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GUIDELINES FOR CONTRIBUTORS

The following shall serve as guidelines to all contributors for publication of research articles to the Global Researchers Journal Volume 11, February 2024 issue:

1. All articles must have a high degree of scholarship;
2. All articles must be evaluated thru double-blind system by selected referees for publication;
3. The articles may either be written in English or Filipino. All articles written in either languages must be accompanied by an Abstract which is written in English;
4. All contributions must be original;
5. Articles must use APA style sheet; and,
6. Articles must be typed single-spaced, Times New Roman 11 pts on letter-sized (8 x11) paper in not more than twelve (12) pages.

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MARUNGKO READING AND TRADITIONAL READING (ABAKADA) INSTRUCTION: EFFECTIVENESS IN TEACHING BEGINNING READING

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ABSTRACT

One of the perennial agonies of a kindergarten-teachers is of how to teach beginning reading. They have difficulties in letting their pupils read at the end of the school year. Some pupils were left behind, or they were called "Non-readers". These observations challenged the researchers to conduct an experimental study on the effectiveness of Marungko Approach, a reading strategy that helps the pupils learn how to read through mastery of phonemes and letter recognition. As they believe that effective reading approaches rationalize change in the lives of every learner. It can possibly change their lives if not for the better but for the best especially in their academic performance. This study presents the effectiveness of Marungko Approach in teaching beginning reading. Employing the experimental type of research, it was found out that Marungko approach is very effective strategy or method in teaching beginning reading to kindergarten as well as primary grade pupils as presented by the results of their pretest and post-test.

Keywords: *Marungko approach, effectiveness, traditional approach, phonemes*

INTRODUCTION

Since reading is the cornerstone of education, a youngster who cannot read will not be able to accomplish anything worthwhile (Egong 2014). Reading is a vital tool for learning and aids in the acquisition of all other subjects covered in the curriculum.

Johnson (2008) states that improving reading skills is fundamental to every child's education and has been the main emphasis of education for more than a century. Unlike oral language development, reading does not come easily to most youngsters, even in contexts with lots of print. Instead, reading requires systematic and explicit training (Bald, 2007). Because reading is so important both inside and outside of the classroom, and because literacy has a cumulative long-term cost, intervention is critical especially at the foundation phase. Learners, who do not learn how to read during their elementary school years, have difficulty in navigating the school curriculum during middle and upper grades Smichdt, Rozendal & Green (2002).

A child's ability to read is critical to their academic performance since it will enable them to explore a wider range of material and develop their language and communication abilities. Furthermore, youngsters can have a great time reading and using their imaginations, which opens up a world of possibilities for them.

For Kindergarten and First Grade, it is necessary to learn how to read. It is the duty of the teacher to design, implement, and oversee an efficient reading program that will help the student become a proficient reader as soon as they start school.

According to McDonald (2007), South African students' reading abilities are generally underdevel-

oped throughout elementary school through postsecondary education. The government has recently realized that a portion of the problem with children's reading difficulties stems from the fact that they are unable to read in both their mother tongue and their first language.

The Department of Education (DepEd) has implemented several programs aimed at enhancing the reading abilities of Filipino children. These programs include Every Child A Reader Program (ECARP), the Mother Tongue-Based Multilingual Education (MTB-MLE), and more school-based reading initiatives (Cristobal, 2015). But worrying circumstances are revealed by national trends in education. In 2015, the Education for All National Review Report observed that the nation's illiterate population was on the rise among adults, youth, and children. Lesnick et al., referenced by de Dios (2013), highlighted that two out of every five third-graders who struggled with reading were likely to fall short when they started junior high school. Early and intermediate Filipino students were described by Devine and Payan (2006) as struggle readers. Nava et al., (2017) observed lower performance in silent and oral reading of pupils in the regions and provinces farther south of the National Capital Region (NCR). Reading inventory conducted in the Division of Tanauan City also reveals several non-reader grade two pupils during the fourth quarter of School Year 2017-2018 who were promoted in grade three the following school year.

There are many methods and instructions used in teaching reading. One of it is Traditional reading (abakada) approach and the other is the marungko reading approach.

The Marungko method of teaching reading is regarded as a powerful instrument for improving students' foundational reading abilities and fostering reading fluency. This reading strategy, which starts instruction by emphasizing sounds that occur from most frequently to least frequently in the learners' native tongue, supports culture-based language acquisition. Literature-based activities serve to reinforce the correct sequencing of sounds while taking into account the native language of the students, thereby fostering an appreciation and enjoyment of reading (Bustos-Orosa and Ferrer, 2013). It is anticipated that students with reading difficulties will grow to love and appreciate reading if they get appropriate reading teaching complemented by engaging activities.

In his study "The effects of phoneme awareness on the reading performance of the grade one pupils," Nicolau (2013) claims that there is a significant difference between the grade one students' reading performance and phoneme awareness. The findings of the study were able to demonstrate that the grade one students' reading performance is significantly impacted by phoneme awareness. This demonstrates that regardless of the number of vowels and letters that have already been introduced, becoming familiar with the sounds of each letter is crucial before starting to read. Nicolau's (2013) study supports the goals of the marungko approach to reading.

The Traditional approach is another strategy or method used to teach beginning readers. The Traditional approach to teaching reading in Setswana, another African nation, appears to have elements in common with other languages, including English, Southern Sotho (Sesotho), and Northern Sotho (Sepedi) Morrow (2006). Since educational theories gave instructors more authority in the classroom, this approach may have also found a healthy place to take root in an African classroom Morrow, (2006). Teachers were expected to guide students in their learning as leaders. The goal of the Traditional approach of teaching beginning reading was to progress with the student. However, the teacher led the student rather than following them, and they chose the path and pace with minimal input from them.

Mama Tuni (2006) claims that the Traditional method's drawback is that the child learns to read more slowly because they are only exposed to one letter at a time. She saw that by assigning texts for the kids to read or write, the teacher here has a significant influence on the literacy development of the students. Once more, in an attempt to prevent reading difficulties, this approach has a tendency to be too focused on phonics at the expense of other reading-related.

STATEMENT OF THE PROBLEM

This experimental study aimed to determine the effectiveness of the two-reading instruction, the Marungko approach and the Traditional approach.

Specifically, it answered the following questions:

1. What is the performance of the pupils in the pre-test and post-test using:
    a. Traditional approach; and
    b. Marungko approach?
2. Is there a significant difference on the performance of pupils in the pretest and post-test using:
    a. Traditional approach; and
    b. Marungko approach?
3. Is there a significant difference in the reading performance of the pupils using:
    a. Traditional approach; and
    b. Marungko approach?
4. What is the effect of the Marungko and Traditional approaches in the beginning reading ability of the pupils?

METHODS AND MATERIALS

The quasi-experimental design was used in this research to test the effectiveness of Marungko approach and traditional reading approach in teaching reading.

The study was conducted in San Isidro District, Division of Isabela. San Isidro is a small town in Isabela composing of 13 barangays.

The participants of the study were the Kindergarten pupils of San Isidro West Central School Division of Isabela.

After identifying the controlled and experimental group, a pre-test was done using letter flash cards. The teachers asked the pupils to identify and say the corresponding phonemes of the given letters. This procedure was done both in the controlled and experimental group. The letters M, S, A, I and B were identified.

After the pre-test, a 30-day intervention program was conducted using the Marungko and Traditional approach. During the sessions, pupils used the module to meet their learning objectives. The Module was designed to equip Kindergarten pupils the necessary reading skills to improve achievement in reading. Likewise, it seeks to develop a training model to enhance teachers' competence in the teaching of reading in the primary grades most especially in Kindergarten for beginning reading.

Each pupil in the experimental group used the Marungko-based module. Every letter is pronounced rather than read by the children. Several words were given with the corresponding beginning sound of every letter being introduced by the teacher. The study readily monitored pupils' performance through activities and seatwork specified in the module, as well as assignments. One phoneme is introduced every day. Mastery of phoneme is required before moving to the next phoneme. Thus, if one pupil did not show mastery on the "phoneme-for-the-day" he must stay with the teacher within the day to have remedial class to catch up with the un-mastered phoneme. After introducing the /m/ on the first day, /s/ on the second day, and /a/ phoneme on the third day, the pupils were expected to read phrases like mama, sasama, sama-sama, ama, asa. Then these words were formed into sentences like Sasama sa ama, Mama sasama sa ama. This procedure is done repeatedly until mastery of each phoneme is evident.

For the Traditional group, they performed the same activities as the experimental group, but it was conducted via Traditional method using the "abakada". It follows the arrangement of the alphabet let-

ters beginning from A to Z regardless of whether the pupils can identify or master the phonemes of each letter. After introducing all the letters, the method of ba-be-bi-bo-bu in reading was used.

After the intervention, post-test was conducted to level the performance of the pupils in letter recognition with their corresponding phonemes. Performance in reading was also tested using the "Unang Hakbang sa Pagbasa", an intervention material developed by the researchers that underwent expert validation.

To determine the performance of the pupils in the pre-test and post-test in letter recognition and phonemes the following scale was used:

Score	Description	Indicators
5	Very High	All letters were identified/recognized with their corresponding phonemes.
4	High	Only 4 letters were identified/recognized with their corresponding phonemes.
3	Average	Only 3 letters were identified/recognized with their corresponding phonemes.
2	Poor	Only 2 letters were identified/recognized with their corresponding phonemes.
0-1	Very Poor	No letters were identified/recognized with their corresponding phonemes.

The researchers conducted a reading activity after the intervention. It was done in a one-on-one basis. There were 20 words given and were read by the pupils. This was done to level the effectiveness of the Marungko and Traditional approach in teaching beginning reading.

The scale below was used to level the performance of the pupils in reading:

Score	Description	Indicators
20	Very High	The pupils have read the 20 words
15-19	High	The pupil has read 15 to 19 words only.
10-14	Average	The pupil has read 10 to 14 words only.
5-9	Poor	The pupil has read 5 to 9 words only.
0-4	Very Poor	The pupil has read 0 to 4 words only.

A reading material titled "***Unang Hakbang sa Pagbasa***" was used in the study to level the performance of the pupils both to the controlled and experimental groups. It was developed by the researchers and underwent expert validation.

Tables and graphs were used for the presentation of data to facilitate understanding.

T-tests. After the pre-tests and post-tests, t-test of the difference between means of independent data was employed to determine a group's mean over that of the other group. t-test for independent groups was employed to test the difference between means of the experimental and Traditional groups in the pre -test and post-tests.

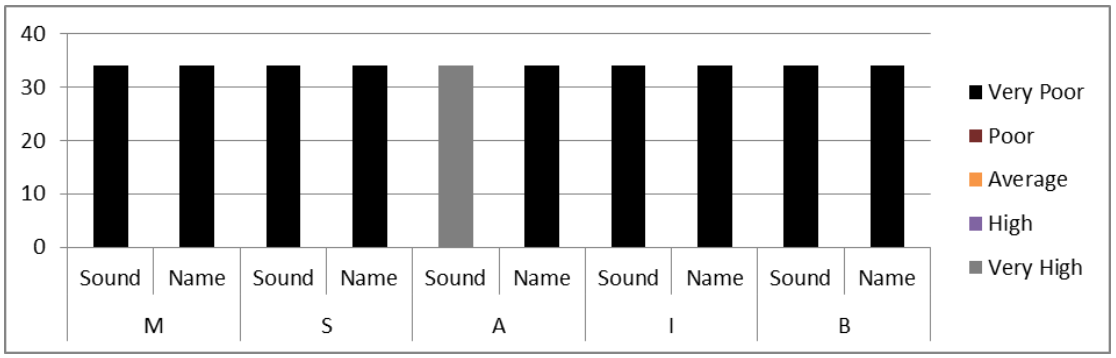
Paired sample t-test of difference between groups was also employed to test the difference between the pre-test and post-test results of the experimental and Traditional or control group both in their performance in letter recognition and phonemes as well as in reading.

For the interpretation of the performance of the students, the following categories were used:

Scale	Range	Description	Indicator
1	1	YES	The respondents identified and recognized the given letters with their correct phonemes.
0	0-0.99	NO	The respondents did not identify and recognized the given letters and their correct phonemes.

RESULTS AND DISCUSSIONS

Figure 1. Pre-test Result of the Controlled Group

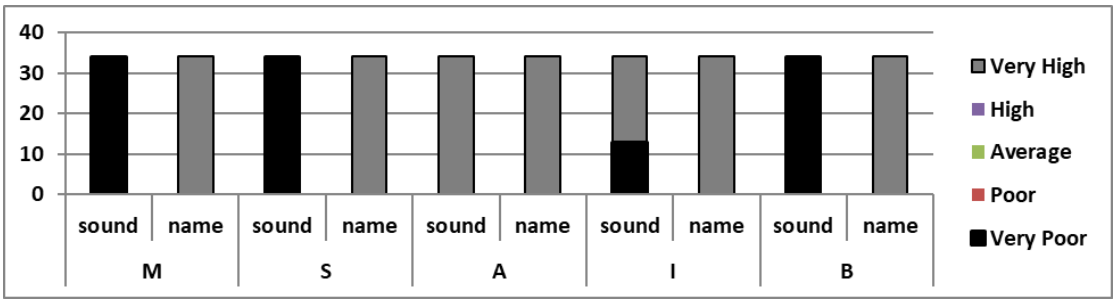


	M		S		A		I		B	
	Sound	Name	Sound	Name	Sound	Name	Sound	Name	Sound	Name
Very High					34					
High										
Average										
Poor										
Very Poor	34	34	34	34		34	34	34	34	34

Figure 1 shows the result of the pre-test of the controlled group. It shows that there is a very poor result on the recognition of letters and their corresponding phonemes except for letter A.

Results show that pupils had low scores which means that they had no prior knowledge in identifying the given letters with their corresponding phonemes.

Figure 2. Post-test Performance of the Pupils in the Controlled Group



	M		S		A		I		B	
	sound	name	sound	name	sound	name	sound	name	sound	name
Very Poor	34		34				13		34	
Poor										
Average										
High										
Very High		34		34	34	34	21	34		34

Figure 2 shows the result of the post-test of the controlled group. It can be gleaned that respondents have a very high scores in terms of letter recognition but very poor in and phonemic awareness.

Table1. Mean Result of the Controlled group during the Pre-Test and Post-Test

Descriptive Statistics					
	N	**Mean (Pre-Test)**	**Desc.**	**Mean (Post-test)**	**Desc.**
M Sound	34	.176	No	0.000	No
M Name	34	.118	No	1.000	Yes
S Sound	34	.088	No	0.000	No
S Name	34	.147	No	1.000	Yes
A Sound	34	1.000	Yes	1.000	Yes
A Name	34	.029	No	1.000	Yes
I Sound	34	.176	No	0.618	No
I Name	34	.118	No	1.000	Yes
B Sound	34	.088	No	0.000	No
B Name	34	.118	No	1.000	Yes
Grand Mean	34	**.206**	**No**	**0.662**	**No**

Legend: 1 – Yes 0-0.99 - No

Table 1 presents the mean result of the controlled group during the pre-test and post-test. It can be seen in the above table that the grand mean of the post-test is .206 that describes as "NO". Respondents has a very low performance in the pre-test. After the intervention, post-test revealed that there is an increase of mean on letter M(name), S(name), A (name and sound), I(name) and B(name) getting a grand mean of 0.662 that describes as "NO". This means that respondents in the controlled group during the post-test have a very low performance on letter recognition with their corresponding phonemes though there is an increase in the mean.

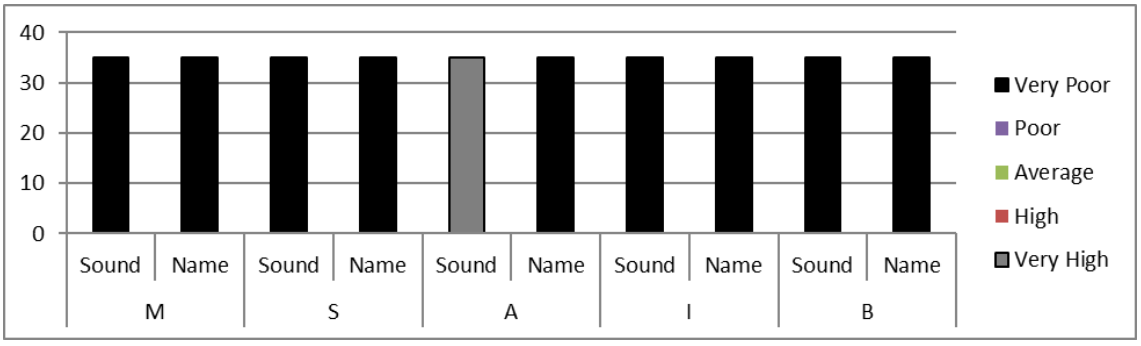
Table 2. Paired Sample t-test of the Controlled Group after the Intervention

		Paired Differences			**t**	**Df**	**Sig. (2-tailed)**	
		Std. Error Mean	**95% Confidence Interval of the Difference**					
			Lower	Upper				
Pair 1	MSound PMsound	.06636	.04146	.31148	2.659	33	.012	Reject
Pair 2	MName - PMname	.05609	-.99646	-.76825	-15.732	33	.000	Reject
Pair 3	SSound - PSsound	.04937	-.01222	.18869	1.787	33	.083	Accept
Pair 4	SName - PSname	.06165	-.97837	-.72751	-13.835	33	.000	Reject
Pair 5	AName - PAname	.02941	-1.03043	-.91075	-33.000	33	.000	Reject
Pair 6	ISound - PIsound	.09619	-.63689	-.24547	-4.586	33	.000	Reject
Pair 7	IName - PIname	.05609	-.99646	-.76825	-15.732	33	.000	Reject
Pair 8	BSound PBsound	.04937	-.01222	.18869	1.787	33	.083	Accept
Pair 9	BName PBname	.05609	-.99646	-.76825	-15.732	33	.000	Reject

Table 2 shows the paired sample t-test of the controlled group. Results revealed that pairs 1, 2, 4, 6, 7 and 9 has a computed p-value lower than 0.05 significant level which leads to the rejection of the null hypothesis. This implies that the intervention used in the controlled group affects the performance of the pupils in the controlled group.

According to Mama Tuni (2006), the problem with the Traditional method is that it takes the child a longer time to be able to read, as the child was reading one letter sound by one letter sound. She noticed that a teacher here plays a key role in the child's literacy development by choosing what children must read or write. Again, in the process of avoiding reading difficulty, this method tended to be overused in reinforcing the phonic skills and neglects other aspects of reading and needs of different children.

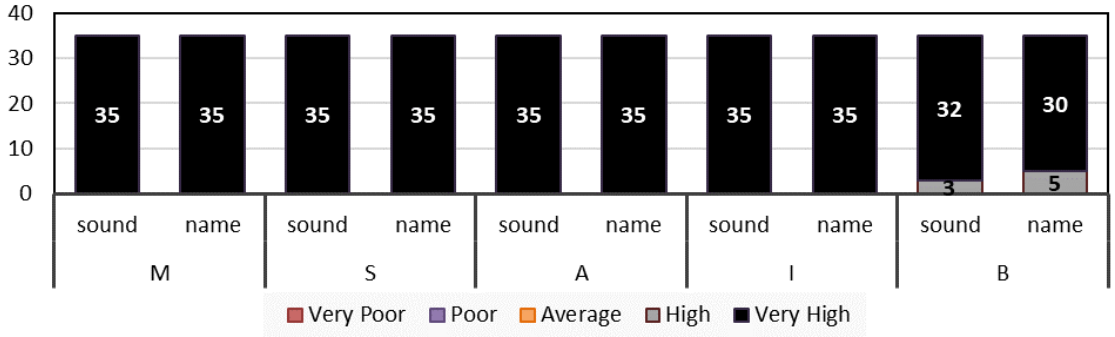
Figure 3. Pre-test Result of the Pupils in the Experimental Group



	M		S		A		I		B	
	Sound	Name	Sound	Name	Sound	Name	Sound	Name	Sound	Name
Very High					35					
High										
Average										
Poor										
Very Poor	35	35	35	35		35	35	35	35	35

Figure 3 shows the result of the pre-test of the experimental group. Letter M, S, I and B has a very poor result in terms of letter recognition and phonemes. On the other hand, letter A resulted very high on its phonemes but very poor in letter recognition.

Figure 4. Post-test Performance of the Pupils in the Experimental Group



	M		S		A		I		B	
	sound	name	sound	name	sound	name	sound	name	sound	name
Very Poor										
Poor										
Average										
High									3	5
Very High	35	35	35	35	35	35	35	35	32	30

Figure 4 presents the result of the post-test of the experimental group. It can be gleaned that respondents have a high to very high performance in terms of letter recognition and phonemes.

Both groups showed that there is an improvement in their performance after each strategy was used in teaching beginning reading. However, Marungko Approach and human intervention with the supervision of the teacher was still more effective to experimental group, due to the fact that during experimentation, they can instantly follow what is in store in the material since it is based on the Marungko approach which clarify concepts that are not clear, unlike in Traditional method, pupils will wait for their teachers cues without any instructional material that will motivate them and be more excited in reading before they can interact with each other.

Table 3. Mean Result of the Experimental Group during the Pre-test and Post-Test

Experimental Group Result Descriptive Statistics					
	N	**Mean (Pre-test)**	**Desc.**	**Mean (Post-test)**	**Desc.**
M Sound	35	.143	NO	1.000	YES
M Name	35	.057	NO	1.000	YES
S Sound	35	.143	NO	1.000	YES
S Name	35	.086	NO	1.000	YES
A Sound	35	1.000	YES	1.000	YES
A Name	35	.057	NO	1.000	YES
I Sound	35	.029	NO	1.000	YES
I Name	35	.114	NO	1.000	YES
B Sound	35	.086	NO	0.914	NO
B Name	35	.086	NO	0.857	NO
Grand Mean	**35**	**.180**	**NO**	**0.977**	**NO**

Legend: 1 – Yes 0-0.99 - No

Table 3 presents the mean result of the experimental group during the pre-test and post-test. It can be gleaned that the grand mean of the pre-test is .180 that describes as "NO". This means that majority of the letters was not recognized same as their corresponding phonemes. After the intervention, result shows that there is an increase in the performance as presented by the mean, both in the letter recognition and phonemes on the letters m, s, a, i and b getting a grand mean of 0.997 that describes as "NO".

Table 4. Paired Samples T-test of the Experimental Group after the Intervention

		Paired Differences						Desc.
		Std. Error Mean	95% Confidence Interval of the		t	df	Sig. (2-tailed)	
			Lower	Upper				
Pair 1	MSound PMsound	.06001	-.97910	-.73518	-14.283	34	.000	Reject
Pair 2	MName PMname	.03981	1.02376	-.86196	-23.685	34	.000	Reject
Pair 3	SSound PSsound	.06001	-.97910	-.73518	-14.283	34	.000	Reject
Pair 4	SName PSname	.04801	-1.01185	-.81672	-19.044	34	.000	Reject
Pair 5	AName PAname	.03981	-1.02376	-.86196	-23.685	34	.000	Reject
Pair 6	ISound PIsound	.02857	-1.02949	-.91336	-34.000	34	.000	Reject
Pair 7	IName PIname	.05456	-.99660	-.77483	-16.233	34	.000	Reject
Pair 8	BSound PBsound	.06463	-.95993	-.69722	-12.819	34	.000	Reject
Pair 9	BName PBname	.07201	-.91778	-.62508	-10.712	34	.000	Reject

Table 4 shows the paired sample t-test of the experimental group after the intervention. Data reveals that all pairs have a computed p-value lower than 0.05 that leads to the rejection of the null hypothesis. This implies that the intervention used in the experiment group has a significant difference on the performance of the respondents.

According to the National Reading Panel, 2007; Duffy, (2007), Strategy in reading approach is most effective when strategies are explicitly taught. This involves the instructional strategies of explanation plus modeling or demonstrating the reading approach as to how and when to use it (Dewitz et al. 2009). In addition, instructional strategies should include scaffolding by teachers and opportunities for students to practice and apply strategies (Palinscar and Brown, 2014; Rosenshine et al., 2016). While the teacher serves as the instructional leader initially, students are actively engaged in the process and should be gradually given the opportunity to take over responsibility for recognizing when and how to use strategies.

Nicolau, (2013) in his study titled "The effects of phoneme awareness on the reading performance of the grade one pupils", that there is a significant difference between the phoneme awareness and the reading performance of the grade one pupils and results was able to point out the phoneme awareness significantly affect the reading performance of the grade one pupils. This shows that familiarization of the sounds of each letter is very important to begin reading regardless of how many vowels and letters is already being introduced. This study of Nicolau (2013) pays support to the objectives of the Marungko approach in reading.

Figure 5. Performance of the Pupils in Reading (Controlled and Experimental Group)

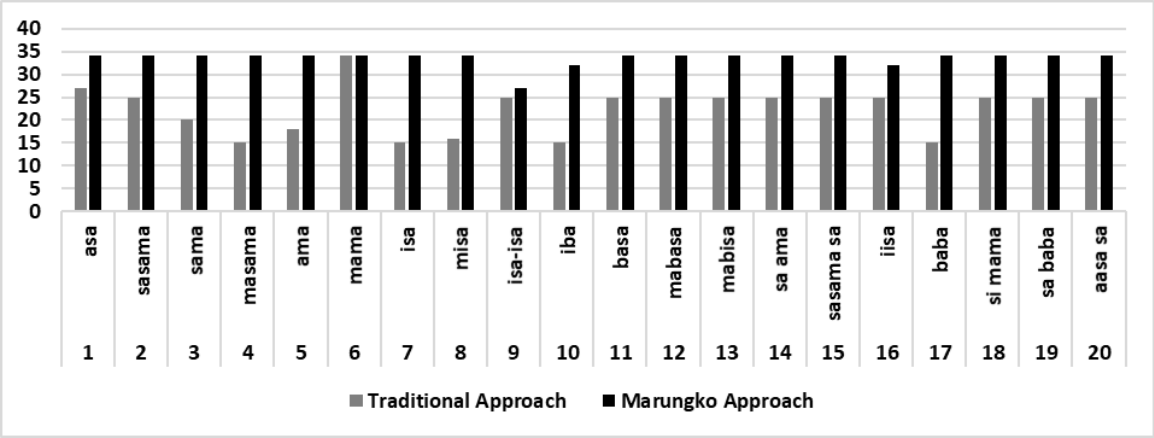


Figure 5 presents the performance of the pupils in reading. Results revealed that experimental group (Marungko approach) shows a better reading performance than that of the controlled group (Traditional approach.)

Table 5. Mean on the Performance of the Pupils in Reading

	N	Mean	Std. Deviation.	Std. Error Mean
Traditional	20	22.50	5.20627	1.16416
Marungko	20	33.45	1.63755	.36617

Table 5 presents the mean on the performance of the pupils in reading in the controlled and experimental group. It can be observed that Marungko group get a higher mean to that of the Traditional group. This implies that the approach used in the experimental group is effective.

Table 6. T-test on the Reading Performance of the Pupils

	Test Value = .05					
	t	Df	P-value	Mean Difference	Interval of the	
					Lower	Upper
Traditional	19.284	19	.000	22.45000	20.0134	24.8866
Marungko	91.215	19	.000	33.40000	32.6336	34.1664

Table 6 presents the t-test on the performance of the pupils in reading. Results revealed that pupils both groups get a significant result having a computed value of lower than 0.05 significant level that leads to the rejection of the null hypothesis. This implies that the intervention materials affect the reading performance of the pupils.

However, tabular value reveals a difference on the result. Pupils who were exposed to the Marungko Approach has a higher value than that of the Traditional approach. This means that the intervention used

in the Marungko group is effective.

The efficiency of Marungko approach in enhancing reading ability is affirmed by Roxas' (2018), that the Marungko approach is designed to equip pupils the necessary materials to improve their achievement in reading.

The researchers proposed the use of the "Unang Hakbang sa Pagbasa" as a learning material to help improve the reading ability of the children especially the Kindergarten. This is the intervention material used by the researchers in this study. The Marungko approach-based instructional material can provide teachers with precise directions for teaching letter-sound relationships. It also provides activities to enhance the fine motor domain of the pupils. The said material is so interesting and enjoyable for learners especially the Kindergarten.

CONCLUSIONS

Based on the findings of the study, the following conclusion was drawn:

1. There is no significant relationship between the pretest and posttest of the control and experimental group. In the posttest, the mean score of the two groups differentiated after the t-test was employed, in favor of the experimental group. There is a significant difference between the pretest and posttest of the control group, in favor of the posttest.
2. Using the Marungko Approach, learners easily identified and recognized the letters with their corresponding phonemes. This was based on the results of the posttest of the experimental group using Marungko approach which registered significant learning on the part of the learners. Thus, Marungko Approach was an effective strategy in teaching beginning reading.

RECOMMENDATIONS:

Based on the findings and conclusions, the following recommendations are hereby presented.

1. Elementary Program Specialists in English and Filipino should look in the effectiveness of the Marungko Approach in teaching beginning reading. The result further attributes pupils' eagerness to learn and read easily using the approach.
2. Administrators should encourage their teachers to use Marungko Approach in the primary grades especially in the Kindergarten level as a strategy in teaching beginning reading.
3. Make a proposal to conduct seminar-workshop in teaching beginning reading in the district and in the division, if possible, to reiterate the use Marungko Approach as a method and style in teaching beginning reading.
4. Adopt the "Unang Hakbang sa Pagbasa", a reading/workbook material which was developed by the researchers as instructional materials in teaching beginning reading.

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IDENTIFYING AND RESOLVING CONFLICTS IN MATHEMATICS TEACHERS INSTRUCTIONAL MATERIAL DEVELOPMENT EXPERIENCES UNDER THE LENS OF ENGESTROM'S EXPANDED ACTIVITY THEORY

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ABSTRACT

This study was an attempt to generate a model in identifying and resolving conflicts among teachers experiences in developing instructional materials in statistics under the lens of Engestrom's Expanded Activity Theory (EAT) in one of the public secondary schools offering senior high school curriculum in the province of Iloilo,Philippines. Using the methodology of Participatory Action Research (PAR), four senior high school mathematics teachers teaching statistics formed a research team. Drawing from multiple data sources, findings of the study were presented as specific and group narratives of participants' experiences in collectively developing instructional materials for senior high school statistics. Analysis of narratives revealed the following conflicts with participants experiences while developing instructional materials: (a) lack of administrative support; (b) lack of collaborative practices; (c) misalignment of IMs objectives to DepEd Senior High School Statistics competencies; and (d) lack knowledge and training on the development of instructional materials. The study generated an integrated model inspired by the Expanded Activity Theory and phases of Kimmes and McTaggarts' Participatory Action Research. Moreover, the study has important theoretical contributions to: (a) Engestrom's Expanded Activity Theory, which guides mathematics teachers in identifying, and resolving conflicts between and among the elements of the activity system in the development of instructional materials; and (b) Experiential Learning Theory (ELT), is a powerful foundational approach to explain learning from individual and collaborative experiences generated through ongoing negotiations of personal, shared, and group interactions.

Keywords: *Conflict, Experiences, Instructional Materials, Engestrom's Expanded Activity Theory*

Introduction

Conflict is a vital part of thinking, watching, performing and managing in an educational organization (Tjosvold, 1991as cited in Dagon, 2016). It has been known that conflict is an organizational reality and there are people who lead up to it having different characters, understandings, value judgment, perspectives, objectives, attitudes, beliefs, personalities, roles, communication skills and interests (Atay, 2001; Parker & Stone, 2003; Seval, 2006; Demir, 2010; Ceylan, Ergün, & Alpkan, 2011).The occurrence of conflict appears to be normal (Dagli & Sigri,2014) in every educational institution, though according to Seval (2006) the first time it comes to mind it implicates furiousness, fear, tension, anger, disappointment, and distrust. Eren (2008) made a generalization that problems between individuals or groups working together causes conflict to arise, and may lead to disruption or complete cessation of normal interactions in the working environment. For some, conflict means an opportunity to change for something better, intellectual revolt, excitement, encouragement (Tjosvolt, 1991 as cited in Dogan, 2016) and a breakthrough.

A school community is composed of administrators, teachers, students, parents and other employees

who are always intensively in contact with one another in order for educational facilities to achieve its goal (Erturk, 2022). However, if school administrators have poor leadership skills, teachers lack proficiency in the field of specialization, staff members has dominating behavior; no one is willing to accept intervention, and neglecting each others' thoughts, these gradually result to failure of the entire educational system.

The implementation of the K to 12 Curriculum for Senior High School in the Philippines aims to respond to the increasing demand of international communities and targets to improve the competitiveness of our Filipino graduates through enhanced basic education (Department of Education, 2016). However, there has been increasing criticism on how ready and supportive our academic communities are in terms of budget, facilities, teachers' competencies, instructional material and operational support. One common problem encountered by Senior High School teachers is the lack of instructional materials, such as books and other instructional resources that causes conflicts within the school system. One particular situation is the teaching of statistics has been dominated by lecture, and giving of notes accompanied by the use of chalkboard only and prescribed textbooks. Mathematics teachers have posed various issues, sentiments, and even faced several challenges. One of the undeniable issues is unavailability of appropriate instructional materials, resources and facilities (Baan, 2021), and at the same time teachers are not adequately prepared Komen (2001).

How can these teachers provide what is expected from them, knowing there are rules and competencies set by the Department of Education and the school community that monitors the implementation of such?

Based on the gap mentioned above this research was conducted to identify and resolve conflicts on teachers' instructional material development experiences.

Epistemology, Theoretical Research Perspective, and Engestrom's Expanded Activity Theory

This research entailed the exploration of mathematics teachers' experiences, as they collectively develop instructional materials in statistics. The focus was on the social interaction of mathematics teachers, how they construct reality, how ideas and attitudes were developed and changed overtime, by their use of agreed and shared meaning as communicated through language. It was therefore apt to anchor this research on constructionism, the epistemology that deals with the construction of meanings as one interacts with the object (Felimon,2011 ; Crotty:1998).

In particular, symbolic interactionism is the theoretical research perspective of this study. This perspective centers on how the mathematics teachers' respond to various elements, the meanings being created, and modified through social interaction, the exchange of meanings through language and symbols.

Specifically, this research study was viewed under the lens of Engestrom's Expanded Activity Theory (EAT) as its theoretical framework. As shown in Figure 1, EATis composed of different analytical units of mediating artifact or tool, subject, community of significant others, division of labor, and object, which created an outcome for every activity being analyzed.

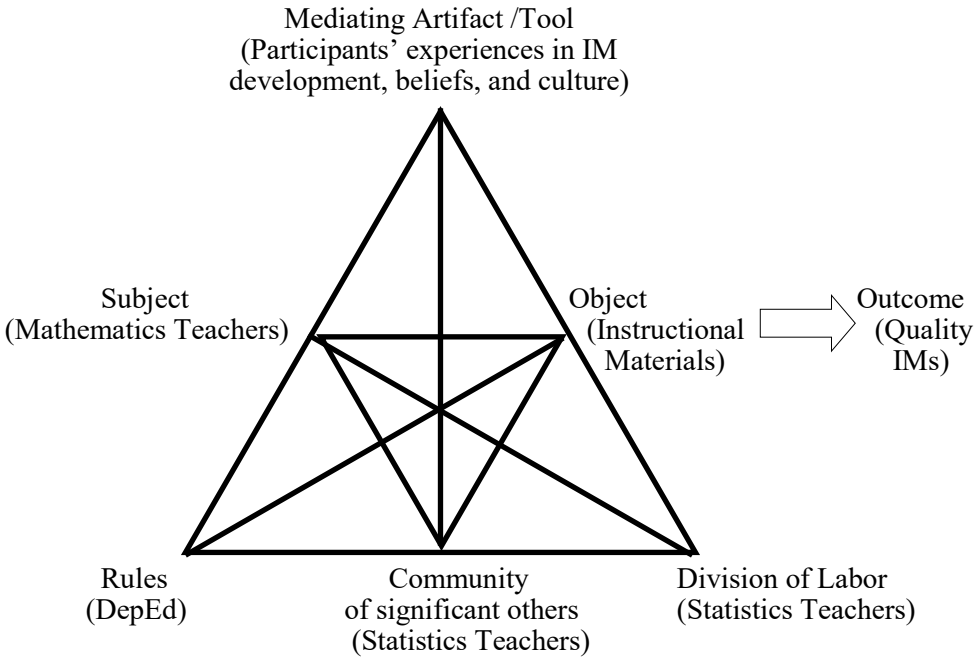

Figure 1. Engestrom's(2001) Expanded Activity Theory

Research Purpose/Research Problems

The purpose of the study is to generate a model in understanding teachers experiences in developing instructional materials in statistics using the lens of Engsetrom's Expanded Activity Theory.

This study was guided by the following research questions: (1) What are the conflicts in teachers' practices involving instructional materials development? (2) How do these conflicts in teachers' practices on instructional materials development are addressed? (3) What model reflects the process of addressing these conflicts?

METHODOLOGY

Methodological Perspective

This research is a qualitative research, particularly a participatory action research, designed to understand and improve the world by changing it. As its heart is collective, self-reflective inquiry that the researcher and participants undertake, to understand and improve upon the practices in which they participate and the situations in which they find themselves (Baum, MacDougal & Smith, 2017). It adopted the Kimmes and McTaggart's (2000) PAR cyclical approach, undergoing two PAR cycles.

Procedure

The four mathematics teachers were purposefully chosen to explore their unique experiences in developing instructional materials in statistics reflecting and limiting on the framework of expanded activity theory. Ethical aspects were given primary considerations before this research commenced.

The Two- PAR Cycleswas observed in the conduct of this study. Figure 2 presents the three phases – Plan, Act & Observe, Reflect of PAR by Kimmes and McTaggart (2000). The process is likely to be more fluid, open, and responsive. Data was collected using three semi- structured interviews, five focus group discussions, reflection journals, and participant observation.

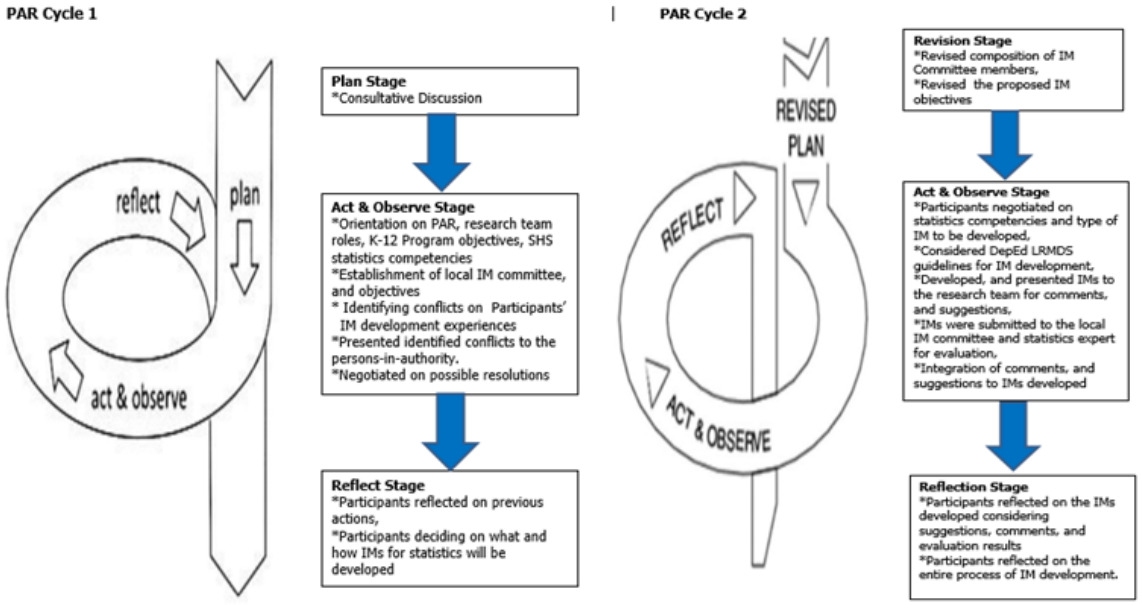

Figure 2.The Kimmes and McTaggart's (2000) PAR Cycle as research methodology.

In this study, the data gathered from interviews, focus group discussion were carefully transcribed verbatim. The researcher developed early codes from the data that were tentative and guided focus on further data collection. The analysis of the data in this study was "recursive, dynamic, and flexible" (Parreno, 2020; Merriam, 1988). Audio and video taped interviews were used to complete the two cycles of PAR processes by reviewing the actual happenings during the exchange of ideas and how the participants respond to every question and situation presented. Audio and video taped interviews were transcribed verbatim, translated to English, analyzed and coded.

The research team responses, reactions, comments, suggestions and feed backing during focus group discussions were translated, analyze as additional data. The participants' notes in their reflective journals were used in analysis and triangulation, but not included in coding process. The researcher adopted and utilized the template that O'Connor and Gibson (2003) suggested to use for qualitative data analysis.The "in vivo" coding process of Gay (2012) cited in Parreno (2020) was used to analyze qualitative data.

To establish the validity of findings, the researcher used multiple verification techniques for this study that included: member checks, triangulation, and an external audit. These verification procedures match Creswell and Miller's (2000) validity matrix cited in Parreno (2020). The member checks included the lens of every member of the research team, triangulation included the lens of the researcher, and the external audit included an external lens of the study in the verification or validity process.

RESULTS & CONCLUSIONS

The conflicts in teachers' practices involving instructional materials development

Using the Engestrom's Expanded Activity Theory, participants were able to identify conflicts in their practices such as teachers lack knowledge and training on IM development, inconsistencies of lessons objectives to DepEd SHS competencies, lack of administrative support on IM development, lack collaborative practices in developing instructional materials.

Mathematics teachers' active participation in a collective work can provide opportunities to fellow faculty members to take part in resolving their own conflicts and lighten the load of academic responsibilities. Establishing a culture of collective effort among faculty members will gradually improve the quality of instruction, and elevate the learners' competency levels.

The administrative support is mainly responsible for ensuring the smooth management and functioning of every department within the school community in a timely manner. Being able to identify and respond to the teachers needs in instructional material development will surely keep them motivated and inspired to deliver quality statistics education.

How do these conflicts in teachers' practices on instructional materials development are addressed

The mathematics teachers resolved conflicts in their practices on instructional materials development by meeting halfway in order to collaborate, established standards for instructional material development, and being open to external intervention to negotiate resolutions of conflicts within their activity system.

Standard processes should be observed in instructional material development. These processes will serve as guide to every mathematics teacher who would wish to develop instructional materials. Setting the objectives straight in the beginning is the ultimate evaluation reference for the quality of instructional materials to be produced.

Mathematics teachers are adaptive in their instructional delivery strategies to meet the demand of statistics education. Pedagogical knowledge will be met by pursuing continuing education in statistics, also to increase their content knowledge which is very essential in developing appropriate instructional materials.

What model reflects the process of addressing these conflicts?

Mathematics teachers developed a model reflecting the processes they went through along the conduct of this study. Their experiences revolved and guided by the expanded activity theory, and going through the two cycle PAR process to resolve the conflicts, and to attain the object of the study

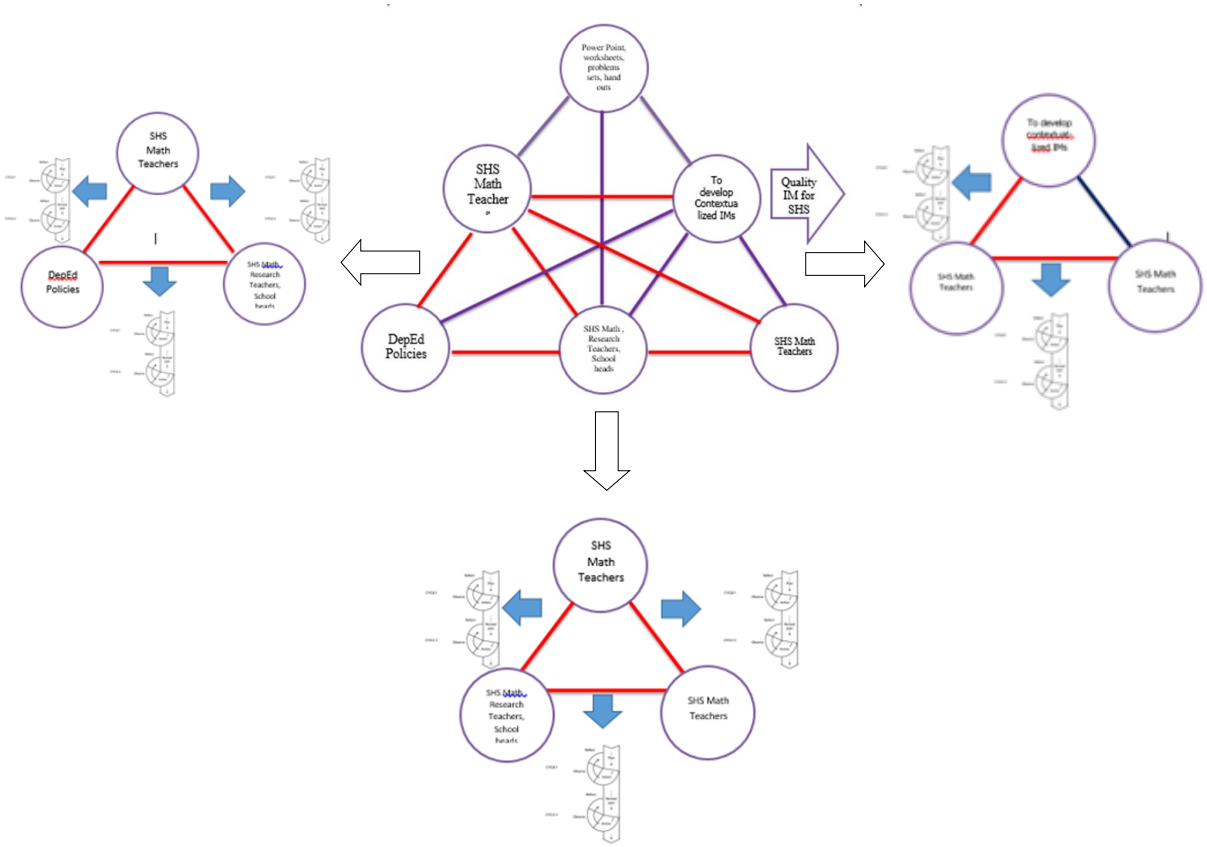

Figure 3. The Model that reflects the processes of addressing mathematics teachers conflicts along with the development of instructional materials

RECOMMENDATIONS

It is recommended that the Department of Education with its basic education institutions should conduct realistic and objective observation and assessment on the delivery of statistics instruction.

It is also suggested to review the teacher education curriculum increasing the number of statistics units , considering the content knowledge, and pedagogy.

The Department of Education should stress advanced experiences in teachers developing instructional materials to aid in the teaching of statistics in the Senior High School level. They should also consider not only the capability of mathematics teachers in teaching Senior High School statistics, but also the necessary professional, administrative and technical support such as the amount of work load, available facilities and supplies, and attendance on trainings and workshops for instructional material development.

The study presented the limited conflicts on the mathematics teachers experiences on developing instructional materials in statistics for senior high school. It is recommended that a larger meta-analysis and further studies could be conducted with a wide range of perspectives for a more profound generalizability.

It is recommended that the basic education institutions should create a developmental program to address teachers problems in instructional material development.

Specialist in statistics and instructional materials should be considered in the composition of instructional material committee to ensure content and appropriateness of the materials.

Future researchers can use the result of this study in establishing collective practices that could help them address conflicts experienced by their co-participants. The result of the study can also be used to study different collaborative practices that could help the researchers with their problems. This can also be used to study different approaches and models in developing instructional materials.

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MACHINE LEARNING MODEL FOR IMAGE CLASSIFICATION OF SNAKE SPECIES IN CALABARZON REGION, PHILIPPINES

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ABSTRACT

The Philippines has more than 100 snake species in its animal biodiversity. Calabarzon Region, or Region IV-A, is home to many snake species. Snakebites, human-snake interactions, and the social, economic, and environmental effects of these occurrences make it essential to recognize snake species correctly. Identification of snake types by utilizing technology could save lives in rural places and developing nations like the Philippines. In this paper, the researcher used Google's Teachable Machine and Python tools to create and test six machine-learning models that can distinguish the differences between different types of snakes in the Calabarzon Region. The models learned from snake images from earlier studies and citizen science projects. The results of these models showed that machine learning can automatically tell the difference between snake species, even on a platform as readily available as Google Teachable Machine. Even though the sample only included data from a limited region in the Philippines, the models resulted in a maximum accuracy above 0.8. When the augmented dataset was used, the loss per epoch subplots did not result in error-free models. However, the models might improve performance using regularization techniques, more extensive training data, and further optimization methods. With these improvements, the methods employed in this paper might work in places with a similar variety of snakes or that face similar problems.

Keywords: *Citizen Science, Google Teachable Machine, Image Classification, Snake Species Identification, Calabarzon*

INTRODUCTION

There are 143 snake species in the Philippines (Uetz et al., 2022). There have been reports of snakebites and sightings from various locations in the Philippines, especially the Philippine cobra (Naja philippinensis). Regardless of accuracy, these narrative accounts are sometimes used as anecdotal evidence. These experiences regarding their snake encounters are usually shared on social media platforms, such as the Facebook groups PHILIPPINE SNAKE ID (n.d.) and Snakes of The Philippines (n.d.), for community awareness or to request assistance in snake identification. Members of these groups often upload media to share information and seek advice from other citizens.

Driven by many factors, one of the most common types of animal-human conflict, even in metropolitan areas, is people coming into contact with snakes (Patria et al., 2022). Wild animals make their homes in urban areas for three main reasons. These include better physical accessibility, improved psychological accessibility, and increased food supply (Kawata, 2014). However, most individuals have strong opinions on snakes, whether they like them or not. Humans' failure to regulate panic and dread has destroyed most snakes in human-snake interactions (Maurice et al., 2018). For instance, the King Cobra (Ophiophagus hannah) sightings in the Philippines in 2019 resulted in 24 of this snake species "killed or found dead" from March to April 5 of that same year in ten (10) provinces, including Laguna, Quezon, and Batangas (Cinco, 2019).

Department of Health (DOH) considers snakebites as zoonotic diseases or diseases transmissible between humans and animals, like leptospirosis and rabies, which the Epidemiology Bureau of DOH tracks typical cases. However, DOH snakebite records do not always match people's reports. For example, a DOH 2021 report (Epidemiology Bureau Public Health Surveillance Division, 2021) showed no snakebites in Calabarzon that year. However, a bite from a Philippine cobra killed a 10-year-old child in Quezon on September 14, 2021 (Bacuña, 2021). Insufficient community data or local health unit reports, especially during the COVID-19 pandemic, may have caused the record disparities. Therefore, snakebite cases might exceed the figures reported to government agencies.

The World Health Organization (WHO) has identified snakebite envenoming and 19 other diseases as Neglected Tropical Diseases (NTDs) (World Health Organization, n.d.). A 1998 paper states that 2.5 million people globally are envenomed annually (Chippaux, Snake-bites, 1998). Half of them seek medical attention, and more than 100,000 die, with the majority from Asia. Snakebite victims are ideally given antivenom based on the actual species that bit them. Medical specialists mostly rely on verbal descriptions of the snake's appearance and behavior provided by the victims. However, this snake identification method may result in wrong information, primarily if the snake is described using general characteristics such as color and length, which may delay the proper treatment for the snakebite victim.

Citizen science has long contributed to ecology, education, and society. Over the last few decades, digital technology has enabled citizen scientists to involve bigger audiences of participants to address ecology's most serious problems worldwide (Kobori et al., 2016). By engaging a larger audience of participants, citizen scientists can contribute to collecting and sharing snake images, which are essential for training machine learning models. This collaborative effort can improve the accuracy of snake identification, leading to more efficient management of snakebites. Additionally, citizen science allows for the engagement and empowerment of the public in ecological research and conservation efforts.

Google Teachable Machine (Google, n.d.) was used in this study to generate machine learning models. The images used to train the model were gathered from biodiversity data sources and other web sources like social media sites. The machine learning model used in this study was trained exclusively on a dataset of images gathered from data sources and other web sources like social media sites comprising photos of snakes from the Calabarzon Region. While this allows for identifying snake species within Calabarzon, its ability to distinguish snakes from other regions within the Philippines or other countries may be limited. The model may encounter difficulties in accurately identifying snakes with regional variations in appearance or species that are not present in the Calabarzon area. Further research and expansion of the dataset to include a more comprehensive geographic range would be necessary to improve the model's applicability beyond Calabarzon. This expansion could involve collecting snake images from other regions within the Philippines or even from other countries to enhance the model's ability to distinguish different snake species.

OBJECTIVES

This paper aims to develop and evaluate a machine learning model capable of automating the classification of snake species in Calabarzon. Automating snake identification has the potential to mitigate treatment delays, preserve lives, and play a role in both pest management and species preservation. Furthermore, the study seeks to provide publicly available datasets of snake images for other researchers and citizen scientists.

REVIEW OF LITERATURE

This chapter evaluates the pertinent literature and research linked to the topic.

3.1 Snake Species in the Philippines

There are at least 41 species of potentially dangerous snakes that consider the Philippines and the waters surrounding it its habitat. Eight (8) of these are species of sea snakes that have not been discovered in the Philippines' coastal waters but may be present there. There are 41 species, and 26 of them are sea snakes. The remaining 15 species are terrestrial, meaning they live in freshwater and on land and can swim in both environments. Other terrestrial animals favor arboreal environments and only infrequently venture down to the ground. Some terrestrial snakes make their homes close to human habitation in agricultural regions and to water sources such as flooded rice fields, waterways, and streams. Elapidae and Viperidae are two families of poisonous snakes that can threaten humans and are found in the herpetofauna of the Philippines. The fake vipers (Psammodynastes), cat-eyed snakes (Boiga), rear-fanged Asian vine snakes (Ahaetulla), and aquatic and semi-aquatic snakes (Enhydris, Cerberus) are all examples of snakes that have venom that is only potentially hazardous. Snakebites from young, dangerously venomous snakes, as well as purportedly non-dangerous venomous snakes, have been linked to the deaths of various professionals, such as Karl Patterson Schmidt, Fred Shannon, Robert Mertens, and Joseph Slowinski. Some of these deaths were caused by juvenile dangerously venomous snakes (Leviton et al., 2014).

Only 137 species of snakes are recorded for the Philippines in the International Union for Conservation of Nature (IUCN) list (2022). One (1) is critically endangered, three (3) are endangered, six (6) are vulnerable, five (5) are near threatened, 94 are least concerned, and 27 are tagged as data deficient. The Ross's wolf snake (Lycodon chrysoprateros) is the only critically endangered species in the Philippines. It is known to be found on Dalupiri Island, in the Babuyan Group of Islands, Cagayan Province. Despite this, this species has no direct conservation measures to protect it. It would appear that the island of Dalupiri does not contain any protected areas. Species such as McGregor's Pit Viper (Trimeresurus mcgregori, recorded in the Batan Island of Batanes), Hologerrhum dermali (recorded in Panay Island), and Gary's Mountain Keelback (Opisthotropis alcalai, recorded in Zamboanga del Norte and Misamis Oriental) were all assessed as endangered. Moreover, two (2) of the six (6) vulnerable species of snakes have been found in the Calabarzon Region: the King Cobra and the Lake Taal Snake (Hydrophis semperi). In the IUCN list, both species are annotated to need updating in the assessment. The King Cobra can be found in large numbers throughout South and Southeast Asia. It is well known that it may be found all over the Philippines. On the other hand, Lake Taal in Batangas is the only known location for the Lake Taal Snake.

3.2. The Human-Snake Interaction and Snake Sightings

One of the most common types of animal-human conflict, especially in metropolitan areas, is people encountering snakes (Patria et al., 2022). Snakes tend to dwell in habitats frequently encroached upon by human beings. Due to anthropogenic actions, there is a discernible effect on these ecosystems, resulting in a greater prevalence of snake mortalities caused by human activities compared to other natural influences. In the Nanded City in India, the key factors contributing to the decline of snakes in the region include incidents of road mortality, encounters with agricultural activities, and a general lack of knowledge among the populace regarding the differentiation between venomous and nonvenomous species (Jadhav et al., 2018).

The expansion of cities and urban areas on a global scale has resulted in a notable rise in instances of conflict between humans and wildlife. To reduce human-snake conflict, snake catchers in Darwin, Australia, are hired to remove and transport snakes that the general public has reported seeing in urban and rural environments. Notably, a significant proportion of documented human-snake encounters in Darwin during one of the studies involved non-venomous snakes, with approximately 90% falling into this cate-

gory (Parkin et al., 2021).

Another factor that some studies are looking at is climate change. As a result of climate change, temperature zones are moving away from the equator. Climate change significantly affects where poisonous animals that live on land dwell and breed. Certain species that can migrate in response to temperature fluctuations may potentially gain access to novel geographic regions. Venomous snakes and spiders will probably maintain their population levels, albeit with a shift in their geographical distribution towards historically temperate regions that humans more densely populate (Needleman et al., 2018). In Mumbai, climate change, specifically the heightened precipitation patterns resulting from climate change, has also been cited as one of the three factors that affect the increase in snake sightings in the city. The other two are the encroachment of urban development upon Mumbai's forested areas and the accumulation of unsanitary waste heaps throughout the city (The Economist, 2021).

Southeast Asian reticulated pythons are nonvenomous constrictors and are the largest snakes in Asia. Due to its vast range, the IUCN classifies the snake as "least concern." However, deforestation and urbanization force pythons and other wild animals to enter and leave human-occupied areas, increasing conflict between humans and wildlife (Department of Environment and Natural Resources, n.d.). Emerson Sy from the Philippine Center for Terrestrial and Aquatic Research (PCTAR), in a newspaper interview (Cinco, 2019) about the King Cobra sightings, attributed the events to the breeding season and the weather. Because of the breeding season for the King Cobra and scorching weather, there has been an increased number of snake sightings in human habitations. They are forced out of their burrows and on the hunt for new habitats if the weather is very hot or excessively dry.

Natural disasters such as flooding significantly enhance the likelihood of sighting a snake since they bring humans and snakes closer to one another (Ghose & White, 2017). There are a couple of incidents of snake sightings and snakebites after floodings in the Philippines. In late September 2009, Typhoon Ketsana (Ondoy) poured one month's rain on Metro Manila and Central Luzon in 12 hours. Low-lying residents were taken off guard by the rising waters and had to wait on their roofs to escape being swept away. One such case of a fatal human-snake encounter is the death of two among five individuals in 2020 due to snakebites as a result of Typhoon Vamco (Ulysses) floodings in Bulacan (Reyes-Estrope, 2020).

3.3. The Importance of Public Awareness about Snake Sightings

Snakes will inevitably change their geographical habitats closer to humans. However, these snake sightings usually harm either the human or the snake. The 2019 King Cobra sightings in the Philippines (Cinco, 2019), for instance, resulted in 24 of this snake species "killed or found dead" from March to April 5 of that year in ten (10) provinces, including Laguna, Quezon, and Batangas.

Attitudes towards snakes are characterized by a remarkable degree of heterogeneity, with individuals demonstrating marked preferences for or against their presence. Humans' failure to regulate panic and dread has destroyed most snakes in human-snake interactions. The indiscriminate slaughter of snakes for human protection has nearly wiped off numerous snake species. The study by Maurice et al. (Maurice et al., 2018) also revealed a strong association between snake sightings and snakebite prevention in the areas where they often occur.

Some groups also encourage the public to report snake sightings to help preserve their target species. For instance, ThinkGrassSnake (n.d.) is funding a grass snake telemetry (radio tracking) project to study the habitat preferences of the barred grass snake (Natrix helvetica), the sole native snake and difficult-to-find species of reptile in Jersey. Public reports of the sightings of this species help the group comprehend the behavior and routines, expand the understanding of the ranges, and protect the barred grass snakes.

Contrary to the reason of the ThinkGrassSnake (n.d.), public reporting of any snake sightings could

also be encouraged to control the population of the target species, especially invasive ones. An instance would be the Burmese pythons (Python molurus bivittatus), which traced their origins back to Southeast Asia and were introduced to the United States as escaped domesticated animals or through intentional release. The presence of pythons in southern Florida, particularly within Everglades National Park, presents a significant risk to human safety (University of Georgia - Center for Invasive Species and Ecosystem Health). These invasive species have experienced a notable increase in population size and geographical distribution since 2000, leading to the consumption of numerous mammals and birds (Dorcas et al., 2012). FWC or Florida Fish and Wildlife Conservation Commission (n.d.) collaborates with other organizations to control Burmese pythons in many ways. On the other hand, the organization strongly invites members of the public to participate.

The same case happens in the countries in Hawaii, Guam, and other Pacific regions (USGS Communications and Publishing, 2016). BTS or Brown Tree Snake (Boiga irregularis), a nocturnal South Pacific snake, was mistakenly brought to Guam in the 1940s. Because it is not regulated by its predatory animals, competitors, or diseases, the BTS has a devastating impact on islands where it is not native. An economic assessment in Hawaii predicted BTS might cost $28,500,000 to $405,000,000 yearly. The US Department of Interior granted $3.4 million to suppress and control BTS in Guam, the Commonwealth of the Northern Mariana Islands, and Hawaii in 2020 (Hawaii Invasive Species Council, n.d.).

3.4. Snakebite Envenomation as a Neglected Tropical Disease

Twenty tropical diseases comprise the "neglected tropical diseases," or NTDs. These diseases disproportionately affect women and children, primarily in poor areas. These diseases afflict more than a billion people throughout the world. The epidemiology of NTDs is ecologically and procedurally complex. Many of these diseases are transmitted by animals and have intricate life cycles. These factors complicate efforts to improve public health. Snakebite envenoming was included on the WHO's NTD list (World Health Organization, n.d.) for the first time in 2009 [31], removed in 2013, and reinstated on June 9, 2017, as category A. All parties involved in addressing this global pandemic that disproportionately affects developing countries appealed for its reinstatement for a long time before it was finally granted (Chippaux, 2017). The 2021-2030 NTD road plan guides WHO's efforts to regulate, prevent, eliminate, and eradicate NTDs.

A dossier sponsored by Costa Rica (Lead Sponsor: Costa Rica, 2017) and several other nations, including the Philippines, supports the WHO's reinstatement of snakebite envenoming as an NTD in 2017. The document argues that snakebite envenoming typically affects disadvantaged rural people in tropical and subtropical nations. Poor individuals are especially in danger because of high treatment expenses, loss of income, and forced debt. Since snakebite envenoming is now an NTD, research into novel therapeutic, diagnostic, and control techniques is expected to increase. In this situation, the leadership of WHO and partner organizations is crucial.

3.5. Snakebites Envenomation Across the World

The Chippaux article (1998) shows that snake bites were a public health issue in most countries during that period, albeit the numbers are hard to track precisely. Accordingly, 2.5 million people are envenomed annually, half of them seek medical attention, and more than 100,000 die. The majority of the bites, envenomation, and death were from Asia.

Snakebite envenomation results in significant morbidity, disability, and mortality, mainly in the regions of Oceania, Latin America, Africa, and Asia. In a dossier supporting the incorporation of snakebite envenoming in the list of NTD (Lead Sponsor: Costa Rica, 2017), it was mentioned that snakebite envenoming impacts 1.8 to 2.7 million individuals annually, with 94,000 to 125,000 deaths. According to the data from WHO, in 2019, 5.4 million snake bites resulted in 1.8 to 2.7 million envenomation annually. There were 81,410 to 137,880 deaths, while thrice that number were amputations and other permanent impairments occurring annually (Gutiérrez et al., 2017). Still the same as studies prior, most occur

in Africa, Asia, and Latin America. Snake envenomation affects 2 million Asians each year, while 435,000–580,000 snake bites in Africa need medical care annually. Envenoming affects rural women, children, and farmers in low- and middle-income countries. Underdeveloped nations with insufficient medical resources have the most significant burden (World Health Organization, 2019).

A study by Patikorn et al. (2022) deduced that the ASEAN countries collectively witness an annual incidence of approximately 242,648 individuals affected by snakebites. Out of these victims, 15,909 individuals lost their lives, and 954 underwent amputations. The study also projected that approximately 161,835 snakebite victims, accounting for 69% of those who require antivenom treatment, did not receive the necessary medical attention. Snakebite incidents resulted in 391,979 disability-adjusted life years (DALYs) and incurred a cost of 2.5 billion USD. This cost represented approximately 0.09% of the local economy's gross domestic product (GDP), with premature deaths accounting for most of the burden.

3.6. Venomous Snakes of the CALABARZON (Terrestrial / Sub-Terrestrial)

In the Philippines, Leviton et al. (2014) listed the genera under two families, Elapidae and Viperidae. Three subfamilies of Elapidae are Elapinae (kraits, cobras, and coral snakes), Hydrophiinae (sea snakes), and the Laticaudinae (sea kraits). The Elapinae subfamily consists of four dangerous genera: Calliophis, Hemibungarus, Naja, and Ophiophagus, while the Hydrophiinae subfamily consists of the genus Aipysurus, Emydocephalus, and Hydrophis. Only one genera is listed under the Laticaudinae subfamily – the Laticauda. Finally, listed under the Viperidae are two genera: Trimerusurus (Parias) and Tropidolaemus.

The Philippine Coral Snake (Hemibungarus calligaster), Philippine cobra, King Cobra, Yellow-spotted or Philippine Viper (Trimeresurus (Parias) flavomaculatus), Philippine Temple Pitviper (Tropidolaemus subannulatus) are among the terrestrial snakes found in the Calabarzon region based on the list of Leviton et al. (2014).

During the 16th Congress, Senator Manuel "Lito" Lapid filed, on April 7, 2014, Senate Resolution No. 596, called "Resolution Directing the Committees on Environment and Natural Resources and Other Appropriate Senate Committees to Conduct an Investigation, In Aid of Legislation, On the Illegal Trade of Philippine cobras with The End in View of Protecting These Endangered Species" (Lapid, 2014). It was submitted to the committee in charge of the matter on May 5, 2014. Since then, it has been tagged pending in the committee.

In the "Connected to the Wild Biodiversity Research Series" webinar (Mayuga, 2020) on October 6, 2020, Yñigo del Prado, a student pursuing an MS in Biological Science at the University of Santo Tomas, delivered a presentation on the Philippine pit viper. His work emphasized the unique biological diversity and endemism found in the country. During the webinar, del Prado said Philippine pit vipers' bites are uncommon. Extreme arm swelling, agonizing agony, and eventual necrosis are the worst possible outcomes of a bite. According to him, there may be no documented cases of fatal snake bites of pit vipers, but that does not imply they never happen.

3.7. Antivenom in the Philippines

Despite the number of venomous snakes in the Philippines, the country still has huge issues with the antivenom. The Biologicals Production Service (BPS) has been responsible for the nation's antivenin production since the 1960s. Research Institute for Tropical Medicine (RITM) assumed leadership in 1999. It was BPS that eventually became the Biologicals Manufacturing Division (BMD). The antivenin in a single 5 mL vial of Purified Cobra Antivenin (PCAV) is potent enough to neutralize 4.8 milligrams of venom. Since it is monovalent, PCAV is effective only against Philippine cobra venom. The PCAV primarily assists farmers in Bicol and Nueva Ecija, known for their elevated snakebite incidents. The RITM is the designated facility for housing the PCAV, particularly to combat the effects of venomous

bites from the Philippine cobra. (Dimaano, 2018).

3.8. Citizen Science and Epidemiological Surveillance

HerpMapper and iNaturalist are two of the most well-known citizen science platforms, and their users have contributed significantly to the reputable digital information on snake distribution and physical attributes that is freely available to the public. HerpMapper is focused solely on amphibians and reptiles, while iNaturalist covers all taxa. Information on iNaturalist and HerpMapper, like time, place, and species, must be entered in a structured format. While a voucher photo is not required for iNaturalist, it is strongly suggested for use with HerpMapper. Other online sources for snake information exist, but many do not have very well-organized data (Durso et al., 2021). Despite the massive amount of data stored in iNaturalist, there are still limitations. For instance, the Philippine cobra can be found in its database, but it is still pending in its Computer Vision Model due to the number of observations logged into its system.

3.9. Snake Identification and Machine Learning

Precise species identification is the basis for all taxonomic investigations and constitutes a crucial element of process steps in biological research. Having the ability to identify species accurately is of utmost importance for a multitude of endeavors, encompassing the evaluation of the diversity of organisms within a specific area, the surveillance of endangered species populations, the analysis of the influence of climate change on species' geographic range, and the execution of strategies for managing invasive plants (Wäldchen & Mäder, 2018).

The automatic identification of snakes using machine learning algorithms poses particular challenges. Due to their elongated and flexible anatomical structure, snakes typically exhibit significant variations in body posture and deformation. In the context of a restricted image dataset featuring a snake, the body may obscure the head or tail. Additionally, the body may be contorted in various orientations, resulting in various dorsal color patterns and ornamentations. Obtaining characteristics from the dorsal body design of snakes presents a considerable challenge. Furthermore, training a deep convolutional neural network necessitates a substantial image dataset. However, there is a paucity of specialized datasets about snakes. The situation of uncommon snakes is particularly dire. Conversely, museum specimens are unsuitable for inclusion in comprehensive body image datasets due to their lack of natural coloration and posture (Rajabizadeh & Rezghi, 2021).

The Google Teachable Machine developed by Google is a versatile tool that caters to a wide range of users, including individuals who seek to delve into their creative concepts. Background experience in machine learning is not a requirement. The individual employs a technique to facilitate the computer's ability to identify and differentiate between various visual and auditory cues and physical postures without manual programming machine learning algorithms. Subsequently, the user may employ the model in their personal projects, websites, applications, and other related endeavors. The user can export the output model for utilization in various projects. TensorFlow.js, a Javascript library for machine learning, is utilized by Teachable Machine to facilitate the training and execution of models within the web browser. The methodology employed in these models is transfer learning. By integrating a preexisting neural network with user-defined classes, the latter can be conceptualized as the concluding layer or stage of the neural network. The picture and pose models are trained on preexisting mobilenet models, while the sound model is constructed using the Speech Command Recognizer (Google, n.d.).

Wong and Fadzyl (2022) conducted a study to develop a species recognition application. The study's primary objective was to assess the effectiveness and precision of employing a Teachable Machine model for identifying shorebirds and waterbirds at a designated location in Malaysia. The model's accuracy was verified by using actual photographs obtained on location. Yeruva et al. (2022) have employed the Google Teachable Machine to develop MATSYASTRA, a web-based application for identifying species. The application developers utilized Teachable Machine to ensure their software provides

precise outcomes in classifying diverse fish species. The methodology employed in the research entails capturing images of fish specimens and subsequently categorizing them based on their unique characteristics.

Since 2011, the Conference and Labs of the Evaluation Forum (CLEF) has sought to improve biodiversity monitoring systems with annual evaluation campaigns. In 2022, five data-driven biodiversity identification and prediction challenges were launched. One of its challenges is SnakeCLEF 2022, which identifies snake species in clinically critical situations (CLEF, n.d.). For the 2022 challenge, the performance of Convolutional Neural Networks (CNNs) was inferior to that of systems based on transformers. EfficientNet, ConvNext, Swin Transformer, Vision Transformer, and MetaFormer are only some of the deep neural network designs that were examined during the 2022 campaign. Transformer-based architectures were also considered. For 2022, in contrast to the previous year, 2021, when CNN architectures completely dominated the performance, Vision Transformer architectures emerged as an essential asset for most of the presented methods. Furthermore, the choice of Loss Function is of significance. The victorious team employed the technique of Label Aware Smoothing. The study revealed that the incorporation of geographical metadata enhances the accuracy of classification performance. The conventional methodology involved calculating the mean of the discrete models' determinations. Certain teams employed an ensemble technique involving the late fusion of deep features through concatenation. While there is a noticeable enhancement in accuracy, the importance of augmented computational intricacy compared to the improved accuracy was noted since the inference time of the model is of utmost importance in the context of snakebite.

METHODOLOGY

This study involves a mix of observational, descriptive, correlational, and quasi-experimental elements, incorporating both qualitative and quantitative approaches. The study utilizes existing data, cross-verifies information, and employs machine learning techniques for image classification to achieve its objectives.

The Methodology section presents the systematic steps used in the study for identifying and analyzing snake species in the Calabarzon Region using data from the biodiversity databases, previous studies on the local snake species, and images from various sources. It provides critical subsections for the data extraction process, image collection, the Google Teachable Machine, the process of training the image classification model, data augmentation, and accuracy and loss analysis.

4.1. Data Extraction from the IUCN Website

The IUCN (IUCN, 2022) is a comprehensive repository containing data on various flora and fauna, including snakes. Specifically, the IUCN Red List of Threatened Species, regardless of the IUCN Red List Categories and Criteria, maintains records of species assessment in its catalog. The information provided for each species may vary depending on its availability, encompassing taxonomy, assessment data, geographic distribution, population, habitat and ecological characteristics, threats, utilization and trade, conservation efforts, bibliography, and external data sources. This study used an exported comma-separated values (CSV) file from the IUCN website as an initial checklist.

Extracting data from the IUCN website was crucial for identifying snake species in the Philippines. By retrieving data from the IUCN Red List, the researcher could compile a comprehensive inventory of snake species in the Philippines and their respective conservation statuses. This data proved essential in comprehending the range of snake species diversity in the country and pinpointing any species that may be susceptible to extinction.

The data extraction process involved filtering species information on the IUCN website based on the following parameters:

Type: Species
Taxonomy: Animalia à Chordata à Reptilia à Squamata
Land Regions: South and Southeast Asia à Philippines

The CSV file was obtained by initiating a download request on the IUCN website, followed by pre-approval via email notification. This CSV file served as the foundation for the list of snake species in the Philippines, containing essential details such as scientific names, Red List Categories, habitat descriptions, range information, and additional attributes.

To assist in data analysis of snake species data in the Calabarzon Region, the regional provinces' records were filtered using Microsoft Excel. These range details were cross-verified manually with The Reptile Database and the Global Biodiversity Information Facility (GBIF) (n.d.). The researcher deemed it essential to manually authenticate the range information by referencing external sources to guarantee the dataset's precision and comprehensiveness. As the IUCN Red List encompasses a worldwide scope, it is plausible that the range information for snake species in the Philippines might be obsolete or lacking in detail. By thoroughly verifying the range details using various sources, the researcher could ascertain the accuracy of the data. This verification process led to identifying 25 snake species with observation records in the Calabarzon Region.

4.2. Image Collection

Photographs of each species were manually gathered from Google Search, GBIF, iNaturalist (n.d.), and Facebook, regardless of the size of the photographs. The search queries for images were based on scientific and common names of the snake species. In Facebook, only snake species positively identified by experts in the field and unanimously accepted by other citizen scientists were included in the dataset. Images were accepted by citizen scientists with a track record of accurate snake species identification and reviewed by a panel of experts for verification. In addition to the initial image collection, further curation was performed using the SnakeCLEF2022 training data (CLEF, n.d.). Specifically, a subset of images termed "Training set – Small photos" was filtered. To streamline the training dataset's size and mitigate the risk of model overfitting, a subset of images with a maximum side dimension of 240px was filtered from the initial image collection. Duplicate images were manually removed based on visual identification by the researcher.

4.3. Google Teachable Machine

Google Teachable Machine (Google, n.d.) was selected for image classification due to its user-friendly interface and ability to categorize input data into training and testing sets. The training process utilized 85% of the available samples to enhance the model's capacity to accurately classify new data into specified classes. The remaining 15% of samples were reserved for model evaluation and were excluded from the training process. Subsequently, the trained model was tested with these reserved samples to assess its performance with unseen data. This split was chosen to balance teaching the model with sufficient data and evaluating its performance with unseen data.

4.4. Training the Image Classification Model

Verified images were uploaded in batches to the Teachable Machine, with each set assigned to a specific class corresponding to the snake species. In total, 25 classes were created using the species' common and scientific names. The images in the training dataset were automatically resized to 224x224 pixels, serving as the input size before the training process. The training configuration remained consistent with default settings, including 50 epochs and a batch size 16.

Multiple learning rates were employed with two distinct datasets, precisely 0.001, 0.0005, and 0.0001. The researcher conducted training and evaluation for a total of six models. After successful training, project files from Teachable Machine were saved locally and on Google Drive, serving as a

safety measure against potential crashes due to high computing resource usage. The latest output model was made accessible in the Tensorflow.js format with a shareable link, and it could also be downloaded using TensorFlow save formats (Keras and Savedmodel). Post-training quantization options, such as Floating Point, Quantized, and EdgeTPU, were available for TensorFlow Lite.

4.5. Data Augmentation

The scarcity of specialized snake image datasets challenges automatic snake identification using machine learning (Rajabizadeh & Rezghi, 2021). Data augmentation techniques were employed to address the scarcity of specialized snake image datasets. By augmenting the dataset with various transformations, such as flipping, rotation, zoom, and contrast adjustments, the model was subjected to a broader range of snake images. This increased diversity in the training dataset helps the model recognize and classify snake species more accurately, even when presented with new and unseen data. Data augmentation stands out as the most efficient approach for mitigating this predicament. The main goal of data augmentation is to augment the training data by increasing its quantity, improving its quality, and diversifying its variety. (Mumuni & Mumuni, 2022). To minimize the computing resource overhead required for data augmentation, this process was executed on Kaggle (n.d.).

Data augmentation was implemented using TensorFlow and Keras preprocessing layers, incorporating horizontal and vertical random flipping, 0.2 random rotation, random zoom with 0.1 width and height factors, and random contrast adjustments of 0.2. Each input image was augmented to generate nine (9) additional images, contributing to a more diverse training dataset. These augmented images were subsequently incorporated into the Google Teachable Machine for model building. The raw images (Arrieta, 2023) and the augmented dataset (Arrieta, 2023) were also uploaded to Kaggle for public access.

4.6. Accuracy and Loss Analysis

Google Teachable Machine offers insightful graphical analyses for evaluating the model's performance. The following metrics and representations were derived from the training dashboard:

- Accuracy per class: This table calculates class-specific accuracy based on test samples, providing insights into how well the model performs for individual classes.
- Confusion Matrix: This concise representation illustrates the precision of the model's predictions, helping identify classes where the model may struggle. It compares actual labels to model predictions after the learning process.

Additionally, two dynamic graphs are automatically updated during the learning process:

- Accuracy per epoch: This graph illustrates the percentage of accurately classified instances, represented in decimals, thereby offering valuable information regarding the model's learning advancement.
- Loss per epoch: This graphical representation evaluates the model's ability to predict classifications for a given set of samples accurately. In cases where the model makes error-free predictions, the loss function yields a value of zero. However, imperfect predictions result in a non-zero loss value.

FINDINGS

This section presents the outcomes and analyses derived from the study, focusing on two key aspects: the number of images for each species and the impact of learning rates on accuracy within each category.

5.1. Number of Images Per Species

Although the Philippines has a remarkable diversity of snake species, the researcher found that only 25 species had enough observational data. These data were meticulously sourced from repositories such as IUCN, The Reptile Database, GBIF, and iNaturalist. Subsequently, these 25 species became distinct classes within the Teachable Machine model developed for this study. After cleaning the dataset, the researcher obtained 2,352 images in the original training/test dataset (Dataset A). The researcher augmented the original dataset using various techniques to create Dataset B, which contains 21,168 image files.

Fig. 1 compares the number of images per species in Dataset A and Dataset B, providing insights into the distribution of images. On both datasets, the Philippine stripe-lipped snake (Hologerrhum philippinum) had the lowest number of images (five), while the King Cobra (Ophiophagus hannah) had the highest number of images (393). The original dataset's mean image count per species was 94.1, with a standard deviation of 112.8, as detailed in Table 1. On the contrary, the average number of images per species in the augmented dataset was 846.7, with a standard deviation 1015.6. Notably, both datasets exhibited significant right skewness, characterized by a skewness value of approximately 1.512, as the histogram in Fig. 2 reaffirmed.

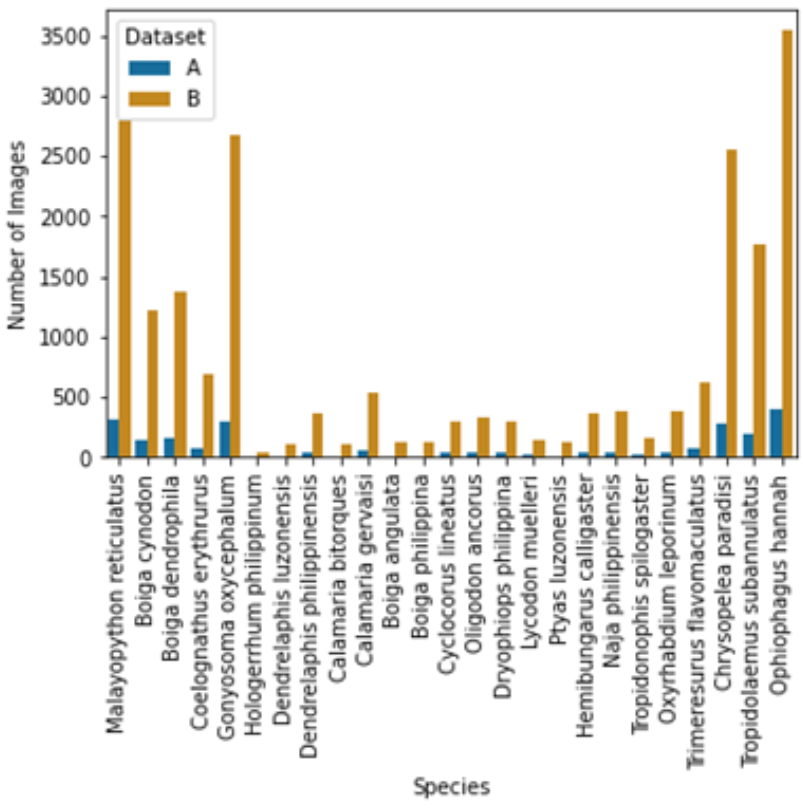

Fig. 1. Image count per species in both datasets

Table 1. Downloaded versus augmented images descriptive statistics

	A	*B*
mean	94.080	846.720
std	112.849	1015.645
min	5.000	45.000
max	393.000	3537.000
median	41.000	369.000
skew	1.512	1.512

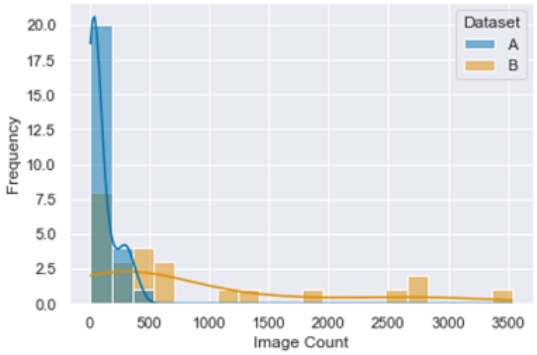

Fig. 2. Histogram for the number of images on both datasets

5.2. Learning Rates and Accuracy Per Class

While data augmentation did not improve the dataset's skewness (as indicated in Table 1), it notably enhanced accuracy per class by mitigating overfitting, particularly for classes with limited data. Despite the potential to exacerbate class imbalance, data augmentation effectively prevents overfitting, a critical consideration in machine learning (Wei et al., 2023). The overfitting results were further detailed in Section 3.3.

Comparing Dataset A and Dataset B at various learning rates, it is evident that the latter consistently exhibited higher accuracy per class, as shown in Fig. 3. For Dataset A, a learning rate of 0.001 yielded slightly better accuracy, while Dataset B achieved its highest accuracy with a learning rate of 0.0005. Table 2 summarizes the descriptive statistics for these datasets under different learning rates.

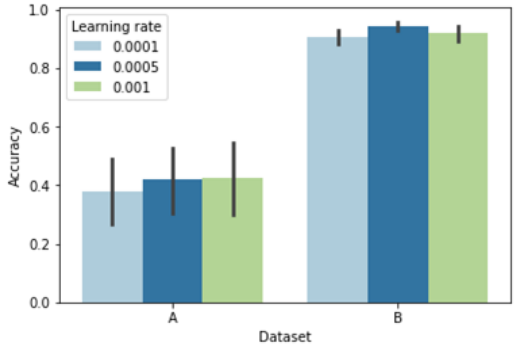

Fig. 3. Learning rates tested per dataset and the resulting accuracy

Table 2: Descriptive statistics for learning rates tested per dataset and accuracy per class

	A (0.001)	*A (0.0005)*	*A (0.0001)*	*B (0.001)*	*B (0.0005)*	*B (0.0001)*
mean	0.425	0.422	0.378	0.920	0.946	0.908
std	0.300	0.301	0.293	0.065	0.038	0.055
min	0.000	0.000	0.000	0.760	0.860	0.760
max	0.910	1.000	0.800	1.000	1.000	1.000
median	0.480	0.430	0.500	0.950	0.950	0.900

The confusion matrix is a valuable instrument for assessing a classification model's effectiveness, offering a comprehensive overview of the accurate and inaccurate predictions made for each class. Consequently, it enables researchers to understand the specific classes in which the model encounters difficulties. In this study, the researcher gathered confusion matrices after each learning process to identify the classes that challenged the model, displaying both the correct label and the prediction. Fig. 4 illustrates each dataset's six (6) confusion matrices under different learning rates. Subplots in the first row correspond to the learning process using Dataset A, while those in the second row correspond to Dataset B.

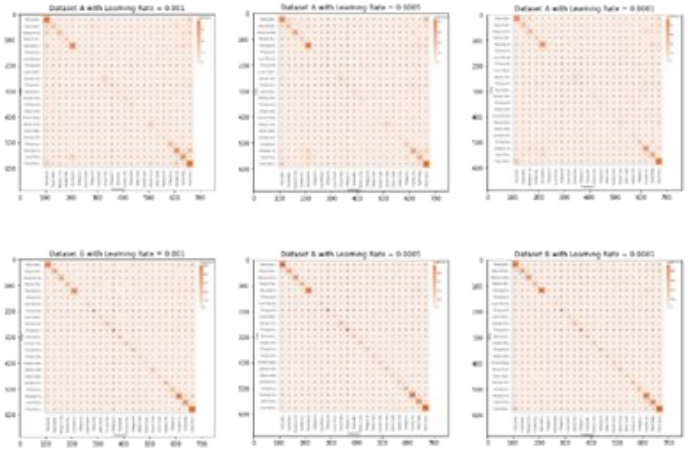

Fig. 4. Confusion matrix

5.3. Accuracy and Loss per Epoch

The accuracy per epoch subplots presented in Fig. 5 were generated separately during each learning process.

A notable observation is the gap between the training accuracy (orange curve) and the testing accuracy (blue curve) in the first three subplots of Fig. 5, which signifies overfitting in models trained on Dataset A. Overfitting is further evident in Fig. 6, with the increasing loss values observed in the loss per epoch subplots for Dataset A, particularly at learning rates of 0.001 and 0.0005. When using Dataset A with a learning rate of 0.0001 (the subplot in the first row, third column of Fig. 6), the curve for the loss per epoch appears to exhibit a very slight smooth upward trend.

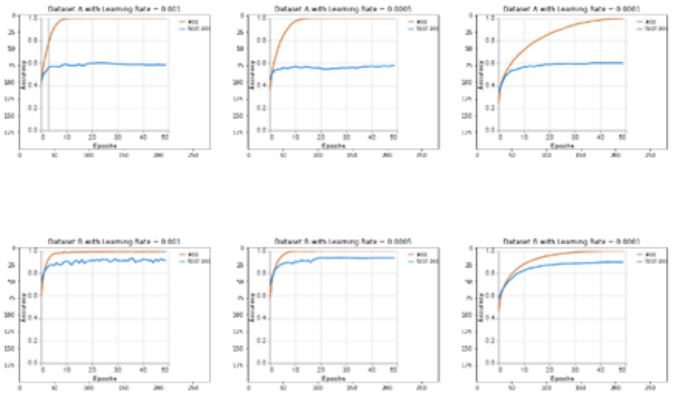

Fig. 5. Accuracy per epoch for different learning rates

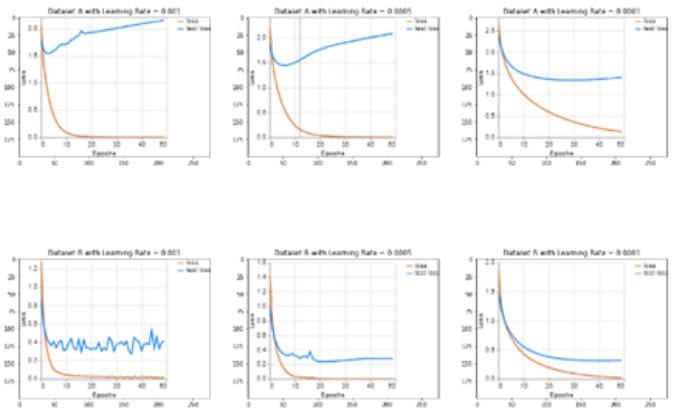

Fig. 6. Loss per epoch for different learning rates

In contrast, models trained on augmented data (Dataset B) exhibited narrower gaps between the training and test accuracy curves. The maximum accuracy, regardless of the learning rate, consistently exceeded 0.8. However, a 0.001 learning rate exhibited oscillations in the test loss curve, possibly indicating overfitting. Conversely, the test loss for a 0.0005 learning rate slightly increased between epochs 10 and 20. Finally, the learning rate 0.0001 maintained a gap between training and test loss but displayed smooth, descending curves. The loss per epoch subplots using augmented data demonstrated that all the models were not error-free, suggesting room for improvement, which can be achieved through regularization, increased data, and further optimization techniques. The model with a 0.0005 learning rate using Dataset B could be tested by accessing https://teachablemachine.withgoogle.com/models/axmrsBZGh/.

CONCLUSIONS

This study tested machine learning to identify snakes in Calabarzon, Philippines. By analyzing data scarcity and utilizing different datasets and learning rates, the researcher constructed six (6) models with different strengths and limitations. Making the original and augmented information public on Kaggle allows collaboration and creativity in studying snake species and improving identification algorithms. The researcher concluded the following.

6.1 Data Availability

a. A significant variation in image counts among snake species highlights the uneven data distribution in Calabarzon.
b. Data augmentation is presented as a vital strategy to mitigate the impact of limited data availability, as demonstrated by the effectiveness of Dataset B in enhancing model accuracy per class.
c. Enriching data quantity and quality through targeted data collection initiatives and augmentation techniques is crucial for advancing the understanding of snake species and addressing regional antivenom demands.

6.2 Model Development

a. This study presents six (6) distinct models, each trained on diverse datasets and utilizing various learning rates.
b. The original and augmented versions of the datasets are readily accessible on Kaggle, fostering collaboration and innovation across multiple domains.

6.3 Applications

a. Researchers and herpetologists can leverage these datasets to study snake species in the Calabarzon Region.
b. Software developers, citizen scientists, and machine learning enthusiasts can utilize the datasets for training and testing snake species identification models.
c. The datasets can contribute to understanding snake ecology and developing strategies for minimizing human-snake conflicts.
d. The datasets can directly affect healthcare, informing decision-making regarding snake antivenom inventory and availability.

6.4 Limitations and Opportunities

a. Although the models developed in this study provide valuable insights, it is imperative to recognize that they have certain limitations and cannot ensure completely error-free predictions.
b. Google Teachable Machine empowers individuals from diverse backgrounds, regardless of their IT expertise, to build models effortlessly and gain valuable insights into the learning process post-training.
c. By making the datasets available, this study paves the way for collaboration and innovation across diverse fields, fostering advancements in herpetological research studies and machine learning applications and ultimately contributing to improved regional health outcomes.

RECOMMENDATIONS

Considering the results and conclusions of the study, the researcher extends the following recommendations for future research:

a. Enhance and expand the functionality of the Google Teachable Machine by introducing features that offer enhanced data visibility to users. Consider incorporating metrics like the F1-score for model evaluation. Additionally, Google may explore integrating export capabilities in CSV format to complement graphical representations, facilitating more comprehensive model analysis.
b. Keep IUCN assessment information up to date to provide researchers with the latest status updates for each species, thus ensuring the accuracy and relevancy of research endeavors.
c. Develop mobile-based citizen science applications that leverage the machine learning models made available through this dataset. This incorporates features such as species information dissemination and public reporting mechanisms. Upon successful development and deployment, data generated by these applications could prove invaluable to health experts in decision-making concerning snake antivenom inventory and availability.
d. Maintain ongoing updates to the datasets on Philippine snake species, incorporating new observations as they arise. Consider expanding the scope beyond Calabarzon to encompass the entire Philippines.

e. Keep an eye on the progress of the SnakeCLEF campaigns to find new top-ranked submissions that might bring about significant changes in how snake images are categorized, like using Vision Transformers (ViT) instead of CNN.
f. Undertake further investigations into machine learning models for snake species identification, emphasizing using pre-trained models to optimize accuracy and inference time.

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MAYSILO MALABON RIPARIAN DICOT MACROPHYTES AS POTENTIAL BIOLOGICAL CONTROL AGAINST THE POLLUTED RIVER BACTERIAL ISOLATES

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ABSTRACT

Macrophytes along the banks of Maysilo, Malabon must be retained and cared for because of their role as water breakers and water filters. Additionally, this study demonstrates the antimicrobial role of these huge trees in the decaying water system. The probable biological controlling activity of three macrophytes with edible plant parts against the five unknown bacterial isolates from the polluted water system of Maysilo, Malabon was determined through disc diffusion and agar well techniques of bacterial susceptibility testing. All the unknown isolates were nevertheless susceptible to streptomycin sulphate. The crude leaf aqueous extracts (CLAE) of Muntingia calabura and Terminalia catappa showed ability to inhibit the growth of all the five unknown isolates, though at various levels; Morinda citrifolia seeds only slowed down the growth of three of the five bacterial isolates. M. calabura and T. catappa CLAE showed better inhibitory activity than those of standard antibiotic discs namely SAM, AMC, STX, IMI and oxacillin against the unknown Gram- positive rod, catalase negative, off-white forming colonies. The three macrophytes in this study have promising potential to biologically control the proliferation of bacteria that thrive in dying rivers, hence the need to sustain them and promote their growth on the riverbank.

Keywords: *macrophytes, Muntingia calabura, Terminalia catappa, Morinda citrifolia, riparian, polluted river*

INTRODUCTION

Maintenance of a clean and green community has been a standing concern of the College of Arts and Sciences outreach program. The adopted barangay in Maysilo, Malabon has been visited by the MCU (Manila Central University) students and faculty of the BS Psychology and the BS Biology Programs. The psychological well-being of the residents is addressed through seminars and social activities. But the health of the environment is the concern of the BS Biology faculty and students. The stench of the dying river does bring a lower quality of clean air to the area. The un-kept wetlands that have been turned into a dumping site in the past decades must be given attention, even as of the time of this writing when the local government has started to dredge away the trash and the mountains of solid wastes that have contributed much to the extinguished viable status of the Maysilo Malabon estuary.

However, the Biology group has found great wonder on the macrophytes thriving richly in the area. That these dicot plants should remain in the riparian area of the river has to be substantiated – that is their potential antibiosis in the decaying river must be explored apart from principal function as water breaks, and water filters that from time to time when the river water encroaches in the residential areas.

Objectives of the study:

This study therefore seeks to 1) conduct susceptibility tests of unknown bacterial isolates from the polluted river system; 2) determine the level of inhibition of the crude aqueous extract from specific plant parts, namely talisay leaves, noni leaves, fruit pulp and seeds respectively, and aratiles leaves on unknown bacterial isolates and 3) to compare the level of inhibition of the plant extracts if found, against selected isolates to those of the standard antibiotics used in the study;4) sustain the macrophyte stands in the river bank.

REVIEW OF RELATED LITERATURE

The use of vegetated wetlands to clear waste waters was first demonstrated by Dr.Kathe Sidel in Germany in the 1950's (Vymazal, 2008). Polluted rivers harbor toxic algal blooms that can harm humans, fishes, and the economy, according to the Environmental Protection Agency in 2019. Toxicity in polluted river systems can be aggravated by certain species of cyanobacteria containing phycobilin, the blue-green pigments, and phycocyanin found in eubacteria like Pseudomonas which is pathogenic.

Water analysis of the polluted Maysilo Malabon estuary has revealed high concentrations of nitrates (above 0.5 mg/Li) and phosphates (0.25mg/Li) according to Capili & Legaspi in 2018, and presence of bacterial isolates (Bactung et al., 2019) that reek of pyocyanin, resembling the musty odor of pus. This blue green pigment yields the same odor released by Pseudomonas aeruginosa, a very virulent bacteria to human health.

Following the earlier study on the characterization of bacterial isolates from the Maysilo, Malabon river system is the observation of the presence of luxurious growth of non-toxic, edible species that thrive in the area, namely Terminalia catappa (Talisay, Indian almond tree); Muntingia calabura (aratiles) and Morinda citrifolia (noni).

The niche of every species defines its functional role in the ecosystem. The space, the season, the time, the source of nutrients, the physical factors surrounding them, the substrate condition for plants and many animals, and the site of species interactions all define the lifestyle of the organism and justify that it exists in a space and time for a purpose.

Large plants including tall trees and grasses help maintain the stable conditions of riparian zones, contribute to leveling off water levels, and thus serve as breakwater as stated by the USDA Natural Resources Conservation.

Large plants called the macrophytes standing in the riparian zone of polluted rivers along domestic and residential areas can help in the alleviation of toxicity of the water to aquatic life.

Talisay, known as an umbrella tree for its broad leaves and spreading branches, was found growing and fruiting in the site. Famous for the shade it provides, talisay is also known for its medicinal benefits; its seeds are eaten by birds. Noni, popularized some decades back as a potent ingredient of a tonic drink, is also known for its medicinal wonders. Aratiles referred to as datiles in some dialects, have aromatic and sweet seeds that make it a favorite snack for children; additionally, it is known for its antibacterial activities.

While these trees grow well in the land skirting the polluted river system, the need to demonstrate the probable biological controlling activities of specific organs - talisay leaves, aratiles leaves and noni leaves, fruit pulp and seeds respectively against the five unknown bacterial isolates from the polluted river system in Maysilo, Malabon comes to fore. With the view that these macrophytes are potential biological control agents to regulate the over proliferation of bacteria that can compete with fish life, the justification to promote sustain and promote the growth of these trees must be evident.

Methods:

Field specimen collection

The leaves of talisay (Terminalia catappa), leaves and fruits of noni (Morinda citrifolia), and leaves of aratiles (Muntingia calabura) were collected from the riparian zone of the Maysilo, Malabon river system.

Laboratory:

Characterization of the unknown test isolates

Colony growth characteristics

The colony growth features like the edge, surface, texture, and pigmentation were taken through ocular observation of each of the five unknown bacterial isolates.

Gram staining

The standard procedure for Gram staining was followed using crystal violet as the primary stain, Gram's iodine as mordant, 95 % ethanol as decolorizer and safranin red as the counter stain. Gram staining of the unknown isolates was done to describe them as to shape, cell arrangement and gram staining response.

Catalase test

A small drop of 3% hydrogen peroxide was put on a clean glass slide. On the droplet was applied the tip of a nichrome loop after touching with the same the surface of a 24- hour unknown bacterial isolate subculture.

Antibiotic disc susceptibility tests on the unknown bacterial isolates

All the unknown isolates were subjected to disc diffusion method to determine susceptibility to streptomycin sulphate. A vial of 5 grams of streptomycin sulphate was dissolved in 5ml of distilled water. Punched out discs of Whatman filter paper No. 1 were immersed in 1 ml of the dissolved streptomycin sulphate. Each unknown bacterial isolate was inoculated fully on a nutrient agar plate then seeded at the center with a streptomycin sulphate disc.

Antibiotic susceptibility testing using eight (8) available antibiotics SXT, CIP, SAM, AMC, IMI 10, OX1 and TE 30 namely PIP, were done on only two of the isolates, one having only an off white colony growth that is the unknown bacterial isolate I, and one representative from the pyocyanin like pigment producing unknown isolates, and as such J was randomly selected.

Sub-culturing of the test isolates

The test bacterial isolates obtained from the study of Bactung et al. in 2019 were sub-cultured in nutrient agar (14 g: 500 ml distilled water) slants, then incubated for 18 to 24 hours. The isolates referred to as S2 A3, S2 C1, S2 A3, and S2 C2 were encoded as specimens G, H and I, J and K, respectively. Sub -culturing was done twice, hence the isolates named S2C1 were confirmed to be two different isolates, though taken from the same spot in the river water collection site.

Preparation of the Crude Aqueous Extracts

The leaves of talisay, aratiles and noni were thoroughly washed with tap water, then finally rinsed with distilled water. Five grams of each leaf specimen was minced to small bits then homogenized manually using sterilized mortar and pestle. Five milliliters of sterile distilled water were used in each case to get a crude aqueous extract. The fruit and seeds of noni were separated, then homogenized in the same way.

Susceptibility testing to the crude aqueous plant extract

Two methods were used to test for the probable presence of inhibition by a specific plant organ

aqueous extract on the growth of the polluted river bacterial isolates.

Disc diffusion tests were done using 6mm wide sterilized Whatman 1 filter paper discs, prepared using a common office tool puncher. Five milliliters (5,000 ul) of sterile distilled water were used to homogenize five grams (5, 000 mg) of each plant part. The fluid that can be absorbed by a filter paper was 20 microliters; as such each disc carries 20 mg of the crude plant aqueous extract. A lawn of each of the unknown bacterial isolates was respectively made by swabbing aseptically on a plated nutrient agar the sterile cotton tip touched onto the surface of sub-cultured isolate. The seeding of the impregnated filter paper disc with a plant crude aqueous extract was done by using sterilized forceps dipped in 95% ethanol and flamed thereafter. The seeded plates were incubated for 16 to 24 hours at 37 degrees Celsius. The zones of inhibition were measured when present in each case. Agar well diffusion was also done as a supplementary method to detect the susceptibility of the unknown isolates to the plant extracts. The tip of a cork borer was first dipped in 95% ethanol, then flamed. Aseptically this was used to bore out a hole on a sterile nutrient agar plate inoculated with an unknown bacterial isolate. Twenty (20) microliters of plant crude aqueous extract were used to fill up the well. The plates were thereafter incubated for 18 to 24 at 37 degrees Celsius. The zone of inhibition was measured whenever found.

FINDINGS

Unknown Bacterial Isolate G assumed a transparent green colony with granular surface when placed against the light, as shown in Figure 1. Unknown H has velvety or hairy edge that produced light green lawn of colony growths. Unknown I assumed a mucoid surface, with irregular edges. Unknown J isolate developed a greenish transparent lawn of growths when viewed against the light. Unknown K isolate produced strong a jade green lawn of growths, with mucoid surface.

Figure 1. Except for the unknown I, all produced yellow green to deep blue green pigments, within 16-18 hours after subculturing and incubation at 37 degrees Celsius. The pigments of the isolates begin to fade as they age over a week.

Gram Staining Results

Microscopic examination after Gram staining showed that the unknown bacterial isolate G was of short rods; the unknown isolate I which was of huge rods, and isolate K which looked like coccobacilli was found to be Gram-positive; isolates H and J were Gram-negative rods.

Catalase test results

All the unknown bacterial isolates, except for UBI were catalase-negative, in that they quickly produced bubbles thus metabolizing the 3% hydrogen peroxide to where their loopfuls were respectively applied on.

Results of antibiotics susceptibility tests in the study:

Table 1. Zones of inhibition around the antibiotic discs against the unknown bacterial isolates I with off white colony, and of the unknown isolate J which is with greenish pigmented colony.

Antibiotics	I (Gram- positive rods; off white colony)	Interpretation	J (Gram- negative short rods; greenish colony)	Interpretation
PIP 100 (piperacillin)	19 mm	Susceptible	19 mm	Susceptible
SAM 20 (ampicillin sulbactam)	9 mm	Resistant	None	Resistant
AMC 30 (amoxicillin)	9 mm	Resistant	None	Resistant
OX1 (oxacillin)	None	Resistant	None	Resistant
SXT (trimethoprim -sulfamethoxazole)	None	Resistant	None	Resistant
CIP 5 (ciprofloxacin)	25 mm	Susceptible	35 mm	Susceptible
MRP (meropenem)	No data	No data	29 mm	Susceptible
IMI (imipenem)	None	Resistant	No data	And STX. No data
TE 30 Tetracycline)	20.5 mm	No data	9 mm	No data

The unknown isolate I, which are Gram-positive rods producing off-white colonies was found to be susceptible to PIP 100, and to CIP 5, but resistant to SAM 20, AMC 30, OXI, STX and IMI, but were resistant to SAM 20, AMC 30, OXI,

The unknown isolate J, which are Gram-negative short rods with greenish colonies was found to be susceptible to PIP 100, CIP 5 and to MRP.

Table 1 shows that OX1 (oxacillin), SXT (trimethoprim –sulfamethoxazole) and Imipenem (IMI) did not inhibit the unknown bacterial isolate I, which was of Gram-positive and catalase- negative rods producing off white colonies. IMI is effective primarily against Gram-negative bacteria. Oxacillin, a beta lactam antibiotic works against the latter stages of peptidoglycan wall synthesis. SXT with its sulfamethoxazole content competes with para-amino benzoic acid (PABA), and with its trimethoprim content stops the production of tetra hydrofolic acid by binding to the enzyme dihydrofolate reductase; altogether the DNA synthesis in the bacteria is inhibited.

The bacteria inhibited by STX include Pneumocystis pneumonia, which is one of the causative agents of bladder infections, traveler's diarrhea, and middle ear infections.

Table 2. Diameters (mm.) of the Zones of Inhibition around the Crude Aqueous Extract Antibiotic Disc and Agar Wells

Unknown Bacterial Isolate code (Test Specimen)	G (Gram-positive)	G (Gram - positive)	H (Gram-negative)	H (Gram-negative)	I (Gram-positive)	I (Gram-positive)	J (Gram-negative)	J (Gram-negative)	K (Gram-positive)	K (Gram - positive)
	disc	Well	Disc	Well	Disc	Well	Disc	Well	Disc	Well
Talisay leaves	Not clear	11	11	11	15	16	None	None	12	Not clear
Aratiles leaves	Not clear	12	13	15	15	16	10	Not clear	Not clear	12
Noni leaves	None	None	None	None	None	None	None	None	None	None
Noni fruit	None	None	None	None	None	None	None	None	None	None
Noni seeds	10	Not clear	11	10	15 mm	None	9	Not clear	None	None

Table 2 above shows that Talisay leaves crude aqueous extract (LCAE) developed inhibition zones against unknown isolates H and I but less vividly against unknown G. The level of inhibition measured as 15-16 mm against unknown I is close to its susceptibility response to the antibiotic PIP (piperacillin/ tazobactam), of 19 mm. PIP contains a beta-lactamase inhibitor according to the American Society of Health-System Pharmacists in 2017; by this, it can inhibit Gram-positive and Gram-negative negative-bacteria, including the pyocyanin –producing Pseudomonas aeruginosa.

Aratiles (Muningia calabura) LCAE proved to be more potent against unknown H, Gram negative short rods that are catalase positive (Please see Figure 3 in Plates). An inhibition zone of 13-15 mm. developed around its disc and well respectively. This strength is comparable to that of the antibiotic gentamicin (Hudzicki, 2009) which exerts intermediate inhibitory action against non-fermenting Gram-negative bacteria, E. coli and other Gram-negative rods.

Additionally, M. calabura was found to have effected inhibition against the unknown bacterial isolate D (not shown in the tables. Please see Figure 2 in Plates).

Ampicillin and oxacillin did not inhibit the unknown Gram negative bacterial short rods that produced greenish pigment (Please see Table 1). However, aratiles LCAE disc developed a 12 mm. zone of inhibition which is comparable to ampicillin's intermediate inhibitory action against other Gram-negative bacteria.

Aratiles and Talisay crude leaf aqueous extracts (20ul of 1mg/ml) respectively similarly effected inhibition zone diameters of 15-16 mm. against the unknown Gram-positive bacteria, off white, rods that were catalase negative (Please see Figures 4 and 5 in Plates). This is comparable to the intermediate growth inhibition effected by antibiotics like methicillin at 10 ug /ml; oxacillin at 4ug/ml; and nafcillin at 4 ug/ml (McDougal and Thornsberry, 1984), antibiotics effective against Staphylococcus aureus. Biology Libre Texts in its 9: Kirby Bauer Antibiotic sensitivity page holds that 14 mm methicillin and 13 mm oxacillin zones of inhibition respectively indicate susceptibility of the bacteria against which they exert their action against.

Neither noni leaves nor the fruit pulp aqueous extract showed any inhibitory action against any one of the unknowns. An inhibition zone of 10 mm -11 mm developed nevertheless around the antibiotic disc prepared from the crude aqueous extract of its seeds preventing the proliferation of unknowns G and H, respectively. Furthermore, while ampicillin sulbactam, oxacillin, and trimethoprim sulfamethoxa-

zole standard antibiotic discs did not respectively develop any zone of inhibition against these unknown Gram-negative bacterial isolates that are catalase positive rods that form greenish colony, the noni seeds were found to develop a 9 mm. zone of inhibition though not so pronounced. But against the Gram positive off-white unknown lawn of bacterial growth I, noni produced a 15 mm inhibition zone around its crude aqueous seed extract disc (Please see Figure 6 in Plates).

Sulfian et al. (2012) attribute the antibacterial property of aratiles (Muntingia calabura) to 2, 4 hydroxy chalcone. Sanchez et al. (2019) holds that americinA extracted from noni (Morinda citrifolia) actively inhibited S. haelyticus 562B and S. epidermidis 1042.Using organic solvent extraction, Nair and Chanda (2008) stated that talisay (Terminalia catappa) leaves showed superior antimicrobial action against standard antibiotics like piperacillin and gentamicin. The efficacy of the antibacterial principles was not strong in aqueous extract where they were not present but was demonstrated in methanolic extracts where they dissolved sufficiently. In this study the activity of these three macrophytes namely M calabura (aratiles), Terminalia catappa (talisay) and Morinda citrifolia (noni) against the unknown bacterial isolates that thrive in a polluted river was demonstrated using only crude aqueous extract of their respective organs. In the spontaneous process of leaf falls, fruit falls or even seeds cast by the wind, other microorganisms would decompose these would –be particulate organic materials. But the proliferation of the ones that produce yellow to different shades of green pigment resembling pyocyanin found in pathogens like Pseudomonas aeruginosa, and that which thrive in murky waters that can no longer support fish life will surely be subjected to the antibacterial activity of useful these macrophytes that flourish in the riparian zone.

A similar observation can be said about the inhibitory strength of aratiles leaves crude aqueous extract against unknown I (Figure 2 in Plates).This level of inhibition zone of 15-16 mm developed around the aratiles LCAE is even stronger than that which developed around the antibiotic disc SAM (ampicillin -sulbactam) with a diameter of 9 mm. SAM is effective against the Gram negative bacteria namely Bacteroides fragilis and Acinetobacter. With its beta lactamase inhibitory mode of action, it developed a 10 mm zone of inhibition against UBI I. The same could be said about the inhibitory activity of AMC (amoxicillin) against the unknown isolate I.

CONCLUSION

The dicot macrophytes namely Terminalia catappa, Muntingia calabura, and Morinda citrifolia grow lucratively in the riparian zone of the heavily polluted river system of Maysilo Malabon. Certain of their plant parts- the leaves of M. catappa, the fruit and leaves of M.cirifolia, and the leaves of T. catappa were tested for their potential as anti-bacterial against the unknown bacterial isolates from the muddy water.

All the unknown bacterial isolates from the polluted river system were found to be susceptible to streptomycin sulphate.

Muntingia calabura and Terminalia catappa show strong inhibitory activity against the murky river Gram-positive and certain Gram-negative bacterial isolates that produce pyocyanin -like odor and color.

The inhibitory activity of the crude aqueous leaf extracts of the macrophytes used in the study is comparable to those of standard antibiotics.

The three macrophytes in this study have promising potential to biologically control the proliferation of bacteria that thrive in dying rivers, hence the need to sustain them and promote their growth on the river side.

RECOMMENDATION

The Maysilo Malabon estuary water system has long been used by unscrupulous residents as solid waste dumping site, while the asphyxiated aquatic life take time to recover from the toxic contents of the effluents from the nearby industrial and manufacturing sites.

The local government of Maysilo Malabon with the help of non-government agencies has begun the dredging up of the waste, including the river system riparian zone, and the rest of the shoreline that teem with stands of dicot macrophytes.

The area where dicot macrophyte stands are found should be cleaned up, trimmed to ecologically sustainable levels, but should be preserved, and not indiscreetly removed.

The testing of the susceptibility of the microbes that live in the muddy waters to other macrophytes should be conducted.

The identification of unknown bacterial isolates, and studies on their potential degradation properties must also be given attention.

ACKNOWLEDGEMENT

The conduct of the study is indebted to the Manila Central University College of Arts and Sciences, and to the 2019 BS Biology sophomores. The authors thank the support from the local government authorities of the Barangay Maysilo Malabon in the CAMANAVA area, Mero Manila.

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Plates

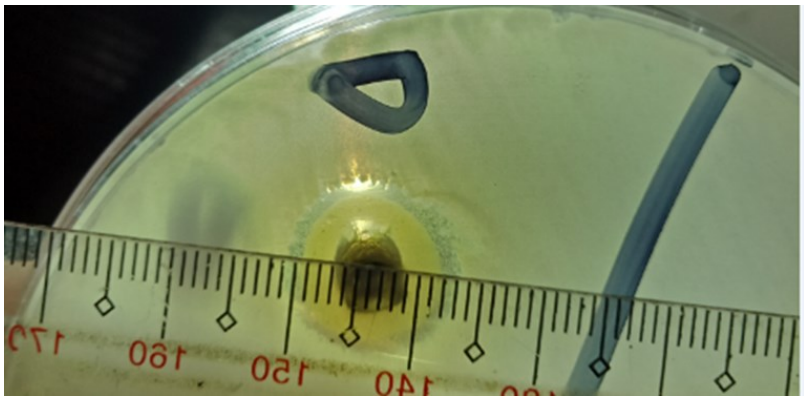

Figure 2. Muntingia calabura (aratiles) leaf crude aqueous extract developed a zone of inhibition on unknown Gram-positive off-white lawn on nutrient agar plate.

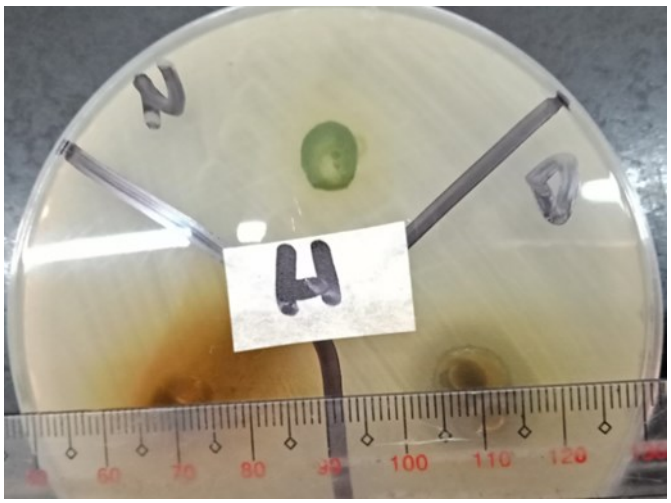

Figure 3. In the Left third part Muntingia calabura crude aqueous leaf extract developed inhibition zone of 11 mm against the unknown isolated Gram-negative H.

Figure 4. Terminalia catappa well inhibition zone of 11 mm against the unknown isolate gram-positive bacterial lawn G.

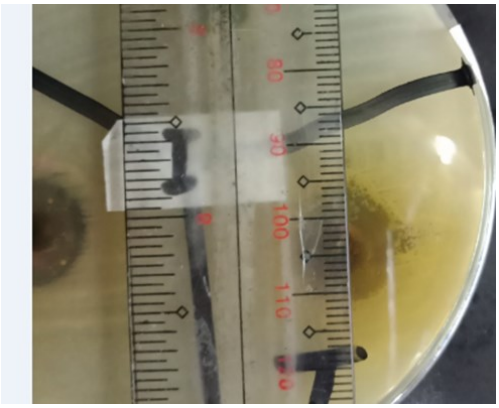

Figure 5. Terminalia catappa crude leaf aqueous extract well showing an inhibition zone of 16 mm against the lawn an unknown Gram positive bacterial isolate I.

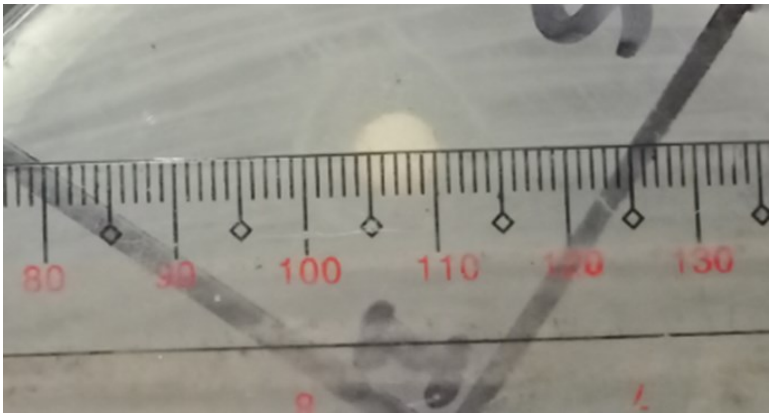

Figure 6. Morinda citrifolia crude aqueous seed extract inhibition zone of 15 mm against the lawn of unknown Gram positive bacterial isolate I.

DEVELOPMENT AND EVALUATION OF A CUSTOMIZED HUMAN RESOURCE INFORMATION SYSTEM (HRIS) FOR SECONDARY SCHOOLS

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ABSTRACT

This study aimed to develop and evaluate Customized Human Resource Information System (HRIS) for secondary schools to help the administrators, teaching and non-teaching personnel organize the searching, updating, retrieving, and saving of forms and reports. Specifically, the study answered the following questions such as the profile of the respondents, features of the HRIS intended for secondary empowered schools in terms of User Interface, Database, Maintainability, Functionality and Acceptability. It also evaluates the usefulness of the developed customized HRIS in terms of Recruitment, Evaluation, Document Management, Training and Awards Monitoring and Report Generation. The study was utilizing a developmental research design specifically the Software Development Life Cycle (SDLC). The system was evaluated and testing using different phases of testing. In the last part of testing which is the pilot testing, the researcher installed the system on four (4) empowered schools in Surigao del Norte and gathered evaluation responses from 147 respondents including teaching and non- teaching personnel using a survey questionnaire. Based on the findings of the study, the respondents are composed of mostly female employees ranging from 30-39 years old and teachers. Most of them rated the system strongly agree on the area of user interface, database, maintainability, functionality and accessibility while on the usefulness of the HRIS system on secondary schools in terms of recruitment, evaluation, document management, trainings and award monitoring, and report generation the respondents also rated strongly agree. Thus, the following are recommended for future researchers: It is recommended that this system should be installed and operated in a computer with a higher specifications than originally being specified. The system could be improve by having a regular update to attain efficiency and accuracy. It is also recommended that there should be a proper training and orientation of the personnel in-charge of the operation of this system .

Keywords: *human resource information system , assessment, development, perceptions*

INTRODUCTION

Human Resources Management (HRM) is the attraction, selection, retention, development, and utilization of labor resource in order to achieve both individual and organizational objectives. Human Resources Information Systems (HRIS) is an integration of HRM and Information Systems (IS). HRIS or Human resource Information system helps HR managers perform HR functions in a more effective and systematic way using technology. It is the system used to acquire, store, manipulate, analyze, retrieve, and distribute pertinent information regarding an organization's human resources. The HRIS system is usually a part of the organization's larger Management Information System (MIS) which would include accounting, production, and marketing functions, to name just a few. Human resource and line managers require good human resource information to facilitate decision-making.

In the study of Benefits and Barriers of Human Resource Information System by Manivannan & Jayasakthivel Rajkumar (2016), stated that the HRIS is a newly implemented system. The employees and the managements should understand and streamline the HRIS system that helps the organization develop the employees‟ skill and being for the organizations to get the timely information from all the departments. Moreover, some barriers preventing the organization to carry out the HRIS successfully are a lack of funds, a lack of expertise.

Most of the government organizations are not so advanced in terms of HRIS implementation due to high cost of technologies (Parvin, 2015). Private firms are putting emphasis on optimization of cost, efficiency of process and system, to be punctual in performing partnering functions, focus on less usages of paper as well as working manually etc. as these firms has an intentions to secure strategic benefits (Islam, 2016). HRIS assists top management in forming strategic decisions which will undoubtedly provide organization with an advantage to supersede competitors (Muturi, Kiflemariam, & Acosta, 2018). Besides, HRIS has been considered as an important strategic tool in managing HR and it provides organizations with numerous benefits (Muturi et al., 2018; Rasmussen, Andersen, & Haworth, 2010). However, the use of HRIS in a strategic manner differs from organizations to organizations, besides majority of organizations started to use HRIS only to replace manual processing and to minimize costs rather decision making (Bhargava, 2014; Jahan, 2014).

These mentioned informative scenarios have motivated the researcher to determine the effectiveness of the development of a customized HRIS for empowered secondary schools. It concentrates on determining specific information and reports needed about the employees. It is generally a collection of databases that integrate together to form a vast record of all employee issues that exist within the school. However, customization of system is needed, since every school has its own uniqueness. Human Resource Information System is not one size fits all. Different Schools have different needs.

CONCEPTUAL FRAMEWORK

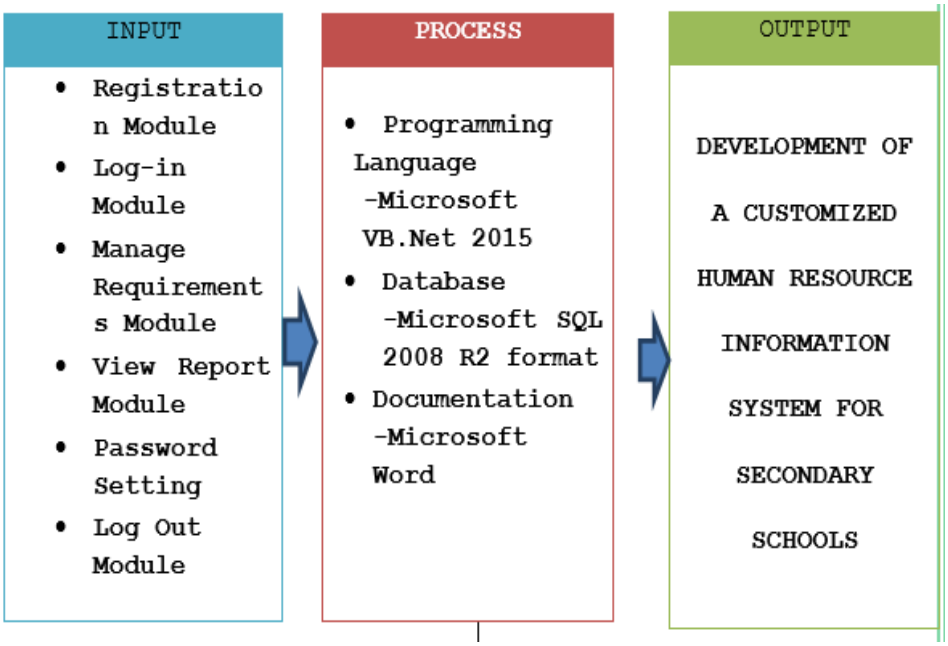

Fig 1. Research Paradigm

STATEMENT OF THE PROBLEM

This study aimed to development a Customized Human Resource Information System (HRIS) for secondary schools was developed to help the administrators, teaching and non-teaching personnel organize the searching, updating, retrieving, and saving of forms and reports. Specifically, the study answered the following questions:

1. What is the profile of the respondents in terms of?
    - 1.1 Sex;
    - 1.2 Age;
    - 1.3 Position?
2. What are the features of the HRIS intended for secondary empowered schools?
    - 2.1 User Interface;
    - 2.2 Database;
    - 2.3 Maintainability;
    - 2.4 Functionality and Acceptability?
3. How does the development of a customized HRIS for secondary schools help the management in terms of:
    - 3.1 Recruitment;
    - 3.2 Evaluation;
    - 3.3 Document Management;
    - 3.4 Training and Awards Monitoring;
    - 3.5 Report Generation?
4. Is there a significant difference on the perceived features of HRIS and its help to management with respect to the profile of the respondents?

METHODS

Research Design

The researcher made use of the developmental research design. This design is deemed appropriate because the study describe the contribution and effectiveness of the Development of a Customized Human Resource Information System for secondary schools. A comparative-differential method was also employed on account that this study determined the significant difference in the traditional management and the use of Human Resource Information System.

Research Environment

The area of the study comprises the school under the Surigao del Norte empowered secondary schools. Tagana-an National High School located in Brgy. Sampaguita, Tagana-an, SDN, Placer National High School is a school , academic institution located in Placer Surigao del Norte; Amando Fabio National High School located in Bad-as, Placer, Surigao del Norte; and Surigao del Norte National High School located in Surigao City are some of the empowered secondary schools of Surigao del Norte Division.

Respondents

The respondents in the study were the Administrator, Teachers and Non-Teaching Personnel of empowered secondary schools of Surigao del Norte Division like Tagana-an National High School, Placer National High School, Amando Fabio National High School and Surigao del Norte National High School. They were the subject of the study because they are the recipients of Human Resource Information System.

Research Instrument

The questionnaire was composed of two (2) interrelated parts. These are:

The first part of the questionnaire was designed to determine the profile of respondents according to sex and job position.The second part of the questionnaire was subdivided into two (2) sub-sections, which were labeled with A, and B.

Section A. This section was intended to determine the level of difficulty encountered by the respondents in the existing system in terms of effectiveness of the Development of a Customized Human Resource Information System for secondary schools which will determine its extent contribution to the empowered secondary schools of Surigao del Norte Division. The respondents will be instructed to choose among the five (5) alternative choices based on the 5-rating Likert Scale, such as: 5 for "Strongly Agree", 4 for "Agree", 3 for "Neither Agree nor Disagree", 2 for "Disagree", and 1 for "Strongly Disagree".

Section B. This section was intended to determine the positive and negative aspects encountered by the respondents, give comments and suggestions that would like to add to improve the overall HRIS experience that should be included in the development of system.

Data Analysis

Frequency Count and Percent. These were used to determine the profile of the respondents in terms of sex, age, and position.

Median and Rank. These were used to determine the perceived features and help of HRIS.

RESULTS AND DISCUSSION

Description of the Project

Human Resource Information System (HRIS) were a lot common nowadays especially to companies and institution that has a lot of employee. HRIS usually manages the information of the employees as well as the document requirements and qualifications. The computerized world is a highly efficient and convenient one that is why using HRIS increases productivity of the employees especially to the people involved in the field of managing Human Resources.

The developed customized Human Resource Information System is a user-friendly and easy to use automated system. The user can enter employee's data and information based on the Personal Data Sheet form of 2017, and thus the system can generate automatically the employees PDS form. The system also has a module name Employee Requirements wherein users can upload or save document requirements to database and retrieve it later for later purposes. The Employee Requirements module accepts the following documents: PDS, Teacher's Program, Accomplishment Report, Trainings and Seminars Attended and IPCR.It has also a module wherein users can view their uploaded documents and print it. The View reports module can also generate a list of employees according to their position or ranking, educational attainment and trainings or seminars attended level. Another module that the system had is the User Accounts module wherein the Administrator of the system will be the one to create the User accounts of the employees using their Identification Number as their username. The administrator can also view all of the registered user accounts. The last module is the Log-out wherein users can exit the system or change user accounts by pressing the logout button.

User Requirements of the Project

User Requirements of the system comprised the user's need and wants in interacting with the system. It includes the functionalities and the non-functionalities of the system. Data and information from the user are needed to design the system and for it to work properly according to the user's specifications.

Microsoft VB.net 2015 is one of the most common programming language used as of today. This is

due to a fact that it is very easy to use and the support were always readily available. Using its Integrated Development Environment (IDE) makes a programmer more productive due to a lot of predefined functionalities and designed. Microsoft also develop its own robust and stable database software which is the MS SQL 2008 R2, in which this system utilized as its backend. Like many Microsoft software MS Sql is easy to use and full of support in terms of functionalities and syntaxes.

The following are the requirements included in the development of the system.

Requirement of the Project

Functional Requirements

The functional requirements of the study are as follows

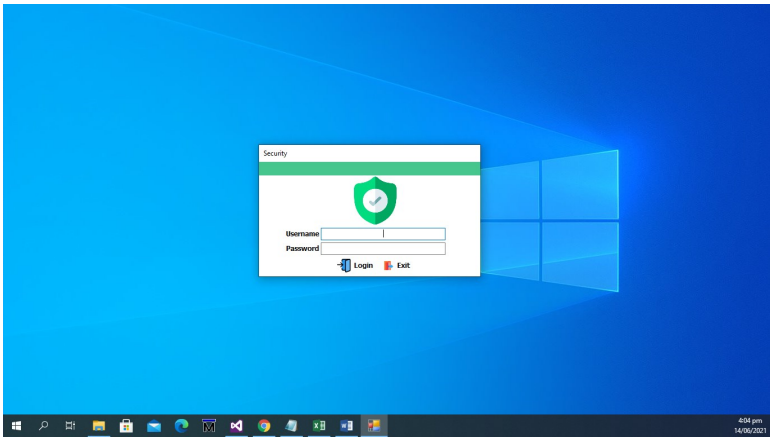

Figure 10. – Login Module

In this module, the user will be required to enter the username and password based on the registration by the administrator of the system. The username and password must match with each other, if the user enters the wrong username or password the user will be denied from entering the system and a notification will appear. When a correct password and username is entered the user will now be evaluated as to what account type the user has. In the system it has three account types, the Administrator, the Clerk and the User. The administrator account has an access without any limitations, while the clerk is not allowed to create users. If the user is a User type of account it can only access its own record and data.

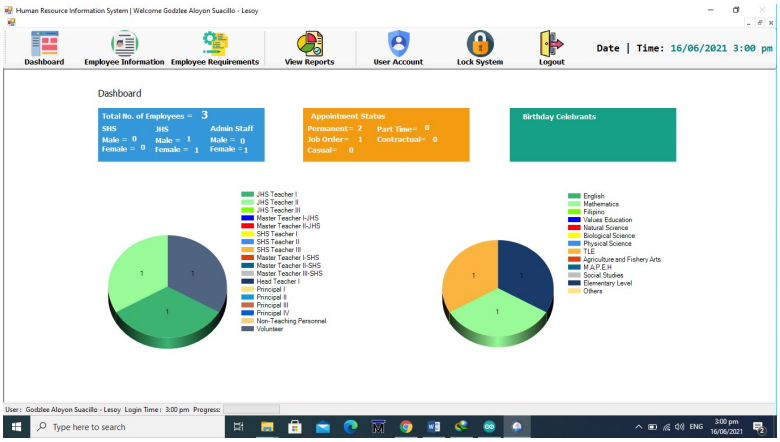

Figure 11. – Main Form/ Dashboard Form

In this module, it will display the summarized status of records in this system as well as a simple notification of an employee Birthday Celebrants. One of the data in the dashboard is the total number of employee and the breakdown as to how many are working in a Junior High School, Senior High School and Administrative staff. It also includes the number of men or women working in those specific categories mentioned above. Another data showed in the dashboard is the Appointment Status of the employees as to how many are Permanent, Part Time, Job Order Contractual and Casual. The dashboard also shows the employee ranking or position distribution by using a pie graph. Another pie graph is used to display the teacher's major distribution based on PRC categories.

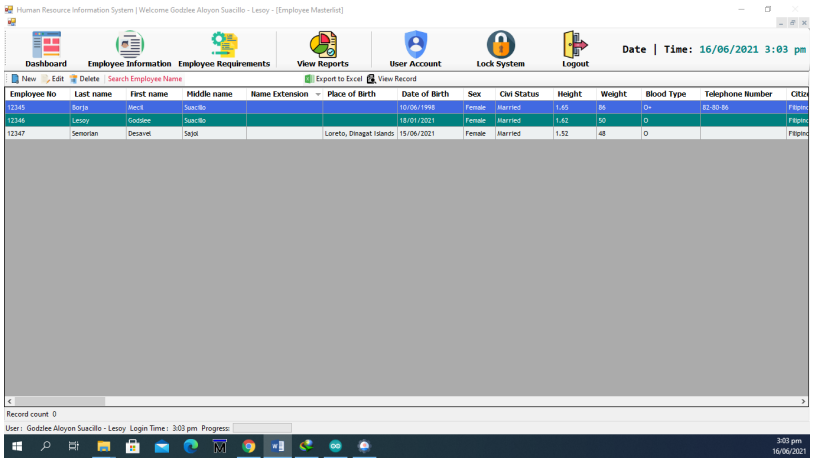

Figure 12. – Employee Information Module

In this module, the clerk will encode the details of information of every employee according to the required information needed in the Personal Datasheet (PDS). The clerk can create, edit and delete a certain employee record by clicking or searching the record then select a certain function. In creating or updating a record it will open the **Employee Details Form**.

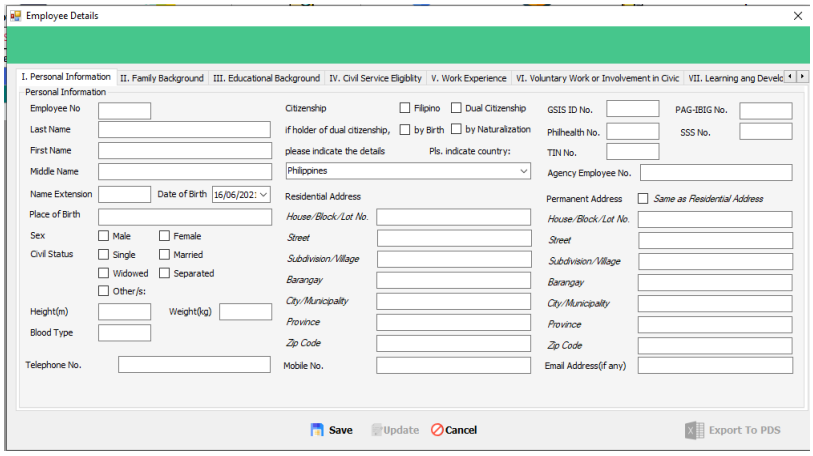

Figure 13. – Employee Details Form

In this form, all of the details regarding a certain employee will be encoded here. The details of information was based on the Personal Datasheet(PDS) of every employee. This form contains 10 tabs including additional information, questions that can be answered by yes or no and selecting a checkbox should be answered otherwise the system will not proceed to be save or updated. After an employee de-

tails has been encoded, the PDS of that employee can be generated by clicking the **Export to PDS** button.

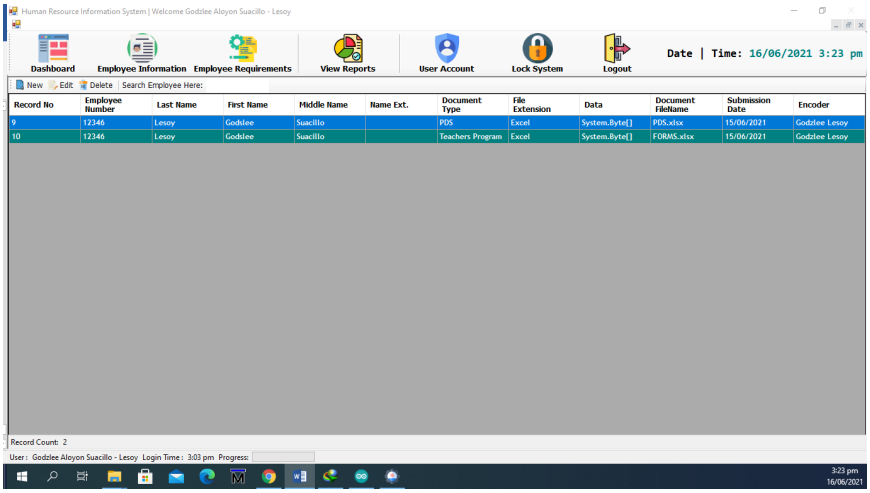

Figure 14. – Employee Requirements Module

In this module, the employee can upload / submit the required documents like the PDS, Teacher's Program, Accomplishment Reports, Trainings and Seminars and IPCR. These documents can be in a PDF, Word or Excel format when uploaded. To upload a new document for a certain employee, the user should click the New button then it will pop-up the Employee's Document Details Form.

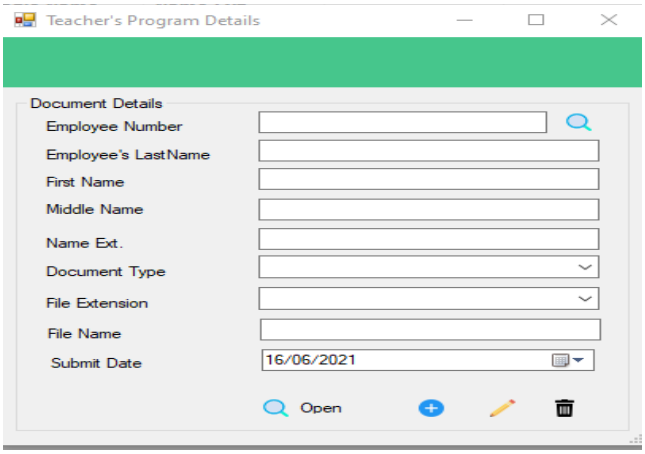

Figure 15. – Employee's Document Details Form

In this form, the user will select an employee record that will be added or updated with required documents by pressing the search button beside the Employee Number Textbox. After doing that, the form Lookup Employee will display and the user should select or search the record that he/she wants to update. After selecting an employee record the user should press the Open button to look for the file to be uploaded, once the file has been located and selected the user may now press the Add buton.

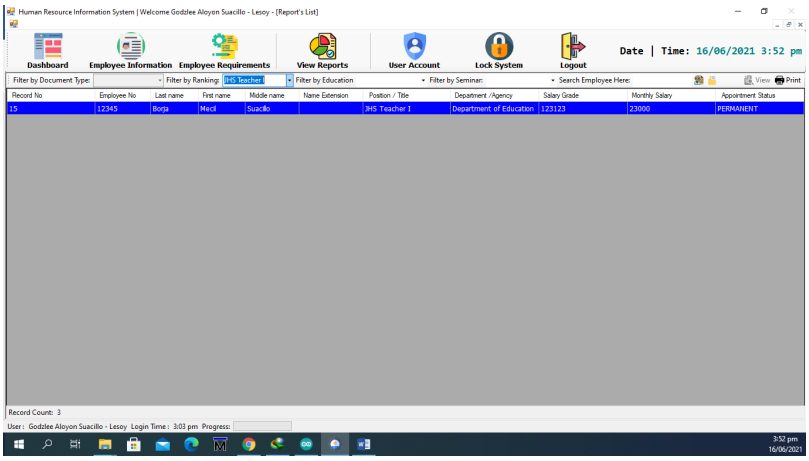

Figure 16. – View Reports Module

In this module, the user can generate reports based on the filter being selected. The authorized user can view the uploaded requirement documents by the employee by pressing the Document button and select the type of document it wishes to view or open. If the user wants to view the Employees Ranking, Education and Seminar it should select the Personnel button.

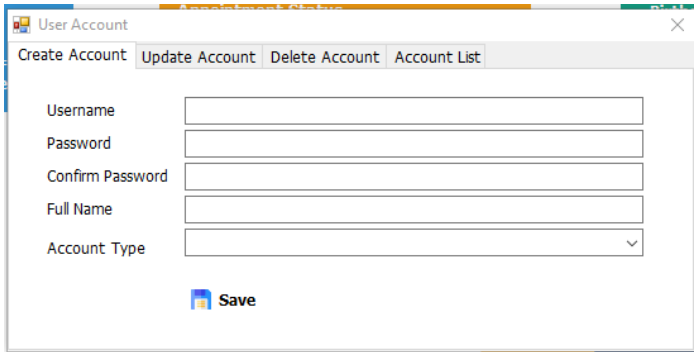

Figure 17. – User Accounts Form

In this form, the authorized user can Create, Update, Delete and View the user accounts of the system. It contains 4 tabs with each tab for each of the functions mentioned above. The Accounts List form can only be viewed by entering a currently login administrator account password to add more security to the User accounts details

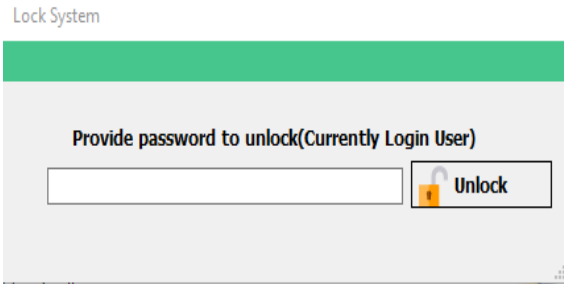

Figure 18. – Lock System Form

The lock system form is used to lock the entire system so that no other users can use the system while the currently login user is away for a while. The system can only be unlock by the password of the currently login user. It serves as a mechanism to prevent unauthorized access while the user is attending to other important matters and has a work on progress in the system which needs to be finished after a while.

Non-Functional Requirement

The requirements of the project define the software and hardware specification and other non-functional requirements. The school in which this system will be installed will provide the computer hardware, connectivity and other IT requirements needed for the implementation of this system.

Maintenance Issue. The system is designed for future upgrade and modification with respect to the fast technological advancement demands.

User Issue. The system is easy to use and comprehend. However, some may find it difficult to navigate that is why it is a must that a training must be conducted to give the User the basic knowledge and skill to operate the system.

Table 10. Hardware Requirements

Hardware Components	Recommended Specifications
Processor	Corei3
Memory	4GB
Hard Disk	500 GB
Operating System	Windows 10
Database	MS SQL Server 2008 R2

Development and Testing

During the development of the system, the researcher gathered data from previous studies all over the internet, reviewed previous related studies from the library and interviewed school personnel. The researcher utilizes the System Development Life Cycle (SDLC) which refers to a methodology with clearly defined processes for creating high quality software. In detail, the SDLC methodology focuses on the phased of software development, namely the requirement analysis, planning, software design such as architectural design, software development, testing and deployment. Through the data being gathered, the researcher understands the gap and problems of most empowered schools with regards to its Human Resource Information. With the gathered information the researcher formulate the title, Development of a Customized Human Resource Information System for Secondary Schools.

After knowing the problems and processes with Secondary Schools, the development of the interface and design started. The researcher utilize the advantages of Microsoft VB.net 2015 as an Integrated Development Environment (IDE) to develop the system which uses Microsoft SQL Server 2008 R2 as its backend software for its database. The researcher also uses the program Microsoft Word, Excel and PDF viewer to view the uploaded documents. Aside from the software development of the system, the researcher had also conducted software testing in order to ensure the functionalities and avoid inconsistences that may come up while using the system.

Alpha Testing

In this phase of software testing, the researchers were the one who tried and test the functionality of the system. The interface were scrutinized and check for its design and functionality. The researcher also validates the security aspect of the system especially when it deals with data privacy of the employee or user. This type of testing is somewhat due to a fact that the researcher which is also the programmer uses

the system in the way he/she knows how it should work that is why lapses really occurs and sometimes discovered only at the next phase of testing.

Beta Testing

In this phase of testing, the researcher invited some of its colleague to do the test and let them operate the system. At the moment of testing, some of the researcher's colleague encountered some sort of error and sometimes find it difficult to navigate the system. It is suggested that the design should be simplified and the icons and button should be easy to identify its function. As to this suggestions the researcher modified the system and applied their suggestions.

Pilot Testing

In this phase of testing, the system was installed at four different empowered schools in the Province of Surigao del Norte namely the Tagana-an National High School, Placer National High School, Amando Fabio Memorial High School and Surigao del Norte National High School. It has been used and observed by the Administrator, Teacher and Non-Teaching Personnel of their respective schools. After using the system for two weeks, the respondents were given survey questions to evaluate the functionality and usability of the system.

Table 11.Profile of Respondents

Profile		f(n=60)	Percent
Sex	Male	18	30.0
	Female	42	70.0
Age	20-29	10	16.7
	30-39	19	31.7
	40-49	20	33.3
	50-59	11	18.3
Position	Teacher	48	80.0
	Administrator/Staff	12	20.0

Table 12. Feature of HRIS in terms of User Interface

Indicator	Median	Rank	Description	Interpretation
Using the Human Resource Information System….				
1.1 I quickly understand the functions of every icons and buttons.	4	1	Strongly Agree	Highly Observed
1.2. I thought the system was easy to use.	4	1	Strongly Agree	Highly Observed
1.3. I felt very confident while using the system.	4	1	Strongly Agree	Highly Observed
1.4. I felt comfortable using this system.	4	1	Strongly Agree	Highly Observed
1.5. I would imagine that most people would learn to use this system very quickly.	4	1	Strongly Agree	Highly Observed
Over All	**4**		**Strongly Agree**	Highly Observed

The overall strong agreement across all indicators implies that the user interface of the HRIS is highly effective and well-received by users. The system is not only easy to use, but users also feel confident, comfortable, and believe that it is quick for others to learn.

In summary, the HRIS demonstrates a strong user interface, promoting ease of use, confidence, and quick learning for users. This positive perception is crucial for user satisfaction and efficient utilization of the HRIS in daily operations. Continuous monitoring and feedback can help maintain and enhance the effectiveness of the user interface over time.

Table 13. Feature of HRIS in terms of Database

Indicator	Median	Rank	Description
Working with the system, I noticed that…			
2.1. I can store large data into the system.	4	1	Strongly Agree
2.2. I can complete my work quickly.	4	1	Strongly Agree
2.3. the records are effectively organized in the system.	4	1	Strongly Agree
2.4. the information in the database is accurate.	4	1	Strongly Agree
2.5. the system is flexible enough to support my needs as well as the organization's requirements.	4	1	Strongly Agree
Over all	**4**		**Strongly Agree**

The overall strong agreement across all indicators implies that the HRIS, particularly its database capabilities, is highly effective and well-received by users. Users express satisfaction with the system's ability to handle large data, facilitate quick work completion, organize records effectively, ensure data accuracy, and adapt to various needs.

In summary, the HRIS demonstrates strong database features that contribute to efficient data storage, quick task completion, effective organization, accuracy, and flexibility to meet both individual and organizational needs. This positive feedback suggests a well-designed and functional database within the HRIS, enhancing its overall utility for users. Continuous monitoring and feedback can help maintain and improve these database features over time.

Table 14. Feature of HRIS in terms of Maintainability

Indicator	Median	Rank	Description
I can guarantee that…			
3.1 the system provides help options to solve minor issues.	4	1	Strongly Agree
3.2 the system has option to automatically report to developer or programmer if an issue or error is encountered.	3	5	Strongly Agree
3.3 the system can detect data errors like when a letter is encoded instead of a number.	4	1	Strongly Agree
3.4 the system has options to request for modifications to suit to new work requirements.	4	1	Strongly Agree
3.5 the system can be used in common computers.	4	1	Strongly Agree
Over all	**4**		**Strongly Agree**

The table show the overall strong agreement across all indicators suggests that the HRIS is perceived as highly maintainable. Users express confidence in the system's ability to address minor issues, report problems automatically, detect data errors, accommodate modifications, and work seamlessly on common computers.

In summary, the HRIS exhibits strong maintainability features, providing users with the tools and support needed to address issues, report problems efficiently, and adapt the system to evolving work requirements. Continuous monitoring and user feedback can further enhance the system's maintainability over time.

Table 15. Feature of HRIS in terms of Functionality and Acceptability

Indicator	Median	Rank	Description
I find that…			
4.1. using the system increases my productivity.	4	1	Strongly Agree
4.2. that various functions in the system were well integrated.	3	9	Strongly Agree
4.3. the system is flexible enough to support my needs as well as the organization's requirements.	4	1	Strongly Agree
4.4 the system had all the modules needed for a customized Human Resource Information System.	4	1	Strongly Agree
4.5 the system is useful in my job.	4	1	Strongly Agree
4.6 using the system would increase my contentment and satisfaction.	4	1	Strongly Agree
4.7 using the system I can save my time and efforts to accomplish reliable data.	4	1	Strongly Agree
4.8 the system can store, maintain, and update records of the personnel.	4	1	Strongly Agree
4.9 I am satisfied with the whole experience of using HRIS.	3	9	Strongly Agree
4.10 I would recommend this system to my teachers, administrator and friends from other school.	4	1	Strongly Agree
Average	**4**		**Strongly Agree**

The overall strong agreement across all indicators suggests that the HRIS is highly functional and widely accepted by users. Users find the system to be productive, flexible, useful in their job, and capable of increasing satisfaction. While there may be some areas for improvement, the overall positive feedback indicates a successful implementation of the HRIS.

In summary, the HRIS demonstrates strong functionality and acceptability among users, contributing positively to productivity, flexibility, job usefulness, satisfaction, and overall positive experiences. Continuous monitoring, feedback, and targeted improvements can further enhance the system's effectiveness and user satisfaction over time.

Table 16. Extent of Help of HRIS to Recruitment

Indicator	Median	Rank	Description
1.1 This system is a big help to our Human Resource in the recruitment process.	4	1	Strongly Agree
1.2 The system will fast track the recruitment process as it will generate needed data needed to easily identify lacking positions and manpower.	4	1	Strongly Agree
1.3 Using the system increases my chances of getting recognition in the workplace- e.g., contributes to promotion chances.	4	1	Strongly Agree
1.4 It was easy to find all the information regarding employees' professional growth as basis for recruitment and promotion.	4	1	Strongly Agree
1.5 I am satisfied with my chances for promotion using the data generated from the system.	4	1	Strongly Agree
Average	**4**		**Strongly Agree**

The overall strong agreement across all indicators implies that the HRIS is highly effective and well-received in the context of recruitment. Users perceive the system as a valuable aid that expedites the recruitment process, contributes to career recognition, and provides essential data for informed decision-making.

In summary, the HRIS is perceived as a significant asset in the recruitment process, contributing to efficiency, recognition, and informed decision-making for employee growth and promotion. Continuous feedback and updates can further enhance the HRIS's capabilities to meet evolving recruitment needs and user expectations.

Table 17. Extent of Help of HRIS to Evaluation

Indicator	Median	Rank	Description
2.1 I am confident that this system aids our administrators in evaluating every employee's performance.	4	1	Strongly Agree
2.2 It will be easy for the administrator to rate employees due to the ease of access with employees information	4	1	Strongly Agree
2.3 It will also be easy for the administrator to verify information for the purpose of evaluation.	4	1	Strongly Agree
2.4 I believe that this system will help employees to do self -evaluation and monitoring with its achievements and accomplishment.	4	1	Strongly Agree
2.5 This system will ensure a fast and accurate evaluation of the employee's performance and achievements.	4	1	Strongly Agree
Over All	**4**		**Strongly Agree**

Table 18. Extent of Help of HRIS to Document Management

Indicator	Median	Rank	Description
3.1 Placing my documents in the system where other people may view them – may positively affect my reputation.	4	1	Strongly Agree
3.2 The system is the preferred way to share documents with the department in my organization.	4	1	Strongly Agree
3.3 Using the system, it gives me a chance to view, and print my previous data.	4	1	Strongly Agree
3.4 The system will aid the administrator in managing requirement documents of its employee.	4	1	Strongly Agree
3.5 I will not be concerned with my data privacy as other employees cannot access my information except my administrator.	4	1	Strongly Agree
Over all	**4**		**Strongly Agree**

Table 19. Extent of Help of HRIS to Training and Awards Monitoring

Indicator	Median	Rank	Description
4.1 Using the system's search function it allows me to locate records efficiently.	4	1	Strongly Agree
4.2 I find that the records are effectively organized in the system which is better for monitoring awards and recognition of employees.	4	1	Strongly Agree
4.3 I rely on the system to provide reliable evidence of my personal accomplishments.	4	1	Strongly Agree
4.4 The system will help individual employees to monitor its own trainings and awards accomplishments.	4	1	Strongly Agree
4.5 I have no trouble searching for records in the system.	4	1	Strongly Agree
Average	**4**		**Strongly Agree**

The overall strong agreement across all indicators indicates that the HRIS is highly effective in supporting training and awards monitoring. Users find the system to be efficient in locating records, well-organized for monitoring awards, reliable for personal accomplishments, supportive of employee self-monitoring, and trouble-free in terms of searching for records.

In summary, the HRIS is perceived as a valuable tool for training and awards monitoring, providing users with efficient search capabilities, organized information, and reliable evidence of accomplishments. This positive feedback suggests that the HRIS contributes significantly to the overall management of training and awards-related data. Continuous user feedback and system updates can further enhance the HRIS's capabilities and user experience in this regard.

Table 20. Extent of Help of HRIS to Report Generation

Indicator	Median	Rank	Description
5.1 The system will aid the administrator in generating reports for employee profile.	3	2	Strongly Agree
5.2 The system will also help the admin in generating reports for the ranking and achievements of the employee.	3	2	Strongly Agree
5.3 I believe by using this system accurate reports will be generated.	3	2	Strongly Agree
5.4 I am satisfied with how easy to generate reports from this system.	4	1	Strongly Agree
5.5 Overall, I am satisfied with the system.	3	2	Strongly Agree
Over all	**3**		**Strongly Agree**

The table provides an overview of the extent to which a Human Resource Information System (HRIS) aids in report generation, based on various indicators. “Employee Profile Reports” with Median of 3 and Rank as 2 and described as Strongly Agree.

The respondents strongly agree that the HRIS aids administrators in generating reports for employee profiles. This indicates a high level of satisfaction and confidence in the system's capability to handle this aspect.

Also, Ranking and Achievements Reports with Median of 3 and rank as 2 was described Agree

Similar to Indicator 5.1, the system is perceived to effectively assist in generating reports for ranking and achievements of employees. This suggests that the HRIS is robust in capturing and presenting data related to employee performance and recognition.

Similarly the indicator 5.3 - Accuracy of Reports with a median of 3 and rank as 2 was described as Agree.

Users believe that using the system will result in accurate reports. This is crucial for decision-making and other HR processes, highlighting the importance of data precision within the HRIS.

In addition the indicator 5.4 - Ease of Report Generation with a median of 4 and rank as 1 was described also as Strongly Agree

The highest rank and strong agreement with satisfaction indicate that users find the system very easy to use for generating reports. User-friendly interfaces contribute significantly to the effectiveness and efficiency of HRIS utilization.

The collective feedback across all indicators results in a strong agreement that the HRIS is effective

in aiding report generation. This implies that the system is meeting or exceeding user expectations in terms of functionality and performance.

In summary, the table suggests that the HRIS is well-received by users, offering strong support for generating various types of reports, and users are particularly satisfied with the ease of use for report generation. Regular assessments and user feedback can help identify areas for improvement and ensure the continued success of the HRIS in meeting organizational needs.

Table 21. Difference on Perceived Features of HRIS according to Profile of Respondents

Profile	Indicator	H	p	D	I
Sex	User Interface	0.39	0.53	NR	NS
	Database	0.10	0.75	NR	NS
	Maintainability	0.91	0.34	NR	NS
	Functionality and Acceptability	0.52	0.47	NR	NS
Age	User Interface	2.94	0.40	NR	NS
	Database	1.22	0.75	NR	NS
	Maintainability	2.26	0.52	NR	NS
	Functionality and Acceptability	1.53	0.68	NR	NS
Position	User Interface	2.59	0.11	NR	NS
	Database	3.66	0.06	NR	NS
	Maintainability	0.10	0.75	NR	NS
	Functionality and Acceptability	0.68	0.41	NR	NS

Legend: *D - Decision on Ho* *I - Interpretation*
NR - Not Rejected *NS - Not Significant*

The table shows that there is no significant difference on the perceived features of HRIS when compared according to the profile of the respondents in terms of sex, age, and position. The null hypotheses are not rejected because the p-values are greater than 0.05, the level of significance. This means that the ratings of the respondents are just the same with each other even if there are differences in their profile. In other words, there is consistency on the ratings of the respondents on the features of HRIS.

Table 22 shows the results when the perceived help of HRIS to the secondary schools were compared according to the profile of the respondents.

Table 22. Difference on Perceived Help of HRIS according to Profile of Respondents

Profile	Indicator	H	p	D	I
Sex	Recruitment	0.65	0.42	NR	NS
	Evaluation	0.17	0.68	NR	NS
	Document Management	1.72	0.19	NR	NS
	Trainings/Awards Monitoring	2.29	0.13	NR	NS
	Report Generation	0.89	0.35	NR	NS
Age	Recruitment	0.91	0.82	NR	NS
	Evaluation	1.79	0.62	NR	NS
	Document Management	1.26	0.74	NR	NS
	Trainings/Awards Monitoring	2.00	0.57	NR	NS
	Report Generation	3.53	0.32	NR	NS
Position	Recruitment	0.03	0.86	NR	NS
	Evaluation	0.33	0.56	NR	NS
	Document Management	0.13	0.72	NR	NS
	Trainings/Awards Monitoring	1.34	0.25	NR	NS
	Report Generation	0.40	0.53	NR	NS

Legend: *D - Decision on Ho* *I - Interpretation*
NR - Not Rejected *NS - Not Significant*

The table also shows that there is no significant difference on the perceived help of HRIS to secondary schools when compared according to the profile of the respondents in terms of sex, age, and position. The null hypotheses are also not rejected because the p-values are greater than 0.05, the level of significance. This means that the ratings of the respondents on the help that HRIS could offer are just the same with each other even if there are differences in their profile. This means that there is consistency on the ratings of the respondents on the help of HRIS.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

Based on the result of the study, the developed Human Resource Information System provides the user with the functionality and information needed to do their task in an effective and efficient manner. Below is the result and findings of the evaluation being conducted in four empowered schools in the Province after having a Pilot Testing of the system on their respective institutions.

Findings:

1. The respondents are composed of mostly female employees. They are 30-39 years old and teachers.
2. They strongly agree that the HRIS has the following features: user interface, database, maintainability, functionality and accessibility.
3. They also strongly agree that the HRIS could help secondary schools in recruitment, evaluation, document management, trainings and award monitoring, and report generation.
4. There is no significant difference on the perceived features and help of HRS when the raters are grouped according to their profile.

Recommendations

Based on the foregoing findings and conclusions, the following are recommended for future researchers:

1. It is recommended that this system should be installed and operated in a computer with a higher specifications than originally being specified.
2. The system could be improve by having a regular update to attain efficiency and accuracy.
3. It is also recommended that there should be a proper training and orientation of the personnel incharge of the operation of this system.

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DEVELOPMENT AND EVALUATION OF E-PROFILING SYSTEM: AN ASSESMENT

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ABSTRACT

This study aimed to develop and evaluate an automated student record-keeping system that is accurate, fast, and accessible. Specifically, it discuss the requirements and features of the e-profiling system and the extent of contribution of e-profiling system to record keeping in terms of accessibility, speed, accuracy, and efficiency. The study was utilizing a developmental research design specifically the Software Development Life Cycle (SDLC). The system was evaluated and testing using different phases of testing. In the last part of testing which is the pilot testing, the researcher installed the system in Surigao del Norte National High Schools in Surigao del Norte and gathered evaluation responses from 47 respondents including 46 teaching and 1 non- teaching personnel using a survey questionnaire. Result revealed that the system based on the perceptions of the respondents they rated the system with an average of strongly agree on the areas of accessibility, speed, accuracy, and efficiency of the e- profiling system while on the perceive the factors of a system they rated agree in general. Thus, the following are recommended for future researchers: It is recommended that this system should be installed and operated in a computer with a higher specifications than originally being specified. The system could be improve by having a regular update to attain efficiency and accuracy. It is also recommended that there should be a proper training and orientation of the personnel in-charge of the operation of this system.

Keywords: *E-profiling, System development, Assessment, Perceptions*

INTRODUCTION

As the immeasurable growth of technology prosper in our world, comes innovations rise up, from paper-based registration to electronic storage of information, from the manual process of giving letters to online social media, this development cycle will remain until everybody won't seek refinement for their lives. To increase productivity or to keep up with everyday competition especially in the business world, you need to process everything as fast as you can. This is where the records management system comes in, where records are in digital form and information systems are used to create, store, retrieve, distribute and dispose records. The records management process begins with the conversion of paper documents and records to electronic files. Conversion eliminates many of the obstacles created by paper: labor-intensive duplication procedures, slow distribution, misplaced originals and the inconvenience of retrieving files from off-site storage. Because paper files are also costly to process, distribute and store, digitizing paper archives ultimately reduces operating expenses and overhead. Records Management enables more efficient distribution of and control over information, files and records throughout an organization. These will simplify business procedures and expedite business processes by allowing instant access to information; greater collaboration within and among departments and offices; enhanced security for files and records; and the application of procedures that facilitate compliance.

This process is very tedious and time consuming. The entire school is contingent upon one staff who supports the student's records. Data records are maintained under file maintenance system on this current system. Because of this, the employment of the data is not at one specific place. Hence, it is time consuming for the proper maintenance of records. Besides, the system does not maintain any category of data integrity.

Registrar Office is using manual system in keeping records of students. There are cases that some of the documents were lost or misplaced due to misfiling of student's records. There is no proper arrangement and procedure in issuing grades. It is also hard to the part of the students; they fall in line about a couple of minutes or an hour just to get their grades but the flow of issuance of grades is too slow. If they are still using the manual system the Registrar can't give better service to the students. With this, the researcher was challenged and developed a study on the development of a computerized record-keeping system, entitled "development of e-profiling system", that is accurate, fast, and accessible for the registrar's office of the school.

Development of e-profiling system would facilitate the record-keeping and issuance of grades. It will provide smooth operation purposes and it seeks for further advancement in the school system where technology can help the office to be more efficient. The development of e-profiling system will automate the records of students and the process of grade issuance of the school. If the student's records will be automated, the school will be able to increase staff efficiency, perform routine tasks automatically, and deliver their services more efficiently.

Conceptual Framework of the Study

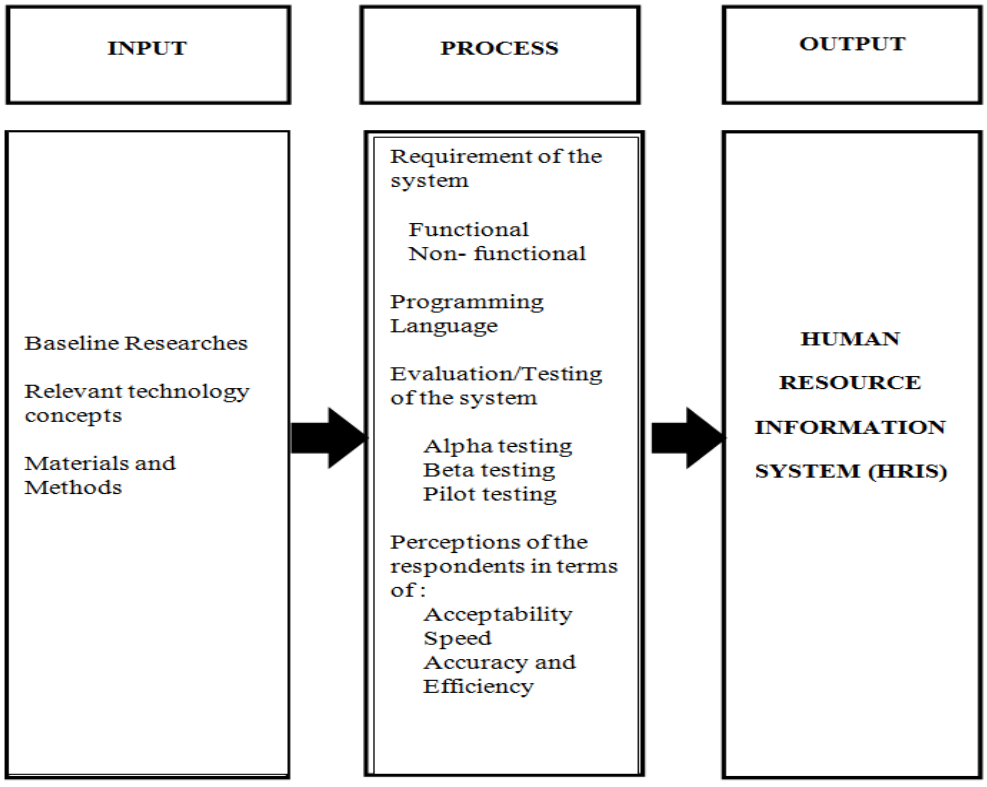

Figure 1. Research Paradigm

Statement of the Problem

This study aimed to develop an automated student record-keeping system that is accurate, fast, and accessible.

Specifically, it sought answer to the following problems:

1. What are the requirements and features of the e-profiling system?
2. To what extent of e-profiling system will contribute to record keeping in terms of:
   1.1 Accessibility,
   1.2 Speed,
   1.3 Accuracy, and
   1.4 Efficiency?
3. To what extent to the respondents perceive the factors of e-profiling system?

RESEARCH METHODOLOGY

Research Design

E-profiling system is utilizing developmental research design in the sense that this study is evolving and changing incrementally over time. Progress and development are iteratively growing. It is also considered as constructive research design in the sense that this study was being constructed based on the manual existing knowledge, however there some enhancement and development that would fill the missing links in manual process. During the construction of the system, the researcher applied the concept of System Development Life Cycle (SDLC). This is a process used in building, designing and constructing the system. It is compose of four phases such as: planning, analysis, design and implementation. In implementing properly the concept of SDLC, the researcher used Waterfall development methodology wherein the flow of this methodology is done in sequence from one phase to the next. The figure below shows the flow of the waterfall development.

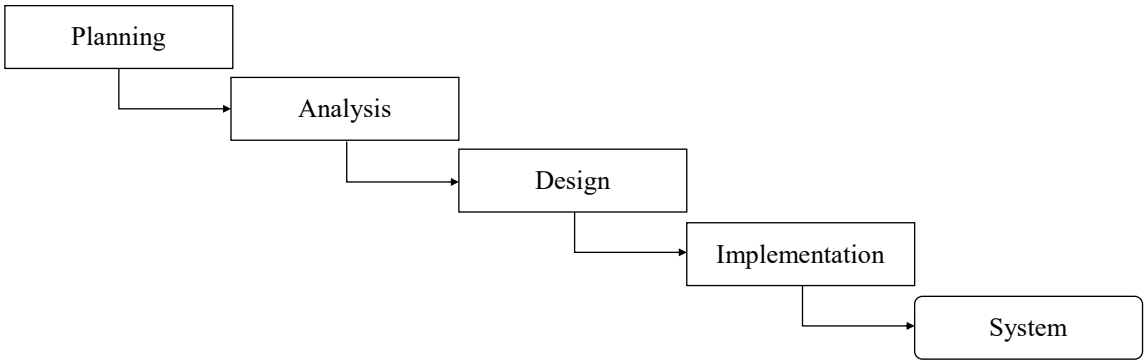

Figure 2. Waterfall Development Methodology

Planning

This phase is the fundamental process of understanding why an information system should be built. The planning phase determines how the researcher will go about building the information system. The researcher executes the planning stage during the project initiation.

Analysis

The analysis phase answers the questions of who will use the system, what the system will do, and where and when it will be used. During this phase the researcher investigates any current system(s), identifies improvement opportunities, and develops a concept for the new system.

This phase was critical to the success of the development project. The requirements must be actionable, measurable, testable, related to identified needs or opportunities, and defined to a level of detail sufficient for system design.

Design

In this phases it is decided how the system will operate, in terms of the hardware, software, and network infrastructure; the user interface, forms, and reports that will be used; and the specific programs, databases, and files that will be needed.

The researcher considered different aspects in the design of the student grade records management system. Each aspect must reflect the goals that the researcher and school administration were trying to achieve. Some of the aspects that the researcher incorporated in their study are the following: compatibility, extensibility, maintainability, reliability, reusability, and usability.

Implementation

During this phase, the system is either developed or purchased (in the case of packaged software).

Implementation is the process of writing, testing, debugging/troubleshooting, and maintaining the source code of computer programs. This source code is written in a programming language. The purpose of programming is to create a program that exhibits a certain desired behavior. Coding requires expertise in many different subjects, including knowledge of the application domain, specialized algorithms and formal logic.

The researcher used PHP for the coding and the interface and for the system to be available for the schools and DEPED, the researcher created two applications both for the schools and DEPED. Upon creating it errors were expected to emerge since the codes must also be correct and compatible with the technology Advanced Encryption Standard and PKI that supports, further debugging was done until there are no errors found.

Design

This tackles the technical view on the development of the project. Processes are carefully analyzed by the researcher for the design of the system.

This serves as an application intended for school users. The application will collect and maintain the

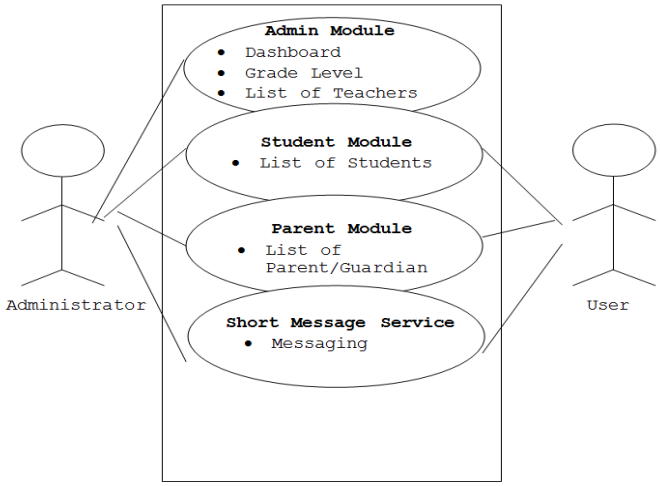

Figure 3. Use Case Diagram of an E-profiling System

Figure 3 shows the use case diagram of e-profiling system. E-profiling system is composed of 4 components: Admin module, student module, parent/guardian module and sms module. Admin module that creates a dashboard updating the students and teachers statistics, sectioning by grade level and teachers important data. Student module that keeps students details like learner's reference number (LRN), date of birth, contact number, grade and section, their residence address and other very important information. Parent/guardian module that equally comes important to the above-mentioned modules, because it shares information of the learner's parents or guardians, their address, telephone numbers, etc.

Research Respondents

The respondents of the study are the 1 School Registrar and 54 teachers in Surigao del Norte National High School – Senior High School, Division of Surigao del Norte.

Research Environment

This study will be conducted at Surigao del Norte National High School, a public school located at Peñaranda Street, Surigao City, Surigao del Norte, Philippines. Specifically, this study accommodated random senior high school students of the school which will be the source of information to be stored in the system. It can be reached through riding multicab, tricycle, and even motor bike.

Statistical Analysis

Mean and Standard Deviation. These were used to determine the perceived contributions of e-profiling system. This was also used to determine the perceived factors or characteristics of the system.

RESULTS AND DISCUSSIONS

Description of the Project

E-profiling system is designed provided to give an accessible, fast, accurate and efficient process. The system is used and maintained by the administrator.

Requirements of the Project

Minimum hardware requirement:

Processor: Intel Pentium Core to Dou 1.9 Ghz
Memory: 1 Gb DDr
Monitor: Cathode Ray Tube
Mouse: PS/2
Keyboard: PS/2 102 keys
AVR: 3 Gang for 220V

Software requirement:

Operating System: Windows 7 Ultimate 32 bit ZAMPP
Language: PHP
Database: MySQL
Server: Apache

Design of Software

There are different considerations when it comes to design of software. Some of these aspects are:

Maintainability. Modifications and updating can be done to accomplish the user requirements.

Security. Proper security from any hostile practices can be accomplished.

Reliability. The software is capable in providing essential functions based upon the requirements.

Reusability. The software is able to cater additional features for enhancement and modification.

Usability. User-friendly interface is attainable for the user's benefits.

Screenshot

This part displays the different interfaces of an E-profiling system. Also, it shows the definition of every image.

Figure 5. Log-in Box for Admin/User

Figure 5 shows the log-in box for the administrator. It provides username and password. The system can be accessed by providing valid username and password. And also you can create an account for the new user.

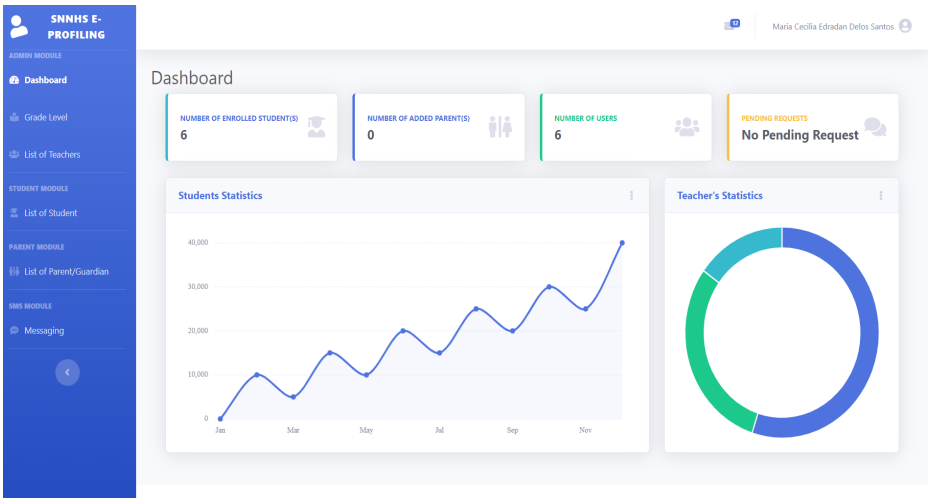

Figure 6. Dashboard

Figure 6 shows the main window of an e-profiling system. At its left, displays the list of buttons for different modules like admin module consist of dashboard, grade level & list of teachers, student module for the list of student, parent module for the list of parent and guardian and sms module if you want to message for all students.

At the upper side, displays the number of enrolled students, number of added parents, number of users and pending requests. And there are two charts the left side is line graph for students statistics and right side is pie chart for teachers statistics.

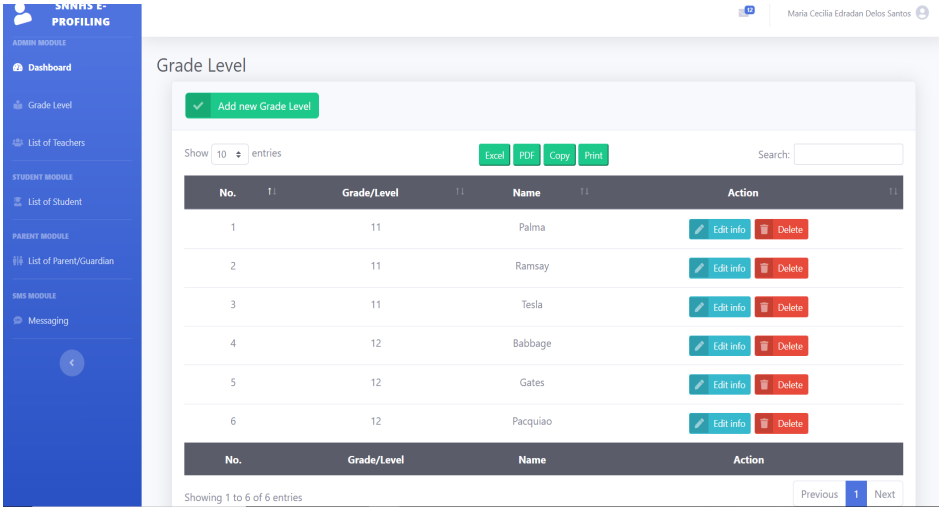

Figure 7. Grade Level

Figure 7 shows the lists of Grade and section. At the right side button you can edit profile and delete the section and grade level.

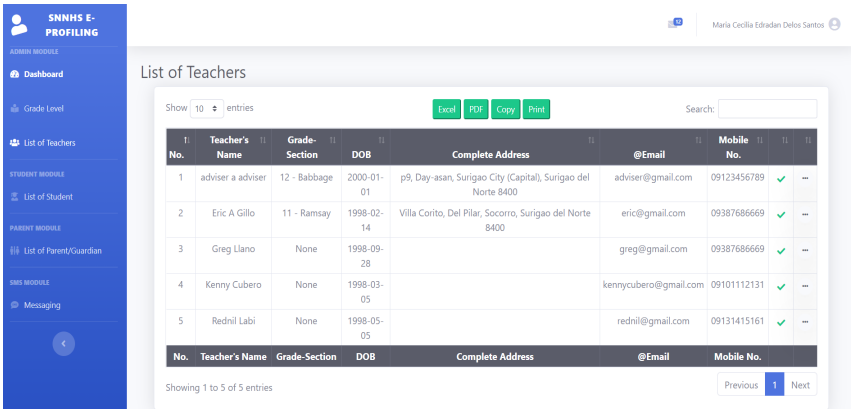

Figure 8. List of Teachers

Figure 8 shows the list of teacher that contains information such as full name, grade & section, date of birth, complete address, email address and contact number.

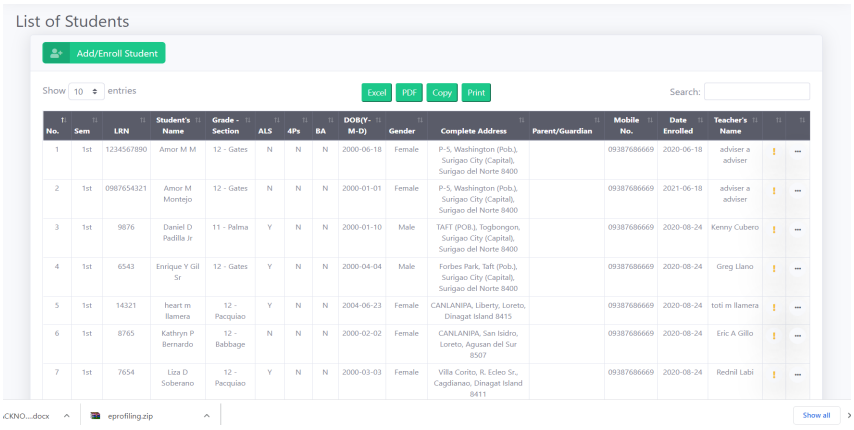

Figure 9. List of Students

Figure 9 shows the list of students, where you can register new student. It provides basic information such as Learner's reference number (LRN), Learner's Reference Number (LRN), membership to Alternative Learning System (ALS), student's name, grade and section, date of birth, gender, complete address, parents' or guardian's name, and contact number

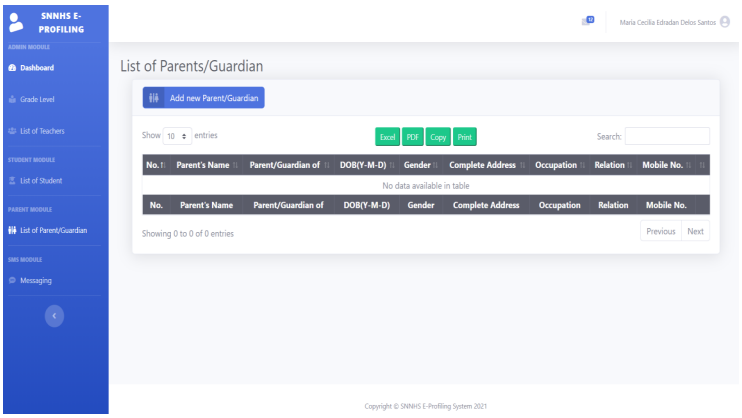

Figure 10. List of Parents/Guardian

Figure 10 shows the list of parent/guardian information, for in case of emergency, announcement and other matters.

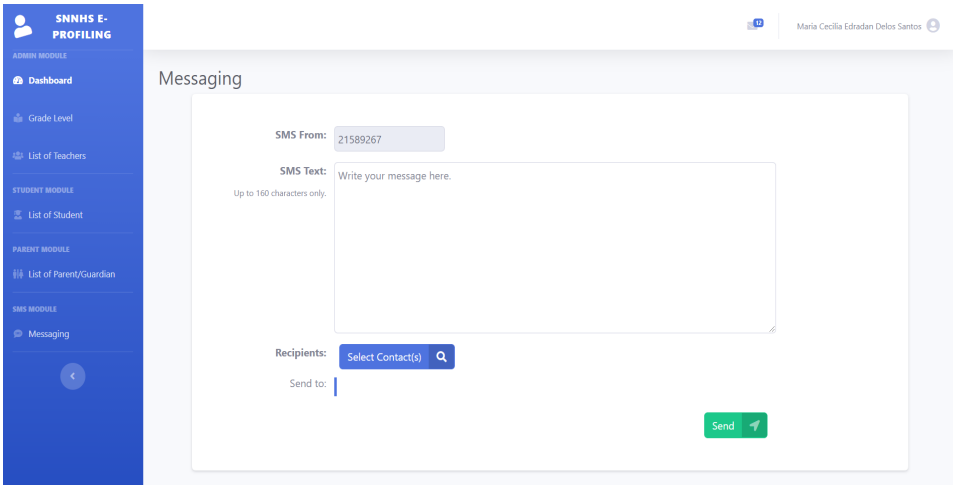

Figure 11. Sending Messaging Dialog Box

Figure 11 shows the dialog box for sending message. It provides the textbox for the recipient, the message area and submit button. This window is useful the administrator can send message to teacher, student and parent/guardian on the list. Same as the teacher can send the student and parent/guardian inform and announce the schedule of exam and distribution and retrieval of module and other matter.

Development and Testing

The system received good response after it was tested by the teachers in junior high. It is when the teachers tried to add students and their profile data. The system proved that it is capable in profiling the data of the students with additional features of sms.

Another test was done and made by the senior high teachers of Surigao del Norte National High School teachers where the researcher received more comments and suggestions that are useful for the enhancement of the system.

However, the system did not fail to give the desired output to the users. In addition, the teachers was impressed as to the fast, efficient and how it contributes to the profiling the data of the students.

Alpha testing was tried and tested by the registrar. Minor design changes may be made as a result of such testing. Beta testing was typically done by end-users or others where anyone can obtain test and provide feedback on the application.

After the testing made, the researcher can assure that the system can be implemented for it satisfies all user requirements.

Table 3. Extent of Contribution to Record Keeping of E-Profiling System in terms of Accessibility

Statement	Median	Rank	Description
1.1 Learning to operate the system is easy for me.	4	1	Strongly Agree
1.2 The system is flexible enough to support my needs as well as the organization's requirements.	4	1	Strongly Agree
1.3 A record stored in the system is retrievable.	4	1	Strongly Agree
1.4 When I open the system, it only consumes small data usage.	3	5	Agree
1.5 The files are downloadable.	4	1	Agree
Average			**Strongly Agree**

Table shows that Statement 1.1 - Learning to Operate the System with a median of 4 and rank as 1 was described as Strongly Agree, Users strongly agree that learning to operate the E-Profiling System is easy. This suggests that the system has an intuitive interface or effective training resources, contributing to user-friendly interactions.

In the same way Statement 1.2 - System Flexibility with a median of 4 and rank as 1 was also described as Strongly Agree. Users strongly agree that the system is flexible enough to meet both individual needs and organizational requirements. System flexibility is crucial for adapting to evolving business processes and user preferences.

Similarly, Statement 1.3 - Record Retrieval with a median and rank as 1 was also described as Strongly Agree. The strong agreement indicates that users find the E-Profiling System effective in retrieving records. Quick and efficient record retrieval is essential for seamless workflow and decision-making.

On the other hand, Statement 1.4 - Data Usage with a median of 3 and rank as 5 was described as Agree only. While the agreement suggests that users generally find the system's data usage acceptable, it ranks lower compared to other statements. This could be an area for improvement, as users seem to be moderately satisfied but not as strongly as in other areas.

While, Statement 1.5 - Downloadable Files with a median of 4 and rank as 1 was also described as Strongly Agree. Users agree that files stored in the system are downloadable. This enhances the accessibility of information for users who may need offline access or want to share documents externally.

The average of the statements indicates a strong agreement across all aspects of accessibility-related to record-keeping. This suggests a high level of user satisfaction and positive experiences with the E-Profiling System in terms of ease of learning, flexibility, record retrieval, and file download capabilities.

In summary, the E-Profiling System appears to be highly effective in contributing to record-keeping, especially regarding accessibility. Users find the system easy to learn, flexible, capable of efficient record retrieval, and supportive of file downloads. Addressing any concerns related to data usage could further enhance user satisfaction and the overall effectiveness of the system. Regular user feedback can help in refining and optimizing the system's features.

Table 4. Extent of Contribution to Record Keeping of E-Profiling System in terms of Speed

Statement	Median	Rank	Description
2.1 If I use the system, I will increase my chances of saving time in my paper works.	4	1	Strongly Agree
2.2 Since the use of the system/process is speedy, more works are getting accomplished.	4	1	Strongly Agree
2.3 The workload is lessened.	3	4	Strongly Agree
2.4 The system is automated.	3	4	Strongly Agree
2.5 The release of grades is submitted prior to the deadline.	4	1	Agree
Average			**Strongly Agree**

The overall strong agreement across all statements indicates that the E-Profiling System is perceived as highly effective in contributing to record-keeping in terms of speed. Users see the system as a time-saving, speedy, and automated tool that enhances productivity and accomplishes tasks efficiently.

In summary, the E-Profiling System seems to be a valuable asset in terms of speed and efficiency, contributing positively to time management, workload reduction, and timely completion of tasks. Continuous monitoring and user feedback can help identify areas for further improvement and optimization.

Table 5. Extent of Contribution to Record Keeping of E-Profiling System in terms of Accuracy

Statement	Median	Rank	Description
3.1 The information of the system is complete and correct.	4	1	Agree
3.2 The data in the system has minimal to no errors.	4	1	Agree
3.3 I would find the system easy to use because I understand its functions of every icon and button.	3	5	Strongly Agree
3.4 The system effectively manages security to the level required for my sensitive records.	4	1	Agree
3.5 The input of the data is consolidated and reviewed.	4	1	Agree
Average			**Agree**

It can be seen in the table that the overall agreement across all statements suggests that the E-Profiling System is perceived as contributing effectively to record-keeping in terms of accuracy. Users trust the completeness and correctness of information, note minimal errors, and appreciate the system's ability to manage security and ensure data input consolidation and review.

In summary, the E-Profiling System appears to be a reliable tool for maintaining accurate records. Addressing any user concerns related to system complexity could further enhance user satisfaction and the overall effectiveness of the system. Regular reviews and updates to security measures are also crucial to maintaining data integrity.

Table 6. Extent of Contribution to Record Keeping of E-Profiling System in terms of Efficiency

Statement	Median	Rank	Description
4.1 The system leverage automation to identify important information.	3	4	Agree
4.2 The system integrates devices to assist with document capture.	3	4	Agree
4.3 Using the system increases my productivity.	4	1	Strongly Agree
4.4 The system can be tracked.	4	1	Agree
4.5 The system ensures safe disposal of unneeded documents, and facilitates retrieval of documents.	4	1	Agree
Average			**Agree**

The perceived factors of e-profiling system are shown in Table 7. The overall agreement suggests that the E-Profiling System is perceived as contributing efficiently to record-keeping. Users generally agree on the positive impact of the system on productivity, trackability, and document management. While there is some variability in opinions regarding automation and device integration, the overall trend is positive.

In summary, the E-Profiling System appears to be effective in enhancing efficiency in record-keeping tasks, leading to increased productivity and improved document management. Addressing any concerns related to automation and device integration could contribute to a more consistent user experience. Regular assessments and user feedback can guide further improvements to optimize the system's efficiency.

Table 7. Perceived Factors of E-Profiling System

Statement	Median	Rank	Description
1. By recording my knowledge in the system, I will be more valuable in my workplace.	4	1	Agree
2. Placing my documents in the system – where other people may view them – may positively affect my reputation.	4	1	Agree
3. By placing my records in the system, I feel that I have more control over them	4	1	Agree
4. I am confident to put my documents into the system.	4	1	Agree
5. The e-profiling system's is everyone's responsibility.	3	13	Agree
6. The e-profiling system will help me work efficiently.	3	13	Agree
7. The system is the preferred way to share documents with other teams or business units in my workplace.	4	1	Agree
8. I save my records into the system with the thought that someone in the future will read them.	4	1	Agree
9. I would depend on the system to provide reliable evidence of my personal accomplishments.	4	1	Agree
10. Regular usage of the system may enhance the reputation of the user.	4	1	Agree
11. Users are inclined to use a system that is easy to navigate.	4	1	Agree
12. The system enables its users to sort out the documents based on the advisory class.	4	1	Agree
13. I feel that the system offers an accurate and reliable search algorithms in finding the desired elements when I look for a particular record.	3	13	Agree
14. The system generates a real-time monitoring system.	4	1	Agree
15. The e-profiling system has unique features from other automation.	4	1	Agree
Average			**Agree**

This is followed by the overall agreement which suggests a positive perception of the E-Profiling System. Users see value in recording knowledge, believe it positively affects their reputation, and feel in control of their records. Confidence in document placement, the system's responsibility, efficiency enhancement, and other positive aspects contribute to an overall agreeable perception.

In summary, the E-Profiling System is perceived as a valuable tool that contributes positively to individual and organizational dynamics. The confidence users have in the system's various features and its potential impact on knowledge management and reputation reflects a positive user experience. Regular feedback and user engagement can further enhance the system's alignment with user expectations and needs.

Implementation Plan

The researcher is eager to develop this e-profiling system because of the inaccuracies, inefficiency, slow and inaccessible record-keeping system that teachers and advisers of Surigao del Norte National High School is experiencing. Using this system, the school can immediately respond giving data of students to persons needing it, compliance to requirements for scholarships, participation to athletic competitions, and even for submission to some division office reports. To make the workloads of advisers lessen, this e-profiling system is very timely and needed so as not to commit errors especially that data must be supplied correctly, otherwise they do not represent the right person. The users should really appreciate the efficiency of the system and likely to be implemented and be used for enrolment, and for the upcoming needs of the succeeding school years.

CONCLUSION

This document presents the functionalities of an e-profiling system. This study concludes its accessibility that is more reachable for teachers especially the advisers and the school registrar to explore or find data of a particular learner. The speedy response to data inquiries also can be addressed and the ability to keep important details is adhered.

Furthermore, this e-profiling system develops the following:

1. Log-in module for security purposes.
2. Admin module that creates a dashboard updating the students and teachers statistics, sectioning by grade level and teachers important data.
3. It has a student module that keeps students details like learner’s reference number (LRN), date of birth, contact number, grade and section, their residence address and other very important information.
4. The parent’s module that equally comes important to the above-mentioned modules, because it shares information of the learner’s parents or guardians, their address, telephone numbers, etc.
5. Above all, this e-profiling system has a very unique feature that filed the gap that other researches lack. It has the salient Messaging that is added to make important notices, announcements, reminders and the like that can be automatically sent right from the system itself. You won’t need to transfer for another gadget to make important messages related to school requirements.

RECOMMENDATIONS

After studying the e-profiling system, the researcher recommended that this system should be used and implemented. However, future enhancement must be considered. Software and hardware parts must be updated always. Proper training for the teachers should be made to avoid misuse of the system. In addition for the future enhancement, this system should be integrated to the e-profiling system.

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