Chapter I

INTRODUCTION

Background of the Study

Wood, the primary raw material utilized in the production of paper and paper-related items, is extracted for its cellulose fibers. It finds application in crafting notebooks, newspapers, laminated documents, and even toilet paper. This usage contributes to the yearly depletion of billions of trees, intensifying the pace of deforestation globally according to CARTLY (2023). Alternative sources for paper production include bagasse, papaya leaves, and trunks.

Buho is one of the important resources upon creating materials and in construction. *Buho* grows in groups resulting in a bamboo forest and produce leaves that will eventually fall resulting in organic waste. A *buho* produces 4-7 leaves per culm in an oblong-lanceolate shape and the size of 15-40 cm by 2.5-7.0cm wide based on Cainta plant nursery (2023).

Bagasse finds application in the manufacturing of packaging, printing, writing tissues, and newsprint. Enhancing pulp drainage, minimizing chemical consumption, and refining tensile properties are outcomes of pith removal from bagasse. The pulp production involves both chemical and mechanical pulping processes, utilizing traditional fourdrinier and twin-wire formers. Dissolving pulps undergo transformation into rayon and cellulose acetate as stated by Rainey et al. (2016).

The potential utilization of papaya leaves and trunks as an alternative raw material for commercial paper bags and paper production has been explored in a study titled “Carica Eco-Paper bag Utilization of Papaya Leaves and Trunks as an Alternative Materials for Production of Paper Bag” conducted in 2019.

Collecting fallen leaves in public parks and gardens provides an excellent source of raw material for paper production. Utilizing the cellulose extracted from leaves, the manufacturing of cardboard, wrapping paper, and paper pulp packaging is facilitated as stated by Obluska (2019). Additionally, fiber from dried bamboo leaves can be employed in the paper-making process based on Bartleby (2023).

The process for making paper is complicated and includes the use of chemicals, water, and filler. The goal of the papermaking process is to produce paper of the necessary quality at the lowest possible cost. As described by Risto Ritala et al. (2011), the process consists of multiple subprocesses that prepare, combine, and dilute raw materials with water, produce the paper web, and remove water.

The researchers proposed this study to test the texture, stiffness and the water resistance of different composition of BuDLeaf multi-purpose paper and to create an eco-friendly and innovative process for papermaking.

The study aimed to determine the effectiveness of buho dry leaves as a raw material for papermaking. BuDLeaf multi-purpose paper is made out of *buho* dry leaves. It’s chosen to be an eco-friendly multi-purpose paper due to the abundance of buho within the area. Furthermore, *buho* leaves share common similarities with wood use upon paper production their chemical components which contain cellulose fibers, lignin and hemicellulose which are important for creating paper.

The researchers conducted this study to make a multi-purpose paper out of *buho* dry leaves. The main importance of this study was to make the *buho* dry leaves as a raw material for papermaking.

Statement of the Problem

This study aimed to determine the effectiveness of using *buho* dry leaves as a multi-purpose paper.

It sought to answer the following questions:

1. What are the possible compositions of BuDLeaf multi-purpose paper?
2. What are the qualities of different composition of BuDLeaf multi-purpose paper in terms of;
   a.) Texture
   b.) Stiffness
   c.) Water resistance
3. Is there any difference between the qualities of different composition of BuDLeaf multi-purpose paper in terms of;
   a.) Texture
   b.) Stiffness
   c.) Water Resistance

Significance of the Study

The Senior High Students at Salvacion National High School have not conducted any research regarding the making of BuDLeaf as a multi-purpose paper. This is why the researchers proposed such a study which aimed to establish an understanding about BuDLeaf multi-purpose paper.

The proposed study had been a great contribution to the general knowledge of *buho* dry leaves as a multi-purpose paper. The result of the study will benefit the following:

To the innovators, this study provides innovators with an eco-friendly paper production, fostering the development of green technologies, contributing to environment conservation and inventive solutions in the field of materials.

To the school administrator, it offers an eco-friendly and versatile solution for various educational activities, reducing environmental impact and providing a resource-efficient option for classroom and administrative use. The school can also get an acknowledgement from the proposed study of the researchers.

To the community, by using *buho* dry leaves instead of traditional tree-based paper it can help minimize deforestation and preserve forests by reducing the demand for traditional tree-based paper. It can also encourage local entrepreneurs to creates a local and source of income through the production and sale of BuDLeaf multi-purpose paper.

To the entrepreneurs, entrepreneurs can seize the opportunity to establish businesses centered around producing and selling BuDLeaf multi-purpose paper. It can also contribute to job creation, economic development and environment conservation.

To the future researchers, this study serves as a foundation for future researchers, offering insights into paper production methods and encouraging further exploration in the field of environmentally friendly materials. It also provides a foundation for future studies on paper production and adds to the body of knowledge on practices, inspiring further research and innovation in the field.

Scope and Delimitation of the Study

The general intent of the study was to determine if *buho* dry leaves would create an eco-friendly multi-purpose paper, provided to have new materials for suitable multi-purpose paper production and to minimize deforestation and preserve forest by reducing the demand of paper. The researchers evaluated the stiffness and water resistance of the BuDLeaf paper and also randomly selected participants to evaluate the texture of BuDLeaf paper. This study was conducted in the Salvacion National High School.

This study limits the coverage to *buho* dry leaves as its subject. *Buho* dry leaves were suitable for papermaking, the researchers focused making BuDLeaf multi-purpose paper. Thus, the results and conclusions were limited to the subject treated. This study also limits to the participants that were randomly selected to evaluated the texture of BuDLeaf multi-purpose paper and to the researchers that will evaluate the stiffness and water resistance of BuDLeaf multi-purpose paper.

The researchers proposed this study from September, 2023 to May, 2024 at Salvacion, Busuanga, Palawan.

Chapter II

RESEARCH FRAMEWORK

Review of Related Literature Study

The following literature had helped in the conceptualization of this proposed study, especially to BuDLeaf multi-purpose paper.

On the Definition of Buho

Buho is also known *Bambus Lumampao* in scientific terms according to Manuel (2019). The unique physical characteristics of *buho* include culms that can reach heights of 12 meters and have a diameter of 50 mm, emphasizing its value in various crafts and constructions.

Buho is a plant native to tropical lowlands and elevations up to 1,500 meters, thrives in conditions with an annual rainfall of 1,900 mm and temperatures ranging from 28 to 32 degree Celsius. It grows on sandy loams or clay loams with a pH of 5.0 to 6.5, often found on forested hills. Young shoots reach full height in 4 to 6 months, while mature culms grow within one to two years, attaining maximum diameter at five meters. Healthy clumps can produce up to 10% of mature culms in young shoots annually. Harvesting occurs during the dry season, with culms older than three years harvested every two years. In dense natural stands, *buho* yields up to 2,500 culms per hectare annually, generating 15 tons of dry weight. Air drying and preservation techniques, including soaking, curing, and chemical methods, are used for the culms as said by Fern. K (2014)

Buho, is a bamboo species native to the Philippines. This clump-forming or sympodial rhizome type plant spreads through seeds, culm cutting, and rhizome divisions. Its sturdy, upright culms form clusters, reaching heights of 10-15 meters and measuring 4-8 centimeters in diameter with walls 4-10 millimeters thick. These robust culms are extensively utilized for various applications, including bamboo matting (sawali), baskets, fences, spears, fish pens, flutes, and handicrafts, as cited by Roxas (2012) based on De Guzman et al. (2021).

As stated by Dofour (2015), *Buho* is a native of the Philippines, and it may be found in great quantities in the provinces of Pangasinan, La Union, Ilocos Norte, Ilocos Sur, Leyte, and on the islands of Panay and Basilan. On occasion, it is grown in the Philippines*, buho* is one of the most significant bamboos economically. Although there are no sizable plantations, it grows very well in wild stands. There are no published economic or production figures, and its exploitation is typically unregulated. In rural areas, consumption and trade are primarily regional. A manufacturing facility for plywood has been developed in the northern Philippines using natural stands. The culms are extensively utilized to create bamboo “sawali”, a textile woven from thin strips in use in a variety of ways in rural communities. In addition, they are frequently use for building, ply bamboo panels, paper pulp, spears, fish pens, fences, handicrafts, baskets, and other items.

Buho is a bamboo species known for its clump-forming growth pattern and upright structure, flourishing in various provinces across Northern Luzon. This resilient bamboo variety has not only thrived in its native regions but has also successfully adapted to the environmental conditions in Laguna and neighboring

Southern Tagalog provinces. Its ability to grow in clumps and stand tall showcases its robust nature, making it a significant presence in the bamboo species landscape. *Buho's* adaptability highlights its versatility and resilience in diverse geographical settings according to Tongco J, et al. (2013)

On the Definition of Dry Leaves

According to Eugene P (2023), dried leaves offer a plentiful supply of organic matter, versatile enough to serve various purposes in gardens, lawns, and other outdoor spaces. One option is to shred the leaves into fine pieces and utilize them as mulch, providing a protective covering around trees or other plants. These leaves can be incorporated into a compost bin, complementing other nutrient-rich compost. When added to the soil in appropriate proportions, the leaves decompose slowly over time, enhancing the soil's fertility.

Depending on the specific type of leaves available, they can also be repurposed for aesthetic purposes. Certain leaves can be used in decorative arrangements, adding a natural touch to indoor or outdoor spaces. These leaves, when combined with newspaper or coir, can serve as bedding for worms, creating a conducive environment for worm composting.

The high cellulose content (60%-80%) of fallen leaves is what makes it possible to make paper from them in the first place but, in order to remove the cellulose fibers, the leaf must first be properly handled. About 30 tons of leaves may be processed every day using carefully chosen, but regrettably pricey, production equipment based on Abuska. E (2019).

According to Crowe (2017), utilizing fallen leaves could lessen the need for virgin wood pulp, which is now used as the main raw material for making paper. By reducing the need for tree harvesting, this could aid in the preservations of forests and ecosystems. Fallen leaves are frequently seen as waste and are disposed of in a variety of ways. They could aid in waste reduction and encourage a more circular economy if used for paper production. Fallen leaves are easily accessible every year, and using them as a renewable resource might have a smaller carbon footprint than using long-growing trees for paper manufacture. Since leaves are typically local, there is less need for extensive transportation, which could benefit local business and communities.

On the Definition of Papermaking

Paper recycling is a recognized critical component of the papermaking industry, which is a sustainable industry. 54% of the feedstock used by the European paper sector is recovered paper, translating to a 72% paper recycling rate according to Angeles Blanco et.al (2018).

The process of creating paper involves a massive dewatering operation using a diluted pulp suspension solution with less than 0.5% fiber solid. The forming section, press section, and dryer section are a paper machine's main components. Using suction applied below the forming fabric and gravity-driven drainage, the fibers in the water-slurry-diluted pulp create a paper web in the forming area. The wet web is consolidated in the press area, where more water is eliminated by mechanical pressure provided through the nips of several presses or spinning rollers. Similar to coagulation, flocculation is employed in the papermaking process but it involves the

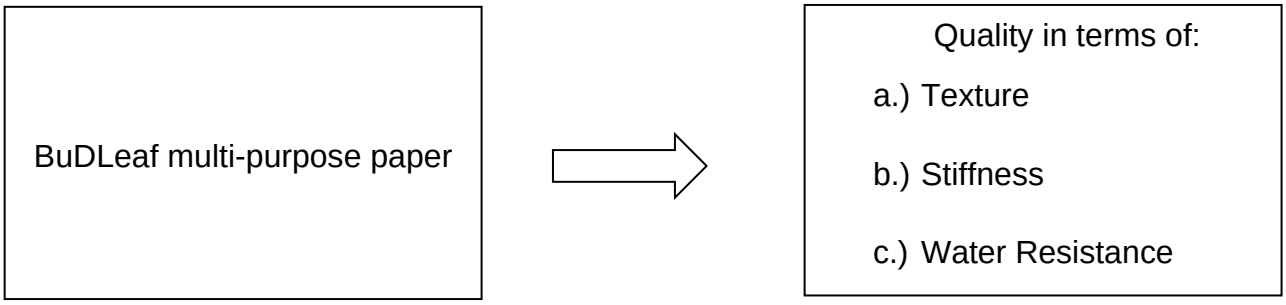
use of a charged polymer to either reduce the repulsive forces or work with several particles simultaneously(bridging) in order to create aggregation. Take into consideration the suspension of wood fiber particles with negative surface charges using cationic polymer. Due to similar charges, fines would repel one another in the absence of polymers. The anatomy of papermaking fibers greatly influences their properties. The species and growing environment of different fibers sources affect their pulping properties according to Bajpai, Pratima (2018)

Papermaking is a complicated process that uses chemicals, water, filler, ad pulp. In the process of making paper, the objective is to minimize expenses while producing paper of the required quality. The process is divided into multiple smaller steps that prepare, mix, and dilute raw components with water produce paper web and eliminate water based on Ropponen A et. al. (2011)

Making paper involves suspending water on wire screen to create a matted or felted sheet, typically made of cellulose fibers. Paper is the fundamental substances utilized in written communication and information sharing. Toweling, wrapping, packaging, insulating and photography are just a few of the hundreds of more application for paper and paperboard based on Britt K cited by Brittanica

The inclusion of these literatures and studies was deemed necessary the researchers as they provide light on the potential outcomes of the current investigation. It made the researchers knowledge and comprehension of the study's variables deeper.

Research Paradigm



The conceptual framework showed the result of BuDLeaf multi-purpose paper and the relationship of independent and dependent variables. In this case, BuDLeaf multi-purpose paper was the independent variable, while the texture, stiffness, and water resistance were the dependent variable.

Research Hypothesis

Ho: There is no significant difference between different composition of BuDLeaf multi-purpose paper when it comes to texture, stiffness and water resistance.

Definition of Terms

The following terms are used in the study for a better understanding of the variable and are based on its use.

Aluminum sulfate – it was used to strength the BuDLeaf multi-purpose paper by binding to cellulose fibers. It also helps to strengthen the water resistance of BuDLeaf multi-purpose paper.

BuDLeaf (*Buho* Dry Leaf) - is a multi-purpose paper that is composed of *buho* dry leaves.

***Buho* dry leaves** - are dried leaves from the *buho* tree, collected during the dry season. It has a brittle texture and natural color and is not mixed with other plant types during the drying process.

Cornstarch – the cornstarch was used as a binding agent in making BuDLeaf multi-purpose paper.

Paper making - is the simple process of making paper from wood or recycled materials, involving steps like pulping, shaping, pressing, and drying.

Stiffness - is about how easily it bends or folds, measured by a test that checks the force required to deform it in a standardized way.

Texture - is the feel, appearance, or consistency of a surface or substance of the BuDLeaf multi-purpose paper.

Water resistance - in paper refers to its ability to resist water without excessive absorption or damage.

CHAPTER III

RESEARCH METHODOLOGY

Research Design

Many fields used experimental research design, such as psychology, education, and the social and physical sciences. In experimental research, a scientific method is utilized to examine the impacts of manipulating one or more independent factors on one or more dependent variables, which are typically monitored and recorded over a period of time according to busayo.longe (2023).

This quantitative research design used an experimental research design. This research has a deep connection to the researchers STEM strand. It's also applicable to the product, which is a BuDLeaf multi-purpose paper, since this design helps us determine the results of using *buho* dry leaves as a multipurpose paper. At the same time, the researchers observe and manipulate the research and control all the possible hinderances or extraneous variables.

Sample and Sampling Procedure

In sampling, the researcher used heuristics to identify the sample size of the study. The total number of participants in the study is 30 randomly selected from school campus and Bambuhay craftsmen.

Sampling technique is a procedure, process, or technique for choosing a sub-group from a population to participate in the study. Using simple random sampling, each participant in the population has an equal chance of being chosen. The

researchers used a simple random sampling technique to obtain participants to observe the texture of BuDLeaf multi-purpose paper.

Research Instrument

The researchers used an observation checklist as a tool for gathering research data. Semantic differentiation was also used as a scale in quantitative research. The researcher-as-instrument tested and rated the sample subject. According to Hammersley and Atkinsons (1995), as cited by Goldblatt and Band-Winterstein (2016), the phrase researchers-as-instrument referred to the researcher as an active respondent in the research process. The tools that the researchers used was validated by our research adviser, Sir Harjim Truman.

The researchers used the following instruments in making the different compositions of BuDLeaf multi-purpose paper; sack, blender, molder, basin, measuring spoon, measuring cups, weighing scale, block of wood, and cloth. A sack is used for collecting *buho* dry leaves; a blender is used for pulverizing the *buho* dry leaves; a measuring spoon and measuring cups are used to measure the exact composition of BuDLeaf multi-purpose paper; a weighing scale is used to measure the weight of each composition that will be used to make BuDLeaf multi-purpose paper; a basin is used to mix all the compositions that will be used in making BuDLeaf multi-purpose paper; a cloth is used to cover the BuDLeaf multi-purpose paper; and a block of wood is used to compress the BuDLeaf multi-purpose paper while being covered in cloth.

To test the texture of the BuDLeaf multi-purpose paper, the researcher used a rating sheet, scale, or table to rate the sensory evaluation for texture based on the observations of participants. The following description was used to rate the texture of the BuDLeaf multi-purpose paper based on the observations of the participants; 1-very rough, 2-rough, 3-smooth and 4-very smooth. The researchers based their tool for evaluating the texture of BuDLeaf multi-purpose paper on the rating scale used in the sensory evaluation for texture according to Belmes, N. (2019).

The researchers created their own instrument for evaluating stiffness and water resistance. For stiffness, the researchers created a table for recording the maximum times when the BuDLeaf multi-purpose paper can be folded. For water resistance, the researchers created a table for recording, and the researcher's used a timer to record the time of how long the BuDLeaf multi-purpose paper can resists water and the diameter of the water in the paper per drop.

Data Gathering

The researchers asked permission from the principal of Salvacion National High School to conduct this research study. The researcher prepared the materials and tools that were used in conducting this research experiment. Before conducting the study, the researchers prepared plans, compositions, and procedures so that the study would be successful. The researchers first gathered *buho* dry leaves from places where *buho* is abundant. The researchers also prepared all the tools and materials that are needed in the process of making BuDLeaf multi-purpose paper.

During the process, the collected leaves were cut into smaller pieces and the stems were removed since they didn’t contain any cellulose fibers; and soak it in the water overnight because it was easier for the blender to make it into a mush. After that, the researchers put the blend in a pot and let it boil for 1 hour to create a pulp while at the same time separating the cellulous fibers and strengthening them. The researchers put the blended leaves into a blender to make a more pulp. Afterwards, they prepared the binding agent or cornstarch by cooking and boiling it until it became a paste-like structure. Next, the researchers mixed it together with the blended leaves and aluminum sulfate. Then, using the molder, the leaves were collected from the basin and left there to dry for a day. The researchers did different ways of drying, like letting it dry under the sun and air drying.

After the process, the researchers evaluate and test the texture, stiffness, and water resistance. To collect the data for the texture of the BuDLeaf multi-purpose paper, the researchers randomly selected 30 participants to observe the product. The researchers used a simple random sampling technique to choose participants for the study. The researcher did a drawlot for randomly selecting students and faculty workers on the campus and a member of Bambuhay Handicraft. The participants evaluate the texture of different compositions of BuDLeaf multi-purpose paper. In evaluating the stiffness, the researchers folded the BuDLeaf multi-purpose paper to test how many times it could be folded without being damaged or broken. To test the water resistance of BuDLeaf multi-purpose paper, the researchers created a table where they recorded the maximum time the BuDLeaf multi-purpose paper could hold water.

The researchers created three compositions to choose the right composition for making BuDLeaf multi-purpose paper. The first composition is composed of 2000 grams of *Buho* Dry Leaves,104 grams of aluminum sulfate, 75 grams of cornstarch and 4 liters of water. The ratio of this composition is 27:1:1:4. The second composition is 1000 grams of *Buho* Dry Leaves, 75 grams of aluminum sulfate, 100 grams of cornstarch and 4 liters of water. The ratio of this composition is 13:1:1:4. The third composition is composed 1500 grams of *Buho* Dry Leaves, 84 grams of aluminum sulfate, 150 grams of cornstarch and 4 liters of water. The ratio of this composition is 18:1:2:4. Aluminum sulfate is used as a sizing agent and helps to improve the strength of paper by binding to the cellulose fibers and also strengthening its water resistance of the paper. On the other hand, the cornstarch is the formation for making BuDLeaf multi-purpose paper, and water is used to mix all the other composition to create a BuDLeaf multi-purpose paper.

Data Analysis Procedure

The researchers used the following statistical tools: frequency counts, mean, standard deviation, and t-test.

The researchers used frequency counts to total the ratings of the participants based on their observations; a mean is the total sum of values in a sample divided by the number of values in your sample; a standard deviation indicates how far the individual responses to a question are, and a t-test is used to compare the means of two groups. The researchers used Microsoft Excel and Smiths Statistical Package for processing the data.

Chapter IV

PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

This chapter presented, analyzed, and interpreted the data gathered in the study. The figures and tables provided information that was used as a lead to answer the statements of the problem of this research.

Table 1. Composition of BuDLeaf Multipurpose Paper

Composition	Components			
	Buho Dry Leaves	Aluminum Sulfate	Cornstarch	Water
Composition 1	2000g	104g	75g	4L
Composition 2	1000g	75g	100g	4L
Composition 3	1500g	84g	150g	4L

Table 1 suggests that BuDLeaf multipurpose paper have three different compositions;

Composition 1 was composed of 2000g of *buho* dry leaves, 104g of aluminum sulfate, 75g of cornstarch and 4L of water.

Composition 2 was composed of 1000g of *buho* dry leaves, 75g of aluminum sulfate, 100g of cornstarch and 4L of water.

Composition 3 was composed of 1500g of buho dry leaves, 84g of aluminum sulfate, 150g of cornstarch and 4L of water.

Overall, these differences in composition may contribute to variations in the qualities of the BuDLeaf multi-purpose paper, as observed in other tables or analyses. Composition 3 of BuDLeaf multi-purpose paper is the best composition based on the results.

Table 2. Quality of BuDLeaf Multipurpose Paper in terms of Texture

Items	Mean	Description
Composition 1	1.9	Rough
Composition 2	2.27	Rough
Composition 3	2.57	Smooth

Legend:

1.00-1.75 Very Rough	1.76-2.51 Rough	2.52-3.27 Smooth	3.28-4.00 Very Smooth

Based on Table 2, the quality of BuDLeaf multi-purpose paper varies in terms of texture across different compositions. Composition 1 and Composition 2 are categorized as “rough,” with mean values of 1.9 and 2.57, respectively. However, Composition 3 is categorized as “smooth,” with a mean value of 2.57. Overall, Composition 3 offers a smoother texture compared to Compositions 1 and 2.

Table 3. Quality of BuDLeaf Multipurpose Paper in terms of Stiffness

Items	Average maximum number of times that can be folded without damage
Composition 1	3
Composition 2	9
Composition 3	12

Based on Table 3, the quality of BuDLeaf multi-purpose paper also varies in terms of stiffness across different compositions. Composition 1 has the lowest stiffness, with an average maximum of 3 folds before damage occurs. Composition 2 shows an improvement in stiffness with an average maximum of 9 folds; Composition 3 demonstrates the highest stiffness with an average maximum of 12 folds before damage; therefore, Composition 3 offers the highest stiffness and durability compared to Compositions 1 and 2.

Table 4. Quality of BuDLeaf Multipurpose Paper in terms of Water Resistance

Items	Average maximum amount of time to absorb water
Composition 1	3 min 20 sec
Composition 2	1 min 36 sec
Composition 3	3 min 15 sec

Based on Table 4, the quality of BuDLeaf multi-purpose paper varies in terms of water resistance across different compositions. Composition 1 shows an average maximum time of 3 minutes and 20 seconds to absorb water, indicating a relatively lower water resistance. Composition 2 demonstrates the lowest water resistance, with an average maximum time of 1 minute and 36 seconds. However, Composition 3 exhibits better water resistance compared to Compositions 1 and 2, with an average maximum time of 3 minutes and 15 seconds to absorb water. Therefore, Composition 3 offers better water resistance compared to the other compositions.

Table 5. Difference Between the Qualities of BuDLeaf Multipurpose Paper

Indicators	p-value	Decision	Remarks
Texture	0.0112	Reject Ho	Significant
Stiffness	0.0001	Reject Ho	Significant
Water Resistance	0.000007	Reject Ho	Significant

Note: "if the p-value is less than or equal to (0.05) level of significance, reject Ho, otherwise failed to reject Ho".

Based on the table, the remarks indicates that the texture is significant. Therefore, the null hypothesis was rejected, suggesting there was a significant difference in texture between samples. Similarly, there was a significant difference in stiffness, leading to the rejection of the null hypothesis. The water resistance was also significant, resulting in the rejection of the null hypothesis.

In summary, the study finds significant differences in texture, stiffness and water resistance between BuDLeaf multi-purpose paper.

CHAPTER V

SUMMARY, CONCLUSION, AND RECOMMENDATION

Summary

This study targeted to create a good composition for creating BuDLeaf multi-purpose paper.

The study utilized an experimental research design. It involved a three composition of BuDLeaf multi-purpose paper, which each composition has a one sample. The study was conducted in Salvacion National High School in the year of 2023-2024.

Research checklists were used as the research instrument in gathering data on the composition and quality of BuDLeaf multi-purpose paper.

Frequency counts, standards deviation, and the T-test were the statistical techniques that the researchers employed. The data processing tools utilized was Microsoft Excel.

The following are the major findings of the study.

1. Composition 3 which composed of 1500g of *buho* dry leaves, 84g of aluminum sulfate, 150g of cornstarch and 4L of water is the best composition among composition 1 & 2

2. Composition 3 which composed of 1500g of *buho* dry leaves, 84g of aluminum sulfate, 150g of cornstarch and 4L of water have smoother texture. It also has the highest stiffness and water resistance compared to composition 1 which is

composed of 2000g of *buho* dry leaves, 104g of aluminum sulfate, 75g of cornstarch and 4L of water and composition 2 which is composed of 1500g of *buho* dry leaves, 84g of aluminum sulfate, 150g of cornstarch and 4L of water.

The study finds that the composition 3 which composed of 1500g of *buho* dry leaves, 84g of aluminum sulfate, 150g of cornstarch and 4L of water distinguished itself with a smoother, higher stiffness and better water resistance.

3. There is a significance difference in between different composition of BuDLeaf multi-purpose paper when it comes to texture, stiffness and water resistance.

Conclusion

Based on the summary, the conclusion was drawn, the researcher's original hypothesis asserted that (*Ho*) there is no significant difference between different composition of BuDLeaf multi-purpose paper when it comes to texture, stiffness and water resistance. However, the results of the study proved the hypothesis otherwise. Each composition of BuDLeaf multi-purpose paper significantly different in quality in terms of texture, stiffness, and water resistance.

In conclusion, among the three composition, Composition 3 which composed of 1500g of *buho* dry leaves, 84g of aluminum sulfate, 150g of cornstarch and 4L of water of BuDLeaf multi-purpose paper distinguishes itself with a smoother texture, less stiff, and better water resistance compared to the other compositions.

Recommendation

Based on the conclusion drawn, the following recommendations are suggested.

- **To the innovators**, the study must explore to find the potential of BuDLeaf multi-purpose paper in different industries such as packaging, printing, etc.
- **To the school administrator**, the researcher suggested that the school must emphasize the importance of supporting eco-friendly initiatives and promote the use of BuDLeaf multi-purpose paper in educational institutions to foster environmental consciousness among students.
- **To the community**, the researcher encourages the community to collect *buho* dry leaves to reduce the waste and to minimize cutting down of trees in paper production and encourage them to learn the process of BuDLeaf paper production and use it in paper craft.
- **To the entrepreneurs**, the researchers suggested they should sell BuDLeaf at a reasonable price and create partnership to other entrepreneur to establish and promote BuDLeaf multi-purpose paper.
- **To the future researchers**, the researchers suggested that the future researchers must conduct more studies about creating a better composition to have a good quality in terms of texture, stiffness, and water resistance. The researchers must find a better procedure on creating BuDLeaf multi-purpose paper and the future researchers must find a better equipment in creating BuDLeaf multi-purpose paper. The researchers also suggested that the future researchers must have a better workplace for creating BuDLeaf multi-purpose paper.

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APPENDIX A
LETTERS

May 6, 2024

SOFIA D. VILLAREAL
School Principal
Salvacion National High School

Subject: Letter of Request to conduct the 1st SNHS Innovators Summit

Dear Madam,

We are writing to request permission to conduct the 1 Innovators Summit. This initiative is part of the project INNOVATORS that was proposed by the selected teacher-innovators of our school. It aims to equip the students in the field of innovations, will also serve as the school's credibility in excelling academic competence. To ensure quality and establish well-skilled young innovators in various field of math and science that will soon be practiced and benefited by everyone.

And in response to the challenge given by the project innovator, the Grade 12 Innovators will showcase their research innovations on May 7, 2024, 8:00 AM-5:00 PM at Senior High School Science Laboratory, Grade 12 STEM learners are the presenters, while the SSC Grade 7-10 and Grade 11 STEM students as well as teacher-innovators will serve as observers.

Moreover, this initiative is also in preparation for the school's participation in the Division Science Fair. We believe that by equipping our learners with research and innovation skills and encouraging them to engage in meaningful science projects, we can contribute to the overall growth and development of our educational programs and initiatives.

We would greatly appreciate your support for this endeavor. Thank you for considering our request.

Thank you and God bless.

Very truly yours,

GERALDINED. LIBARRA
Proponent

Noted:

SOFIA D. VILLAREAL
School Principal

May 6, 2024

HON. ELIZABETH M. CERVANTES
Municipal Mayor
Mayor's Office
Busuanga, Palawan

THRU: JOHN PATRICK GAJARDO
Environmental Management Specialist I
Busuanga, Palawan

Madam:

Greetings of Peace and Prosperity!

With the ardent desire of this school to religiously implement excellence and competence in academic programs of the Department of Education, the advocacy of research and innovation has been conceived of.

Pursuant to Division Memorandum No. 391, s. 2023, the Department of Education, Schools Division of Palawan, through the Curriculum Implementation Division, announces the conduct of the "2023 Division Science and Technology Fair and the 6th PICHE-Palawan Chapter Palawan Wide Science and Engineering Quiz Bowl that was held at Puerto Princesa City.

In this regard, the Salvacion National High School group teacher-innovators created Project INNOVATORS to equip the learners and become young innovators as well as to prepare them for the different areas of science fair.

In view of this, the school will be holding a program titled: Innovators Research Summit which will showcase the different research innovations on May 7, 2024, 8:00 AM - 5:00 PM at Senior High School Science Laboratory. This program will also serve as the school' credibility in excelling academic competence. To ensure quality and establish well-skilled young innovators in various fields of math and science which will soon be practiced and benefited by everyone.

It is for this reason that we are kindly requesting your presence to witness the research innovations that promotes sustainability by the student innovators.

Thank you very much for your continued support to all our school's events!

Very truly yours,

GERALDINED. LIBARRA
Proponent

Noted:

SOFIA D. VILLAREAL
School Principal

May 6, 2024

HON. ELIZABETH M. CERVANTES
Municipal Mayor
Mayor's Office
Busuanga, Palawan

THRU: EDILBERTO D. GATCHALIAN
Municipal Engineer
Busuanga, Palawan

Madam:

Greetings of Peace and Prosperity!

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Thank you very much for your continued support to all our school's events!

Very truly yours,

GERALDINED. LIBARRA
Proponent

Noted:

SOFIA D. VILLAREAL
School Principal

May 6, 2024

HON. ELIZABETH M. CERVANTES
Municipal Mayor
Mayor's Office
Busuanga, Palawan

THRU: SB. JOHN SILVER D. EDONGA
Committee on Education, Culture, Arts, and Religion
Busuanga, Palawan

Madam:

Greetings of Peace and Prosperity!

With the ardent desire of this school to religiously implement excellence and competence in academic programs of the Department of Education, the advocacy of research and innovation has been conceived of.

Pursuant to Division Memorandum No. 391, s. 2023, the Department of Education, Schools Division of Palawan, through the Curriculum Implementation Division, announces the conduct of the "2023 Division Science and Technology Fair and the 6th PICHE-Palawan Chapter Palawan Wide Science and Engineering Quiz Bowl" that was held at Puerto Princesa City.

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Very truly yours,

GERALDINED. LIBARRA
Proponent

Noted:

SOFIA D. VILLAREAL
School Principal

APPENDIX B

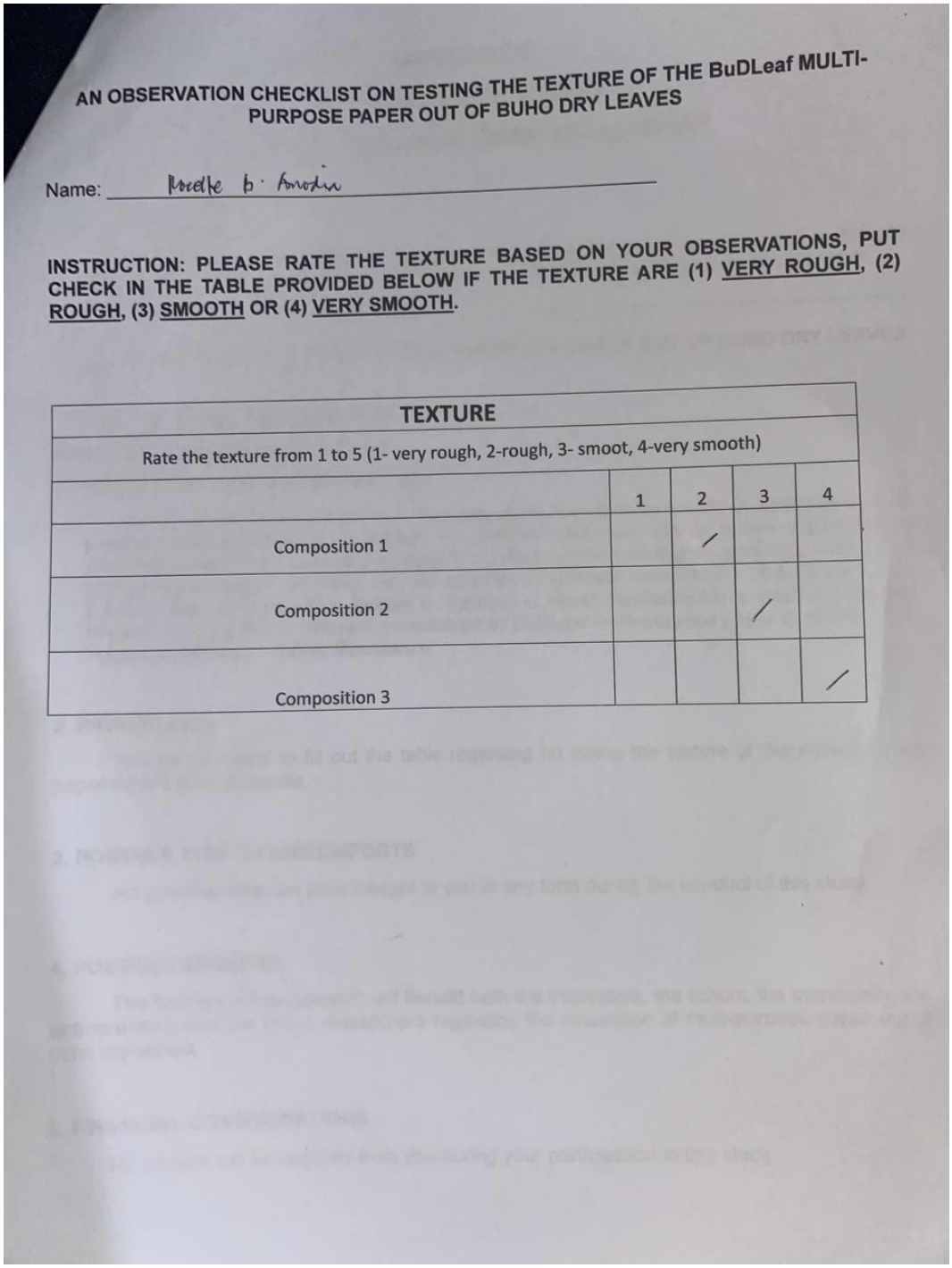
DATA GATHERING NARRATIVE REPORT

Last February 5, 2024 the researchers gathered data regarding to the researcher's study entitled "BuDLeaf: CRAFTING A MULTI-PURPOSE PAPER OUT OF BUHO DRY LEAVES". The researchers created three compositions to determine the best composition on creating a multi-purpose paper. The composition 1 are composed of 2000g of buho dry leaves, 104g of Aluminum Sulfate, 75g of cornstarch and 4L of water. The composition 2 are composed of 1000g of buho dry leaves, 75g of Aluminum Sulfate, 100g of cornstarch and 4L of water. The composition 3 are composed of 1500g of buho dry leaves, 84g of Aluminum Sulfate, 150g of cornstarch and 4L of water.

After the composition was made, the researchers gathered data at Salvacion National High School. The researchers randomly selected 30 participants to test the texture of BuDLeaf multi-purpose paper. The researchers test the stiffness and water resistance of the BuDLeaf multi-purpose paper. After the researchers test the qualities of BuDLeaf multi-purpose paper which are the texture, stiffness, and water resistance, the researchers tabulated, evaluated and analyzed the data that have gathered. Based on the gathered data, the best composition for creating BuDLeaf multi-purpose paper was composition 3 which is composed of 1500g of buho dry leaves, 84g of Aluminum Sulfate, 150g of cornstarch and 4L of water. The researchers have encountered difficulties and challenges while gathering the data but aside from that, the data gathering was a success.

APPENDIX C

SAMPLE OF RESPONSES



AN OBSERVATION CHECKLIST ON TESTING THE TEXTURE OF THE BuDLeaf MULTI-PURPOSE PAPER OUT OF BUHO DRY LEAVES

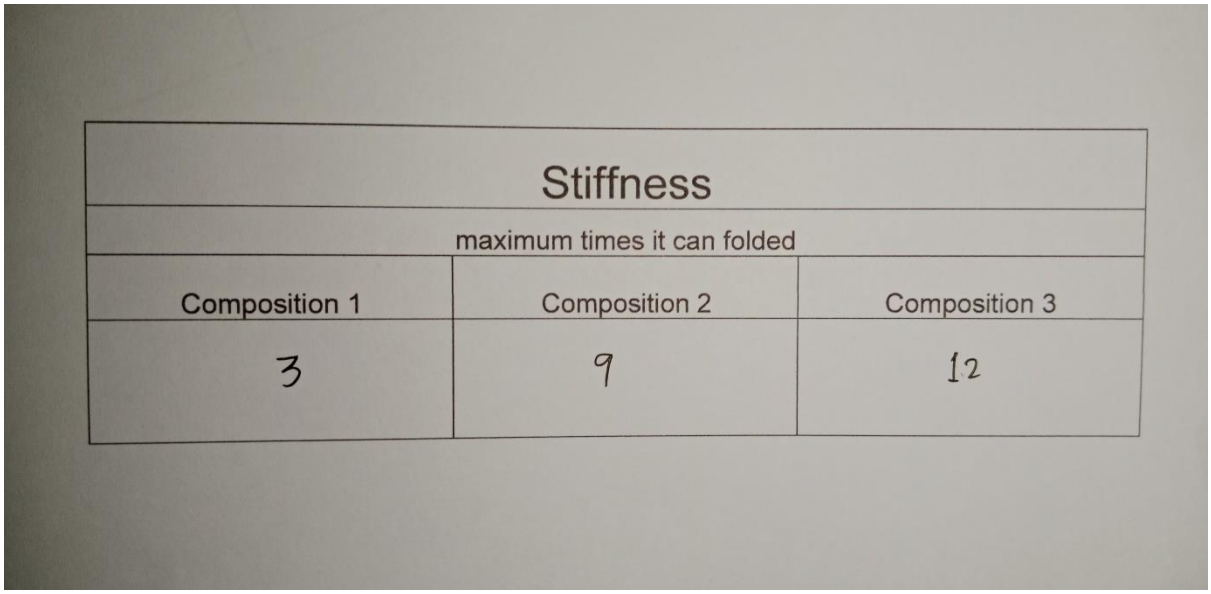
Name: Noelle b. Amodia

INSTRUCTION: PLEASE RATE THE TEXTURE BASED ON YOUR OBSERVATIONS, PUT CHECK IN THE TABLE PROVIDED BELOW IF THE TEXTURE ARE (1) VERY ROUGH, (2) ROUGH, (3) SMOOTH OR (4) VERY SMOOTH.

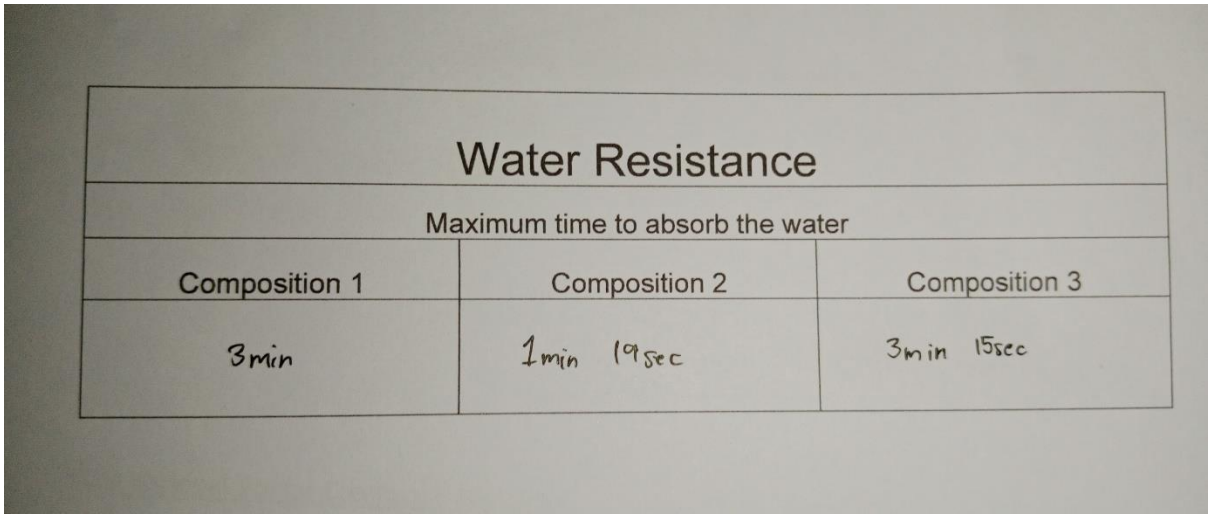
TEXTURE				
Rate the texture from 1 to 5 (1- very rough, 2-rough, 3- smoot, 4-very smooth)				
	1	2	3	4
Composition 1		/		
Composition 2			/	
Composition 3				/

APPENDIX C

SAMPLE OF RESPONSES



Stiffness		
maximum times it can folded		
Composition 1	Composition 2	Composition 3
3	9	12



Water Resistance		
Maximum time to absorb the water		
Composition 1	Composition 2	Composition 3
3min	1min 19sec	3min 15sec

APPENDIX D

DOCUMENTATION

BEFORE:

DURING:

APPENDIX D

DURING:

AFTER:

APPENDIX D

AFTER: