 2100 (Sodhi et al., 2009).

Zambales mountain range is situated on the west-central area of Luzon. Specifically, the mountain range is located by the South China Sea and extends from the western to the northern part of Luzon, with the Central Plains to the east, and Subic Bay and Mt. Natib complex to the southeast. Based on the composition of endemic flora and rich avian fauna, the mountain range is designated as a Key Biodiversity Area and has been recognized as a high priority conservation area in the Philippines (Ong, 2002). Mt. Tapulao with an altitude of 2037 m is considered as the highest point on the Zambales mountain range (Ong et al., 2012). This study was conducted in order to assess the diversity of trees in the forest ecosystem of Mt. Tapulao. Specifically, the study determined the ecological parameters, conservation status, endemism, and population trend of the trees present in the study area. The functions and economic importance of the assessed trees were also determined. Threats affecting the population of trees and the sources of all levels of impacts of environmental problems and degradation of Mt. Tapulao's forest ecosystem were also identified. It is important to manage

Mt. Tapulao's forest ecosystem as it serves as a huge contributor to natural and economic resources through food supply, livelihood, other revenues, and environmental services that it provides. The results obtained from the study will therefore enrich existing information and knowledge about plants and animals. This information will help in the protection of the plants and wildlife from extinction. Overall, this study shows the characteristics of trees which are endemic, native, or introduced in the area, thereby promoting knowledge of the treasured flora of Mt. Tapulao.

MATERIALS AND METHODS

Study Area

Mt. Tapulao is specifically located between the coordinates of 15˚24'25" and 15˚31'22" latitude and 120˚02'00' and 120˚12'04" longitude. With an approximate total area of more than 17,000 hectares, the mountain is located within the municipalities of Palauig, Iba, and Masinloc in Zambales and in some parts of Mayantoc, Tarlac (Department of Environment and Natural Resources Region 3 [DENR Region 3], 2019). Mt. Tapulao's name originated from the Sumatran pine, Pinus merkusii, locally known as "tapulao" which is present in the area (Balete, Heaney, Veluz, & Rickart, 2008).

The mountain has distinct ecosystems--a long stretch of dipterocarp forest with patches of grassland ecosystem dominated by cogon. The upper part of the mountain consists of a pine forest located at approximately 1, 389 masl and a mossy montane forest at 1, 859 masl. The presence of a plantation of fruit trees was observed on the lower part of the study area. The study of Ong et al., (2012) described Mt. Tapulao as consisting of five different forest types: tropical semi-evergreen rainforest, tropical lowland evergreen rainforest, tropical lower montane rainforest including pine forest, tropical upper rainforest, and tropical sub-alpine forest. These forest types serve as a habitat preference of different types of species which are mostly composed of birds, mammals, and herpetofauna, respectively.

Selection of sampling areas

A total of five (5) stations within the study area were established as the

sampling points. The sampling sites were established from varying elevational gradients of 1910 m, 1360 m, 957 m, 618 m, and 456 m. The stations were located at the western slope of Mount Tapulao facing the South China Sea. In each station, two (2) quadrats with a scale dimension of 10 X 12 meters were established. Potential sampling stations were assigned to ensure that the different types of niches for different types of animals were included (Alberto, 2005).

Figure 1. The study site with the designated sampling stations on Mt. Tapulao, Palauig, Zambales (Source: Google Earth Pro)

Collection, Identification, and Documentation of Tree Species

Trees with a diameter of breast height greater than 10 cm present inside the quadrats were included in the study. Samples were collected, properly labeled, and placed in a plastic bag for identification purposes. Information, such as local name of the trees, number of individuals per species, and the quadrats where species occurred were also noted. The samples were collected to aid in the identification process and were preserved as herbarium specimens. Moreover, necessary permits from DENR were acquired prior to the conduct of the study. Courtesy calls to the barangay and municipality of Palauig were also sought. Each tree was identified up to its species level, when possible, with the help of the available references and with the assistance of a plant taxonomist from the

National Museum of the Philippines. The conservation status of each species was determined according to the International Union for Conservation of Nature (IUCN) Red List Categories and DAO 2017-11 (Updated National List of Philippine Threatened Trees). Species endemism and population trend were also determined based on IUCN and multiple studies.

The trees were also categorized based on their economic uses (e.g., forest trees and fruit trees). Hence, additional data such as the economic uses of the trees were recorded.

Ecological Parameters of Trees

Different ecological parameters such as percentage of occurrence, total number of individual species, frequency, relative frequency, dominance, relative dominance, density, relative density, species importance value and Shannon's diversity index were obtained. The formulas were adapted from Smith and Smith (1998) as cited in Alberto (2005).

Sources and Level of Impacts of Environmental Degradation of Mt. Tapulao

In order to obtain firsthand information on Mt. Tapulao's forest area, the following data-gathering methods were conducted: a) focus group discussions (FGDs) with the locals of Sitio Dampay, Brgy. Salaza, Palauig, which is the nearest community to Mt. Tapulao; and b) key informant interviews (KIIs) with the representatives of local government units and people's organizations. The FGDs and the KIIs using semi-structured interview questionnaires were employed to gather additional information on the community's utilization of the resources provided by Mt. Tapulao, specifically the mountain's influence on the people's socio-economic condition. These methods also aided in identifying problems that affected the vegetation in the area.

To assess the present condition of the forest ecosystem and the sources and levels of impact on environmental degradation, the researchers utilized a checklist adapted from Alberto (2005) along with direct observation. To determine the present condition of the forest ecosystem of Mt. Tapulao, evaluators from DENR, researchers, and LGUs who were knowledgeable about the area rated the four-point (i.e., 1-4) checklist. Four levels of impact under

each source of environmental degradation were used; a value was assigned to each level. The level of impact was measured based on the percentage of impact or damage observed in the study area. In order to determine the mean of respondents' answers, the sum of the answers for each level was divided by the total number of respondents. A scale was used in interpreting the scores on the levels of impact of the environmental degradation on the ecosystem.

RESULTS AND DISCUSSION

Assessment of Trees in Mt. Tapulao, Palauig, Zambales

Abundance

Based on the results of the study, 77 species of trees were assessed. Sixty-five (65) tree species were identified and classified while 12 trees were identified only through their local names. Table 1 shows that only three (3) out of 77 species of plants recorded the highest percentage occurrence of 80%. Results showed that *Eugenia xanthophylla* (Panlumbuyen), *Terminalia microcarpa* (Kalumpit), and Ficus sp. 9 (Talakitik) occurred in four out of five stations. This was due to the different kinds of habitat and physical parameters such as elevation, temperature, and humidity of each station. It is also possible that the aforementioned species were the only plants that had adapted to such kind of environment. It is surprising to note that *Eugenia xanthophylla* was one of the plant species that had the highest percentage of occurrence since this plant is considered as uncommon and thrives well at low elevations (Jansen, Jukema, Oyen, & Van Lingen, 2016). Meanwhile, *Terminalia microcarpa* has a wide distribution in the Philippines, also grows well at low elevations, and is found in different parts of the rainforest (Fern, Fern, & Morris, 2018). Furthermore, the *Ficus* genera is extant in different forest types and elevations in the Philippines (Pelser, 2017a).

Diversity

Based on the results of the study, 77 species of trees were assessed. Sixty-five (65) trees species were identified and classified while 12 trees were identified only through their local names. In the survey conducted, *Sterculia* sp. (Bubu)

had the highest number of individual tree species (24 individuals), while *Ficus* sp. 9 (Talakitik) had the highest relative frequency at 4.67%. *Sterculia* sp. also had the highest relative density and relative dominance at 7.55% and 18.67%, respectively. *Sterculia* sp. also had the highest IVI at 28.89%. This was followed by *Shorea astylosa* (Yakal) (25.88%) and *Pygeum* sp.1 (Paitan pula) (19.35%). This finding indicates that these trees were the most important tree species observed among the 77 species of trees assessed in this study (Table 1). In the Philippines, species under the genus *Sterculia* thrive in different habitats, ranging from coastal thickets to different types of forests such as primary and secondary forests at low and medium elevations, semi-open forests, dry forest, and forested ravines (Pelser, 2018). Moreover, *Shorea astylosa* is considered as a premium species of the tropical rainforest. It is noteworthy that this species, which is abundant in the study area, is highly sought for its timber (Pacific Consultants International, 2006). *Pygeum* spp. in the Philippines also thrive widely in different types of forests (i.e., primary and secondary forests, mossy forests, forests, montane forests, and forest edges) (Pelser, 2018c). Shannon's Diversity Index on the surveyed area showed a value of 3.77, which exhibits a very high diversity according to Fernando's Biodiversity Scale interpretation. This shows that there were numerous trees species present in the study area, and this explains why the tree species present were abundant and evenly distributed. This high diversity of trees was due to conservation programs that were being instigated in the area for the purpose of reforestation and preservation. The inclusion of Mt. Tapulao as a new protected area under New Conservation Areas in the Philippines Project (NewCAPP) plays a main role in the protection on the biodiversity in the area.

Table 1

Ecological Parameters of the Surveyed and Identified Trees Species in Mt. Tapulao

Species name	No. of individuals	Percentage Occurrence	Relative Frequency	Relative Density	Relative Dominance	Importance Value Index
Schizostachyum lumampao	7	20%	1.33	2.201	1.421	4.96
Calophyllum inophyllum	2	20%	0.67	0.629	0.068	1.36
Dillenia philippinensis	1	20%	0.67	0.314	0.000	0.98
Diospyros discolor	1	20%	0.67	0.314	0.000	0.98

Diospyros pilosanthera	1	20%	0.67	0.314	0.000	0.98
Palaquium obovatum	3	20%	1.33	0.943	0.203	2.48
Palaquium philippense	1	20%	0.67	0.314	0.000	0.98
Palaquium sp.	2	40%	1.33	0.629	0.068	2.03
Lecythidiaceae	1	20%	0.67	0.314	0.000	0.98
Ardisia sp.	1	20%	0.67	0.314	0.000	0.98
Rubiaceae 1	1	20%	0.67	0.314	0.000	0.98
Rubiaceae 2	5	40%	2.00	1.572	0.677	4.25
Rubiaceae 3	1	20%	0.67	0.314	0.000	0.98
Cinnamomum mercadoi	4	40%	1.33	1.258	0.406	3.00
Cinnamomum sp.	5	60%	2.67	1.572	0.677	4.92
Goniothalamus amuyon	2	20%	1.33	0.629	0.068	2.03
Haplosticanthus sp.	1	20%	0.67	0.314	0.000	0.98
Phaeanthus sp.	1	20%	0.67	0.314	0.000	0.98
Euphorbiaceae	6	20%	1.33	1.887	1.015	4.24
Euphorbia sp.	10	20%	2.00	3.145	3.045	8.19
Antidesma sp. 1	3	20%	0.67	0.943	0.203	1.81
Antidesma sp. 2	1	200%	0.67	0.314	0.000	0.98
Breynia vitis-idaea	5	40%	2.00	1.572	0.677	4.25
Eleocarpaceae	2	20%	0.67	0.629	0.068	1.36
Sterculia sp.	24	60%	2.67	7.547	18.674	28.89
Moraceae 1	13	60%	4.00	4.088	5.277	13.37
Moraceae 2	1	20%	0.67	0.314	0.000	0.98
Ficus benjamina	1	20%	0.67	0.314	0.000	0.98
Ficus septica	5	40%	1.33	1.572	0.677	3.58
Ficus sp. 1	3	40%	0.67	0.943	0.203	1.81
Ficus sp. 2	1	20%	0.67	0.314	0.000	0.98
Ficus sp. 3	2	20%	0.67	0.629	0.068	1.36
Ficus sp. 5	1	20%	0.67	0.314	0.000	0.98
Ficus sp. 6	1	20%	0.67	0.314	0.000	0.98
Ficus sp. 7	2	20%	1.33	0.629	0.068	2.03
Ficus sp. 8	6	40%	2.00	1.887	1.015	4.90
Ficus sp. 9	16	80%	4.67	5.031	8.119	17.82
Ficus sp. 10	3	20%	1.33	0.943	0.203	2.48
Streblus asper	2	40%	0.67	0.629	0.068	1.36
Anacardiaceae	2	20%	0.67	0.629	0.068	1.36
Anacardium sp.	1	20%	0.67	0.314	0.000	0.98
Combretaceae	4	20%	2.00	1.258	0.406	3.66

Myrtaceae	1	20%	0.67	0.314	0.000	0.98
Terminalia microcarpa	9	80%	4.00	2.83	2.436	9.27
Eugenia xanthophylla	10	20%	2.67	3.145	3.045	8.86
Eugenia sp. 1	2	80%	1.33	0.629	0.068	2.03
Eugenia sp. 2	1	20%	0.67	0.314	0.000	0.98
Syzygium sp. 1	2	80%	1.33	0.629	0.068	2.03
Syzygium sp. 2	1	40%	0.67	0.314	0.000	0.98
Pygeum megaphyllum	1	20%	0.67	0.314	0.000	0.98
Pygeum preslii	2	20%	0.67	0.629	0.068	1.36
Pygeum sp. 1	18	20%	3.33	5.66	10.352	19.35
Pygeum sp. 2	10	20%	2.67	3.145	3.045	8.86
Semecarpus sp. 1	1	20%	0.67	0.314	0.000	0.98
Semecarpus sp. 2	1	60%	0.67	0.314	0.000	0.98
Canarium sp.	1	60%	0.67	0.314	0.000	0.98
Sapindaceae	2	20%	1.33	0.629	0.068	2.03
Ailanthus triphysa	1	20%	0.67	0.314	0.000	0.98
Dipterocarpaceae	3	20%	0.67	0.943	0.203	1.81
Shorea astylosa	22	20%	3.33	6.918	15.629	25.88
Shorea contorta	13	40%	1.33	4.088	5.277	10.70
Shorea palosapis	8	20%	3.33	2.516	1.894	7.74
Shorea polysperma	15	60%	2.00	4.717	7.104	13.82
Cyathea contaminans	14	60%	1.33	4.403	6.157	11.89
Alawi	1	40%	1.33	0.314	0.000	1.65
Bagni	4	40%	1.33	1.258	0.406	3.00
Buligri	1	40%	0.67	0.314	0.000	0.98
Camilia	1	20%	0.67	0.314	0.000	0.98
Gualberto	1	20%	0.67	0.314	0.000	0.98
Lapnit	1	20%	0.67	0.314	0.000	0.98
Lapugan	1	20%	0.67	0.314	0.000	0.98
Magkakalamansi	2	20%	0.67	0.629	0.068	1.36
Magkakato	3	20%	1.33	0.943	0.203	2.48
Malabyong	1	20%	0.67	0.314	0.000	0.98
Parayna	3	20%	1.33	0.943	0.203	2.48
Tarukan	3	20%	2.00	0.943	0.203	3.15
Tuey	2	20%	0.67	0.629	0.068	1.36
Total	**318**		**100.00**	**100**	**100.000**	**300.00**

Assessment of the Conservation Status and Endemism of the Trees Species Present in the Forest Ecosystem of Mt. Tapulao

National List of Threatened Philippine Trees (DAO 2017-11) showed that among the identified trees, six (6) species were under vulnerable condition. Thus, these species were under threat from adverse factors throughout their range and were likely to move to the endangered category (Table 2). *Shorea astylosa* (Yakal) as a Critically Endangered Species was facing an extremely high risk of immediate extinction in the wild, and *Cyathea contaminans* (Mountain Tree Fern) was considered as endangered. The survival of C. *contaminans* in the wild was unlikely if the causal factors continued operating. *Cinnamomum mercadoi* (Cinamomon) was categorized under Other Threatened Species. This species was also under threat from adverse factors throughout its range and was likely to move soon to the vulnerable category. According to the IUCN Red List, four (i.e., *Shorea astylosa, Shorea contorta, Shorea palosapis* and *Shorea polysperma*) species were categorized as critically endangered, and three (i.e., *Dillenia philippinensis, Palaquium philippense,* and *Cinnamomum mercadoi*) were vulnerable. Moreover, two (i.e., *Calophyllum inophyllum* and *Pygeum preslii*) were under the least concern category, and one (i.e., *Diospyros discolor*) was an endangered species.

Among the 23 trees species that were identified up to their species level, majority (57%) were native to and endemic in the Philippines while 43% could be found only in the Philippines (Philippine endemic) (Figure 2). This finding indicates that the integrity of Mt. Tapulao's forest ecosystem was still intact and healthy and that there were no invasive tree species that have successfully established in the area, out-competed the endemic species, and constrained the goods available from the ecosystem (Thomson, 2011).

With the 10 trees species evaluated by the IUCN, only one (i.e., *Calophyllum inophyllum*) showed a stable population trend (Barstow, 2019) while the rest (i.e., *Dillenia philippinensis, Diospyros discolor, Palaquium philippense, Cinnamomum mercadoi, Terminalia microcarpa, Pygeum preslii, Shorea astylosa, Shorea contorta, Shorea palosapis,* and *Shorea polysperma*) had an unspecified population trend. Nevertheless, due to the threats (e.g., wood harvesting, habitat destruction, and illegal trade of high-quality timber) these tree species were facing, an immediate decline in the population of these species was highly possible.

Table 2
Conservation Status and Endemism of the Assessed Trees Present in Mt. Tapulao

Scientific Name	IUCN	DAO 2017-11	Endemism
Schizostachyum lumampao	NE	Not listed	Philippine Endemic
Calophyllum inophyllum	LC	Not listed	Native
Dillenia philippinensis	VU	Not listed	Philippine Endemic
Diospyros discolor	EN	VU	Native
Diospyros pilosanthera	NE	VU	Native
Palaquium obovatum	NE	Not listed	Native
Palaquium philippense	VU	VU	Philippine Endemic
Cinnamomum mercadoi	VU	OTS	Philippine Endemic
Goniothalamus amuyon	NE	Not listed	Philippine Endemic
Breynia vitis-idaea	NE	Not listed	Native
Ficus benjamina	NE	Not listed	Native
Ficus septica	NE	Not listed	Native
Streblus asper	NE	Not listed	Native
Eugenia xanthophylla	NE	Not listed	Philippine Endemic
Pygeum megaphyllum	NE	Not listed	Native
Pygeum preslii	LC	VU	Native
Ailanthus triphysa	NE	Not listed	Native
Shorea astylosa	CR	CR	Philippine Endemic
Shorea contorta	CR	VU	Philippine Endemic
Shorea palosapis	CR	Not listed	Philippine Endemic
Shorea polysperma	CR	VU	Philippine Endemic
Cyathea contaminans	NE	EN	Native

*Note: LC=Least Concern, NT=Near Threatened, CR=Critically Endangered, EN=Endangered, VU=Vulnerable, NE=Not Evaluated, OTS=Other Threatened Species

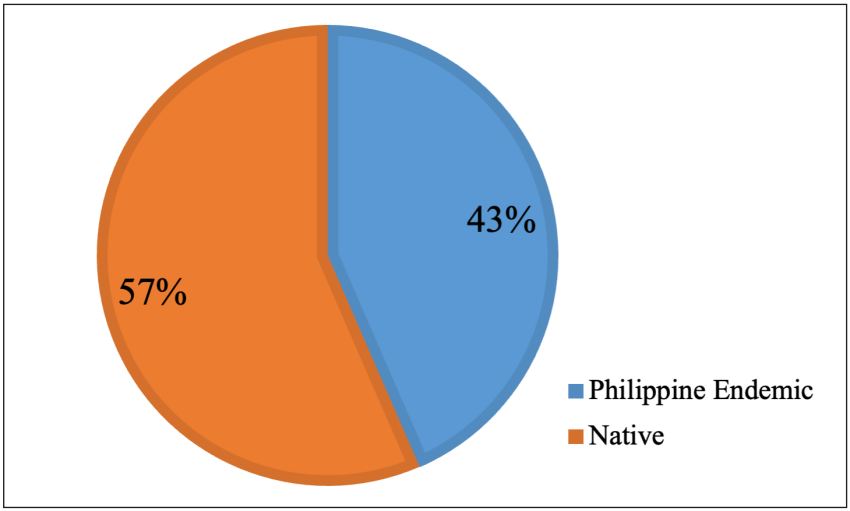

Figure 2. Endemism of the assessed and identified trees in Mt. Tapulao.

Functions and Economic Importance of the Surveyed Trees

Table 3 presents the functions and economic importance of the assessed trees in Mt. Tapulao. Among the surveyed trees, majority (88.31%) were categorized as forest trees while the rest (10.39%) were considered as fruit trees. Through an interview with the local guides, the study further assessed the trees based on their economic use. Twenty-eight (28) species were classified and used by the locals as a good source of lumber. These species were considered as hard wood trees. Meanwhile, 18 trees were used for shelter, specifically as foundation for small houses as these were soft wood trees. Seven (7) of the tree species were utilized as firewood and some of them were known sources of food for wild animals such as birds, monkeys, and wild boars (6 trees species). Moreover, four (4) of tree species were considered safe for human consumption, and two (2) tree species were utilized as a source of medicine. Some of them (i.e., 9 species) were exploited for furniture making. Another tree species had ornamental functions (i.e., one species), provided nectar for the bees (i.e., one species), and was considered important for its water-holding capacity (i.e., one species). However, it was also noted that cutting of trees to produce firewood was already prohibited in the area as utilizing trees for firewood production entailed having to cut them. It was stressed by an interview respondent that the trees used for water storage and those that served as food for the animals must not be cut because these trees were

highly valuable to the environment and wildlife. Humans exerted pressure on tree resources because of the economic significance the trees had; this, however, had led to the depletion of these resources.

Table 3

Economic Importance of the Surveyed Trees of Mt. Tapulao to the Locals of Sitio Dampay

Species Name	Types		Economic Importance
	Forest Trees	Fruit Trees	
Schizostachyum lumampao			Multiple use for houses and furniture. Used in making sticks
Calophyllum inophyllum	√		Serves as a good lumber
Dillenia philippinensis	√		Source of sheltering materials and food source for humans
Diospyros discolor	√		Serves as a good lumber
Diospyros pilosanthera	√		Serves as a good lumber
Palaquium obovatum		√	Serves as a good lumber
Palaquium philippense		√	Serves as a good lumber
Palaquium sp.		√	Serves as a good lumber
Lecythidiaceae		√	Serves as a good lumber when reaches maturity
Ardisia sp.		√	Serves as a good lumber
Rubiaceae 2		√	Source of sheltering materials
Cinnamomum mercadoi		√	Medicine: Treatment for flu
*Cinnamomu*m sp.		√	Source of sheltering materials
Goniothalamus amuyon		√	Medicine: Treatment for stomachache and boils
Euphorbiaceae		√	Source of wine and food flavoring
Euphorbia sp.		√	Serves as a good lumber
Antidesma sp. 1		√	Serves as a good lumber
Antidesma sp. 2		√	Serves as a good lumber
Breynia vitis-idaea		√	Food for birds and used as a bracelet
Eleocarpaceae		√	Serves as a good lumber and used in making furniture
Sterculia sp.		√	Serves as a good lumber
Moraceae 1		√	Source of firewood and food for wild boars
Moraceae 2		√	Source of sheltering materials

Ficus benjamina		√	Food for birds and monkeys
Ficus septica		√	Serves as a good lumber
Ficus sp. 2		√	Firewood source and food for birds and humans
Ficus sp. 3		√	Source of sheltering materials
Ficus sp. 4		√	Source of sheltering materials
Ficus sp. 5		√	Serves as a good lumber
Ficus sp. 6		√	Food for birds
Ficus sp. 7		√	Source of sheltering materials
Ficus sp. 8		√	Serves as a good lumber and source of sheltering materials
Ficus sp. 9		√	Serves as a good lumber
Ficus sp. 10		√	Source of sheltering materials
Terminalia microcarpa	√		Serves as a good lumber
Eugenia sp. 1		√	Serves as a good lumber
Eugenia sp. 2		√	Serves as a good lumber and source of firewood
Syzygium sp. 1		√	Source of sheltering materials
Syzygium sp. 2		√	Source of furniture and firewood
Pygeum sp. 1		√	Serves as a good lumber
Pygeum sp. 2		√	Serves as a good lumber and used in making furniture
Semecarpus sp. 1		√	Source of sheltering materials
Semecarpus sp. 2		√	Source of sheltering materials and firewood
Canarium sp.		√	Serves as a good lumber
Dipetrocarpaceae		√	Source of sheltering materials and firewood
Shorea astylosa		√	Source of furniture
Shorea contorta		√	Source of furniture
Shorea palosapis		√	Source of furniture
Shorea polysperma		√	Serves as a good lumber
Cyathea contaminans		√	Water support
Bagni		√	Source of sheltering materials
Camilia		√	Source of sheltering materials
Lapnit		√	Serves as a good lumber
Lapugan		√	Serves as a good lumber
Magkakato	√		Source of sheltering materials and food source for humans

Malabyong		√	Serves as a good lumber
Tarukan		√	Flower serves as nectar for honeybees
Tuey		√	Serves as a good lumber
Total	10.39%	88.31%	

Threats Affecting the Diversity of Trees

FGDs with the mountain guides and members of the Aeta Tribe in Palauig were conducted in the community in order to gather first-hand information on the current threats on the tree biodiversity in the area, environmental issues present in Mt. Tapulao, and the causes of these concerns. According to the local communities, illegal logging still occurred in the area, and this had caused the decline in the number of trees present in the forest. However, these activities had become more uncommon at the time of the study than they were before.

The locals observed that there is a decrease in the vegetation on the forest area of Mt. Tapulao. Logging of trees for domestic and commercial use was considered as the main reason for the significant reduction in the number of trees in the area. However, according to the locals, these instances had become less frequent than they were before, due to the prohibitions of the government. The continuous cutting of trees, if not controlled and managed, may lead to the extinction of these species in the area. The people contended that the major causes of decreasing tree population were charcoal making and harvesting of trees for additional revenue. Increase of human population in the area was also perceived by its inhabitants as one of the reasons for the decrease of trees. That is, rapid human population growth is concomitant to the demand for natural resources, thus putting considerable pressure on them (Meijaard et al., 2013).

Assessment of the Environmental Problems and Sources of Degradation in Mt. Tapulao

The forest of Mt. Tapulao is continuously threatened by human activities. It was discerned from the study that road construction, wildlife hunting, soil erosion/silt runoff, and tourism areas, and recreational areas posed major threats to the forest ecosystem. Meanwhile, mining, solid waste, ecotourism,

and quarrying, had moderate impacts on the degradation of Mt. Tapulao. Illegal logging, fires, charcoal making, shift cultivation/kaingin, and firewood collection had small impacts on the forest ecosystem, but these should never be overlooked or neglected (Table 4).

Table 4

Sources and Level of Impacts of Anthropogenic Activities in Mt. Tapulao's Forest Ecosystem

Sources of environmental degradation	Computed value	Interpretation
Road construction	3.99	Major Impact
Wildlife hunting	3.62	Major Impact
Soil erosion/silt runoff	3.54	Major Impact
Tourism Area/Recreational Area	3.37	Major Impact
Mining	3.12	Moderate Impact
Solid Waste	2.86	Moderate Impact
Ecotourism	2.80	Moderate Impact
Quarrying	2.53	Moderate Impact
Illegal logging	2.25	Small Impact
Fires	2.16	Small Impact
Charcoal making	2.14	Small Impact
Shift cultivation/Kaingin	2.12	Small Impact
Firewood collection	1.99	Small Impact

CONCLUSION

Mt. Tapulao still preserves its forest ecosystem and has a very high diversity of tree species. The National List of Threatened Philippine Plants indicated that among the identified trees, majority were under vulnerable conditions, and others were categorized as critically endangered, and other threatened species. Meanwhile, according to the IUCN Red List, some of these species were under the critically endangered, vulnerable, and endangered species categories. Most of the identified trees were native to and endemic in the Philippines. Among the surveyed trees, majority were categorized as forest trees, and they were mostly utilized as a source of lumber and as shelter. According to the local communities, illegal logging still occurred in the area,

and this had led to the decline in the number of trees present. However, these activities had become more uncommon at the time of the study compared before. Logging of trees for domestic and commercial use were considered as the main reason for the significant reduction in their number. Furthermore, the forest ecosystem of Mt. Tapulao was being continuously threatened by human activities like road construction, wildlife hunting, soil erosion and silt runoff, and tourism/recreational areas, past mining activities, and quarrying whose impacts should not be ignored.

RECOMMENDATIONS

Considering the results of the study, the following are recommended:

1. Conduct plant diversity assessment in different periods of the year, such as the wet season.
2. Carry out vegetation assessment in other parts of Mt. Tapulao and Zambales Mountain Range.
3. Perform DNA analysis for proper identification of plants present in the area for more accurate identification.

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Changes in the Coastal and Fishery Resources and Local Ecological Knowledge (LEK) About Fishery Practices as Perceived by the Fisher Folks in Selected Coastal Municipalities of Zambales, Philippines

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This study was conducted to carry out a perception study on the changes in the coastal and fishery resources and the local ecological knowledge (LEK) about fishery resources and practices in selected municipalities in the province of Zambales. The researchers conducted a survey interview with the fisher folks living along the coastal areas to assess their knowledge and perception of the coastal and fishery resources in the four coastal municipalities, namely Palauig, Masinloc, Candelaria, and Sta. Cruz in Zambales, Philippines and documented their local ecological knowledge concerning fishery resources.

The majority of the fisher folks responded that there was already a decrease in fish population in the coastal and fishery resources, while half replied that the seashore and coastline aesthetic appearances had been destroyed. However, there were no changes in mangrove and seagrass ecosystems. Instead, most of them alleged that the main reasons for these problems are human activities and overexploitation.

The local ecological knowledge (LEK) is still rich and varied among the different coastal communities considering their cultural differences, practices, and topography. However, results revealed that most of the documented LEK focused on the fishing practices in coastal and fishery resources for fishing serves as their main livelihood. Only half of those interviewed from Palauig, Candelaria, and Masinloc, and Sta. Cruz followed and observed their old ways of fishing, such as using *payao, sunggapong,* and *kawil,* while some of them implemented the modified

ways like *hila-hila* and l*ambaklad*, among others. LEK in fishing practices and coastal and fishery resources are now very scarce, and only a few fishermen are well informed of this traditional knowledge. Also, it seems that these practices have been modified, revised, and converted by the younger generation of fishers. These traditional knowledge, systems, and practices are at a declining rate due to the continuing loss of interest of the young fisher folks.

In the face of ongoing environmental changes, and cultural and biological diversity, the coastal and fishery resources are likely to be severely impacted. Moreover, local resilience capacities suffer from this loss of traditional and local ecological knowledge. Thus, if LEK will continue to be harnessed, adapted, and practiced by the local fishers, this could be a holistic management tool in conserving fishery and coastal resources in the changing environmental conditions.

Keywords: fishery resources, coastal resources, fishing practices, ;local ecological knowledge (LEK)

INTRODUCTION

Zambales is a coastal province with a total coastal area of 56,792.25 ha and 232.6 km coastline. The coastal municipalities of this province have various aquatic ecosystems such as rivers, lakes, wetlands, seagrasses, coral reefs, mangroves, and tropical rainforests (Rivera, 2014). These ecosystems are declared protected areas locally and by the national government, such as the Masinloc-Oyon Bay Seascape and Landscape, Uacon Lake, Panglit Protected Area (San Salvador Island), Hermana Mayor, and Hermana Menor and Mt. Tapulao, among others.

Zambales, covering 361,110 hectares, shares common boundaries with Pangasinan in the North, Tarlac, and Pampanga in the East, and Bataan in the South. The entire stretch of the province in the West is rimmed by the crystal-clear waters of the vast China Sea. The 13 sprawling towns dotting the province from the North to South, most of them along the shoreline, are Sta. Cruz, Candelaria, Masinloc, Palauig, Iba, Botolan, Cabangan, San Felipe, San Narciso, San Antonio, San Marcelino, Castillejos and Subic. Until it became a chartered city, Olongapo was the 14th town (Provincial Government of Zambales Official Website, n.d.)

The coastal ecosystems in the province of Zambales have been facing many pressures from anthropogenic activities such as overexploitation, dynamite fishing, illegal fishing, solid wastes problem, and others that have been exacerbated by the changing climate and occurrence of natural hazards. Impacts from human activities on the ecosystems on

land and in the water can influence ecosystems greatly. Climate change, ocean acidification, polar ice caps melting, habitat loss, eutrophication, stormwater runoff, air pollution, contaminants, and invasive species are other sources of problems affecting the coastal ecosystems (Statistics Canada, 2015.)

Local ecological knowledge (LEK) has been existent as part of human life in the past, and it is essential in the formation and realization of how people interact with their environment. However, several scholars have different views of what LEK or indigenous knowledge entails (Fabiyi & Oloukoi, 2013). According to Kelman et al. (2012), LEK is viewed as indigenous/ local knowledge or traditional knowledge derived from local communities. Agrawal (1995) defined LEK as the knowledge passed down from one generation to another, gained and expanded from the information of the environment and surroundings, which is revealed through intuition, dreams, or visions. On the other hand, another researcher stated that indigenous knowledge refers to what local people know, recognize, and do for many generations that have evolved through trial and error and proved to cope with change (Melchias, 2001). Finally, Chianese (2016) agreed that LEK is the knowledge and know-how accumulated across generations, tested and adapted through millennia, guiding the local people in their interactions with their environments. A closer look at all these concepts supports that indigenous knowledge is locally grown, passed down from one generation to another and that the knowledge is gained over many years.

LEK is vital to broadening people's understanding of environmental changes, especially in fishery resources. The LEK of fishers may be of use in order to obtain first-hand knowledge or information on how to advance the management of coastal resources, the proper handling and use of their gear, and to provide specific answers on the habitat use of species of importance to their survival (Berkstrom et al., 2019). Local Ecological Knowledge (LEK) is relevant to increase understanding about environmental information and the participation and involvement of the local communities in the management of resources. The fishers' LEK could be helpful in order to obtain information on how to manage coastal fishery resources (Berkstrom et al., 2019). In addition, LEK could help provide answers to questions related to the connectivity and identification of fish

habitat use and migrations for species and areas where such knowledge is scarce.

Local ecological knowledge plays a crucial role also in biodiversity conservation and ecosystem management. The local ecological knowledge, coastal ecosystem management, fisheries management, and biodiversity conservation are interrelated through various socially shared aspects, such as values and norms, spiritual beliefs and perceptions of ecosystem functions and benefits as well as operational conditions, including livelihood strategies and economic constraints (Joa et al., 2018). While many of the reviewed studies evaluate local knowledge as holding great promise for conservation of resources and biodiversity, conclusions regarding practical implications of this knowledge into conservation management are mixed and varied. However, LEK is very imperative in the integration of conservation schemes in the changing environmental conditions.

With the weather and climate being unpredictable and with the changes that happen in the coastal areas, the indigenous communities face tremendous cultural and even economic changes that possibly lead to the deterioration of their local knowledge base. In the face of profound and persistent changes in the climate and degradation of coastal areas, LEK, coastal resources and fishery resources management, and biodiversity conservation, and local resilience from these changes are likely to be seriously affected. The loss of local and indigenous information is likely to pose a critical threat to the successful protection of biodiversity, especially in community-based local conservation efforts (Aswani et al., 2018).

In this context, this study intended to carry out a perception study on the changes in coastal and fishery resources and the local ecological knowledge (LEK) about fishery resources and practices in selected municipalities in the province of Zambales.

METHODOLOGY

This study utilized quantitative and qualitative methods. The study areas are the four coastal municipalities in Zambales, such as Palauig, Masinloc, Candelaria, and Sta. Cruz. The municipal and barangay profiles of these coastal communities were gathered and assessed together with their historical background, socio-demographic, economic, and political conditions.

A survey was conducted to determine the perception of fisher folks regarding their observation of the changes that occurred in the coastal and fishery resources and the fish populations and other organisms.

The local ecological knowledge about fishing practices, coastal resources, and biodiversity conservation was documented. The implementation of LEK on the grassroots level was determined through Focus Group Discussion (FGD) to increase peoples' involvement.

Due to the intensive coverage of the study areas, the data-gathering procedures involved three phases. The first phase was conducting a survey using a questionnaire to determine the changes in coastal and fishery resources. The second phase was the semi-structured interview of randomly selected respondents to gather preliminary data about local ecological knowledge (LEK) of indigenous knowledge systems and practices (IKSP). The research covered thirteen (13) barangays from Palauig, ten (10) from Masinloc, eight (8) from Candelaria, and eleven (11) from Sta. Cruz. Fifteen percent (15%) of the total number of fisherfolks/households within each coastal community were chosen as respondents for the interview. The target respondents were the fisherfolks in the study sites, dependent on the coastal resources of the four coastal municipalities for their livelihood. Therefore, samples of the study were limited to the top three highest number of fishing households who reside along with the coastal areas of the four (4) study areas of Candelaria, Masinloc, Palauig, and Sta. Cruz. A total of 320 respondents were interviewed from the aforementioned municipalities.

Knowledgeable respondents such as community leaders, peoples' organizations, executives, and policy-makers (local executives or Municipal mayors and members of Sanggunian) from the LGUs were selected as potential key informants (KIs) for the second phase of data gathering.

The second sub-phase focused on using several qualitative methods like field immersions, direct observations, in-depth interviews (semi-structured) of the key informants, focus group discussions (FGD), and the *pakikipagkwentuhan* or story-telling. In this procedure, a descriptive reconstruction of the prevailing community belief system, livelihood, and the existence of a community support system was documented. The data gathered were systematically arranged to constitute the community profile part of the research. Data were tabulated using pre-designed tables and subsequently analyzed descriptively.

Summary tables with consolidated relevant data from phases 1 and 2 were constructed to trace the relationship between LEK /IKS practices and the prevailing livelihood and the existence of community support system such as cooperatives, people's organizations, and other civic groups, as well as other factors that have contributed to the evolution of such practices. Triangulation or cross-referencing was applied to ensure the reliability of the data. Data gaps were supplemented by techniques used for primary and secondary data collection in phases 1 and 2. Finally, results were presented to the community for validation.

RESULTS AND DISCUSSION

Table 1 shows the distribution of respondents by gender and age group. The majority were married (85.94%), male (90.94%), and in their post-adolescent to mid-life years, of which 75.94 % of them belong to the middle age group of 31 to 60 years old. Only a few belong to the senior citizen's group (13.75%), the 21-30 years age groups (7.19%), and below 20 years (1.25%). Across the four study areas, many of those engaged in fishing are in their prime years and considered the productive age population. Candelaria, Masincloc and Sta.Cruz had the most number of fishers who were interviewed, while Palauig had the least number.

Less than 50% of the respondents (48.75%) were high school graduates and drop-outs, while 38.13 percent were elementary graduates and drop-outs. Only a few (4.06%) were graduates from vocational courses, and even fewer of them (2.81% each) attained a college level of education. Candelaria and Masinloc had the highest number of elementary and high school graduates. Similarly, only Candelaria and Masinloc had the highest incidence of college graduates, and this may be attributed to the proximity of President Ramon Magsaysay State University or PRMSU to their community.

Among the four (4) municipalities, Candelaria, Masinloc and Sta. Cruz had over fifty percent (59.69%) of 1-5 members in the family, and less than half (34.06%) had 6-10 members in the family. Only Palauig had an equal proportion of 11% between 1-5 and 6-10 household sizes. This indicates that there is now a growing trend of Filipinos who prefer smaller families, as can be gleaned from Table 1.

In terms of ethnolinguistic identity, the Tagalog-speaking population (46.25%) was predominant in all four study areas. Masinloc is the only municipality that has no Zambal speaking group and is a predominantly Tagalog speaking community. A mixed group of Zambal-Tagalog-Ilocano speaking population is the second highest ethnolinguistic group present in all the four municipalities. Such mixed ethnolinguistic groups are more concentrated in areas of Candelaria, Sta. Cruz and Palauig. Furthermore, those who speak pure Zambal are found in areas of Candelaria, Palauig, and Sta. Cruz (Table 1).

Figure 1 shows the annual income of the families per study area. A little over 50% were those earning P60,001 to P80,000 and P40,001-P60,000 annually. Less than one-fourth (17.19%) earned over P100,000, and 16.56 % declared their income to about P80,001-P100,000. There were still families who earned below P40,000 (8.44%) and P20,000 and each year (5%). These income groups may be considered the poorest of the poor and the marginalized income earners. The group with over P100,000 income annually was high among the municipalities of Candelaria, Sta. Cruz and Masinloc, while the group with the lowest income of P20,000 and below, were also from the municipalities of Masinloc and Sta. Cruz. The highest income earned by the respondents was pegged at P100,000 annually or P8,333.33 a month, and the lowest income received by some respondents is P20,000.00 annually or P1,666.67 a month.

These data reflect that many of the fisher sectors from the study areas live below the poverty line. The Philippine Statistics Authority (PSA) currently pegs the poverty threshold at Php 10,481.00 a month for a family of five. Thus, many of the respondents are low-income earners who reflect the pervasiveness of poverty among the fisherfolk sectors.

Table 1

Socio-Demographic Data (Gender, Age, Civil Status, Educational Attainment, Household Size, and Languages Spoken) in Candelaria, Masinloc, Palauig, and Sta. Cruz, Zambales

SOCIO-DEMOGRAPHIC	Candelaria	Masinloc	Palauig	Sta.Cruz	Total	Percentage
Gender						
Female	3	11	-	8	22	6.88
Male	106	83	23	79	291	90.94
No Answer	-	2		5	7	2.188

Age						
Below 20 years		3		1	4	1.25
21-30 years	8	1	2	12	23	7.19
31-40 years	31	7	4	32	74	23.13
41-50 years	31	32	7	30	100	31.25
51-60 years	26	26	8	9	69	21.56
61 above	13	23	2	6	44	13.75
No answer		4		2	6	1.88
Civil Status						
Married	95	84	21	75	275	85.94
Single	12	7	1	10	30	9.38
Separated	2	-		2	4	1.25
Widowed		1	1	1	3	.94
No Answer		4		4	8	2.5
Educational Attainment						
Elem drop out	4	12	1	9	26	8.13
Elem graduate	40	32	2	22	96	30.00
HS drop out	11	14	3	12	40	12.5
HS grad	41	25	12	38	116	36.25
Vocational	6	2	1	4	13	4.06
College drop out	2	6	1		9	2.81
College graduate	5	1	1	2	9	2.81
No answer		4	2	5	11	3.44
Household size						
1-5	67	65	11	48	191	59.69
6-10	38	26	11	34	109	34.06
11-15	4			1	5	1.56
No answer		5	1	9	15	4.69
Languages Spoken						
Zambal	14		3	4	21	6.56
Tagalog	35	70	5	38	148	46.25
Ilokano	14	4	3	-	21	6.56
Zambal/Tagalog/atbp	46	15	10	41	112	35.00
No answer		7	2	9	18	5.63

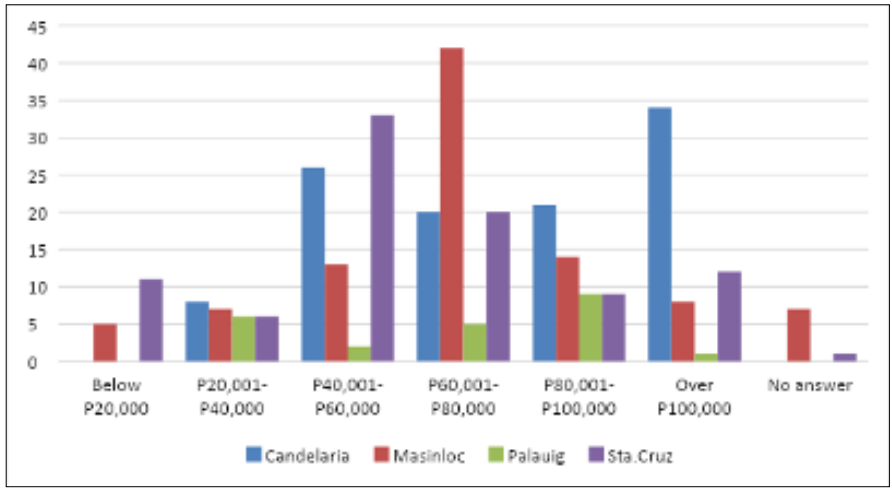


Figure 1. Annual income of the family per study area in Zambales, Philippines

Table 2 presents the supplementary monthly income of the households per study area. The majority (86.56%) of the families from the study areas had no supplementary income. This is not surprising because data show that very few families from the four municipalities have been engaged in livelihood activities such as livestock, raising, farming, and or those who sought employment in resorts, restaurants, and local tourism. Those who had an additional source of income are primarily from Candelaria and Palauig. Only about 10 % had a monthly income of P3,000.00 below, and 2.81 % make P3,001.00 to P9,000.00 a month. A little over half (63 %) had P12,000.00 additional monthly income.

Table 2

Supplementary Monthly Income Per Study Area

Supplementary income	Candelaria	Masinloc	Palauig	Sta.Cruz	Total	Percentage
(n=320)						
P3,000 and below	12	1	12	7	32	10
P3,001 – P9,000	3		2	4	9	2.81
P9,001 - P12,000	1			1	2	.63
No answer	93	22	82	80	277	86.56

During the lean months of the southwest monsoon, the season when fishing is dangerous and risky, only a few (3.75%) local fishers from Candelaria, Masinloc, and Sta. Cruz was engaged in livestock raising, and that generated only P6,000.00 and below as their additional income (Figure 1). Similar observations were seen on those engaged in farming. The majority (95.31%) of all those interviewed from the four municipalities did not engage in farming. Only 4.7% of the 320 respondents from Candelaria, Masinloc, and Palauig were engaged in farming; only a few of the respondents (3.13%) earned P3,000.00 and below, 0.9% earned P3,000.00-P12,000.00 and 0.63% respondents from Candelaria earned P30,000.00 monthly. These economic activities are the local fishers' adaptive ways to augment their income during the lean months of the year.

Respondents Perception on the Changes in Mangroves in the Four Municipalities

The fisher folks were asked about the locations where they usually visit to catch fish. The most frequently visited fishing locations by fishers from the four municipalities were the open sea or offshore, corals and mangroves. The majority of the respondents from Candelaria (81.7%), 52.2 % from Palauig, and 47.9 % from Masinloc caught fish offshore (Figure 2). The coral reef remained the second favorite fishing site among fishers from Sta. Cruz (25 %) and Candelaria (9.25%). Only a small number of fishers from Palauig (13%) went fishing in mangroves (Figure 2). Concerning this, a perception study was done to determine whether there are now changes that happened in the coastal and fishery resources of Sta. Cruz, Candelaria, Masinloc, and Palauig, where the fisher folks depend on their livelihood.

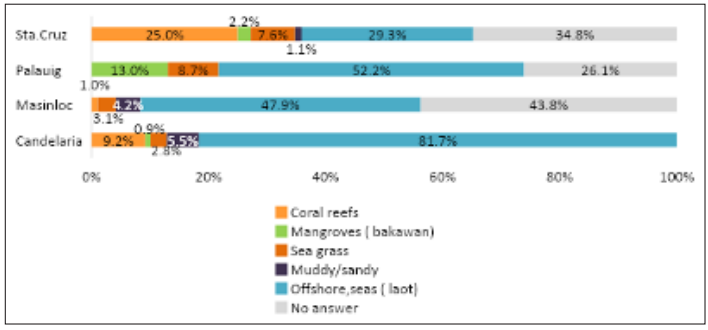


Figure 2. Locations where fishers commonly fish for each study area

Figure 3 shows that most fisher folks in the four coastal municipalities replied that there were no changes in the mangrove ecosystems in their area. Overall, the municipality of Palauig had the highest percentage of no changes that occurred with 94%, followed by Sta. Cruz and Masinloc with 89% and 88%, respectively, compared to Candelaria, which accounted for the lowest proportion (77%). Results revealed no significant changes in the destruction of mangrove ecosystems in the four coastal communities due to the local government units' action and policy to continuously promote the conservation and preservation of mangrove ecosystems. All the local government units require every resident in the barangays within each municipality to plant mangrove trees with different species along the river banks and coastal zones to prevent the impacts of strong typhoons and storm surge that might occur in their coastal areas.

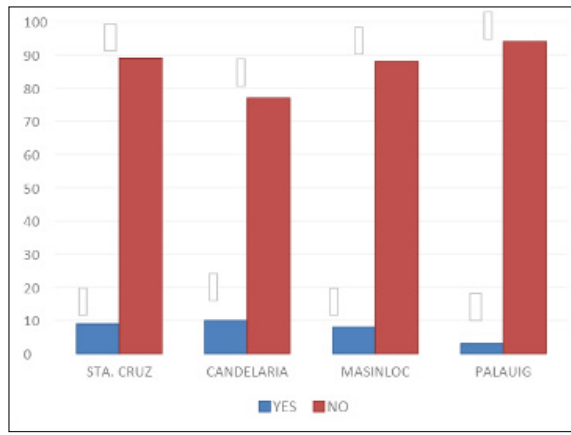


Figure 3. Respondent's perception of the occurrence of changes in mangroves in the four municipalities

Reasons of Changes in Mangrove Ecosystem

Figure 4 illustrates the reasons for the occurrence of changes in the mangrove ecosystem in the four coastal municipalities as perceived by the respondents. The mangrove ecosystem in the coastal areas was mainly affected by strong typhoons and waves, whereas storm surge was disregarded as a cause of change in the mangrove ecosystem. Therefore, residents of the area ignored the concept of storm surge because their area was not mainly affected by the

incident. Moreover, 50% of the respondents also considered human-made activities harmful to the ecosystem, such as cutting mangrove trees.

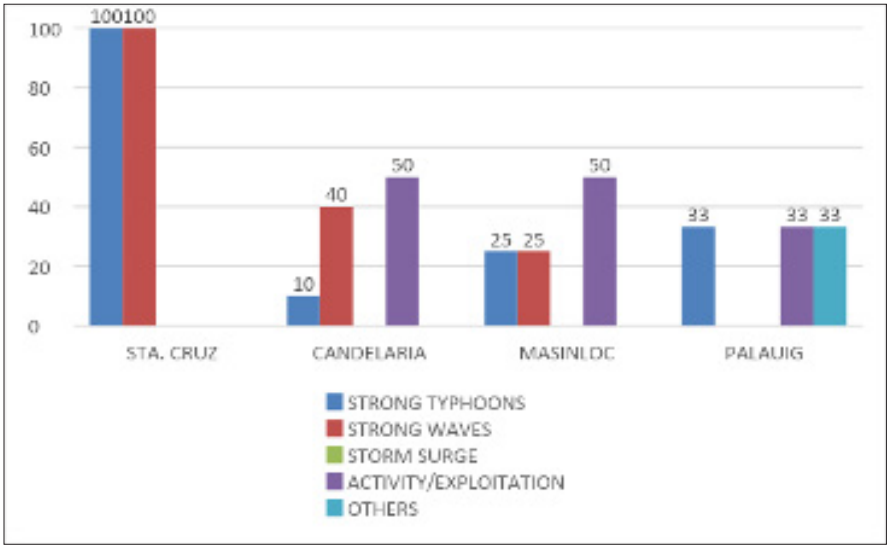


Figure 4. Reasons of changes that happened in mangrove ecosystems in the four municipalities as perceived by the respondents.

Respondents' Perception on the Seagrass Ecosystems Changes in the Four Municipalities

The majority of the respondents in the three coastal municipalities, such as Masinloc, Palauig, and Candelaria, alleged that there were no changes in the seagrass ecosystems in their areas (Figure 5). Conversely, 60% of the fisher folks from Sta. Cruz answered that the seagrass ecosystems in their area had changed a lot. Sta. Cruz residents observed that the seagrass population in their area is already declining, so they planted seagrasses. This was based on the observations of fishers who frequently see the presence of the various fish species for this ecosystem acts as a breeding ground for many marine organisms.

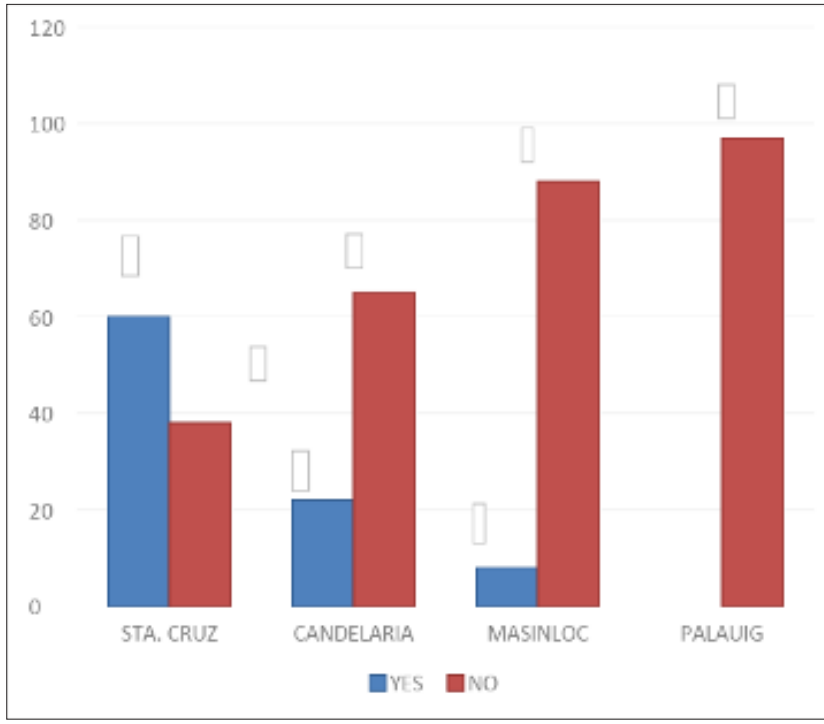


Figure 5. Respondent's perception on the occurrence of changes in seagrass ecosystems in the four municipalities

Reasons of Changes in Seagrass Ecosystem

Parallel to mangrove ecosystems, strong typhoons and waves were the major causes of destruction and changes in seagrass ecosystems as perceived by 100% of the respondents (Figure 6). But, according to the majority of the respondents from Sta. Cruz (77%) and Masinloc (75%) human activities such as dynamite fishing and mining destroy the seagrass ecosystems. These observations corroborate with the studies of Paz-Alberto et al. (2015), where results indicated that seagrasses in Candelaria and Masinloc had low diversity and the sediments were contaminated with lead and chromium, while the results of the study of Espiritu and Paz-Alberto (2018) showed that seagrass ecosystems in Sta. Cruz, mainly the seagrass sediments were contaminated with nickel. However, due to these problems, the local government released an ordinance prohibiting any resident from using and harvesting seagrass species.

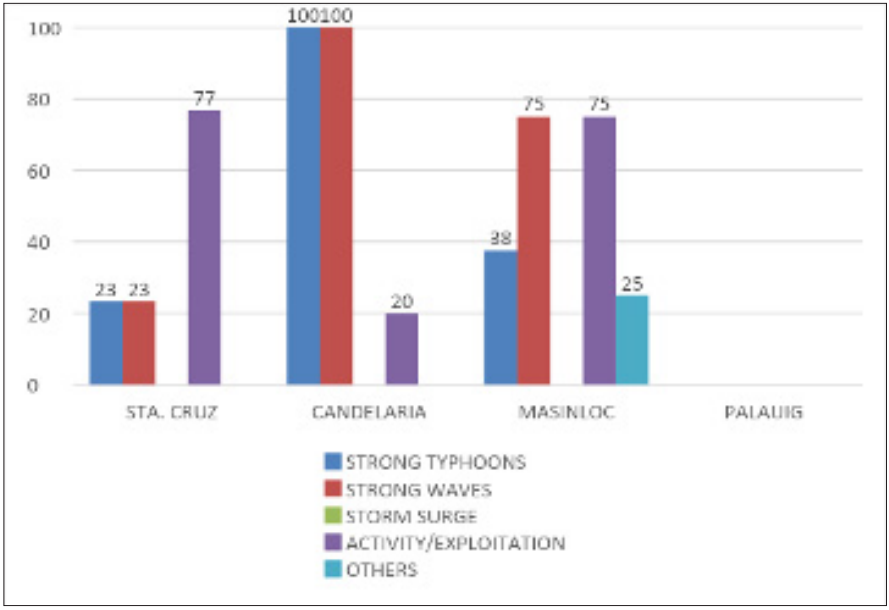


Figure 6. Reasons of changes that happened in seagrass ecosystems in the four municipalities as perceived by the respondents

Perception on Fish Population Changes in the Four Municipalities

Figure 7 shows the respondents' perception of the change of fish population in the four municipalities—the majority of the respondents of Sta. Cruz and Masinloc were well aware of the decrease of the fish population with 95% and 94%, respectively, whereas Palauig fisher folks were the least observant of the decrease in fish population in their coastal areas. Respondents (63%) from Candelaria also agreed that there was already a decline in the fish population. On the other hand, almost half (47%) of the Palauig's fisher folks were not aware of the decreasing fish population. The majority of the fisher folks replied that the main reason for this event in their coastal resources was human activities.

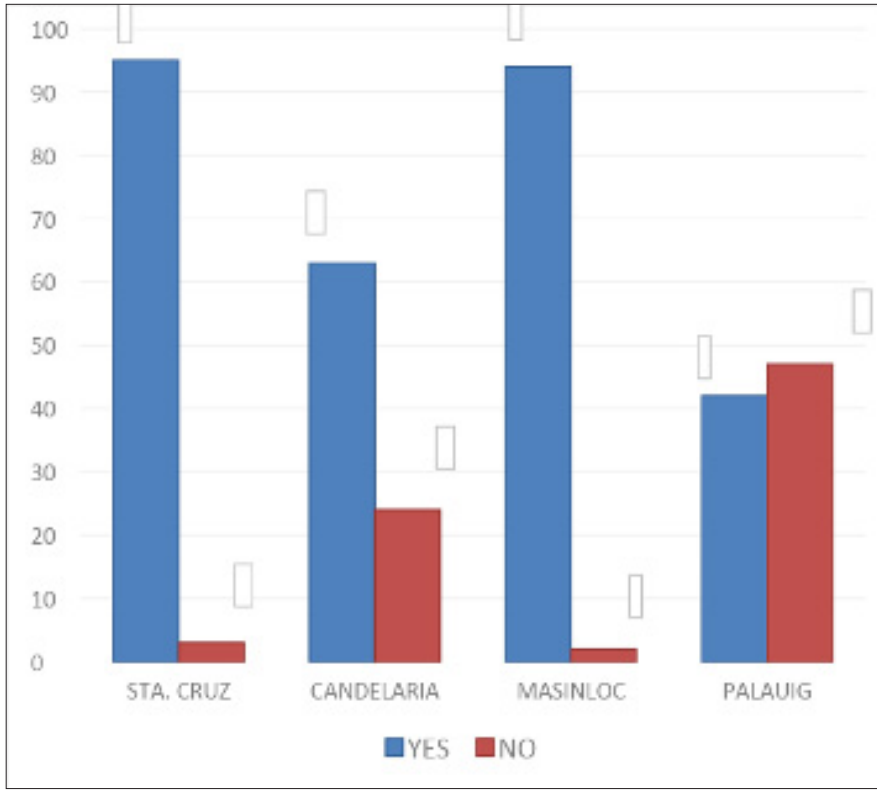


Figure 7. Respondent's perception on the occurrence of changes in fish population in the four municipalities

The fisherfolk's perceptions on the decreasing fish population are also supported by the report of NSAP-Zambales (2017) regarding the most common and top leading fish catches in the municipal and commercial waters of Zambales. Based on their report, combining the total catches of around 5,802.809 MT from municipal and commercial fisheries in Zambales in 2017, only a few types of fishes were being caught. The top ten (10) fishes that were being caught were skipjack tuna (37.57%), yellowfin tuna (29.63%), mackerel scad (10.39%), Philippine flying squid, *Nototodarus philippinensis* (5.20%), anchovy, *Encrasicholina punctifer* (1.82%), Buccaneer anchovy, *Acetes sibogae* (1.10%), rough triggerfish, *Canthidermis maculate* (1.07%), shortfin scad, *Decapterus macrosoma* (1.02%), houndfish, *Tylosurus crocodilus* (0.78%) and dark-banded fusilier, *Pterocaesio tile* (0.72%) (Table 3).

Table 3

Top 10 Leading Fish Catches in the Municipal and Commercial Water of Zambales in 2017 (NSAP-Zambales, 2017)

Fish Species	Catch (MT)
Skipjack tuna	2,180.26
Yellowfin tuna	1,719.63
Mackerel scad	602.87
Philippine flying squid	301.66
Anchovy	105.52
Buccaneer anchovy	63.80
Rough triggerfish	62.29
Shortfin scad	58.97
Houndfish	45.01
Dark-banded fusilier	42.01

Moreover, a study agreed that fish diversity and the population is decreasing in Northern Zambales. Results of this study revealed that the dominant catches covering the months of July to October 2018 and February 2019 were yellowfin tuna (*Thunnus albacares*), mackerel scad (*Decapterus macarellus*), skipjack tuna (*Katsuwonus pelamis*), Hawaiian flying squid (*Notodarus philippinensis*), and common dolphinfish (*Coryphaena hippurus*) in the municipal water. In addition, a recent study also confirmed the respondents' perception regarding the fish population decline in the four municipalities, which indicated a low population and diversity of fishes in the coral reef ecosystems of Sta. Cruz, Candelaria, and Palauig, while Masinloc had moderate diversity for the observed fishes in coral reef ecosystems (Paz-Alberto et al., 2021).

Reasons for the Fish Population Decline

Human-made exploitation such as dynamite fishing and improper fishing techniques were the primary reasons for the low diversity and the diminishing number of fish population in the coastal areas as perceived by the local fishers (Figure 8). Likewise, most of the respondents said that most of the fish thriving in their area tended to migrate and transfer to more distant areas, which hamper the fishing activities of the fishermen and make it

difficult for them to catch fish. Furthermore, the residents considered ocean acidification and increased temperature as the causes of the continuous decrease of the fish population—likewise, Sta. Cruz and Candelaria have mining operations that relatively affect fish growth and could lead to the decrease of the fish population.

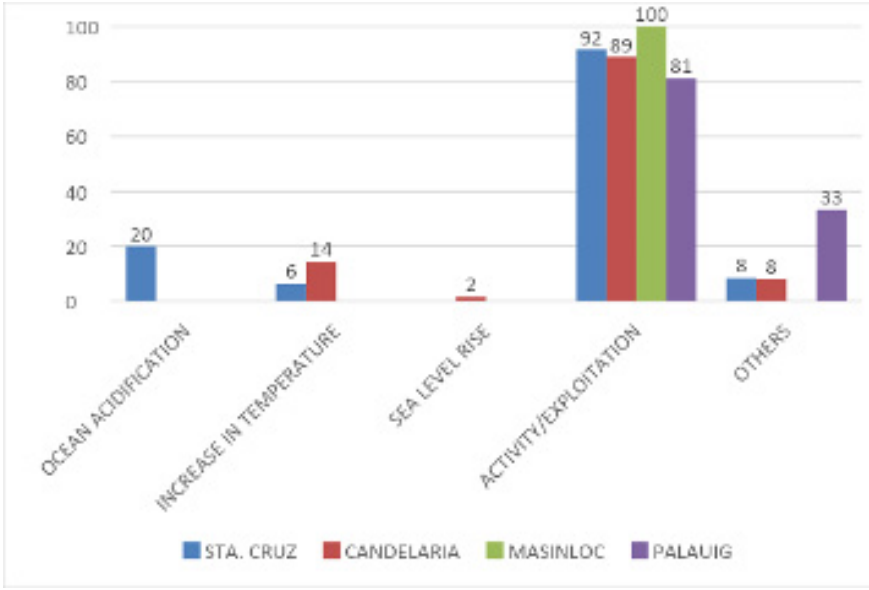


Figure 8. Reasons affecting the number of fish population in the study areas

The respondents' perceptions are supported by another study conducted by Paz-Alberto et al.(2021) about the sources of degradation of coastal resources in the four municipalities, affecting the population of fishes. Results showed that the significant sources of environmental degradation in Sta. Cruz, Zambales were mine drainage pollution and tourism or recreational development while mine tailings, sedimentation/siltation, solid wastes, and environmental, aesthetic degradation had moderate impacts. However, in Candelaria, Zambales the sources of degradation which posed major impacts on the coastal ecosystems are quarrying and dynamite fishing. This was followed by mine drainage pollution and mine tailings and soil erosion and environmental, aesthetic degradation, which had moderate impacts on the coastal ecosystem of Candelaria. Furthermore, eutrophication, dynamite fishing, oil spill, and mine drainage pollution only posed moderate impacts

on the coastal ecosystem of Masinloc, Zambales. While in Palauig, Zambales, eutrophication, dynamite fishing, oil spill, mine drainage pollution, and solid wastes significantly impacted the coastal ecosystems.

Perception on the Changes in Seashore Appearance in the Four Municipalities

Figure 9 shows the perception of residents in the four municipalities on the presence of changes in the seashore appearance. Results revealed that half of the respondents observed that there were no changes that occurred in the seashore. In contrast, less than half of the respondents replied that changes happened, particularly on the proliferation of houses near the seashore despite the local government's ordinance on the prohibition of settling near the area, which could lead to the destruction of the seashore.

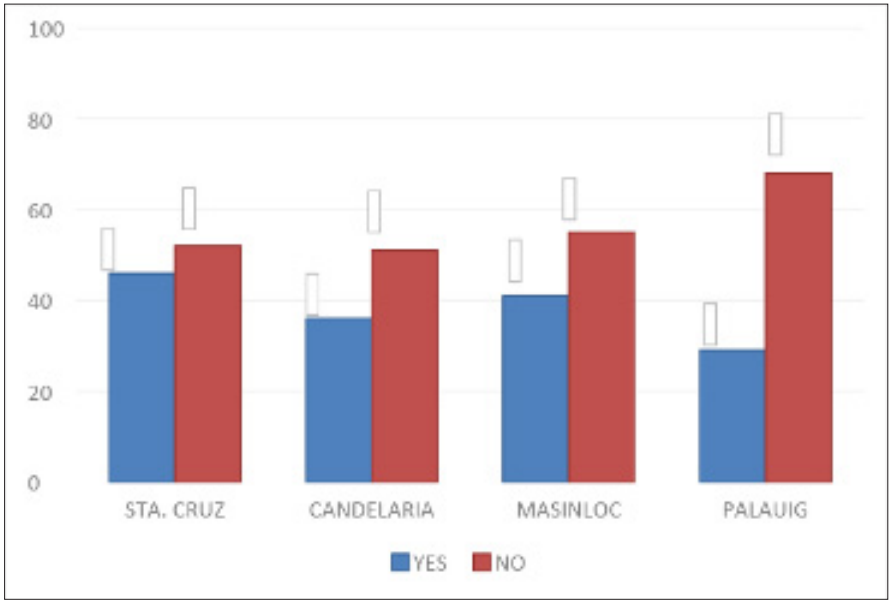


Figure 9. Respondent's perception of the occurrence of changes in the seashore appearance in the four municipalities

Causes of Changes in the Seashore Appearance

Figure 10 shows the factors affecting the aesthetic appearance of the seashore as perceived by the respondents. Results revealed that the impact of human activities and exploitation from the residents in the coastal area of the four municipalities (100%) are the main reasons for the destruction of the aesthetic appearance of the seashore. In addition, improper waste disposals and old and rotting logs from the mountains also contribute to seashore changes in the study sites. Moreover, strong waves in conjunction with strong typhoons also cause the destruction of the seashore in the area (Figure 10).

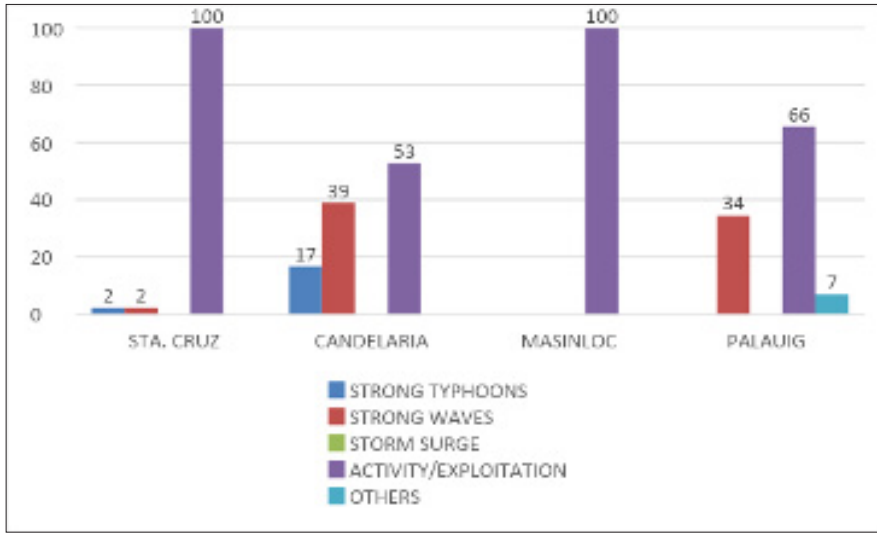


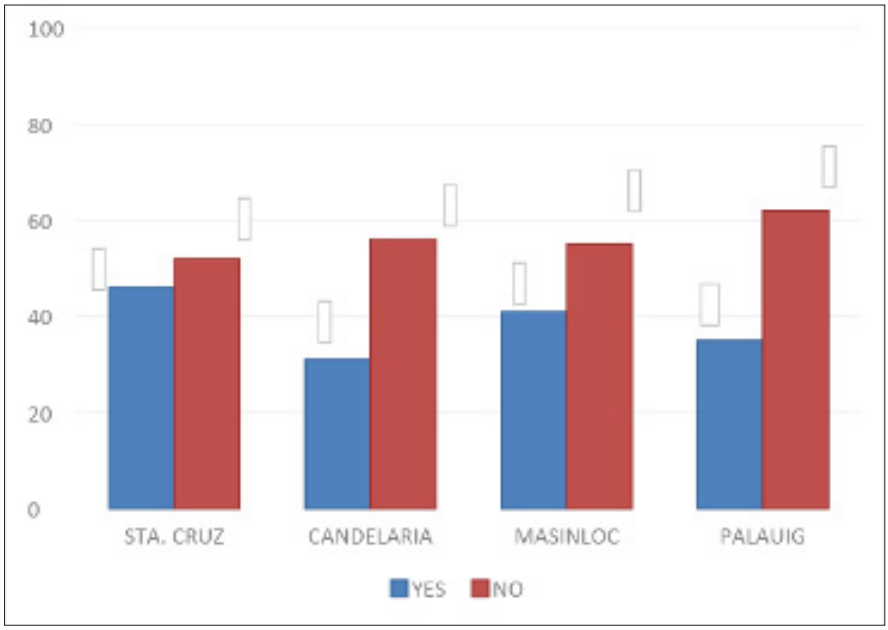
Figure 10. Causes of change in the appearance of seashore in the study areas

Perception on Coastline Changes of the Four Municipalities

An average of 38.25% of the residents of the four municipalities observed significant changes in the coastline's appearance, while around 56.25% did not see any variations (Figure 11). According to some of the respondents, major changes had happened in the aesthetic appearance of the coastline. For example, the coastlines are getting more polluted due to overpopulation and lack of discipline. Additionally, migrants from the islands of Visayas are

the most common occupants of the land along the sea of Sta. Cruz due to the increasing incidence of poverty in the Visayas.

Figure 11. Respondents' perception of the occurrence of changes in the the



coastline of the four municipalities

Causes of the Changes in Coastline Appearance

One hundred percent (100%) of the respondents regarded human activity as the leading cause and source of the problem of the changes that affect the coastline of the four coastal municipalities. Construction of houses and illegal settlements along the coastline without proper permission from the local governments is destroying the coastline's aesthetic appearance (Figure 12).

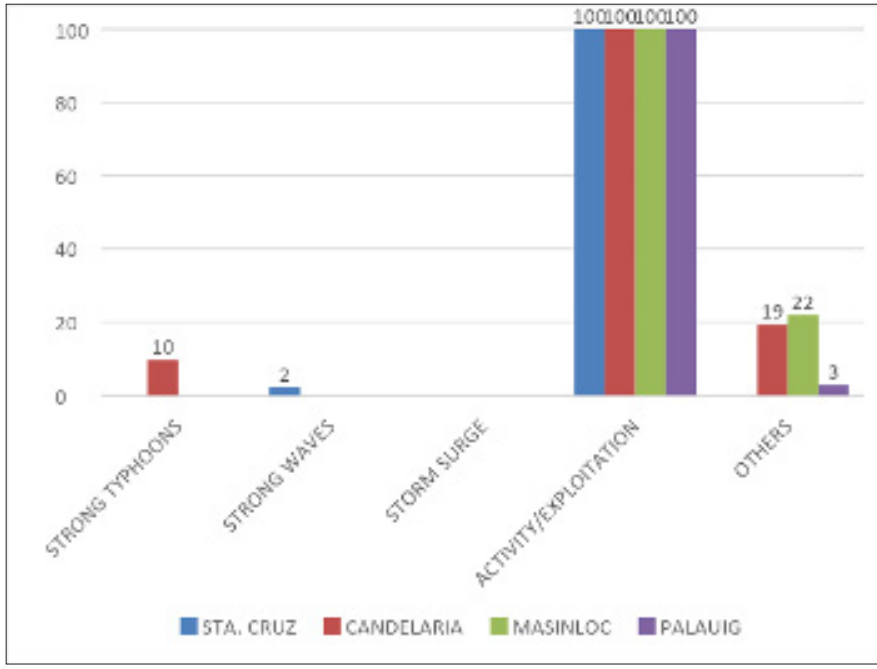


Figure 12. Causes of change in the coastline appearance of the study areas

Diminishing Coastal Resources as Perceived by Respondents

Figure 13 shows that respondents from all four municipalities perceived a dwindling number of fish populations, which confirms their perception of the change in the fish population in the four coastal municipalities, as shown in Figure 7—many fisher folks from Masinloc (79%), Candelaria (68%), Sta. Cruz (66%) and Palauig (57%) noted the decrease in the status of fishes in their areas. They observed that their catch is diminishing and may be attributed to the widespread collection and selling of *Aragan* or brown algae known to be the fish's food, deforestation of mangroves, depleted conditions of corals, illegal use of fishing gears and net techniques, and dynamite fishing. There is a divided view of the respondents from the four study areas concerning the abundance of seagrasses (Figure 14). There is an almost equal proportion of two views between those who observed the decrease of seagrass and those who did not observe the decrease of seagrasses within their areas, which corroborates their perception of the changes that occurred in seagrass ecosystems, as shown in Figure 5. However, a considerable number of unsure

or no answers were noticed, especially for Sta. Cruz (23%) and Palauig (17%) to mitigate the problem, the coastal communities of Palauig had replanted seagrasses in eight (8) hectares of land near the MPA area.

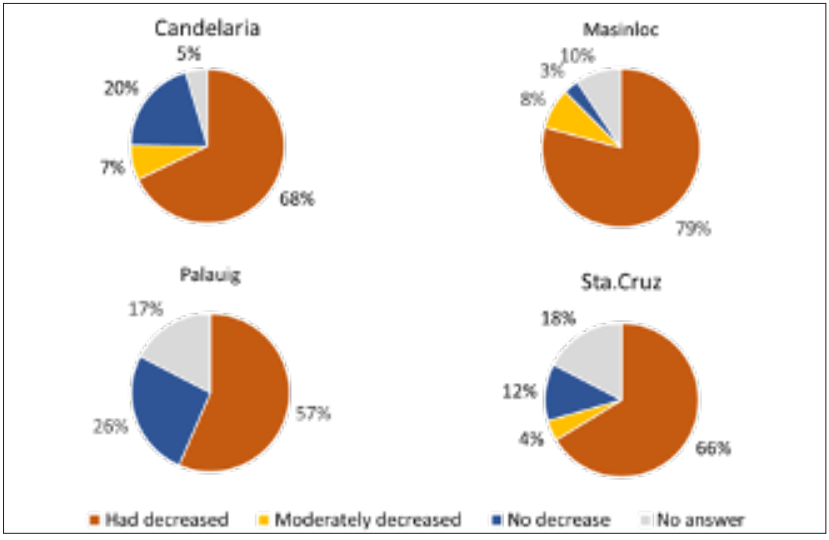


Figure 13. Perception on decreasing fish population per study area

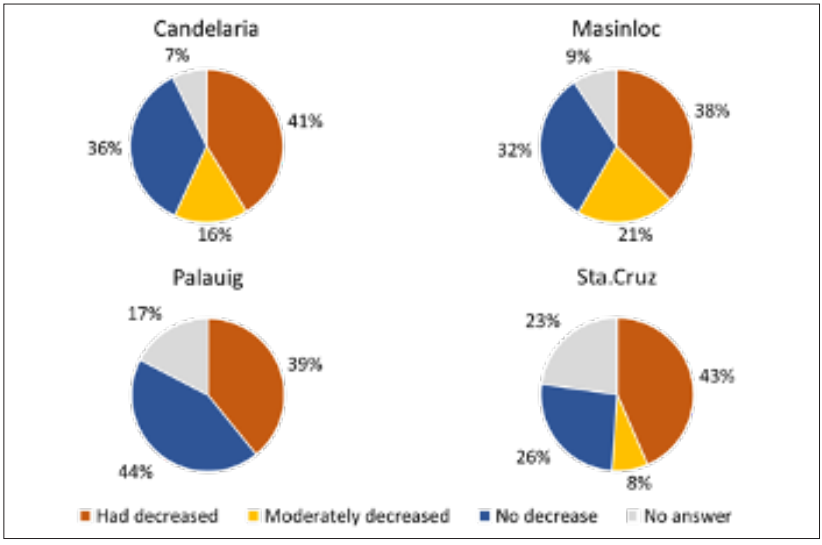


Figure 14. Perception on decreasing seagrasses per study area

Concerning mangroves, respondents from three out of four study areas observed a decrease in the abundance of mangroves within their coastal areas. Figure 15 shows that half of those interviewed (57%) in Candelaria and lower than 50% in Palauig declared no decrease in the abundance of mangroves which also corresponds to their perception of the changes in mangrove ecosystems, as shown in Figure 3. In contrast, respondents from three of the four municipalities, namely Sta. Cruz (43%), Palauig (39%), and Masinloc (38%) perceived a decrease in the abundance of mangroves within their areas. Similar observations were noticed in the condition of their corals, as shown in Figure 16. Thus, the status of the corals within these four municipalities had decreased considerably. Among the four municipalities, depleting conditions of coral reefs were observed by the respondents from Candelaria (51%), Sta. Cruz (46%), Masinloc (43%), and Palauig (35%) while moderately decreasing stages of coral reefs were seen in Palauig (43%), Candelaria (33%), Masinloc (26%), and Sta. Cruz (22%) (Figure 16).

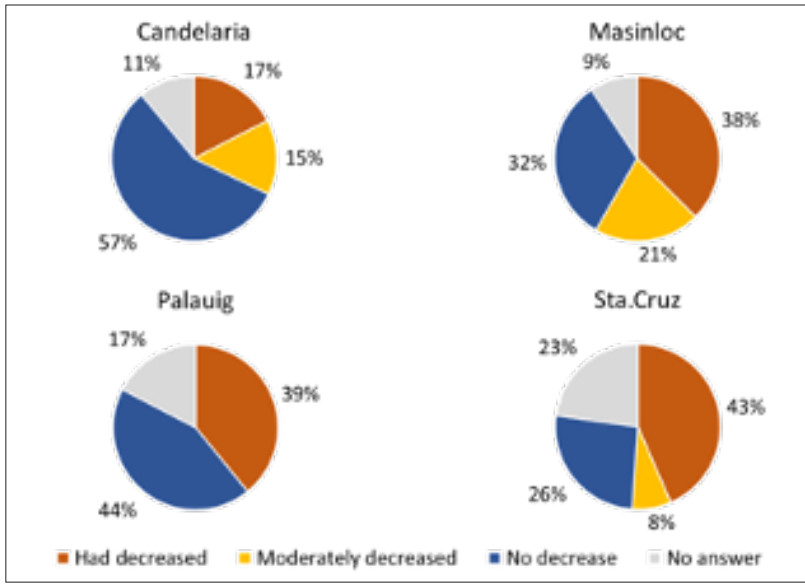


Figure 15. Perception on decreasing mangroves per study area

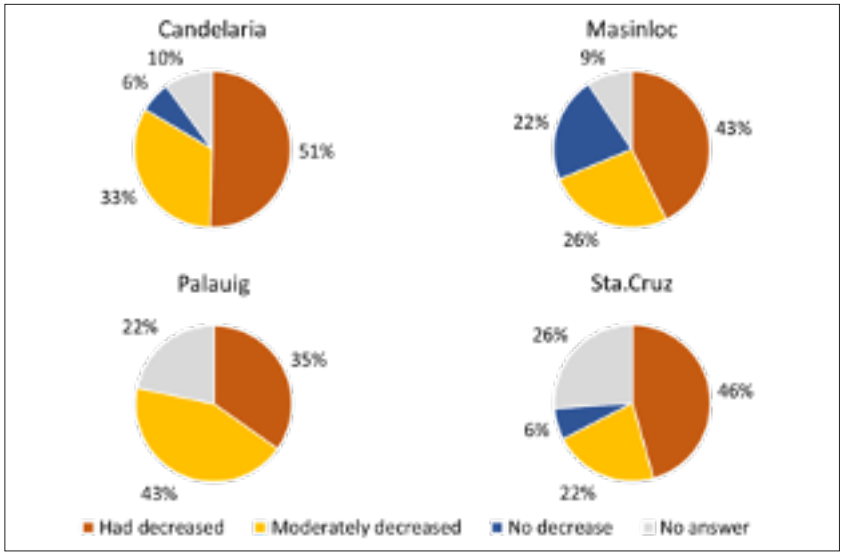


Figure 16. Perception on decreasing corals per study area

Traditional and Local Ecological Knowledge (LEK)

The study areas' traditional and local fishing practices are no longer strictly followed and adhered to by the fishers in the coastal areas in Zambales. For example, figure 17 shows that only half of those interviewed from Palauig (57%), Candelaria (55%), and Masinloc (55%), and only a few from Sta. Cruz (28%) followed and observed their old ways of fishing while some in modified ways.

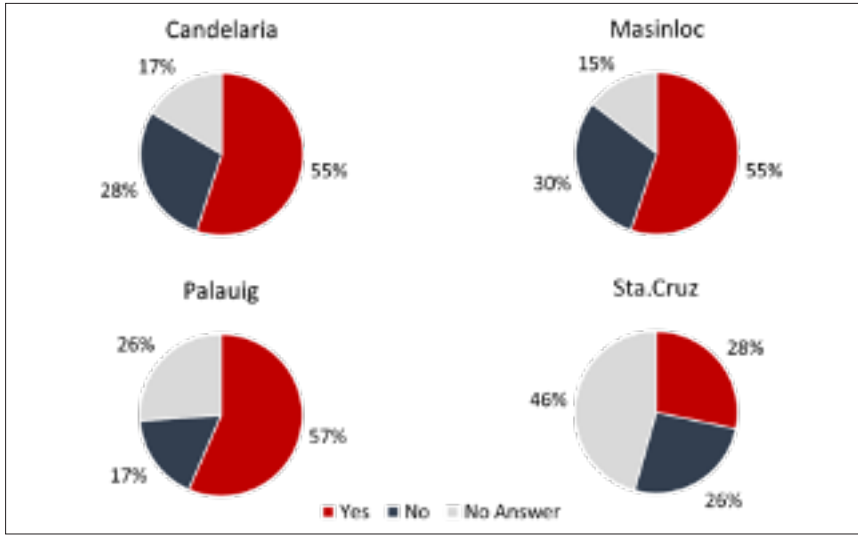


Figure 17. Adherence to the traditional fishing practice (LEK) per study area

According to Wagey et al. (2016), local fishers' indigenous ecological knowledge on the utilization of marine and coastal resources had contributed to sustainable fishing and gleaning practices. Local and indigenous ecological knowledge has been successfully passed on to several generations of fishers until recently, when fishing, as an occupation, becomes obsolete and most gears have been modified.

LEK on Fishing Practices

LEK on fishing practices was documented in the four coastal municipalities, as shown in Table 4. There were six (6) traditional fishing practices that the fisher folks in the four municipalities of Zambales are still following. Due to their long years of experience in fishing, the fishers have developed an extraordinary and uncanny way of knowing specific fish species behaviors.

LEK is essential and valuable in the fishing industry in the Philippines (Macusi et al., 2017). However, studies on fish behavior using Local Ecological Knowledge (LEK) are good complements where data is limited.

Table 4

LEK on Fishing Practices in the Four Coastal Municipalities in Zambales

Hila-hila and Kawil	• Used by some skilled fishers can determine without spotting what fish species is caught by the bait by simply determining the direction of the pull. • If the catch pulls the gear (*hila-hila*) downwards, and the pulling is strong, this is usually done by a tuna. • *Talakitok* pulls the bait (*hila*) up and down, left and right. Then, a *dorado* pulls the *hila* farther from the fishers.
Bingwit and Kawil	• Old fishers only used these baits made from specifically selected refined chicken's feather that resembles a small fish once it was submerged into the seawaters. • Old fishers poach fishes along the shoreline without using a fishing vessel. If boats are used, fishers paddle along the seashores and do not sail too far simply because fishes near the shorelines are abundant before. When motorized boats came into fashion, fishing went farther from the shoreline.
Kurong (Swing-like with cover)	• This is used when there is no ice box available. To keep the freshness of the catch, they will be tied to the side of the boat. When weighing scales were not popular, the fishes were placed in skewers based on size and shape.
Palubog	• It refers to an old technique of fishing where branches of leaves with the fine mesh of fishnets are placed below the river to catch a large number of small fishes.
Lambaklad	• It is a specific type of *"lambat"* or fishnet with a playground and bag that targets small fishes used in the open sea. They are usually set up during summer and are harvested in rainy seasons.
Singgapong	• This is a fishing gear used during February with the sporadic appearance of *"dilis"* and *"tirong"* for anchovies. This type of species thrives for 3-4 days only. Beyond this week, one has to wait for the next month to catch dilis using *singgapong*.
Other Fishing Practices	
Using lamps	• When out on a fishing expedition using a motorized boat at night, Coleman lamps used for lighting are not allowed to avoid being hit by the pointed snout of a swordfish called *"Batalay."* Once the body of a swordfish has been touched or stroked gently, it will weaken and tame.
Aragan (Brown Algae)	• It is food for fishes and is made into organic fertilizer. • However, they are also viewed as hindrances to fishing because they get stuck in the fishnets. Extraction of brown seaweeds or aragan is prohibited because they serve as refuge and hatchery for the eggs of the fishes.
Butete- fish similar to yabut-yabutan	• If its gallbladder erupts, it becomes poisonous when eaten. • These fish species are considered partners when caught: *Buto-bayog* and *Sarhento, Dumalariwan* and *Sabsabado, Taklaw* and *Padas* - small fishes caught in *"kawan"* or school of fishes.

Catching seaweeds, crabs, and squids	• Before, to catch seaweed, crabs and squids which hide inside stone holes of corals, stone beaches, and corals are crushed to get the prized species. Now, their stone habitats are no longer destroyed. Instead, collectors just use improvised sticks to pick on them.

Table 5 shows various fishing tools currently utilized by the respondents from the four municipalities of Candelaria, Masinloc, Palauig, and Sta. Cruz. Fishnets (*lambat*), fish hooks (*kawil*), lift net (*basing*) are commonly used among the respondents from the four municipalities. However, spear (*pana*) and fishing lure, bait, or jig (*bubo*) are still utilized by fishers from the municipalities of Candelaria, Masinloc, and Sta. Cruz.

Table 5

Fishing Tools Utilized Per Study Area in Zambales

Fishing tools utilized	Candelaria	Masinloc	Palauig	Sta.Cruz
Fish Net *(lambat)*	64	50	16	55
Fish hook *(kawil)*	24	19	4	7
Lift net *(basing)*	7	6	2	2
Spear *(pana)*	3	4		10
Fishing lure, bait, jig *(bubo)*	5	10		6
Others	6			3
No answer		7	1	9

Presently, the fishing practices being undertaken by the fisher folks are far more different from the traditional fishing practices. The commonly used gears for catching fishes were hook and line, squid jigger, and gillnet. However, based on the inventory of fishing gears used by the fishers in Northern Zambales in 2002, the following were the commonly utilized gears in the area: gillnet (53.91%), squid jigger (9.40%), longline (8.20%), spear gun (6.61%) and handline (5.90%) (Rueca et al., 2002). In 2017, the first five gears used in municipal water in terms of landed catch were multiple handline (29.80%), scoop net (17.87%), bagnet (16.47%), handline (12.69%), and hook and line (5.67%) (Table 6) (Yutuc et al., 2017). The municipal fishermen were spending 8-10 hours in the water to have an average catch of 49.51 kg.

Table 6

Type of Gear and Computed Catch Per Unit Effort (CPUE) of Gears Commonly Used in the Municipal Water of Zambales (NSAP-Zambales, 2017)

Gear	Landed Catch (kg)	No. of Days	CPUE (kg/day)
Multiple handline	142,869	5,318	26.87
Scoop net	85,671	3,182	26.92
Bagnet	78,961	1,493	52.89
Handline	60,832	3,709	16.40
Hook and Line	27,165	1,846	37.67
Push net	21,066	954	22.08
Jigger	14,847	515	28.83
Fish corral	14,096	56	251.71
Gillnet	9,942	389	25.56
Speargun	9,915	322	30.79
Drift gillnet	7,030	83	84.70
Multiple hook and line	5,277	426	12.39
Bottom gillnet	1,505	573	2.63
Trammel gillnet	173	4	43.25
Bottom set long line	65	5	13.00
Single handline	48	16	2.99
Long line	16	2	8.13
Fishpot	6	1	5.80

LEK on Fish Identification

Based on LEK, the fishers could identify and identify the fishes they caught in the coastal areas. (Table 7). Grounded on their long experience, the fishers stated that more fishes are caught in the aftermath of a storm because sea waters are murky or unclear. During March, the *Talakitok* and *Lapu-Lapu* are the fishes seldom caught in Zambales coastal areas.

Payao from a functionalist perspective is a traditional practice by fishermen, which promotes diversity as long as illegal dynamite fishing is not applied. This is helpful to fishers because various fishes are being caught in this practice. However, diminishing catch (50%) was observed by most

fishers due to overfishing and illegal fishing methods. Likewise, commercial fishers in Zambales stayed for an average of 36 hours in the water to have an average catch of 2,850 kg. Fishing was done using a combination of *payao* and purse seine. *Payao* is a fish aggregating device that serves as an attractant and home to pelagic fishes like tuna and tuna-like species. The aggregate of fish in the *payao* is being surrounded by purse seine to effect a catch. Results of the study were supported by Macusi et al. (2017) where they mentioned that using LEK, such as the anchored fish aggregating devices (FADs or *payao*), transformed the Philippine tuna fisheries into a million-dollar industry.

Table 7

LEK on Fish Identification

Burador and Bugihan	• *Bugihan* is female *borador* which are fatter than the male borador.
Samaral or Pitung	• Expensive type of fish species.
Tuna	• A deep-sea fish. During the day, it swims 60 feet down under
Tanigue, Dorado, Blue Marlin (Susay) and Talakitok	• Caught at daytime. • The fishing gear used to catch these species is *putong-putong* or *hila-hila* with an artificial squid as bait. • At night, they only float 20 feet below because their source of food which is the shrimp, also abound in the sea area. The fishing gear used to catch shrimps was an improvised waterproof light, hook & line gear called balikwasan dipped 20 feet below the sea surface.
Tanigue and Tuna	• Most fishers anticipate the "ber" months (October to December) because these are the months when the schools of large fishes are sighted and caught. However, the months of April and May are the months for coral fishes where fishers catch diverse fish species.
Yellow Fin Tuna or Baralyete	• Fishing or *"nagtitimbog"* is ideal for catching a yellow fin or *baralyete* if waves are large and high.
Stingray or Manta Ray (Pagi)	• When sighted jumping in the sea, large waves are expected to arrive. They served as a barometer or a warning sign for fishers not to proceed in their fishing expedition in the far seas.
Butete	• It is a type of fish which has no bones or *"tinik"* and is considered poisonous.
Talakitok and Lapu-lapu.	• They are rarely caught during March.

The local ecological knowledge is rich and varied among different communities considering their cultural, practices, and topography differences. Unfortunately, as expected, the fishers' knowledge, experiences, and traditional practices accumulated and passed on from one generation to another are infrequently considered by fishery scientists and coastal resource managers.

LEK on School of Fish

A school of fish is detected by seagulls or birds that sometimes dive in the seawater. Another way to identify a school of fish is a darkened area of the sea that looked like a cloud shadow. The occurrence of undercurrent is an additional way to find the school of fish. LEK was utilized to identify the behavior of marine organisms such as fish which was found to be important in fishing activities, particularly about attraction, retention, and departure behavior of fishes (Macusi et al., 2017).

LEK on Topography and Fishing

There are also traditional knowledge and practices documented about topography and fishing in Zambales (Table 8). Results of the study showed that the fishers were still practicing and following these traditions for their fishery resources management. In addition, typhoons, strength, and duration of the southwest monsoon (*habagat*) cloud features were also determined by the locals using LEK, which could be very helpful in their fishing activities (Wagey et al., 2016).

LEK on Predicting/Forecasting Weather Conditions Concerning Fishing Practices

Part of the local ecological knowledge is the uncanny and strange ability of the local fishers to detect bad weather by way of reading changes in wind direction, sounds, and height of waves (Table 9). The local fishers must preserve this traditional knowledge about the prediction of weather conditions for this information are very useful in the present-day situation,

especially that the Philippines is a vulnerable country to natural disasters and climate change impacts. Another scientist corroborates these findings in his study that in the Visayas region, local fishers, especially those accustomed to using the traditional gears, have developed skills to catch fish in the coastal resources amidst hardships brought about by the effects of extreme weather conditions (Wagey et al., 2016.)

Table 8

LEK on the Condition of the River and Ocean as Signs of the Presence of Fish in the Coastal Areas

Mouth of the River	
From December to January, the mouth of the river is silted with sand from the ocean.	• The mouth of the river, covered with sand, is brought about by the waves. As a result, an instant lake is formed. • This is the time when fishes and shrimps become abundant because they thrive in warm water. • The more the water within the river's mouth gets hotter due to the downflow of water from the mountains, the more shrimps tend to pool into the shallow area.
Low Tide Season	• Desiltation and the dredging of the water canal are scheduled during the low tide season to facilitate the release of warm water from the river's mouth. • Desiltation of the mouth of the river is done to reduce the water temperature, thereby reducing fishkill. • To catch shrimps, the fishers consider the low tide season as the best time. They go with the flow of the water where the traps with "housing" are strategically located.
Water Current	
If the water current from the north meets south	• This is believed to affect fish behavior. They tend to migrate to some other areas. Thus, fish catch is low because water becomes murky.

Table 9

LEK on Predicting/Forecasting the Weather Conditions to Fishery Resources and Fishing Practices in the Coastal Municipalities in Zambales

• If the force and sound of the waves are strong • If the sea turns foamy • If the wind from the north turns strong and if clouds move fast and turn dark	• A storm is expected to come. • Warning signs for not going out fishing
• If seagrasses stand erected • If seagrasses lie down flat on the sea bed	• On-set of the southwest monsoon (Habagat) in May • The weather is good for fishing
• If the sound known as "Balkak" can be heard from the mouth of the river	• Indication of bad weather condition
• The sighting of a smooth white fish called "Taburdik" in the sea	• It forewarns fishers of bad weather condition

LEK on Lunar Forecasting Concerning Fishing Practices

Table 10 shows the Local Ecological Knowledge (LEK) of fishers in the four selected coastal municipalities of Zambales on lunar forecasting with fishing practices and fishery resources in Zambales. Once again, the skills and talents in recognizing the moon's appearance, stages, and shapes are quite extraordinary. That is why this knowledge and information must be well-preserved and passed on to the younger generation.

Table 10

LEK on Lunar Forecasting about Fishery Resources in the Four Coastal Municipalities of Zambales

Moon and Squids	
Full Moon and New Moon	• Fishers don't fish squids; the best period to catch squids is when the moon is hidden for 9 to 10 days or two weeks.
Kiw-kiw or Pasiwasiw	• This is a fishing gear used to catch squids.
Jetplane Squids	• It is the most expensive and large type of squid due to its soft and juicy meat. This type of squid is usually collected at night when the moon is hiding. It is the hardest to catch squid species to catch because it is susceptible to sound and noise. Therefore, one has to exercise extreme caution when catching them.

Quarter Moon and Full Moon	
Quarter Moon and Full Moon	• Fishing offshore is avoided because storms or bad weather are expected to occur. • Huge waves appear due to the strong winds from the North. • Very few fishes are caught during the quarter and full moon because fishes hide or hibernate during this period.
New Moon Phase	• The following fish species are caught: *matang baka, bulan bulan* (*buwan buwan*), *dilis at tirong* (anchovies), tuna or *barilyete, sapsap, tanigue, alumahan.* • Red squids and *borador* (flying fish) are used as bait to catch deep sea fishes/big fishes like tuna and *tanigue.* • Blue Marlin (*Susay*), *Dorado* and *Batalay* (Sword fish) known as floating fishes are also caught during this season wherein fishes tend to swim along the shoreline. • Once the moon clears or gets brighter and is approaching the quarter moon, the following fish species are caught: tuna, rainbow-colored tail salmon, *talakitok*, white squids noted as one of the most expensive species that require the use of artificial bait called *"hulang-hulang"* to catch this species). • Fishers do not fish for *Singgapong* (anchovies or dilis) when on a full moon. Instead, they go out fishing for *singgapong* when the moon hides; the school of *singgapong* goes out and plays.
Moon and Its Ring	
Kubkob-Ring around the moon	• If the ring around the moon is dark, rains are expected to come. • If the ring around the moon has a smoke-like appearance, strong winds are expected to come. • If the ring shows a bluish effect, the extreme dry season is in the offing.

In the same study conducted by Wagey et al. (2016), local fishers in the Visayas region also practiced and used LEK in weather and lunar forecasting to determine disturbances in their fishing activities.

LEK on Rare and Diminishing Catch

Fish species that are seldom sighted and caught nowadays include *Tamban*, rainbow-tailed salmon, and *Bonitilyo* (a small type of bonito). Between the 1970s to 1980s, large crustaceans or *alimasag* were no longer caught offshore but along the shorelines only. *Banak* and *tabios* are known for their delicious type of fish but are rare to catch nowadays because they are sighted only from September to December. The *"bia/palya"* and *bunog* are believed to be the parent stocks of *banak* and *tabios*. The river currents draw their eggs into the sea where they are hatched. Once the fishes can swim, they go back to the river.

In various studies conducted on the relationship of LEK to fish catch, only the temporal and spatial patterns of fishery resource distribution are common. Furthermore, results showed that the integration of conventional fishing approaches with experiences accrued by fishers revealed a significant influence of seasonal and spatial dynamics of marine environmental factors, which caused higher fishing pressure in shallow and usually more deficient waters. Results also indicated the importance of having direct on-board observation not only to produce more realistic and detailed data but also as a way to confirm the factors that hamper fishing operations. Once established, the accuracy of LEK may be used to gather a set of reliable information for fisheries management through well-structured interviews capable of quickly revealing ecological patterns of target species. Therefore, translating LEK into an accessible language to scientists is also an important step to achieve its integration into management and provide a more holistic and more realistic understanding of fishing. Specifically, the fishing patterns observed in areas less exploited due to environmental limitations are essential in fishing zone selection for the management of fishing bottom set gillnet and prevent the emergence of ghost nets caused by the loss of nets seabed that continue killing marine organisms indefinitely. These patterns need to be further investigated by joining fishers and landing observations over large spatial and temporal scales. Besides, additional research should use LEK to identify other environmental limiting factors on fishing effort and production used as stepping stones to management. The results also confirmed that fishers detain an essential body of knowledge that could support faster and more affordable management initiatives. Moreover, fishers could certainly contribute with additional information where there are no official statistics. As science advances, it becomes clearer that fishers can enhance our understanding of marine ecosystem dynamics and of fisheries in general, which is not easily or cheaply achieved solely by conventional approaches (Pinheiro et al., 2017).

LEK on Mangrove Resources

Table 11 shows the LEK about the presence and abundance of organisms in mangrove ecosystems. Mangrove ecosystem also provides important ecological and economic services in the fishery resources and management in the coastal ecosystems of Zambales.

Table 11

LEK on the Presence and Abundance of Organisms in Mangrove Ecosystems

Invertebrates (Crustaceans, gastropods, Univalves, and Bivalves)	• Diverse fish or aquatic species are collected from mangrove forests such as shrimps, *alimunga, laguy-laguy, bagsang, giwoy, kopoy-kopoy* (white clam shells), *tubing-tubing, lokan* (white clam shells bigger than *kopoy-kopoy*).
Crabs	• Usually found in between the holes of the mangroves. Fishers have this special skill of determining whether there are crabs inside the holes by listening to the sounds emitted from the holes. • The crab trap or tapangan, which is made out of bamboo, is used to catch crabs. The right timing to catch is during high tide. Crabs get out of their hiding place in these holes, searching for food when the weather cools down. • *Dulag* is one type of mangrove eaten by crabs.
Lukaw	• Collecting shells (*Lukaw*) – a small clam or kabibe. Local folks have the skill of picking on them if the lips are slightly opened, and bubbles are sighted out of the clam's lips.
Teyaila	• *Teyaila* is likewise collected from mangroves along with the land area. *Teyaila* hides in holes covered with a mound of earthworms' waste. *Teyaila* resembles a shrimp with an oversized head and pincers (claws).

LEK on Biodiversity Conservation

Results revealed some local ecological knowledge about biodiversity conservation practiced by the fishers in the coastal areas of Candelaria, Masinloc, Paluig, and Sta. Cruz (Table 12) but assessing these documented practices being done by the local fishers, most of these are current practices that need to be implemented by them for these are included in the fishery and environmental laws and policies.

Table 12

LEK on Biodiversity Conservation in Coastal Resources

Fishing Practices	• Small fishes are released back to the sea if caught. • Prohibit dynamite fishing or *buli-buli* • Avoid using fine-meshed nets • Inhibit oneself from doing illegal fishing practices • Heighten vigilance against illegal fishing • Prohibit fishing inside the sanctuary

Biodiversity Conservation Efforts	• Get involved in any organization or *Bantay Dagat* with advocacy on marine life conservation. • Assist in the construction of *rama* or artificial reefs • Forbid throwing of garbage or wastes into the sea and river. • Participate in the clean-up activities of the rivers and coastlines • Prohibits bio-prospecting, live fish collection, brown seaweeds or *aragan* extraction, and other sediments and pebble materials for aquarium near the Sanctuary area.

Findings of this study indicated that the local ecological knowledge (LEK) in fishing practices and coastal and fishery resources in the coastal municipalities of Zambales are now very scarce, and only a few fishermen are familiar and well informed of this traditional knowledge. Furthermore, it seems that these practices are already being modified, revised, and converted by the younger generation of fishers. However, these knowledge systems and practices are at an escalating rate of deterioration due to consistent assimilation and integration of various information that resulted from the continuing loss of interest in these practices from young fisher folks. In addition, many communities face tremendous cultural, economic, and environmental changes, contributing to the decline and eventual loss of their local knowledge base. In the face of profound and ongoing environmental changes, cultural and biological diversity and the coastal and fishery resources are likely to be severely impacted, and local resilience capacities from this loss of traditional and local ecological knowledge.

LEK is very imperative in the fishing practices of fisher folks, for fishing serves as their main livelihood and important for coastal and fishery resources management. LEK presents many options to governments, scientists, practitioners, and local communities to approach different management practices in coastal and fishery resources. Traditional knowledge is essential and crucial in planning for community development, indicating that traditional knowledge can be used as a planning tool by local communities (Mutasa, 2015). LEK provides information, awareness, and discernment that match science and environmental observations, which can also give a complete understanding of the interrelationships of the various components of the ecosystem/ environment, natural resources, and culture, including the human interaction among these constituents (Galloway-McLean, 2010; Nakashima et al., 2012; Tauli-Corpuz et al., 2009; Cook et al., 2014). Likewise, LEK is important for the information that can be transmitted to other

communities with related sites and conditions (Shaw et al., 2008). It involves community participation and empowers local communities. Also, it provides valuable information and knowledge about the local situations; its non-formal means of dissemination and broadcasting can serve as a model for learning about coastal and fishery management, which is crucial in Zambales coastal resources.

Moreover, the local knowledge and information developed through local community experiences over centuries passed orally from generation to generation were an important catalyst to sustainable development due to their direct connection to resource management and conservation (Donato-Kinomis, 2016). Thus, empirical evidence to showcase the importance of environmental protection and cultural preservation is encouraged. Likewise, studies connecting these indigenous knowledge and practices to the academic curriculum are highly regarded as influential in their preservation. Hence, if LEK is an information source of species, ecosystems, and practices held by ancestral cultures that interact with ecosystems for their benefit and livelihood daily, over long periods (Berkes et al., 2000), then LEK can potentially be a tool for coastal resources and fishery resources management and biodiversity conservation. This can also inform scientific approaches to management, either as a source of baseline data to fill information gaps that cannot otherwise be addressed or to provide alternative management approaches from which scientists and managers might learn (Schafer & Reis, 2008; Rist et al., 2010).

Moreover, fishers with intimate ecological knowledge of local conditions can appreciate the problems associated with overexploitation and are likely to feel that the resource should be managed for sustained harvest rather than for short-term gain (Ostrom, 2009). Accordingly, LEK could be a potential holistic management tool and approach in dealing with coastal resources and fishery resources management (Berkes et al., 2000, 2001). Therefore, LEK involvement and influence on coastal and fishery resources management must be observed more keenly and profoundly and with founded focus and attentiveness.

CONCLUSION

There was already a decrease in fish population in the coastal and fishery resources as perceived by most fishers in the coastal areas of Zambales. There

were no changes in the mangrove and seagrass ecosystems, but less than half of them observed that the seashore and coastline aesthetic appearances had been destroyed. Most of them alleged that the main reasons for these problems are human activities and overexploitation.

The local ecological knowledge (LEK) is still rich and varied among the different coastal communities considering their differences in culture, practices, and topography. The coastal fisheries considered LEK as very essential in their fishing practices. Thus, most of the documented LEK and information were focused on fishing practices and ways to look, find and catch fish and other marine organisms in coastal and fishery resources for fishing serve as their main livelihood and vital for their fishery resource management. Local Ecological Knowledge (LEK) in fishing practices and coastal and fishery resources in the four municipalities in Zambales are scarce, and only a few fishermen are familiar and well informed of this traditional knowledge. It seems that these practices are now being modified, revised, and converted by the younger generation of fishers. These traditional knowledge, systems, and practices are at intensifying rates of decline due to the continuing loss of interest of the young fisher folks.

In the face of profound and ongoing environmental changes, cultural and biological diversity and the coastal and fishery resources are likely to be severely impacted as well as local resilience capacities from this loss of traditional and local ecological knowledge. Hence, if LEK will continue to be harnessed, adapted, and practiced by the local fishers in the coastal areas, this could be a potential holistic management tool in conserving fishery and coastal resources in the changing environmental conditions.

RECOMMENDATIONS

The following are the recommendations deduced from the results: a) promote and utilize LEK related to coastal and fishery resources conservation and for marine protected area (MPA) management; b) strengthen inter-agencies joint efforts for coastal resource management; c) establish community-based coastal marshals along with coastal communities as an auxiliary force to reinforce the Bantay Dagat against illegal fishing; d) work for the regeneration of disturbed coastal ecosystems; e) conduct massive IEC campaign drive with Marine Biodiversity Conservation and preservation of

LEK about coastal and fishery resources management; f) increase capacity building of the MPA team on MPA management and provide continuous incentives to the MPA team; g) strict enforcement of "No fishing zone," "No Take Zone" and "For Your Eyes Only" inside the MPA.

It is further recommended that fishery scientists and conservationists consider local ecological knowledge (LEK) in coastal resource management, local conservation efforts, and policy formulation.

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A Modified Method for Dextrin-capped Gold Nanoparticle Synthesis

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Dextrin methodology is an aqueous alkaline chemical process for gold nanoparticle (AuNP) synthesis that takes eight long hours of reaction. A modified procedure is hereby described to simplify the procedure and equipment, and reduced the reaction time to only one hour. The key features of the modified protocol are the reversal of the addition of reagents in the original dextrin protocol and the increase of reaction temperature. Optimum synthesis was achieved by sequential neutralization of 50 mL of 2 mM $HAuCl_4$ with 0.5 mL of 10% Na_2CO_3 and alkaline reduction using selected volumes of 25 g/L dextrin. The AuNPs produced were monodisperse based on dynamic light scattering (DLS) measurements. The surface plasmon resonance band ranged from 517 to 520 nm indicating spherically-shaped AuNPs. High resolution transmission electron microscopy (HRTEM) further confirmed the spherical shape with average sizes from 7.3 ± 1.1 to 18.9 ± 1.5 nm, depending on the volume of dextrin. Chemical reactions are hereby proposed to explain the chemistry of AuNP formation based on the alkaline reduction of $[AuCl_4]^-$ complex with dextrin as the reducing agent.

Keywords: dextrin, gold nanoparticles, high resolution transmission electron microscopy

INTRODUCTION

Among the noble metal nanoparticles, AuNPs have stimulated tremendous research in the field of biosensors due to their unique optical properties, biocompatibility, and their relatively simple preparation and modification

(Holzinger, Le Goff, & Cosnier, 2014). AuNPs can be prepared by different techniques such as laser ablation (Sylvestre et al., 2004), photo-reduction, γ-radiation, and chemical syntheses (Alzoubi, et al., 2015).

Chemical syntheses are mainly based on the reduction of $HAuCl_4$ in the presence of a stabilizing agent (Tiwari et al., 2011). Various methods have been developed for the "bottom up" chemical synthesis of AuNP. The Turkevich and the Brust methods are two common techniques for the chemical synthesis of spherical AuNPs. The increasing interest in AuNP research has paved the development of many other chemical methods like synthesis mediation by homopolymer (Zhou et al., 2009), the use of carbon dioxide (Young et al., 2011), carbohydrates (Compostella et al., 2017), and AuCl (Lu et al., 2008). Other published works involved modifications of standard methods to improve techniques, enhance biocompatibility, provide better size control, or for a greener alternative (Zabetakis et al., 2012).

Dextrin methodology was a novel work of the Nano-Biosensors Laboratory, Michigan State University, Michigan, USA. It was developed to provide a greener alternative to the Turkevich method. This method involves synthesis in an alkaline aqueous condition and generates dextrin-capped AuNPs (Anderson et al., 2011). Dextrin-capped AuNPs were reportedly applied in biosensing studies which included AuNP-based biosensors for the detection of *Mycobacterium tuberculosis* (Torres-Chavolla & Alocilja, 2011), dengue-3 virus (Contreras et al., 2016), and unamplified DNA sequence from *Pseudoperonospora cubensis* (Baetsen-Young et al., 2017). Although the dextrin-capped AuNP has shown versatility in some biosensing applications, its synthesis needs improvement because the initial steps involved pH adjustment that are tedious, and the reaction takes eight long hours to complete.

This research aimed to modify the standard dextrin synthesis procedure to improve the method. The modified synthesis conditions such as temperature, amounts of Na_2CO_3, $HAuCl_4$, and dextrin were optimized. UV-Vis spectroscopy, HRTEM, and DLS were used to characterize the morphology, stability, dispersity, and sizes of the dextrin-capped AuNPs.

MATERIALS AND METHODS

Gold (III) chloride trihydrate ($HAuCl_4 \cdot 3H_2O$) and sodium carbonate (Na_2CO_3) were purchased from Sigma-Aldrich. Dextrin $(C_6H_{10}O_5)n$ was purchased

from Fluka Analytical. Hydrochloric acid (HCl) and nitric acid (HNO_3) were purchased from EMD Millipore. All chemicals were of analytical grade, and all aqueous solutions were prepared using Type I water (≤18.2 MΩ cm) from Direct-Q3 Water Purification System. All glasswares used during synthesis were cleaned with aqua regia (3HCl:HNO_3), rinsed 10 times with Type I water, and dried for 30 minutes in an oven at 120°C. All magnetic bars were soaked in aqua regia and rinsed several times with Type I water.

Modified Synthesis of AuNP

All syntheses were carried out such that the total volume of all reactants (20 mM $HAuCl_4$, 10 % w/v Na_2CO_3, 25 g/L dextrin) and water, combined together, was 50 mL. A volume of 24.5 mL sterile water was measured and placed into a 125-mL Erlenmeyer flask. Volumes of 5 mL $HAuCl_4$, 0.5 mL Na_2CO_3, and 20 mL dextrin solutions were added sequentially with swirling of the flask every after addition. The flask was wrapped in aluminum foil and placed on the pre-heated isotemp hotplate/stirrer (Fisher Scientific). All syntheses were performed at constant stirring speed of 525 rpm. At the end of one hour, the mixture was continually stirred for five minutes with the heater off, and then set aside to finally cool down to room temperature. The same procedure was used to separately synthesize AuNPs from different reactant mixtures containing constant 5 mL $HAuCl_4$ and constant 0.5 mL Na_2CO_3 with varied volumes of water (i.e., 34.5, 39.5, and 42 mL) added with 10, 5, and 2.5 mL of dextrin, respectively. The AuNP product was characterized and stored at 4°C.

Optimization of Synthesis Conditions

Optimum synthesis conditions were investigated by evaluating the effects of Na_2CO_3, hotplate temperature setting, $HAuCl_4$, and dextrin. In finding the effect of the volume of Na_2CO_3, reaction mixtures containing constant 5 mL $HAuCl_4$ were neutralized with varied volumes (0.1, 0.25, 0.4, 0.5, 0.6, 0.7, and 1.0 mL) of Na_2CO_3 and reduced with constant 5 mL dextrin, at constant hotplate settings of 150°C. The optimal volume of Na_2CO_3 is that which produced stable colloidal gold. To evaluate the effect of temperature, each of the reaction mixtures containing constant 5 mL $HAuCl_4$ was neutralized with optimal volume of Na_2CO_3 and reduced with 5 mL dextrin at different hotplate temperature

settings (i.e., 100, 120, 130, 140, and 150°C). To evaluate the effect of dextrin, constant 5 mL of $HAuCl_4$ was neutralized with optimal volume of Na_2CO_3 and reduced with varying volumes of dextrin (i.e., 2.5, 5, 10, and 20 mL) at constant hotplate settings of 150°C. To evaluate the effect of $HAuCl_4$, different volumes of $HAuCl_4$ (i.e., 1, 2.5, 3, 4, and 5 mL) were neutralized with 0.1, 0.25, 0.3, 0.4, and 0.5 mL Na_2CO_3, respectively, and were reduced with constant 5 mL dextrin at constant hotplate setting of 150°C.

Characterization of AuNP

The UV–Vis absorption spectra of AuNP were obtained using NanoDrop™ 1000 and One Microvolume UV-Vis Spectrophotometers by Thermo Scientific. The size distribution was evaluated using DLS measurements conducted on a Zetasizer-Nano ZS. A 90° scattering angle, 25 ± 0.1°C temperature, and a refractive index of 1.4 were considered for all samples during DLS measurements. Particle sizes were obtained from HRTEM and TEM images. HRTEM imaging was performed on JEM-2200FS analytical electron microscope equipped with a 200kV field emission gun (FEG) and in-column energy filter while TEM imaging was performed on JEOL JEM-100CX II operated at 100kV. The AuNP synthesis, UV-Vis spectroscopy, and DLS works were done at the Nano-Biosensors Laboratory, Michigan State University, USA. Both HRTEM and TEM works were done at the Center for Advanced Microscopy, Michigan State University, USA. AuNP mean diameters were calculated using ImageJ software developed at the National Institutes of Health (NIH) (Maryland, USA) available online in the public domain.

RESULTS AND DISCUSSION

The differences between the standard and the modified methods are presented in Table 1. The latter is an inverse synthesis protocol of the former. It is assumed that the inverse protocol involved three stepwise processes, which are neutralization, speciation, and redox reaction. In the first step, the addition of Na_2CO_3 to the mixture containing only water and $HAuCl_4$ facilitated the neutralization reaction between $HAuCl_4$ and Na_2CO_3. In the second step, the Na_2CO_3 exceeding neutralization caused the speciation of gold (III) ions into the forms of $[AuCl_{4-n}(OH)_n]^-$ complexes where n increases from 0 to 4 as alkalinity

increases. The addition of dextrin in the last step facilitated the alkaline redox reaction between speciated gold (III) ions and dextrin. The addition of dextrin at the last step ensures that the alkaline condition of the reaction mixture can drive the equilibrium towards opening of the hemiacetal rings in the oxidizable ends of dextrin. The facilitation of the stepwise neutralization, speciation, and subsequent reduction explains the increased reproducibility of successful AuNP synthesis in the modified method compared to the standard method.

The reduction of the synthesis time was attributed to the increased temperature of the reaction mixture. As shown in Table 1, the modified method attained a 91°C reaction temperature while the standard method attained only 50°C. It is a general fact that an increase in temperature increases the reaction rate of most of the reactions. This study identified that an increase in reaction temperature was necessary for the $HAuCl_4$-dextrin system of AuNP synthesis because while dextrin can undergo oxidation under basic medium, the increase in pH drives the speciation of $HAuCl_4$ to $[AuCl_{4-n}(OH)_n]^-$ complexes. It was reported that at pH higher than 6.2, the reactive $[AuCl_3(OH)]^-$ were converted to less reactive $[AuCl_2(OH)_2]^-$ and $[AuCl(OH)_3]^-$ complexes (Ji et al., 2007).

Table 1

Differences between the Standard and the Modified Method

Parameters	Standard method	Modified method
pH adjustment step	Required	Not required
Protocol	Water	Water
	Dextrin	$HAuCl_4$
	$HAuCl_4$	Na_2CO_3
	Na_2CO_3	Dextrin
	pH 9 water	
Heating equipment	Hybridization oven shaker incubator Model 136400 Boekel Shake N' Bake	Isotemp hotplate/stirrer (Fisher Scientific)
Temperature setting of heating equipment	50°C	150°C
Highest temperature attained during reaction	50°C	91°C
Stirring speed	100 rpm	525 rpm
Heating time	8 hours	1 hour

Formation of AuNP

The first step in characterizing the formation of AuNP is through visualization of the color of the reaction product. The red color serves as a pointer for a good quality AuNP. In the standard dextrin system, after 8 hours of heating and agitation in the hybridization oven, the reaction product appeared as a red solution (Anderson et al., 2011).

In the modified synthesis system, when 24.5 mL water was combined with 5 mL 20 mM $HAuCl_4$, the initial yellow color of $HAuCl_4$ became lighter because of the dilution effect. Upon the addition of 0.5 mL Na_2CO_3, the yellow color slowly faded. With the addition of dextrin and swirling, the fading of the yellow color continued. Upon heating, the following series of color change was observed: from very light yellow to grey color that became darker with time, then grey-purple, and finally ruby red. The formation of ruby red color for colloidal gold is consistent with previous reports (Anderson et al., 2011; Zeng et al., 2011). Figure 1 shows the UV-Vis absorption spectra of AuNP by modified method (trial M) compared to the standard method (trial S). Inset of Figure 1 are photo images of reaction products with comparable ruby red color. Both trials M and S were produced from the same reactant compositions of 5 mL $HAuCl_4$, 0.5 mL Na_2CO_3, and 20 mL dextrin.

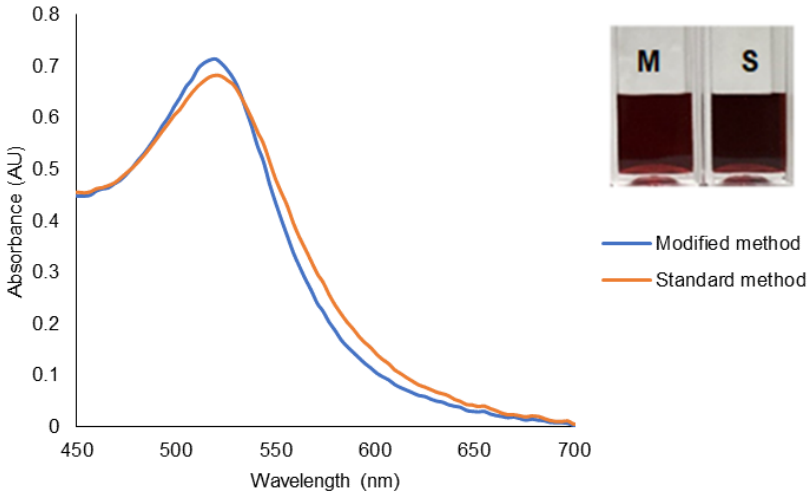

Figure 1. UV-Vis absorption spectra of AuNPs by the modified method (trial M) compared to that of the standard (trial S) (Inset shows vials M and S with comparable ruby red color.)

The spectra of trials M and S as shown in Figure 1 exhibit the same UV-Vis absorption peaks at 520 nm attributed to the surface plasmon resonance (SPR) (Ansari et al., 2015). The similarity in 520 nm maxima (λ_{max}) of trials M and S explains the similarity in their color, and further suggests that both trials were spherical in shape. Colloidal solutions of spherical AuNPs are red with the SPR band centered at 520 nm (Baptista et al., 2008).

It is noteworthy that the spectral band of trial M was narrow compared to trial S. Narrow SPR band indicates homogeneous gold nanoparticles (Goeken, Subramaniam, & Gill, 2015). By comparison, the spectra of trial M showed a higher peak than that of trial S. According to Beer-Lambert Law which governed molecular spectroscopy, the concentration of the absorbing analyte is linearly related to its absorbance (Skoog et al., 2007). From Figure 1, it can be concluded that synthesis by the modified method yields higher concentration of AuNP compared to that of the standard. Higher absorbance implies higher concentration (Ngo et al., 2016) and therefore higher yield (Jia et al., 2012).

Chemistry of AuNP formation

The chemical reactions involved in the modification are hereby proposed where dextrin served both as reducing and capping agent. These reactions in aqueous solutions are given in equations 1-3.

$$CO_3^{2-} + H_2O \rightarrow HCO_3^- + OH^- \quad (1)$$

$$HAuCl_4 + OH^- \rightarrow AuCl_4^- + H_2O \quad (2)$$

$$3R\text{-}CHO + 2Au^{3+} + 9OH^- \rightarrow 2Au^0 + 3R\text{-}COO^- + 6H_2O \quad (3)$$

Dextrin is a low-molecular weight polysaccharide of D-glucose molecules produced by partial hydrolysis of starch (White, Hudson, & Adamson, 2003), and each end of the polymeric chain contains a terminal reducing moiety (Silva et al., 2014). This reducing end is the cyclic hemiacetal ring that can open in aqueous solution to give the reactive aldehyde (CHO) functional group under basic medium. Dextrin with open aldehyde group (RCHO) can be oxidized to carboxylic acid (RCOOH), which in basic medium exists as carboxylate ion ($RCOO^-$). The oxidation of dextrin provides the electrons that reduce the

gold (III) ions to Au^0. The negatively charged carboxylate ion also serves as the capping end of dextrin that stabilized the colloidal gold.

During the synthesis, when Na_2CO_3 was added, hydration produced hydroxyl ions (OH^-) as indicated in Eq. 1. This explains the increase in pH upon addition of Na_2CO_3. A 50 mL reaction mixture containing 5 mL of $HAuCl_4$ and 5 mL dextrin had a pH of 2.80 which increased to 3.76 with added 0.1 mL Na_2CO_3. The pH value showed a further increase as the added volume of Na_2CO_3 increased. Similar reaction mixtures with 0.25 and 0.6 mL of Na_2CO_3 produced pH values of 6.81 and 10.08, respectively.

The OH^- ions served two functions. Firstly, to neutralize $HAuCl_4$ (Eq. 2) and secondly, to provide alkaline redox medium (Eq. 3). Although gold (III) does not exist as bare ion in aqueous solution but rather as a complex, it is represented as Au^{3+} in Eq. 3. This is to show the stoichiometry of the redox reaction and, more importantly, that it was because of the speciation of gold (III) precursor. Gold (III) precursor from $HAuCl_4$ can exist in the forms of $[AuCl_4]^-$, $[AuCl_3(OH)]^-$, $[AuCl_2(OH)_2]^-$, $[AuCl(OH)_3]^-$, or $[Au(OH)_4]^-$, depending on the pH of the solution (Polte et al., 2010). In aqueous solution, $[AuCl_4]^-$ undergoes hydration which in turn acts as a weak acid forming $[AuCl_{4-n}(OH)n]^-$ where n increases from 0 to 4 as alkalinity increases. In highly alkaline solution, gold (III) can be precipitated as $Au_2O_3.3H_2O$ or $Au(OH)_3$ (Nicol, Fleming, & Paul, 1987). In their work on Turkevich method mechanism, Ketteman et al. (2016) presented a pH dependent speciation graph of 0.25 mM $HAuCl_4$ which showed the shift of the gold (III) precursor from $[AuCl_4]^-$ to $[Au(OH)_4]^-$ with increasing pH. The said graph illustrates the dominance of $[AuCl_4]^-$ at pH 2.6 - 5, and the shift to $[AuCl_{4-n}(OH)_n]^-$ (with n = 1-3) at pH 5.6 - 6.8 and finally to a mole fraction of 1 for $[Au(OH)_4]^-$ at pH 10 (Kettemann et al., 2016). Among the gold (III) species, $[Au(OH)_4]^-$ is the most stable (Nicol et al., 1987) and has the lowest tendency to be reduced due to its lower reduction potential (Young et al., 2011).

In the present study, stable red AuNPs were produced from reaction mixtures that contained sufficient amount of OH^- ions for both neutralization and alkaline reduction reactions. This was empirically determined to range from pH $\geq$ 9.07 to $\leq$ 9.88. This finding is in agreement with the required pH 9 in the standard protocol (Anderson et al., 2011). The importance of this pH 9 requirement can be deduced from the synthesis results of two trials AO and AO-2. Both AO and AO-2 were synthesized from constant 1 mL $HAuCl_4$ and constant 20 mL dextrin. Trial AO with pH 8.21 gave a pink colored reaction

product while a repeated trial AO-2 with increased volume of Na_2CO_3 gave a pH of 9.64 and produced stable, red colored synthesis product.

Optimization of Reaction Conditions

Effect of Na_2CO_3. Figure 2 shows the UV-Vis spectra of reaction products synthesized at constant 5 mL $HAuCl_4$ and constant 5 mL dextrin at varied volumes of Na_2CO_3 (i.e., 0.1, 0.25, 0.3, 0.4, 0.5, 0.6, 0.7, and 1.0 mL). The inset photo of Figure 2 shows products from the different reaction mixtures. Reaction mixture with 0.1 and 0.25 mL Na_2CO_3 produced yellow and bluish solutions, respectively. Although reaction mixture with 0.3 mL Na_2CO_3 produced red solution, the colloidal gold was considered unstable because color separation was observed upon standing. Reaction mixtures with 0.4 and 0.5 mL Na_2CO_3 produced dark red solutions that remained stable even after several months. Synthesis mixtures with 0.6 and 0.7 mL Na_2CO_3 produced black-purple mixture while that with 1.0 mL produced colorless liquid with brown-black precipitate. Based on results, the optimal volumes of Na_2CO_3 were found to be 0.4 and 0.5 mL. Synthesis mixtures with <0.4 or > 0.5 mL Na_2CO_3 did not produce stable red colloidal AuNP.

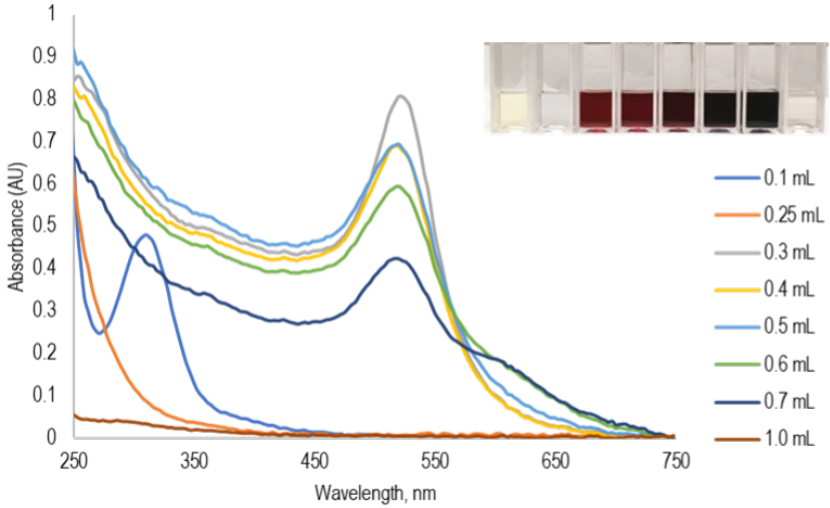

Figure 2. Spectra of AuNP synthesized at constant 5 mL $HAuCl_4$ and constant 5 mL of dextrin with varied volumes of Na_2CO_3 (0.1, 0.25, 0.3, 0.4, 0.5, 0.6, 0.7, and 1.0 mL) (Inset are photo images of corresponding reaction products at indicated Na_2CO_3 volumes from left to right.)

The effect of Na_2CO_3 volume on AuNP formation can be deduced from their corresponding UV-Vis spectra in figure 2. Reaction mixture containing 0.1 mL Na_2CO_3 with a pH value of 6.81 was a case of insufficient OH^- concentration for neutralization and none for alkaline reduction reaction. Its spectrum shows a peak at λ 313 nm with 0.479 AU attributed to unreacted $HAuCl_4$. A 2 mM $HAuCl_4$ solution gave 0.633 AU at the same wavelength. The $HAuCl_4$ aqueous solution exhibited UV-Vis absorption peak at 313 nm due to metal-to-ligand charge transfer (King et al., 2015) assigned to $p\sigma \rightarrow 5dx^2y^2$ ligand-metal transition (Kettemann et al., 2016).

Reaction mixture containing 0.25 mL Na_2CO_3 with a pH value of 6.81 is a case of sufficient OH^- concentration for neutralization but none for alkaline reduction reaction. The absence of needed OH^- for alkaline reduction explains the failure of AuNP formation. Its spectrum lost the 313 nm peak but did not show peak at 520 nm. Instead, it exhibited a steep descending band starting from λ 250 nm with 0.614 AU, sloping down to λ 307 nm with 0.094 AU and runs horizontal thereafter. This band is homologous to previous report involving 0.126 mM $HAuCl_4$ at pH 6 (Kettemann et al., 2016).

Reaction mixture containing 0.3 mL Na_2CO_3 with pH value of 7.81 is a case of sufficient OH^- concentration for neutralization but insufficient OH^- for alkaline redox reaction. Its spectrum exhibits a 520 nm peak indicating formation of AuNP. While the spectra in Figure 2 shows the highest peak for AuNP synthesized using 0.3 mL Na_2CO_3, this peak is considered transient because color separation was observed upon standing. The instability of the AuNPs that was initially formed can be attributed to insufficient carboxylate ends of the oxidized dextrin which can cap and stabilize the colloidal gold.

Reaction mixtures containing 0.4 and 0.5 mL Na_2CO_3 with pH 9.14 and 9.77 are cases of sufficient OH^- for both neutralization and alkaline reduction reactions. Both of their spectra exhibited peaks at 520 nm that remained stable even after one year of storage at 4°C. These volumes were considered as optimal.

Reaction mixtures containing 0.6 and 0.7 mL Na_2CO_3 with pH 10.08 and 10.23, respectively, were cases of excessive OH^- ions. At these pH values, the speciation shifted to $[Au(OH)_4]^-$, and precipitation of $Au_2O_3.3H_2O$ / $Au(OH)_3$ occurred. The combined stability and lower reduction potential of $[Au(OH)_4]^-$ slowed down the reduction process. Moreover, the black solids appeared to be the precipitated $Au_2O_3.3H_2O$ / $Au(OH)_3$ that caused aggregation. The spectra

of both of these trials exhibited broad and low intensity bands at 520 nm. Between pH 10.08 and 10.23, more aggregation is expected from the latter based on speciation and precipitation considerations (Nicol et al., 1987; Nath & Chilkoti, 2004). Experimentally, the latter exhibited absorption band which was broader and much lower 520 nm peak than the former. Reaction mixture containing 1.0 mL Na_2CO_3 with pH 10.69 was a case of very high alkalinity so as to cause complete precipitation of the precursor gold into the form of $Au_2O_3.3H_2O$ or $Au(OH)_3$ and to give an almost horizontal line spectral band.

Effect of temperature. Using optimized volume of 0.5 mL Na_2CO_3, reaction mixtures containing the same reactant volumes of 5 mL $HAuCl_4$ and 5 mL dextrin were heated at different hotplate temperature settings of 100, 120, 130, 140, and 150°C. Among the trials, only reaction products from trial 150°C exhibited the characteristic ruby red color. Reaction product from trial 100°C was purple-red while the rest were light red. From DLS measurements, the polydispersity index (PDI) of trials 100, 120, 130, 140, and 150°C were found to be at 0.139, 0.062, 0.198, 0.208, and 0.068, respectively. Based on PDI classification, AuNPs from trials 100, 130, and 140°C were moderately polydisperse while those from trials 120 and 150°C were narrowly monodisperse (PDI <0.1) (Zabetakis et al., 2012). PDI is a dimensionless number from 0 to 1 calculated from cumulant analysis which is the square of the light scattering polydispersity. This number can be used to describe the non-uniformity of the size distribution of synthesized AuNPs. A low PDI value indicates well dispersed, uniformly sized, and stable gold nanoparticles. A PDI value of 0.087 indicates narrowly monodisperse Au (Hoo et al., 2017). Based on the results, optimal hotplate setting was found to be at 150°C. At this setting, synthesized colloidal gold was ruby red, and it exhibited the highest absorption peak and was highly monodisperse.

Effect of Reaction Time

The progress of reaction was investigated using reaction mixture containing 5mL $HAuCl_4$, optimal volume of 0.5 mL Na_2CO_3, and 5 mL dextrin heated for 1 hour at optimal 150°C hotplate temperature setting. The color, temperature, and UV-Vis spectra of the reaction mixture were monitored with time as the reaction progressed. The reaction mixtures were sampled at 3, 7, 10, 12, 14, 17, 19, 21, 29, 39, 45, and 60 minutes of heating which corresponded to reaction

temperatures of 40, 50, 60, 65, 70, 75, 77, 80, 85, 89, 90, and 91°C, respectively. It was found that from 3-12 minutes of heating, the faint yellow mixture turned grey which darkened with time as the temperature increased from 40-65°C. At 14 minutes of heating, the temperature reached 70°C and the color turned into a very light grey-pink. At 17 minutes of heating, the temperature was 75°C, and the color turned purple. The red color started at 19 minutes of heating at 77°C. From 21 minutes up to one hour of heating, the red color of the mixture remained the same. The highest temperature recorded was 91°C beginning at 57 minutes.

The UV-Vis spectra of the reaction mixture sampled at 14, 17, 19, 21, and 60 minutes demonstrated the evolution of λ_{max} at 520 nm during the progress of reaction due to plasmon resonance of AuNP. The evolution of λ_{max} began at 17 minutes (75°C) with a broad band, low intensity peak at 535nm that continuously shifted and increased in intensity as the reaction progressed, until an intense, narrow λ_{max} at 520 nm was observed at 21 minutes of heating (80°C). This evolution pattern is characteristic of spherical AuNP formation (Zhou et al., 2009). The increase in λ_{max} intensity is attributed to the increase in volume fraction of Au^0 as reaction progresses in accordance with Beer's law (Koerner et al., 2012). The absorbances at λ_{max} 520 nm of the reaction mixture samples were plotted against time and shown in Figure 3.

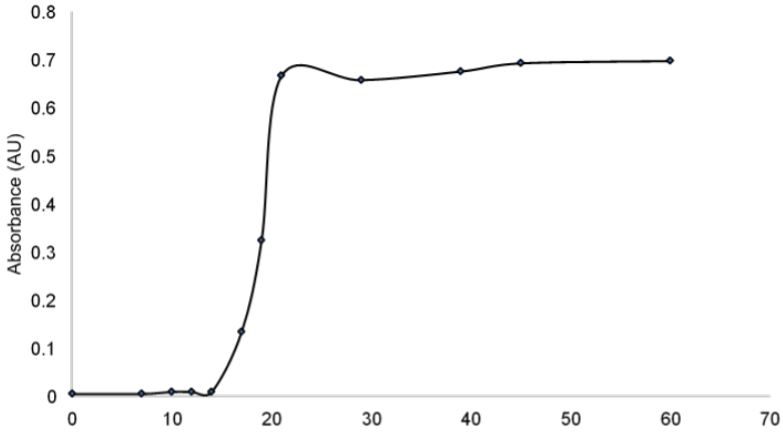

Figure 3. The changes in the UV-Vis absorbance at 520 nm as a function of time

As demonstrated in Figure 3, the absorbances at 520 nm increased with time, reached a maximum at 21 minutes, and made a plateau on the graph thereafter. The curve obtained was comparable to previous reports (Polte et al., 2010; Zhou et al., 2009). The same monitoring of color, temperature, and UV-Vis spectra of the reaction mixture during the progress of reaction was performed for the synthesis of AuNP with 20 mL dextrin. The same curve in Figure 3 was obtained with absorbance at λ_{max} 520 nm reaching a maximum at 33 minutes that formed a plateau thereafter. Further heating up to one hour did not produce significant changes in the absorbance at λ_{max} 520 nm. Based on these findings, heating time for the modified method was set at one hour.

Effect of $HAuCl_4$. The effect of $HAuCl_4$ volume was evaluated by preparing AuNPs using constant 5 mL dextrin at varied volumes of $HAuCl_4$ (5, 4, 3, 2.5, and 1 mL) at an optimal 150°C temperature setting. A volume ratio of 0.1 mL Na_2CO_3 / 1 mL $HAuCl_4$ was maintained to provide sufficient OH^- ions based on the optimal volume of 0.5 mL Na_2CO_3 in the reaction mixture containing 5 mL $HAuCl_4$, as discussed earlier. Figure 4 shows that AuNPs from different volumes of $HAuCl_4$ exhibited different absorption intensities in their respective spectra at all wavelengths. Clearly, the higher the volume of $HAuCl_4$, the higher was the absorption intensity of its spectrum. Notably, despite the differences in their absorption intensities at all wavelengths, all spectra exhibit the same absorption peak at 517 nm. The similarity in λ_{max} indicates that AuNPs produced from this series of synthesis were not significantly different except for their concentrations based on Beer's Law. AuNPs produced from 5 mL dextrin with 5, 4, 3, 2.5, and 1 mL $HAuCl_4$ had absorbances of 0.643, 0.51, 0.396, 0.321, and 0.138, respectively.

Inset of Figure 4 shows the reaction products with decreasing intensity of red color as the volume of $HAuCl_4$ decreased. The decrease in color intensity correlates with their decreasing absorbances at 517 nm. The same series of synthesis was repeated separately for constant volumes of 10 mL and 20 mL of dextrin. The same trend was observed such that the intensity of the AuNP red color also decreased as the volume of $HAuCl_4$ decreased. It was also observed that regardless of the volume of dextrin, the spectra of AuNP produced from the same $HAuCl_4$ /Na_2CO_3 ratio fit was almost identical from 200 nm to 700 nm wavelength range. These results imply that the volume of

HAuCl4 affects the concentration of generated AuNP. Therefore, $HAuCl_4$ was the limiting reagent in the reaction.

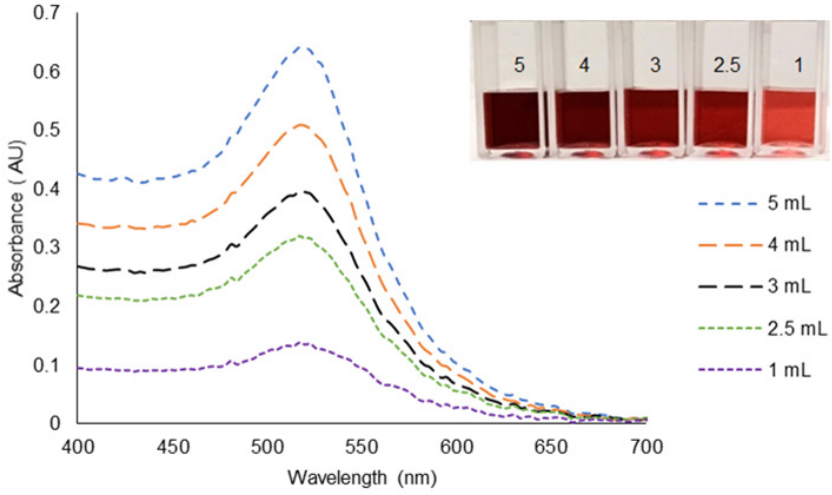

Figure 4. UV-Vis spectra of AuNP at varied volumes of $HAuCl_4$ (5, 4, 3, 2.5, 1 mL) (Inset shows photo images of AuNPs at the indicated $HAuCl_4$ volumes.)

Effect of dextrin. The TEM and HRTEM micrographs of AuNPs synthesized from varied volumes (2.5, 5, 10, and 20 mL) of dextrin are shown in Figures 5 A and 5B-D, respectively. They both reveal the spherical shape of AuNPs without aggregation. Reaction products from trials with dextrin volumes of 2.5, 5, 10, and 20 mL produced AuNPs with average sizes of 18.9 ± 1.5 nm, 9.9 ± 1 nm, 8.7 ± 0.5 nm, and 7.3 ± 1.1 nm, respectively. These TEM and HRTEM results correlated with the UV-Vis SPR band as determined to be at 517-520 nm. Spherical AuNP with diameter size <20 nm exhibited SPR from 515-520 nm (Shah et al., 2014). Additionally, Figure 5C shows the lattice fringes and decahedral structure which confirmed the good crystalline nature of the synthesized nanoparticles. These fringes correspond to atomic planes from gold face-centered cubic (fcc) crystal structure (Molina-Trinidad et al., 2011) and are comparable to previous reports (Dkhil et al., 2015; Bankura et al., 2012; Esparza et al., 2008). Another interesting observation in Figure 5C is the clear image of coating around the particle (indicated by the arrow) especially outside the carbon layer support

of the HRTEM grid. This coating appears to be the dextrin that capped the AuNP.

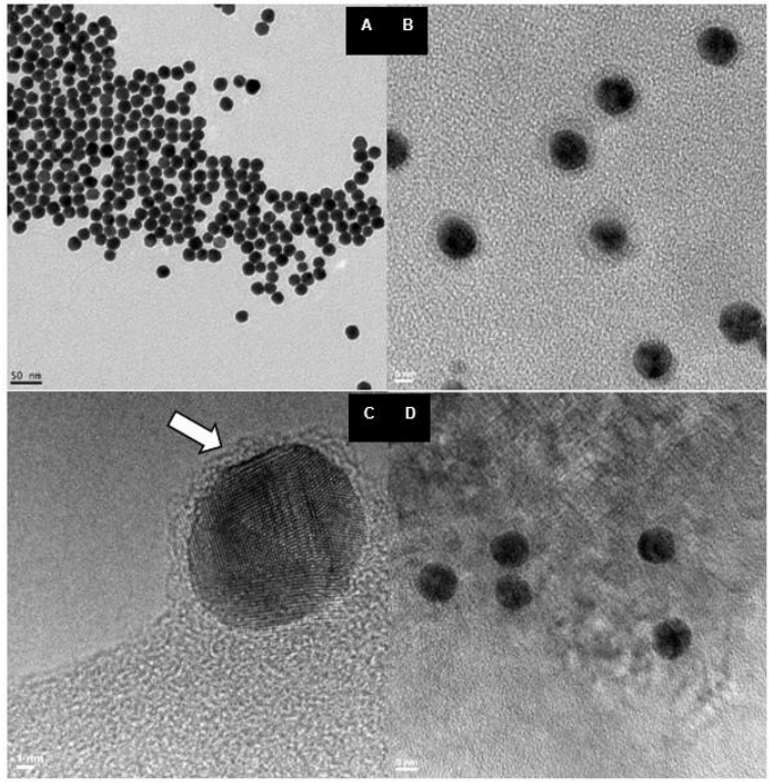

Figure 5. (A) TEM micrograph of 19 nm AuNP from 2.5 mL dextrin (HRTEM micrographs of AuNP: (B)10 nm from 5 mL dextrin, (C) 9 nm from 10 mL dextrin showing fcc crystal fringes and octahedral structure, and (D) 7 nm from 20 mL dextrin)

From HRTEM analysis, the average size of AuNP synthesized by the standard method using 5 mL $HAuCl_4$, 0.5 mL Na_2CO_3, and 5 mL dextrin was found to be 9.8 ± 1.4 nm while that of the modified method was 9.9 ± 1. T-test results indicated that the mean size difference between the modified and standard method for the same reactant composition was statistically not significant (p=0.78). This demonstrates that the dextrin methodology produced AuNPs with controllable size which was dependent on the amount of dextrin.

The sizes of synthesized AuNPs were plotted against the volume ratios of dextrin to $HAuCl_4$. Figure 6 shows the varying dependence of AuNP size on the volume ratio of dextrin to $HAuCl_4$. It was observed that the mean size of AuNP decreases as the volume of dextrin increases. The observed decrease in AuNP mean size with increasing dextrin concentration is consistent with a previous report (Anderson et al., 2011). A volume ratio of 0.5 produced AuNP size of 18.9 ± 1.5 nm. An increase in the ratio by a factor of 2 decreased the size by a factor of ~2, i.e., from 19.9 ± 1.5 to 9.9 ± 1 nm. However, from the volume ratio of 1, a further increase in the ratio caused little changes in the AuNP size. This finding is consistent with previous observation on modeling study of AuNP citrate method by Kumar, Gandhi, and Kumar (2007). Kumar et al. reported a decrease in size by a factor of 7 when initial concentration ratio of citrate to $HAuCl_4$ increased by a factor of 5, but a very little decrease in size was observed when the ratio was increased from 2 to 7 (Kumar et al., 2007).

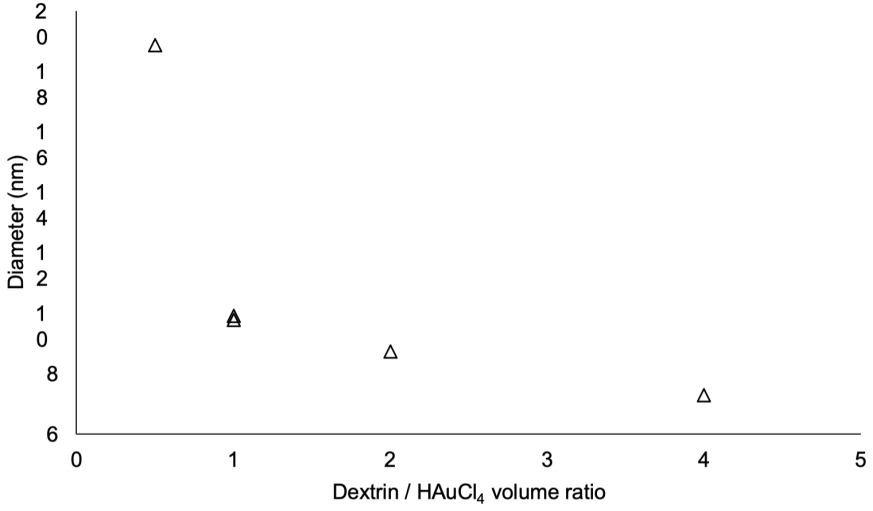

Figure 6. Variation of AuNP size with dextrin / $HAuCl_4$ volume ratio

Centrifugation of AuNP

While transmission electron microscopy is a well-accepted method for the size analysis of AuNP, centrifugation was explored to see if the latter can

be used to somehow identify the different sizes of dextrin-capped AuNP. Tubes containing 1 mL each of the different sizes of AuNP were centrifuged at varied speed and varied centrifugation time. Figure 7 shows the tubes containing AuNP samples GB, GA, AA, AF, and AK centrifuged for 20 minutes at 12,000 rpm at 4°C. Both trials GB and GA were 19 nm AuNPs while the remaining three trials were 10, 9, and 7 nm core sizes of AuNP, respectively. Centrifugation gathered the AuNP pellets at the bottom of the tubes and the resulting supernatants appeared differently, suggestive of the different sizes. Samples GB and GA with the biggest size (19 nm) produced almost colorless supernatants. The three remaining sizes (10, 9, and 7 nm) produced reddish supernatants that became darker as the AuNP size decreased. These results demonstrate that centrifugation can be used to qualitatively identify the different sizes of dextrin-capped AuNPs based on the appearance of the resulting supernatants.

This simple technique can be very helpful in estimating the sizes of dextrin-capped AuNP in laboratories where TEM instruments are not readily available. Centrifugation is a separation process which involves the use of centrifugal force for the sedimentation of heterogeneous mixtures (Majekodunmi, 2015). It is a separation technique based on the principle of density differences such that particles with higher density than the solvent sink and those with lower density float. In summary, gold nanoparticles were successfully synthesized by modification of the dextrin methodology.

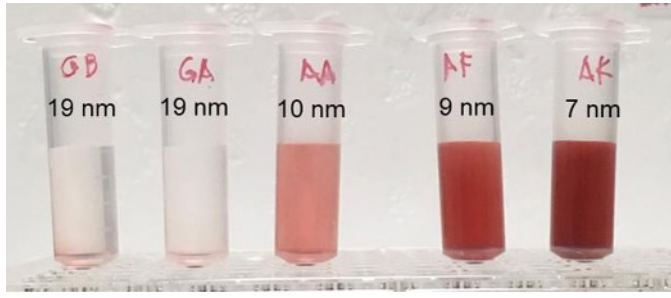

Figure 7. Photo images of the different sizes of dextrin-capped AuNPs after centrifugation for 20 minutes at 12,000 rpm at 4°C (The AuNP pellets gathered at the bottom of the centrifuged tubes and the different colors of supernatants were suggestive of the different sizes of AuNPs.)

CONCLUSION

In conclusion, the standard dextrin protocol for AuNP synthesis was successfully modified. The modification offers a simplified route, substitutes the hybridization oven with less expensive hotplate, and reduces the synthesis time from the eight long hours to only one hour. The size of the AuNPs can be controlled by changing the volume of dextrin. The AuNPs produced were stable, monodispersed and did not show any aggregation even after one year of storage at 4°C. The significant reduction in synthesis time, accompanied by simplified procedure and instrumentation, makes the modified protocol a practical alternative to the standard methodology.

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Learners as Buddies, Buddies as Learners: Reflections on a Language Learning Center's Initiative

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INTRODUCTION

The Silliman University Language Learning Center (SULLC) was established in 2013. Since one of its goals is to provide technical support services to enhance language teaching and learning in the Department of English and Literature, it has taken over the administration of the Intensive English Program, a short-term program intended for a group or groups of students with a non-English-medium background who desire to gain increased proficiency in the English Language. The program has a flexible design because it is responsive to the unique needs of the clients. However, what is constant are the skill-based courses like reading-speaking with grammar, speaking-listening with pronunciation, and reading-writing with grammar. Since its establishment, the program has served clients from Korea and Japan. This has been possible through partnerships with universities that send their students to take the program during their winter and summer breaks.

Since the program started, commonalities among the students have been observed. First of all, although the foreign students always appear excited to have new experiences in a new country, they seem to have low

motivation in learning English. Perhaps this is so because where they come from, English is merely an adjunct language. Another striking observation is that they lack self-confidence, which is understandable because they are thrown into a situation that requires them to communicate in English because they are in a place where their native language is not spoken. In addition, their low English proficiency may cause them a little discomfort. Finally, the students seem to experience culture shock. Cultural differences are not only found in the food, the weather, the language, etc., but also in the way of life. While they are used to the hustle and bustle of modern life, they are lured to the laid-back kind of living Dumaguete offers.

Noting all these, the SULLC endeavored to introduce new initiatives in the program. For example, Filipino ESL students have been invited to co-facilitate in the classrooms, giving international students more opportunities to practice. Another are the activities that expose the students to the local culture and require them to showcase their own culture by making presentations for Filipino students. In recent years, the Buddies Program had been introduced to partner a foreign student with a Filipino ESL student.

Although the Buddies Program was implemented years prior, it was only in 2019 that the SULLC institutionalized it to address common weaknesses of the program, like the buddies' lack of commitment and accountability. Institutionalizing it meant creating a Buddy Pool that necessitated a rigid requirement process. Silliman ESL students had to take an English exam and undergo an interview to be accepted as buddies. After the recruitment process, the accepted buddies also had to be trained through workshops on intercultural communication and communication strategies.

It must be noted that the Buddies Program was not created without careful consideration. The decision to institutionalize it is anchored on four viewpoints: Sociocultural Theory, Interaction Hypothesis, Input Hypothesis, and Motivation and Learner Anxiety.

Social Constructivism by Lev Vygotsky (1978) is one of the theories that put a premium on interaction and collaborative dialogues in cognitive development and second language learning. There is a focus on the role of communication since learning is said to take place through social interactions and mediation of meaningful context (Kim, 2001) in Naidoo and Paideya (2015). Unlike Jean Piaget's claim on the universality of cognitive

development, Vygotsky emphasized the role of the learning environment and culture and that learning varies across cultures.

The concept called the Zone of Proximal Development or ZPD is said to be the distance between what learners can do independently and what they can do when there is guidance from someone more skilled than them. For Vygotsky (1987), learning results when learners internalize language mostly from adults who are sources of their culture's tools. However, for older language learners, the language and culture tools do not necessarily come from adults but from someone who possesses a higher level of ability in using those tools or skills. Therefore, learning is facilitated through social interactions with a skillful interlocutor. These more knowledgeable others (MKO) model the behaviors and instructions to the learners. The learners then internalize the modeled items and use these in thinking and problem-solving.

Through interaction with a More Knowledgeable Other (MKO) who dispenses the knowledge and skills needed, students go through scaffolding to support the learner in acquiring language items and increasing their skills in using the language. Several researchers such as Donato (2000), Schumm (2006), Verity (2005), and Lantolf and Beckett (2009) discussed the role of scaffolding for the novice learner to receive instruction and modeling from an MKO. As the MKO, such as tutors, peers, or teachers, continue to guide, the learners also internalize the language they receive and use them as tools for thinking and problem-solving. Eventually, the MKOs lessen the guidance they provide to promote independence to the learners in learning.

Social Interdependence Theory (SIT) by Johnson and Johnson (1989) highlights the goal of making students independent learners while working together cooperatively and interdependently. Students are expected to join in group tasks while, at the same time, being able to be in charge of their learning. Positive social interdependence is exhibited by cooperation between interlocutors. On the other hand, negative interdependence is manifested through competition. In language learning, learners either cooperate or compete with others to develop their language tools and enhance their skills in using them.

Another consideration is the interaction hypothesis, which gives importance to conversational interactions between interlocutors. The

interactions here are modified to make meaning clearer for the less skillful party.

Input and the process of conveying meaning across interlocutors are essential parts of interactionist theories. Interlocutors say and how they say affect how a language learner who receives it processes the language item and turns it into an input. The term foreigner talk refers to the language of a more knowledgeable person in addressing a novice language learner. Ungrammatical foreigner talk is the language that possesses incorrect forms such as the omission of certain grammatical features or the usage of base form of verbs and alternate phrase constructions. Grammatical foreigner talk, meanwhile, is changing the baseline talk to negotiate for meaning with correct grammatical features. Some modifications include talking slow, simplifying words and structures, using regular or basic forms of words, and elaboration. This modification to input makes input more comprehensible that assists better acquisition.

For Long (1983), the input does not need to be simplified. Instead, the interlocutors need to work together to negotiate meaning and reach mutual comprehension. Through modified interaction, speakers can elaborate, slow down, or add gestures and contextual clues to understand input better Learners then can ask for clarifications whenever they do not fully understand the input or the more skilled speakers can check for comprehension by asking them questions or paraphrasing or repeating what is said partially or entirely.

Receiving comprehensible input has been established as an essential part of language learning. The inputs are expected to come from the language experts such as native speakers and those who have gained mastery. Krashen (1982), in his Monitor Model hypotheses, describes the nature of language acquisition. One of those hypotheses is the input hypothesis, which states that learners acquire a language if they are exposed to comprehensible input. He proposed the metaphor "i+1" where 'i' is the learner's current level of language proficiency and '1' is the language item one step higher than the current level the learner has. The reception of these meaningful inputs facilitates acquisition; however, if the learners' affective filters are up, they may not be received effectively. Krashen's affective filter hypothesis states that barriers preventing available inputs from being absorbed. These barriers, such as boredom, distraction, or demotivation, come from the

affect like feelings, emotions, motives, wants, and needs. These prevent a learner from receiving inputs from the environment making acquisition less effective (cited in Lightbown & Spada, 2008).

Meanwhile, aside from inputs, outputs are also considered in learners' language acquisition. What they produce helps them develop their existing language forms. Outputs are used for learners to notice gaps and errors in their speech. At the same time, it serves as an avenue for them to try out rules they just learned and explore whether the usage of the language is correct in form and context. The roles of input and output are deemed necessary, so interaction is a very useful language learning tool.

The final considered concepts are motivation and anxiety. Motivation is the drive of the students to learn a language. This is affected by their attitudes and affective states that dictate the effort they put into their learning. Two major motivations are known – extrinsic and intrinsic. For language learning, Gardner and Lambert (1972, cited in Lightbown and Spada, 2008) coined two types of motivation: instrumental and integrative. In instrumental motivation, some learners learn a language for a specific practical goal like passing a test or applying for a job. They make the language an instrument to achieve a practical reason. Integrative motivation is when learners use the language to immerse themselves in a culture and interact with people within the culture. This is more for personal growth and interest.

Meanwhile, in resultative motivation, learning the language may be a result of a previous similar experience. For example, being successful in learning one L2 may motivate a learner to learn another (Ellis, 1997). Lastly, intrinsic motivation comes from the personal interest of the person without any influence from experience or outside factors. Thus, the drive of the learner is personal, out of curiosity and an interest to learn.

However, it is not all the time when learners are motivated enough to learn. Anxiety and inhibition might kick in and can discourage them from taking risks and establish self-esteem. Anxiety can be due to worry, fear, and stress, especially if no one supports them and gives them the confidence to use the language. Language learning is manifested through interactions and conversations so learners can have comfortable interaction situations to lessen their anxiety.

Since the institutionalizing of the Buddies Program is a relatively recent development, it needs to be assessed to examine its strengths and

weaknesses to have the basis for its improvement. Hence, this study attempts to make the initial assessment. Specifically, this paper attempts to answer the following questions:

1. What do EFL and ESL students think about the Buddy System of SULLC?
2. How has the Buddy System helped the EFL students in their language learning experience in Dumaguete?
3. How has the Buddy System helped the ESL students in their academic preparation?
4. How can the SULLC improve its Buddy System?

METHODS

This study relies heavily on qualitative data. To answer the posited questions, the researchers conducted two focus group discussions (FGD). The first FGD was participated by 10 foreign students from Hannam University who were randomly chosen using the fishbowl technique. The second FGD was participated by the foreign students' Filipino ESL buddies.

One of the researchers served as the facilitator of the FDG,while the two others did the note-taking and observing. Before each session, participants were apprised about the purpose of the FGD, and their consent was elicited in written form.

RESULTS

The researchers identified the recurring ideas that have emerged from the discussion, established themes from the participants' responses, and provided descriptions and implications of these themes concerning the research questions posed. With that, the discussion will be focused on the themes relative to the theoretical considerations presented.

IntEP Students and Buddies' Thoughts on the Buddy System

In the focus group discussions, both IntEP students and buddies shared varied thoughts and insights towards the Language Learning Center's Buddy System. Both groups found the initiative predominantly academic because

of the nature of the program. Among the academic activities done between students and buddies were decoding unfamiliar vocabulary, constructing meaningful paragraphs, and conducting spelling and pronunciation drills. This connects to Lev Vygotsky's concept of the Zone of Proximal Development, where buddies facilitated IntEP students' assignments through social interactions.

Moreover, given that the setup was for interacting with people from different cultures, the buddy system is also mainly intercultural. For the most part of the Intensive English Program, both the students and the buddies experienced cultural exchange in all the activities. Thus, they were not just communicators but also cultural beings; they brought in and shared their cultural identity with their interlocutors during interactions.

With the challenges experienced by both IntEP students and buddies, they recognized that the buddy system is relatively motivational. IntEP students admitted that they lacked confidence during the first few days of the program. However, they overcame their fear and anxiety through classmates, professors, and, most significantly, the buddies. Buddies, on the other, found an increased motivation and established self-confidence through the buddy system. They were challenged to be less anxious for their buddies and have a good command of the target language.

The buddy system is not only academic, intercultural, and motivational. Since both have found new acquaintances in each other, the initiative is perceived to be relational. Aside from gaining a tutor, IntEP students found new friends and somewhat a new family [member] in their buddies. They described their buddies as precious, guardian angels, and a family in the Philippines. On the other hand, buddies shared a somewhat different impression. Aside from being tutors, they perceived themselves as nannies or chaperones. They became protective because they felt responsible for their assigned IntEP students. Regardless of how they perceived themselves, buddies admitted that the worst part of being a buddy and the Intensive English Program, in general, was bidding farewell to their assigned buddies. As a result, they somewhat experience separation anxiety every IntEP, for they have established a close affinity for their partnered buddies.

With the insights solicited from the discussion, the buddy system is mutually advantageous for both buddies and students. That means it is not only the IntEP students who learned from their buddies; the buddies

themselves had a fair share of learnings from the IntEP students as well. For example, one buddy shared that through the buddy system, they "could help their assigned buddies with their academics and, at the same time, be exposed to their culture."

IntEP Students' Language Learning Experience in Dumaguete

Since the buddy system is perceived as academic, the IntEP students acknowledged that the initiative had helped them in their academic enhancement. Through the tutorial sessions and cultural exposures with their assigned buddies, they could write meaningful paragraphs and speak effectively. Moreover, they shared that the tutorial sessions were not limited to writing and speaking. Their buddies also challenged them through language games such as scrabbles, quiz bees, and other communicative activities.

On the other hand, they perceived the buddy system to be intercultural. Hence, the initiative is for effective intercultural communication. Communicating with people who come from diverse backgrounds and cultures was a primary struggle for all IntEP students. Their buddies helped them make their way through all the barriers of interacting with diverse people. For example, buddies taught them basic Filipino words. However, one student shared that she requested to learn Cebuano (the spoken language in Dumaguete) from her buddy. She reasoned that she felt the need to learn basic Cebuano expressions because "almost all students in the Immersion classes and the university speak Bisaya." This connects to Gardner and Lamberts' concept of integrative motivation, where the student learns the language to immerse in Silliman and Dumaguete's culture and interact with Sillimanians and Dumagueteños.

The mere presence and involvement of their buddies during IntEP and Immersion classes meant so much for the IntEP students. It has somehow helped them in building their confidence to interact and present in class. As mentioned earlier, they found it a struggle to interact with a diverse group of students, and more likely, they tend to avoid any situation that would require them to interact. However, the buddies were around to assure them, guide them, and even help them translate. One student recounted an instance during a presentation in an IntEP class. She narrated, "When I was

shy to present, my buddy said, 'You can do it!' and gave me courage." The student had extrinsic motivation because the buddy was the motivator. All participants even wished that buddies will be required to accompany them or be officially part of their IntEP and Immersion classes.

The buddies served as the IntEP students' official confidante during their stay in Dumaguete. With that, the buddy system helped the latter have a trusted companion during the program's span. The students shared that they had buddies who were responsive, protective, and proactive. For instance, a student recalled when her buddy noticed that her call-and-text promo had expired. She shared that her buddy "told her problem even without telling her." They appreciated that the buddies looked after them and put their needs first during their stay in Dumaguete.

Overall, the IntEP students had a good experience during their stay in Dumaguete because of their buddies, which significantly benefited the former in their language learning.

IntEP Buddies' Academic Preparation

Interestingly, the participants selected in the focus group discussion are all Education majors. Thus, the concept of facilitating learning was not new to the group. All participants agreed that being a buddy would academically prepare them for their practice teaching. They were able to conduct a simulation with their assigned students and apply the appropriate teaching strategy through supplemental activities. From the responses of the buddies, they generally used the communicative language teaching approach for their tutorial. This highlights Michael Long's Interaction Hypothesis, where buddies worked together with their assigned students to negotiate meaning and reach mutual comprehension.

Moreover, it was not only the IntEP students who had their academic skills enhanced. The buddies discussed that their communication skills have improved and that they had to for their buddies. With the vocabulary found in the materials of the IntEP students, their reading comprehension advanced. They also became active listeners towards their assigned buddies, although it was not deliberately straightforward. Some noises such as para-language, enunciation, and word choice had to be dealt with. Nevertheless,

the buddies went the extra mile to make meaning out of what was produced and engage in an interactive discussion.

Since the cultural exchange is a routine in the program, buddies realized that they were somehow becoming interculturally competent. Insights such as orientation and stereotypes towards the Korean culture were the challenges dealt with by the buddies. With this, they were able to acknowledge the differences and respond without judgment. However, the buddies were concerned with the strategy of translating words from Korean to English and vice-versa. Although their cultural grids have expanded by interacting with international students, they still got conflicted with the translation limitations, especially when certain Filipino or English words had no direct counterparts in Korean. One student shared that they resort to paraphrasing, giving examples, and demonstrating the idea.

Ultimately, the buddies have built good relationships and could work well with others, for the buddy system has helped them in their interpersonal skills. In addition, they discovered more about themselves, possessing leadership traits such as being dependable and responsible for their assigned students. In the sharing, a buddy explained that "looking after them became natural" because they felt the sense of doing so. Moreover, they furthered by recognizing that they were more than just a buddy, that the responsibility laid on them was rather challenging yet fulfilling once realized.

In summary, the buddies realized the responsibility placed upon them, and they went the extra mile to attend to their assigned students' needs. These have helped them prepare for their respective courses and perhaps for their future endeavors as well.

IntEP Students and Buddies' Recommendations on the Buddy System

All participants found the buddy system of the Language Learning Center advantageous and facilitative. However, while they underscored strengths and significant reviews of the initiative, both students and buddies also opined points for improving the Language Learning Center's buddy system to effectively cater to optimal language learning and intercultural communication in the Intensive English Program.

The IntEP students disclosed that they had spent more time with their buddies than anyone else during the program's span. They appreciated the

proactiveness of their buddies. However, there were specific observations they wished to point out. For example, most of their buddies came in late for their tutorial, and one student observed that every time they meet, the buddy looked tired. They suggested that the buddies be punctual during meetups and come prepared with an energetic and outgoing personality.

Moreover, the IntEP students noticed that their tutorial schedules tend to change from time to time. Hence, they proposed to have a fixed schedule for their session. With that being said, the students also wished for their buddies to join them in their classes. Tagging their buddies along with them would make them comfortable and less anxious in their IntEP classes.

In terms of pairing the students with their buddies, both have agreed that age should be considered. Therefore, they felt that it might take some time to establish rapport with someone older or younger than them. Having a buddy whose age is somewhat similar or close to the students would be helpful. For buddies, gender is a factor. They reasoned that their dynamics and interaction would differ because of the gender, although the IntEP students did not find it an issue. Lastly, the IntEP students asserted that they preferred to have a Filipino buddy and not have someone who shares the same nationality. They might be tempted to converse in Korean during their tutorial, which for them defeats the purpose of the buddy system.

Both IntEP students and buddies shared sentiments about the way both participants approach one another. The students mentioned that their buddies addressed them as if the former were way older than the latter. They appreciated the display of respect by their buddies. However, IntEP students would feel more comfortable being treated equally by their buddies. An orientation or even a workshop on interaction management strategies could be organized for the buddies.

Furthermore, both participants suggested fellowship opportunities, such as compulsory gatherings, workshops that are not necessarily academic-related, and cultural exposure activities. Buddies shared that not all IntEP students and buddies were familiar with one another; hence, it would be a significant opportunity for all participants to establish camaraderie and mutual trust among each other.

The buddies added that a learning guide would be necessary to help them in their tutorial sessions. Especially for first-time buddies, a number had difficulties designing tutorial topics and activities. They requested

that the Center provide them an outline or a checklist of the skills and competencies expected to be learned and applied by the IntEP student.

DISCUSSION

It can be said that the buddies were significantly helpful in the success of the Intensive English Program, especially on the students. As to how Lev Vygotsky puts it, each student is assigned to a More Knowledgeable Other who journeys throughout the former's language learning in Dumaguete. Buddies were found to have provided a holistic experience for the IntEP students. As mentioned, the buddies played a significant role in shaping their academic, intercultural, and personal development within the 3-week program.

The buddies were also cognizant of their capabilities as tutors and cultural companions. After experiencing buddying, they discerned more about facilitating learning, class management, and teaching strategies. They stressed that different learners require different strategies, implying that a buddy should be at least prepared with adequate teaching-learning strategies. The quest of selecting the appropriate strategy to be employed was a difficulty among IntEP buddies. Hence, they also requested guidance on how to facilitate IntEP students. Regular debriefing and retooling sessions are needed to address this concern.

Lastly, in this study, it is realized that buddies are not just buddies—they are more than what IntEP students think of them. Based on the sharing from buddies and students, buddies went out of their comfort zones and went above and beyond their expectations.. Hence, the Center recognizes and values the effort and commitment of these buddies by awarding them certificates and involving them in the department's affairs.

CONCLUSION

In conclusion, the study successfully addresses the four research problems identified in the Language Learning Center's buddy system. IntEP students and buddies found the initiative mutually advantageous and that the program, in general, provided them with a holistic experience of language learning and intercultural communication. Moreover, IntEP students have cultivated the required communication skills and confidence through the

buddy system. Immersing themselves in different communicative language situations within the campus and elsewhere in Dumaguete made them demonstrate a positive attitude towards using the English language.

On the other hand, buddies are academically prepared because of the buddy system, and that they are equipped with the skills required in their respective courses. In addition, they offered optimal Silliman education to their assigned students through collaborative learning opportunities and cultural exposure. The buddies are also instrumental in addressing recurring concerns among IntEP students, such as low motivation, lack of confidence, and culture shock. Furthermore, the buddies and students proposed considerable recommendations for improving the buddy system and the Intensive English Program as a whole.

It is imperative for the Center to capacitate the buddies with advanced communication skills and intercultural competence through workshops and training such as retooling activities and debriefing sessions. Moreover, in order for the Center to determine whether the buddies are competent enough, the Center should set up a mechanism or develop a tool for IntEP students to evaluate the buddies' effectiveness. It would be substantial to also come up with a sort of self-evaluation instrument for the buddies.

Concerning capacitating the buddies, continuous activities and affairs should be organized periodically for and by the buddies. Through this, the buddies are given more opportunities to explore their capabilities and strengths as Sillimanians. Consequently, establishing an internal mechanism for buddies would be relevant in the long run. It includes electing or appointing representatives and applying to the student center as a co-curricular organization of the university.

Lastly, the ideas that have emerged from the focus group discussion will serve as the basis for cultural exposure activities in the next programs. It is also suggested that buddies who are non-education majors are enjoined to share their experience towards the buddy system, specifically how it helped them in their academic preparation.

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