CURRENT TRENDS IN LANGUAGE SKILLS AND ETHNO-BIOLOGICAL KNOWLEDGE OF UPPER SECONDARY SCHOOL STUDENTS IN PAPUA NEW GUINEA

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STATEMENT OF ORIGINALITY

I, Alfred Kik, do hereby declare to the Senate of the University of Papua New Guinea that this thesis is the product of my own investigations, except where otherwise acknowledged.

This work has not been previously submitted or accepted for any degree by any university or any Institute of higher learning within PNG or abroard. I also certify that this thesis does not contain any defamatory material. All photographs in this thesis are my own unless otherwise stated.

Signed:……

Date:……

DEDICATION

This thesis is dedicated to my late grandma, Ma Rosa Munia Dupai

ABSTRACT

Papua New Guinea is linguistically and culturally the most diverse country in the world. PNG's languages, as the repositories of ethnobiological knowledge and culture, play a crucial role in biodiversity conservation. The current trends in cultural, social and economic changes in PNG are threatening the survival of languages and ethnobiological knowledge, but there are very limited studies done to assess the suspected decline of indigenous language and ethnobiological knowledge of Papua New Guinea.

Using a structured questionnaire, upper secondary school students (n=4220) in 17 schools in three culturally different provinces (National Capital District, Madang and Eastern Highlands) of the country were assessed of their language skills (measured as the ability to name 24 human body parts) and ethnobiological knowledge (measured as the ability to name bird species and list traditional uses of plant species) in relation to their socio-demographic information. The relationship between language skills and ethnobiological knowledge was also established. The relationship between students' and parents' language fluency were evaluated. Using R version 3.4.3, relevant statistical analyses, including general linear model, correlation and ANOVA with subsequent Post hoc tests were employed.

Socio-demographic variables including preschool years environment (rural/urban), home language, parents' education, parents' vernacular fluency, and parent speaking same/different language were significant predictors of students' language skills, while their gender was not . Spending preschool years in rural areas greatly support language acquisition and proficiency. This was also true for ethnobiological knowledge acquisition. There was no gender difference in language skills overall, but significant variation was evident in bird knowledge where males scored higher than females. Students who speak vernacular language at home demonstrated higher level of language acquisition and proficiency than those speaking English or Neomelanesian Pidgin at home. There was a negative correlation between language skills of students and education level attained by their parents. This was also true for ethnobiological knowledge. Ethnobiological knowledge was strongly dependent on language proficiency. New skills, including phone

and computer use skills, were negatively associated with traditional bird knowledge, while hunting skills were positively correlated with bird knowledge. These results suggest that recent cultural and socio-economic changes have complex, but largely negative effects on indigenous language acquisition and proficiency, and ethnobiological knowledge.

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CHAPTER ONE: INTRODUCTION

1. 1 Introduction

Ethnobiology is the study of the biological knowledge of a particular ethnic group – cultural knowledge about plants and animals and their interrelationships. Indigenous societies/tribes all over the world in different geographical regions possess an invaluable bank of ethnobiological knowledge (EK) (Agrawal, 1995; Pushpangadan, 1995). They build this knowledge through curiosity, keen observation, constant trial and error, long experience and close association with nature (Lampman, 2007). However, effective acquisition and transmission of EK would not be possible without language, as language is the repository of human knowledge about plants, animals, ecosystem, local environment, cultural traditions, etc. (Franco, Hidayati, Ghani, & Ranaivo-Malancon, 2015; Kirkness, 2002). Language skills – the ability to develop vocabulary (cultural genes/social genes) of a language overtime (Unasho, 2013) and efficiently used to express EK, is crucial in knowledge transmission (Pushpangadan, 1995). Young people develop language skills acquired from old people overtime.

It is important to note that EK and language skills together play an important role in cultural and biodiversity conservation (Kirkness, 2002; Unasho, 2013). If a language is lost, it takes away the knowledge it carries with it. In PNG today, there is a strong change of lifestyle. It is sad to see that the older people who are fluent speakers of vernacular languages and are well versed with EK are passing on without imparting the essentials to the younger generation. This is because young people are no longer spending their quality time with the elders or have regular contact with nature, instead they are migrating into towns and cities looking for better life, as well as speaking English and Melanesian Pidgin as their main languages of communication. This is purposely to homogenize with people of different ethnicity they are living with. Even children are speaking Pidgin as their first language of communication and seem to forget their mother tongue.

This study would be highlighting the important issues, linked to EK and language skills, the younger generation are facing today in PNG. While social, cultural and economic changes have their own

significance, it is also important that EK and language skills be preserved. With the strong change in lifestyle in recent years, it is hypothesized that: there would be a clearer trend of decline in language skills and EK among the youths of PNG when the language skills and EK of upper secondary school students, representing the educated portion of new generation of PNG were assessed. In addition, the socio-demographic factors such as parental education level, pre-school environment, home language use, etc. would also contribute significantly to this decline of language skills and EK.

1.1.1 Aims and objectives

The major objective of this study is to assess the current trend of language skills and ethnobiological knowledge of secondary school students in face of cultural, social and economic changes in Papua New Guinea. The study will identify how socio-demographic factors determine language skills and ethnobiological knowledge of Papua New Guineans and evaluate how students could accurately name body parts in vernacular, while ethnobiological knowledge will focus on students' ability to identify and name bird species. The study will also look at the relationship between language skills and ethnobiological knowledge, and determine how the loss of language could affect ethnobiological knowledge. Finally, the study aims to establish whether demographic characteristics affect how well students speak their parents' language as this would further clarify how language skills and ethnobiological knowledge could develop in the future.

1.1.2 Research Questions

Primary questions:

1. What are the language skills of the secondary school students representing the educated portion of a new generation of Papua New Guineans?
2. Are language skills declining in PNG? And if so, what factors are contributing most to this decline?
3. What is the level of ethno-biological knowledge in secondary school students, and what family and social factors contribute most to the preservation, or disappearance, of this knowledge?

4. What is the importance of studying ethnobiological knowledge and language skills in the younger generation?
5. How are language skills and ethnobiological knowledge of younger generation affected by modernization and urbanization?

1.1.3 Thesis Structure

This thesis has five chapters: Chapter One provides an overview of the background of this study and specifies research objectives, aims and research questions tested; Chapter Two details the methods involved in this study to answer the research questions on language skills and ethnobiological knowledge of secondary school students; Chapter Three presents the results of language skills and ethnobiological knowledge; Chapter Four evaluates and discusses the results in comparison with the other researchers' findings and Chapter Five provides a general discussion and conclusions of the thesis.

1.2. Background of the study

1.2.1 PNG's Biocultural Diversity

Papua New Guinea (PNG), an island nation in the South Pacific north of Australia and east of Indonesia, is a developing country rich in culture, language and biological diversity. Its rich biocultural diversity is an astounding reality despite the fact that the country covers only 0.5 % of the total global land mass with over 830 languages (Devette-Chee, 2013; Levy, 2005; Litteral, 1999), equivalent to about one sixth of the more than 6,000 languages of the world (Klaus, 2003). PNG is also ranked first in the world for endemic languages (Oviedo, Larsen, & Maffi, 2000). Further, each language represents at least one indigenous culturally distinct group, which means that the 800 plus languages are also the indicators of the minimum number of indigenous cultural communities that exist in PNG (Whitford & Dunn, 2014).

PNG's cultures and traditions are deeply entrenched in every Papua New Guinean. Within each region, visitors experience a rich variety of traditional customs. Taking ownership and pride of this diversity of cultures, many cultural expressions emerge. Each group creates its own expressive form in art, dance, weaponry, costumes, singing, music, architecture, and much more, which helps to preserve and keep alive the cultures and traditions. Cultures and traditions are kept alive in elaborate rituals around deaths, feasts, marriages, compensation ceremonies and initiations rites. The Malagans in the New Ireland province, Fire walk Baining dance and bark cloth masks in the East New Britian province, Asaro mud men in the Eastern Highlands province, and Sepik river wood carvings are just few examples of distinct cultural expressions in various cultural groups in PNG (Whitford & Dunn, 2014).

Geographically positioned in the tropical region and embracing a complexity of mountain landscapes with a rich diversity of environments, soils and climates, PNG hosts rich biodiversity and hence is listed as one of megadiverse countries in the world (Harmon, 1995; Oviedo et al., 2000). The country has 18894 described plant species including fungi, 719 bird, 271 mammal, 227 reptile, 266 amphibian, and 3060 fish species (Pippard, 2009). Indigenous people, living in their cultural communities, enjoy the intact flora and fauna through hunting and gathering of food and other basic needs from the forest and

wild habitats. They have an intimate and long-lasting relationship with this biological diversity, and a deep knowledge of it.

Apart from more than 830 languages, PNG has 4 official lingua franca languages: English, Melanesian Pidgin, Hiri Motu and Sign language. English is the language of business and education instruction (starting from Primary schools) and it is widely spoken across the country by those who attended formal education. Melanesian Pidgin, a creole language derived from English and German (UNESCO, 2008), is spoken casually everywhere in PNG. Hiri Motu, another lingua franca, is based on a local language and mainly spoken in the southern part of the country including the Port Moresby area. Sign language is mostly used by deaf and dumb people.

1.2.2 The importance of language

Language as an identity

A language forms part of a person's identity and uniqueness (Doug, Kazuko, & Jakelin, 2014; Kirkness, 2002; McIvor, Napoleon, & Dickie, 2009; Onditi, 2016). Identity is signalled by the language a person speaks (Byram, 2006). Not only is language an indicator of an individual's identity but it is seen as a highly salient maker of group identity (Kulick, 1997; Levy, 2005) that includes regional and national identity (Byram, 2006). An individual or a particular social group may speak a dialect of a language in a certain village that diverges phonologically, lexically and morpho-syntactically from the dialects of the same language in the neighbouring villages. These diverging features make the individual or group unique and instil the feeling of belongingness (Kulick, 1997; Marmion, Obata, & Troy, 2014). This situation also applies to a language spoken regionally that indicates regional identity. A good example of explaining national identity is in the case of Australians when they are aware of particularities of their language and culture when travelling to places such as New Zealand, America, or England where English language and culture differs from their own. Difference in accents, phrasing and colloquial terms could reaffirm their sense of identity as Australians (Byram, 2006). Language as an identity strengthens and binds families and communities together as a culture group (Marmion et al., 2014).

Furthermore, the role of language as an identity and cultural manifesto contributes to language diversity (Levy, 2005). High regard of his or her identity insures the protection and survival of the language and therefore language diversity.

Language as a communicative tool and the repository of ethnobiological knowledge and culture

Not only does language form part of a person's identity, but it is also a tool for communication (Parikh, 2001) It is used to communicate the information about the world. For instance, a mathematical formula written on a whiteboard does not make any sense unless it is explained using language. Or ecological systems and networks in a local environment can be well explained using language through its specific vocabularies developed overtime from generations to generations.

Language plays very important role as a repository of human knowledge about plants, animals, ecosystems, and so forth. Ethnobiological knowledge or traditional knowledge is highly dependent on language (Franco et al., 2015; Romaine, 2015) because it is through language that the names and the scientific information related to ecology, morphology or utility of lifeforms are transmitted (Onditi, 2016). Equally important, language is the repository of culture (Kirkness, 2002) where cultural information is communicated and preserved. As such, a linguistically diverse region or country is also culturally diverse (Maffi, 2007). For instance, PNG has a complex cultural diversity, which also indicates its complex linguistic diversity (Devette-Chee, 2013; Levy, 2005; Litteral, 1999). Maffi (2007) highlighting the importance of language as a vehicle for communicating and transmitting cultural values, traditional knowledge and practices.

Settee (2008) in her International Expert Group meeting on indigenous languages in New York highlighted the significance of language as the heart of culture and knowledge retention, and further suggested that any discussion of Indigenous Knowledge Systems must include language retention. This suggested the link between language, culture and indigenous knowledge or ethnobiological knowledge, and if language is lost, culture and ethnobiological knowledge system is also lost (Settee, 2008).

1.2.3 The importance of language and ethnobiological knowledge in conservation

Language and ethnobiological knowledge (EK) play an important role in culture and biodiversity conservation (Maffi, 2007; Settee, 2008; Unasho, 2013). Language and EK are inseparable and mutually reinforcing each other. Language as the carrier of traditional knowledge provides linguistic form, and transmits information regarding the structure and mechanism (e.g. ecology, utility, quality, etc.) of an ecosystem, made available by EK (Franco et al., 2015). Both language and EK contribute to the identification, recognition, and transmission of knowledge of life forms (Zent, Zent, & Iturriaga, 2004). For instance, EK provides the traditional knowledge (such as ecology, reproduction, preparation, etc.) of a medicinal mushroom while language names, explains, and transmit this knowledge. Indigenous people in any indigenous communities find EK and language as key elements in their survival hence provide respect and good stewardship of their natural environment. There is often no vocabulary to transmit EK information other than the vernacular language. This is the case for instance the local indigenous taxonomy and nomenclature of plant and animal species, some of them not even known to international science.

While EK and language are inseparable and mutually conforming, one would ask a question: "What will happen if language is lost?" The answer to this question is provided by Onditi (2016), who suggested that the loss of language would proportionally cause loss in EK which will further contribute to environmental degradation (Pilgrim, Cullen, Smith, & Pretty, 2008). Onditi's answer is further supported by Terralingua, an international non-profit organization that was established in 1996 to preserve the world's linguistic and cultural diversity. One of their findings is that the increased threat to cultural, biological and linguistic diversity goes hand in hand with drastic loss in language and the knowledge it carries about the environment and sustainable resource use. The continuous loss will have dangerous consequences for human cultures (Maffi, 2007; Settee, 2008).

Onditi's (2016) answer clearly reveals the link between language, EK and conservation. Zent et al. (2004) study on the use of fungi among the Venezuelan people of Amazon documented a story that best explains the connection of the three. The Venezuelans have certain mushroom species that (with generic

names in their vernacular languages) associate with vulture spirits. If anyone destroys the habitat of the mushrooms, the spirits confront them several times throughout the course of their life time. This belief protects the habitats of the mushrooms. The Nenga Akeleka of the Nenga tribe in the Western Highlands Province of PNG believed that a particular patch of forest known as "kolg" had a huge snake called "kolg mai rang" that scared them from clearing the forest. This belief system was passed on orally through generations. The forest is still untouched today. The two examples highlight the importance of language and traditional knowledge in conservation (Pilgrim et al., 2008).

1.2.4 Threat to linguistic diversity and ethnobiological knowledge

Since language is a carrier of EK, the loss of language also means a loss in EK. Regrettably, there is an increasing threat in the linguistic diversity of the world today (Romaine, 2015), which also means a threat to traditional knowledge system (Settee, 2008), biodiversity (Sutherland, 2003), and a contributing factor to environmental degradation (Onditi, 2016). According to Krauss (1992), 25 year ago, an estimated 20% of the world's 6,900 languages were entering into moribund phase. Sadly, Romaine (2015) recently predicted that increasing extinction rate could mean 50% to 90% of the world's languages will become extinct by the end of this century.

Scholars, apart from other reasons, blamed globalization as the main cause of the decline of the languages (e.g., Amano et al., 2014) and EK (e.g., McCarter et al., 2014; Trimarco, 2016). Much of these are attributed to acculturalization (Crawford, 2007), the spread of western formal education (Trimarco, 2016), and the use of a majority language or a national language (Amano et al., 2014) such as English (Gorter, Cenoz, & Nunes, 1990) are few examples among the many.

When looking at the global threatening trend of language loss, has anyone assessed what is the situation in PNG with more than 830 languages in face of rapid cultural, social, and economic changes in the recent years? Highlights of representative studies done on languages in PNG: Litteral (1999), who was looking at vernacular education and not language status and Novotny and Drozd (2000) studied language population and size. Levy (2005), in her linguistic research in the Awar community in the

northern part of Madang province, stressed the danger of only oral transmission of language, exploring the importance of language in forming one's worldview as well as the goals, methods and tools of language study. Aikhenvald and Stebbins (2007) and Aikhenvald (2014) documented various language groups in PNG, while Devette-Chee (2013) studied the attitudes towards Melanesian Pidgin and vernacular languages of primary school students with specific focus on Tolai language. On the other hand, Baro (2015) studied the relationship between language skills, ethnobiological knowledge and school education in village communities in Madang. Most of these studies however, did not quantitatively assess the status of PNG languages on large scale. Equally important, ethnobiological studies remain limited in PNG. In fact, there is so far only one detailed dictionary and thesaurus for a local language, Kalam, and a single detailed ethnobiology written in that language (Majnep et al. 1978), while there are several ethnobiological studies in English (e.g., Batet et al. 1998, Majnep & Bulmer 2007, Toh & Butler 2011). Many languages remain completely undocumented in written form, or being recorded only as a by-product of the programme of Bible translation to vernacular by the Summer Institute of Linguistics (SIL).

A major trend that is apparent in the modern society today is the lack of contact with the nature leading to loss of useful knowledge and interaction with nature including loss of emotional affinity to nature, and decline in pro-environmental attitudes and behaviour, thus, implying a cycle of disaffection towards nature (McCarter, Gavin, Baereleo, & Love, 2014; Soga & Gaston, 2016). Robert M. Pyle in 1993 termed this alienation as "the extinction of experience". This process is happening in PNG where young people are not spending time with their elders to learn the language skills and traditional knowledge – which means less effective inter-generational transfer of EK. Instead they are migrating into towns and cities in search of education, jobs and "modern" life. In order for them to fit well in the urban settings, a common language such as Melanesian Pidgin or English must be spoken. Furthermore, parents and elders are increasingly valuing formal education as an important aspect of life that guarantees their children a promising future, thereby making every effort to send their kids to schools. They may not realize that the compulsory education policy (Devette-Chee, 2013) that requires students to speak English at all times in schools will have negative effects on their vernacular language (Fillmore, 1991).

Another trend of concern in PNG now is the prevailing use of Neomelanesian Pidgin language by children in majority of homes as the everyday language of communication, which is causing the local languages to becoming obsolete (Kulick 1997). Sepulveda (2011) stressed the exclusive use of Pidgin and English by the younger generation which cause the population of local language speakers to gradually grow old and eventually die off.

The improved communication such as the use of mobile phone is making it easy to use the most widespread lingua franca (Pidgin), breaking language barriers and homogenizing the linguistic diversity (Baro, 2015). The increasing communication and travel also leads to a high rate of inter-language marriage which further encourage the use of Pidgin in the families. The increase in the use of electronics such as laptops, computers, tablets, advanced versions of mobile phones, et cetera, and the increased access to internet including social networks (Facebook) are further encouraging English and Pidgin use. All these factors are believed to cause a decline in language, the skills to utilize the languages, and the ethnobiological knowledge in PNG, but no accurate surveys of the scale of this problem are available.

CHAPTER TWO: METHODOLOGY

2.1 Overview of research design and sampling

The research methodology engaged in this study was mostly quantitative in nature where a structured questionnaire was designed to test the ethnobiological knowledge and language skills of grade 11 and 12 students (i.e. the last two years of secondary school) in three provinces: Madang, National Capital District (NCD) and Eastern Highlands (EHP) **(**Figure 2.1). The choice of participants was restricted to upper secondary school students because (i) this standardized the level of education of the participants, (ii) captured young generation experiencing rapid change of lifestyle and (iii) that this group was considered old enough to consider their current language skills and ethnobiological knowledge. The upper secondary school students represent the educated portion of the younger generation in PNG as less than 10% of population of their age group reaching grades 11 and 12.

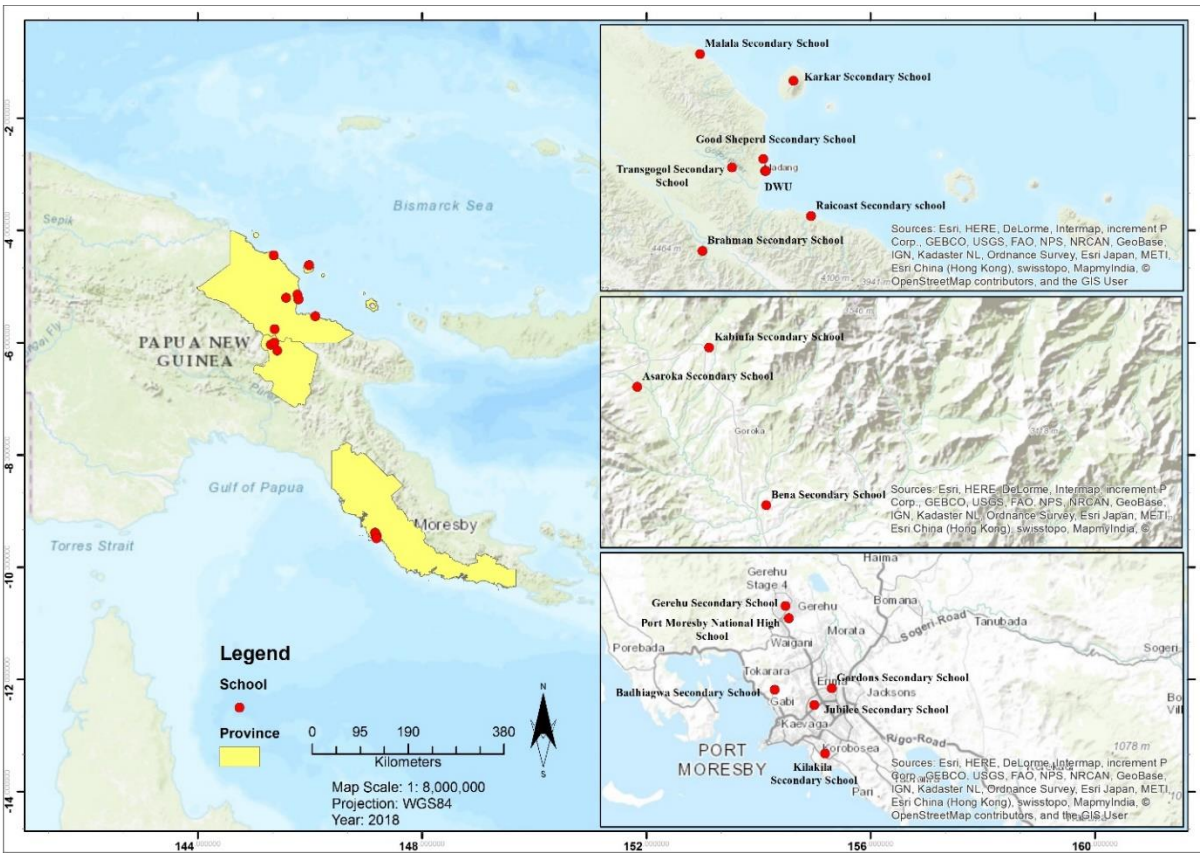


Figure 1 The schools surveyed in the three provinces (Eastern Highlands, National Capital District and Madang)

2.1.1 Choice of schools

Madang province was chosen for study due to the fact that it is the most linguistically diverse province in the country, and probably the most linguistically diverse area in the world (Levy, 2005; Novotny & Drozd, 2000). Thus, providing a high number of languages to be surveyed in schools that could help to assess the trend of languages in PNG. Further, as traditional knowledge is dependent on languages (Franco et al., 2015), Madang also provides both urban and remote rural areas with potentially wide variability of ethnobiological knowledge. Hence all upper secondary schools in Madang were surveyed (Table 1). Divine Word University was chosen to provide a limited sample of university-level participants so that data collected could be compared against the upper secondary school data.

Easter Highlands Province (EHP) was selected to represent a culturally different province from the PNG Highlands region, characterized by shorter history of colonial contact than Madang and also has lower language diversity. While the National Capital District (NCD) represents urban schools with most families living in the Port Moresby capital, representing a mix of languages from the entire country (McCracken & Barcinas, 1991). The schools chosen in the three provinces were a good mix of government and non-government schools. The participation of schools in this study was organized by schools, typically involving the entire classes thus, avoiding the problem of self-selection, especially, if students with poor language skills would be less willing to participate than those fluent in vernacular. The survey was conducted anonymously (Chen et al., 2016).

2.1.2 Participants

Out of the total number of participants surveyed (4,220 – see table 1), 40.88% were females (N=1725) and 55.57% were males (N=2345), while 3.55% did not provide gender information (N=150). The head teachers played important part by organizing their teachers and students to participate in the research. Teachers involvement and assistance was found vital in the past (Ugwuja, 2010) as well as in this study too.

Table 1. 1 ***Schools in their respective provinces and regions, and number of participants surveyed***

Region	Province	School		No. of Participants
Highlands	Eastern Highlands	Bena Bena Secondary		337
		Kabiufa Secondary		295
		Asaroka Secondary		251
			total:	**883**
Momase	Madang	Tusbab Secondary		547
		Malala Secondary		238
		Transgogol Secondary		83
		Good Shepheard Secondary		246
		Karkar Secondary		391
		Raikos Secondary		200
		Brahman Secondary		205
		Divine Word University		148
			total:	**2058**
Southern	National Capital District	Port Moresby National High		181
		Kilakila Secondary		183
		Gerehu Secondary		320
		Gordon Secondary		400
		Jubilee Secondary		84
		Badhiagwa Secondary		111
			total:	**1279**
			Sum total:	**4220**

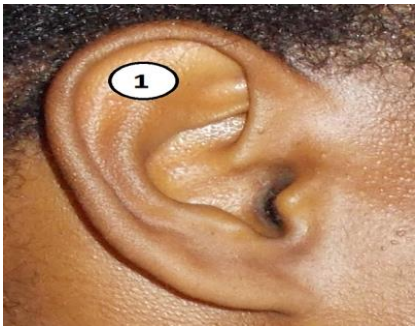
2.1.3 Data Collection

Data collection using a questionnaire is one of the most efficient quantitative methods because the survey can be given to large number of people and collect data in a short period of time (McCracken & Barcinas, 1991; Moonga, 2007; Pagliarulo, 2004; 2010). In this study, the main data collection instrument was a 24 page questionnaire.

In order to answer the research questions, a questionnaire that had seven sections was developed (Appendix D). The first section required personal information of the participant such as the current residence of the participant's family, gender, place of birth, language the participant uses most of the time at home, and so forth. The next section was the participant's mother's information which looked at whether she was born in her village or not, district and province of origin, her language and how well she speaks it, and the highest completed education. The third section contains father's information similar to section number two. The fourth section was prepared to gather information of the participant's language skills which includes questions on whether the participant's parents speak the same language, how well the participant speaks his/her mother's and father's language. Language test represented the fifth section that included 24 pictures of human body parts (Appendix E) at different levels of difficulty that the respondent was asked to name in his/her local language (Baro, 2015). Providing English names of body parts for guidance, students were required to write the vernacular names (Figure 2). The sixth section of the questionnaire contained pictures of two sets of birds (with their scientific names): 10 lowland and 10 highland species, all of them geographically widespread but ranging from well-known to rare and difficult. This was designed to test the participants' ethnobiological knowledge. Participants were only required to name the birds in their local language or circle the 'do not know' option if they could not think of the name (Figure 3). I have considered the results for either lowland or highland set of bird species, whichever provided better results. This allowed for students coming from locations with various bird fauna. Plant test was the final section prepared to gather knowledge of how culturally important plants are used in the participant's locality. Participants were asked to write down 10 plant species that are culturally important, name them in their local language and indicate their traditional use (other than food).

It was important to consider the validity and reliability of the instrument (McCracken & Barcinas, 1991; 2010). The questionnaire developed was submitted to two experts including my supervisor. These experts carefully checked the questionnaire to ascertain the clarity, relevance, adequacy and other attributes which a good research instrument should possess. The questionnaire was refined based on the suggestions provided by the experts as well as pilot surveys with test respondents. The questionnaire was tested on its reliability with 20 young people at the New Guinea Binatang Research Center which was outside of the targeted study areas. Inputs from the tested individuals were further considered for the readjustments.

Body part No. 1



English: Ear

Vernacular (Tokples) name: ..... or circle: [do not know]

Figure 2 Sample body part used to assess language skills

Bird species No. 2

Scientific name: *Casuarius bennetti*

Tokples name: ..... or circle: [do not know]

Tok Pisin or English name .....

Figure 3 Sample bird species used to assess bird knowledge

2.1.4 Conducting Tests in Schools

Actual testing of ethnobiological knowledge and language skills in schools eventuated in March 2015. Tusbab secondary school students were the first to be tested (Figure 2) since the school was the closest to the researcher's resident area. The school also had a huge number of upper secondary school students, and therefore was impossible to get of them into a common room for testing, like what was done at other secondary schools. Each day, two classes were tested which led to the test being completed in six days for 12 classes of upper secondary.

Figure 4. Ethnobiological and language skills test in progress at Tusbab secondary school

Prior to distributing the test papers to students, each question in the questionnaire was clearly explained. The completion of the questionnaire was followed by presentation of stationaries as gifts to students in appreciation of their participation. A supplementary copy of colour photos derived from the black and white images in the questionnaire was also distributed to students that would aid body parts and bird species recognition. Each class was strictly given 60 minutes to complete the test. This method of data collection was used by Chen et al. (2016) in their study on the comparison of sexual knowledge, attitude, and behaviour between female Chinese College students from urban and rural Areas in China but their testing time was only fifteen minutes for each class.

Unlike Tusbab secondary, participants from Brahman secondary school were gathered in a common hall and tested in 60 minutes, which took only a day to finish the survey. Similar techniques of testing were applied for the remaining 16 schools as well as the university (Appendix A).

2.2 Data Analysis

An MS Access database was created to accommodate the 4220 individual data collected from the 17 schools. Information from each questionnaire was entered in the form of 142 data fields so that the entire dataset included 204,764 data entries. The hired students from Divine Word University were closely supervised for data entry (Appendix B). Thorough quality checks were done twice on the entered data to make sure accuracy was maintained throughout. The data for the 17 schools incorporated into one excel sheet was subjected to cleaning which was then followed by analysis using R 3.4.3 version. Firstly, a general linear model (GLM) was used to elucidate the effects of multiple socio-demographic factors (preschool years environment, gender, home language, parents' education, parents' vernacular fluency, same/different language) that predict students' language skills (measured by human body part test). This narrowed down to answering specific research questions. The independent variables were the socio-demographic variables and the dependent variable was the language skills. Socio-demographic information constituted four variables: 1) whether or not there is difference in language skills and ethnobiological knowledge (bird and plant knowledge tests) among students who spent their preschool years in the rural areas and those in the urban areas, 2) whether or not parental education level influence student's ethnobiological knowledge and language skills, 3) whether or not gender influences language skills and ethnobiological knowledge, and 4) whether or not parents' education level determines students' language skills and ethnobiological knowledge. Secondly, language skills (independent variable) and ethnobiological knowledge (dependent variable) were assessed for correlation. Finally, GLM was used to assess how well students speak their parents' languages. The independent variables were the parents' language fluency levels (assessed by students) and the dependent variables were students' language fluency levels (self-assessed by students in four categories: good, poor, passive, none).

2.3 Permissions and Ethics

In order to access one's intellectual property, consent granting is of great importance. The following paragraphs present how prior informed consent was obtained from schools and individuals. The first permission obtained for the research was from the Provincial Education Advisor (PEA) of Madang Province which began in April, 2015. A formal letter requesting permission to conduct research in secondary schools in Madang together with a support letter from the deputy director of New Guinea Binatang Research Centre were presented to the PEA. The objective and the goals of the research and the benefits of the project were clearly outlined in the two letters. On 16th of April 2015, the PEA gave the green light for the research to progress (Appendix F).

The second phase of obtaining prior informed consent was from the principals of the 17 schools. Seventeen formal letters were written and presented to the principals on a mutual understanding that each school would provide participants for the research and in return, representative gifts such as text books and dictionaries would be presented to the school as a token of appreciation (Appendix C). A local wage was paid to teachers involved in conducting tests.

The third phase of obtaining informed consent was from every student who would participate in the research. The focus of the research and the type of questions in the questionnaires were clearly explained to the students. Gifts such as biros of different colours and plastic rulers were given to students to appreciate their participations.

CHAPTER THREE: RESULTS

4.1 The influence of demographic variables on language skills

A general linear model (GLM) was used to elucidate the factors that predict students' language skills. The independent variables in the GLM model (Table 2.1) included categorical variables 1) where students spent their preschool years, 2) gender, 3) home language – daily language that is used at home, and 4) parents speaking same/different language at home, as well as ordinal variables 5) mothers' education level, 6) fathers' education level, 7) mothers' vernacular language fluency, and 8) fathers' vernacular language fluency.

All demographic variables except Gender were significant ($p<0.05$) predictors for language proficiency of the participants (Table 2.1). The insignificant result in the gender variable indicated that there was no gender difference in the language skills test score (female: M=10.40, SD=8.00; male: M=12.19, SD=8.62).

The variables that showed significant difference in the GLM models were further subjected to subsequent follow-up tests to explore the factors causing the differences. Different tests were performed according to the type of data being tested.

Table 2. 1 ***Predicting language skills (language test score) from demographic variables***

Variable	Estimate	Std.Error	*t*	*p*
Intercept	2.53216	0.90562	2.796	0.0052
Preschool years	3.23731	0.27043	11.971	2.00e-16
Gender	0.05439	0.25252	0.215	0.8295
Home language	3.8189	0.32235	11.847	2.00e-16
Mother's education	-0.86229	0.15787	-5.462	5.05e-08
Father's education	-0.97932	0.15949	-6.14	9.20e-10
Mother's vernacular	2.67812	0.44993	5.952	2.91e-09
Father's vernacular	1.84835	0.43158	4.283	0.000019
Same/different language	3.14961	0.26258	11.995	2.00e-16

Significant ($p<0.05$), GLM analysis

Similarly, demographic characteristics and language skills were tested for ethnobiological knowledge (bird test). In this investigation, the same independent variables included in the preceding language skills tests were used again to predict bird knowledge except the inclusion of continuous language skills variable which was considered an important predictor variable for ethnobiological knowledge .

Results from general linear model showed all variables tested were significant predictors ($p<0.05$) of ethnobiological knowledge, except same/different vernacular spoken by the parents which was not significant (Table 2.2).

Table 2. 2 ***General Linear Model summary predicting ethnobiological knowledge (bird test score) from demographic variables and language skills.***

Variable	**Estimate**	**Std.Error**	***t***	***p***
Intercept	1.416934	0.297109	4.769	1.93e-06
Language skills	1.16234	0.08275	14.046	2.00e-16
Gender	0.191064	0.005638	33.888	2.00e-16
Preschool years	1.089474	0.090478	12.041	2.00e-16
Home language	0.226403	0.107803	2.1	0.03579
Mother's education	-0.301162	0.051962	-5.796	7.42e-09
Father's education	-0.307123	0.052555	-5.844	5.59e-09
Mother's vernacular	-0.399477	0.14821	-2.695	0.00707
Father's vernacular	-0.340184	0.141808	-2.399	0.0165
Same/different vernacular	-0.11757	0.087857	-1.338	0.18092

Significant ($p<0.05$)

4.1.1 Predicting language skills and ethnobiological knowledge from preschool years

Results of the t-test showed a significant differences in language skills test scores between students who spent preschool years in the urban and rural areas ($t(84.37)= 4250.9$, $p=2.2e-16$). As shown in Figure 5, the participants who spent their preschool years in the rural setting scored more than two times better in the language skills test ($M= 14.34$, $SD=7.80$) than those who spent preschool years in the urban areas ($M=8.28$, $SD=7.90$).

Similar test conducted to test the influence of preschool environment on bird knowledge test showed even larger, and significant, difference (t (46.54) = 4432.7, p=2.2e-16) (Figure 6). There is consistency of maintaining high score for participants who spent preschool years in the rural areas (M=4.17, SD= 3.29) than urban areas (M=1.47, SD=2.53).

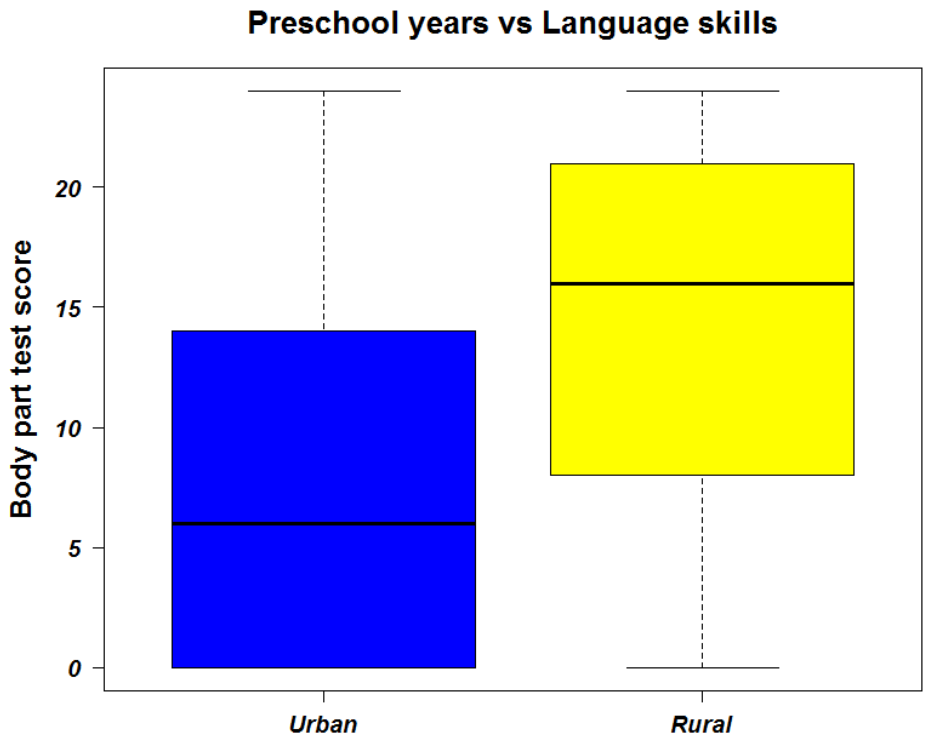


Figure 5 The relationship between preschool years environment and the language skills (mean number of body parts named)

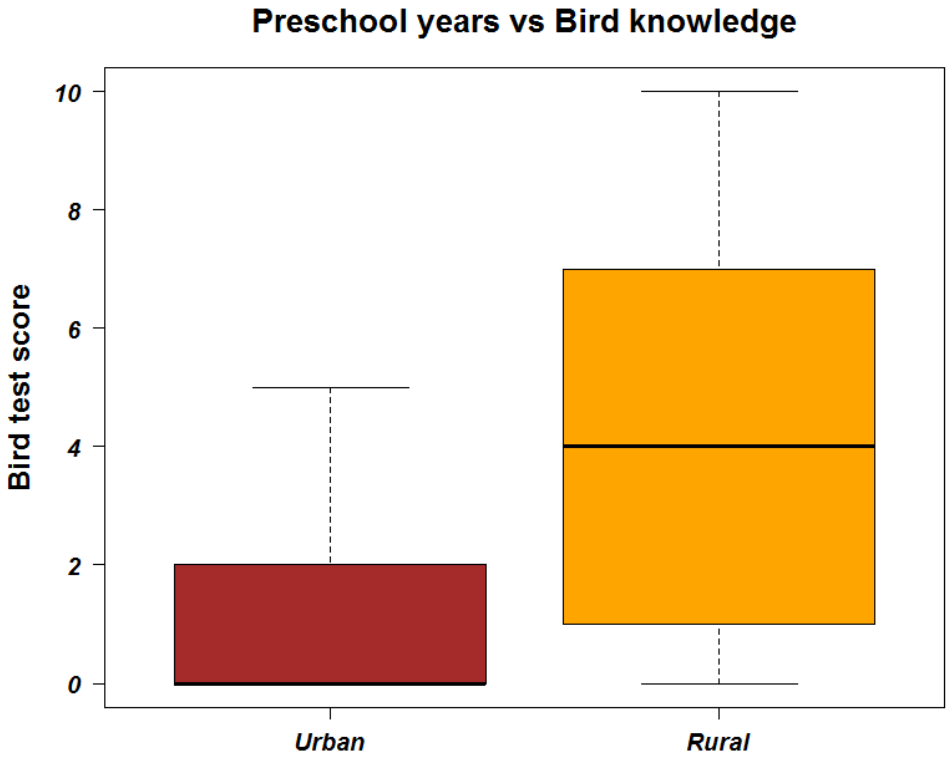


Figure 6 The relationship between preschool years environment and the bird knowledge (mean number of bird species named)

4.1.2 The influence of home language on language skills and ethnobiological knowledge

A one-way ANOVA was conducted to compare the effect of the four groups of languages (English, Pidgin, Vernacular, and Mixed) on language skills (Figure 7). Normality tests were carried out and the assumptions met. There was a significant difference in mean language score [F (3, 4179) =204.5, p=2e-16] between language groups. Post hoc comparisons using the Tukey test showed significant differences between P-E (p=2.7e-08), M-E (p=0.01), V-E (p=2e-16), V-P (p=2e-16), and V-M (p=2e-16). However, there was no significant difference between M-P (p= 0.87), which indicated that students who speak Pidgin and Mixed languages performed at the same level. The results generally showed that students who use vernacular language as their daily language have scored higher (M=18.29, SD=6.12) than those using Pidgin who in turn scored higher than the English language speakers (M=8.00, SD=7.26).

Analysis of variance was also conducted to assess the effectiveness of the four groups of languages on bird test score (Figure 8). There was significant difference in mean test score [F (3, 4179) =167.1], p=2e-16]. Post hoc analyses using Tukey HSD criterion showed significant differences between all language groups ($p<0.05$). This also indicated that students who use vernacular language daily scored better in bird knowledge test than other languages.

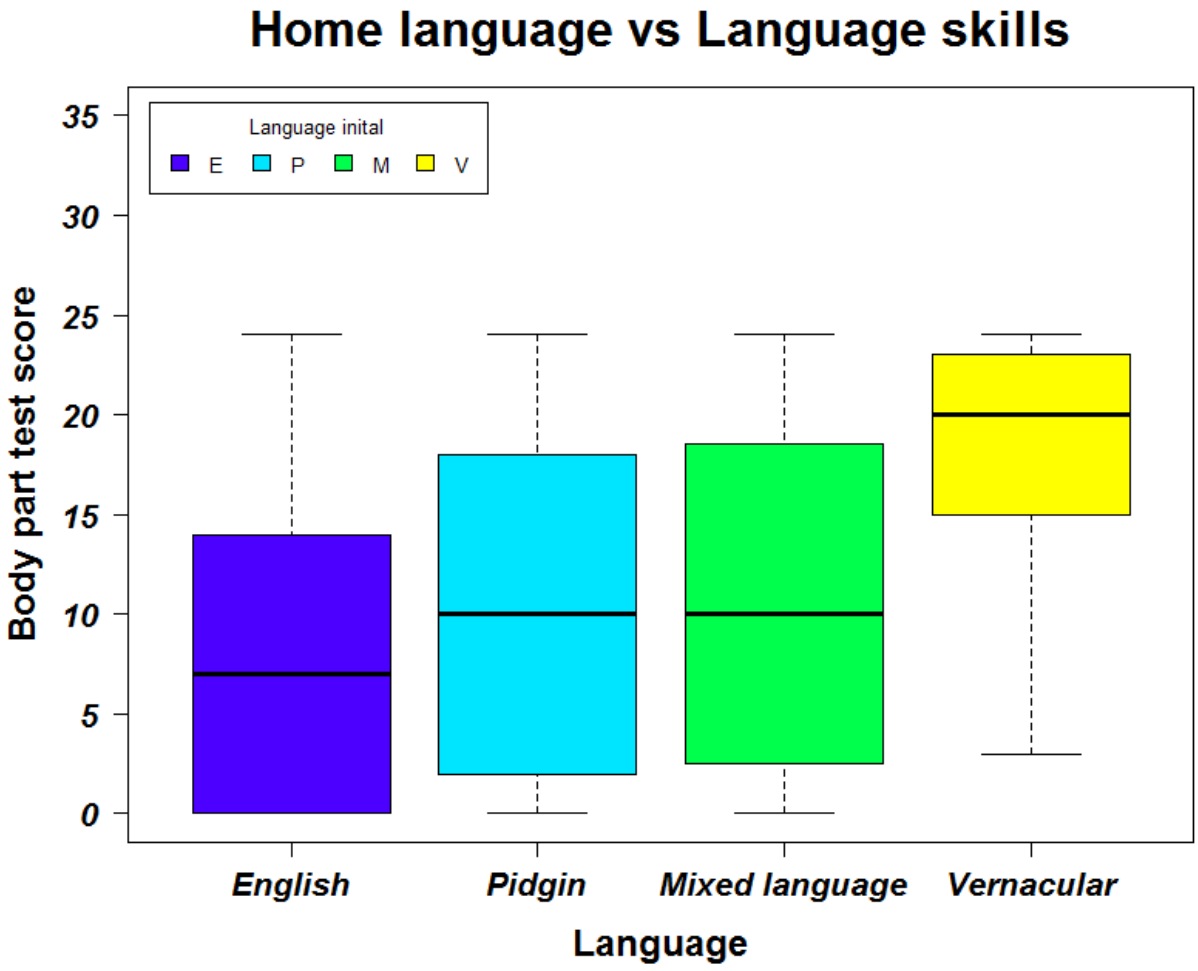


Figure 7 Daily language use at home and its influence on language skills of students

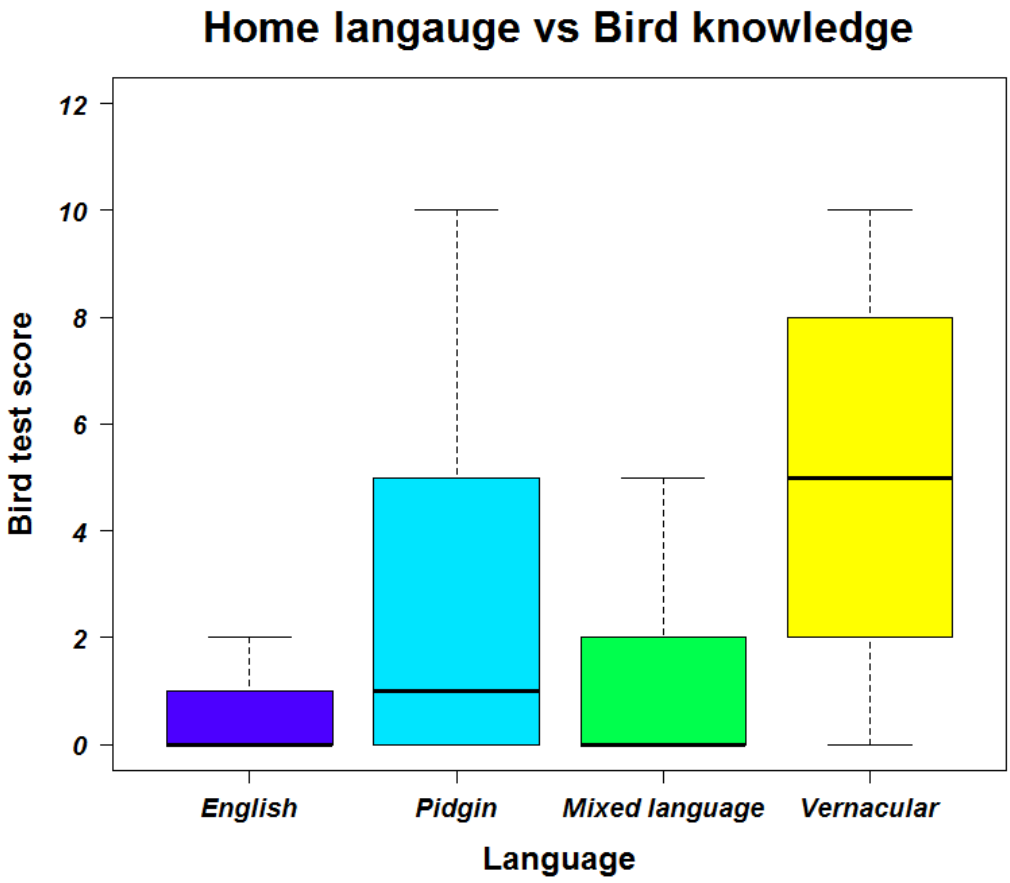


Figure 8 Daily language use at home and its influence on bird knowledge

4.1.3 Predicting language skills and ethnobiological knowledge from parental education level

The Spearman's rank correlation computed to assess the relationship between the students' language skills test score and fathers' education level showed a negative correlation between the two variables, *r* = -0.344, p=2.2e-16 (Figure 9). Similarly, Spearman's rank correlation computed to assess the relationship between the participant's language skills test score and mother's education level also showed a negative correlation, *r* = -0.35, p=2.2e-16. Both results reveal a continuous decline in languages skills with increasing education level (Figure 10).

Equally, Spearman's rank correlation computed to assess the relationship between parental education level and students' bird knowledge (Figures 11 & 12) had shown similar results as test for language skills; there is a clear decline in bird knowledge with increasing education level of both parents ($p<0.05$).

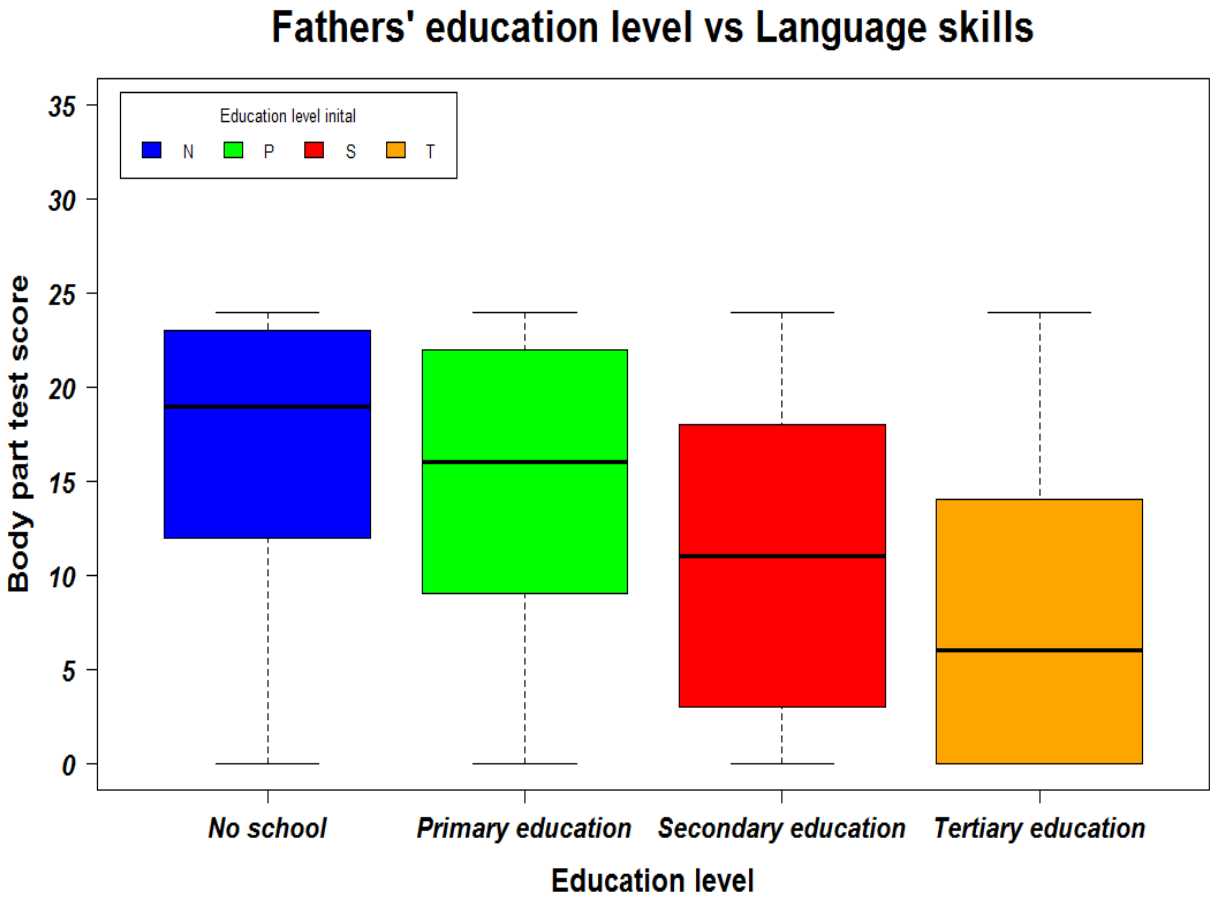


Figure 9 The influence of fathers' education level on language skills test score of the student

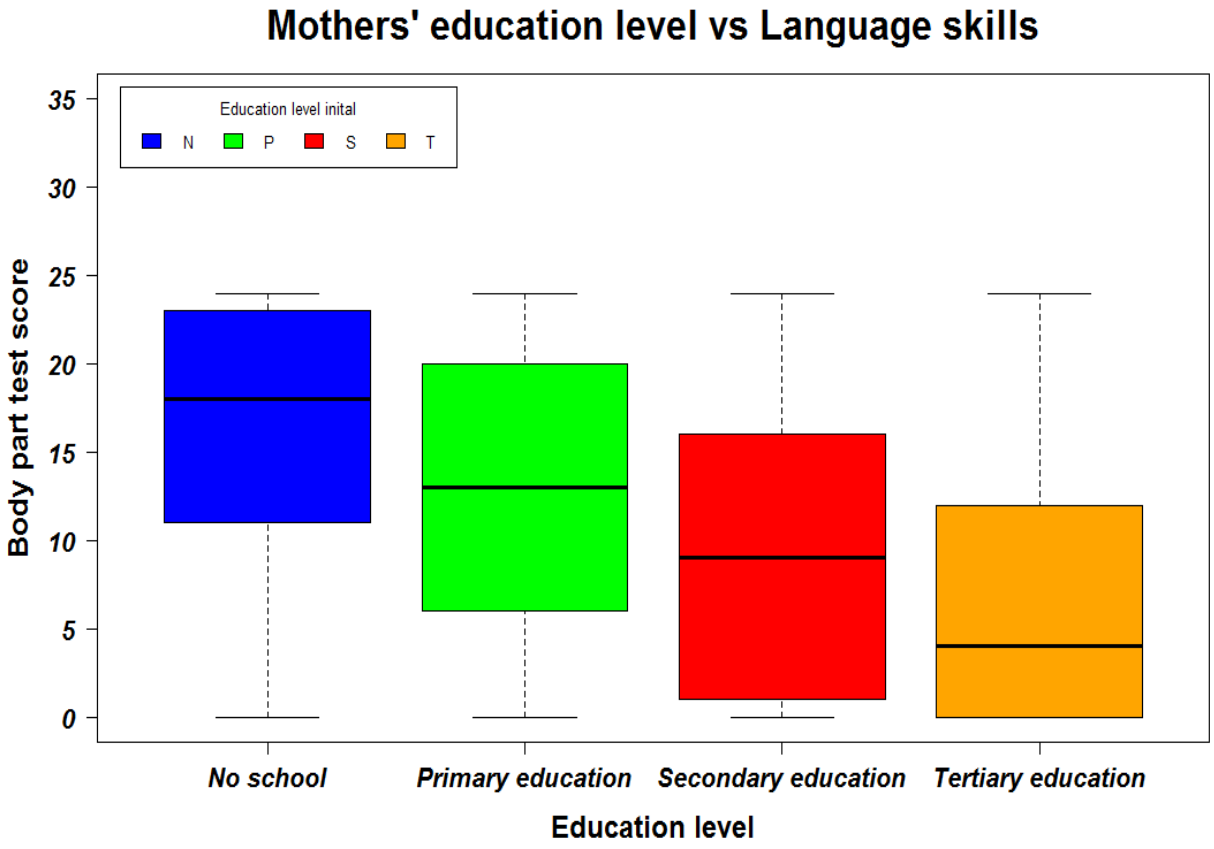


Figure 10 The influence of mothers' education level on language skills test score of the student

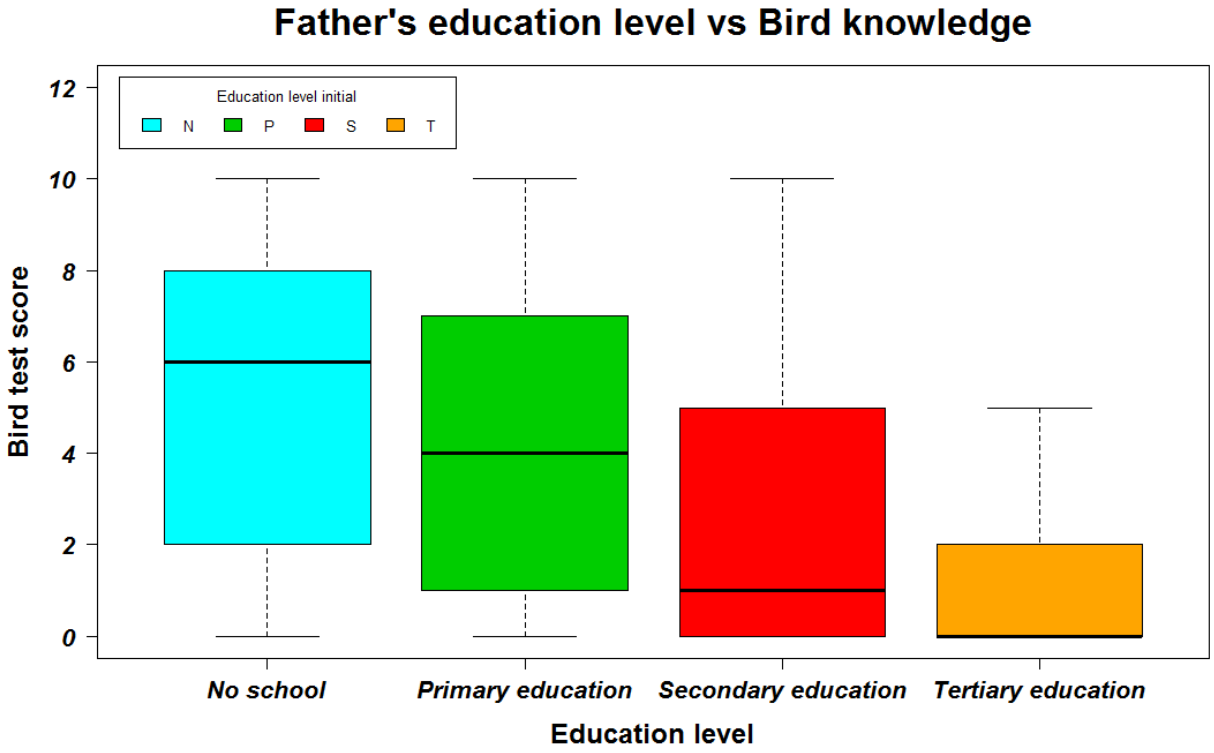


Figure 11 The influence of fathers' education level on bird knowledge test of the student

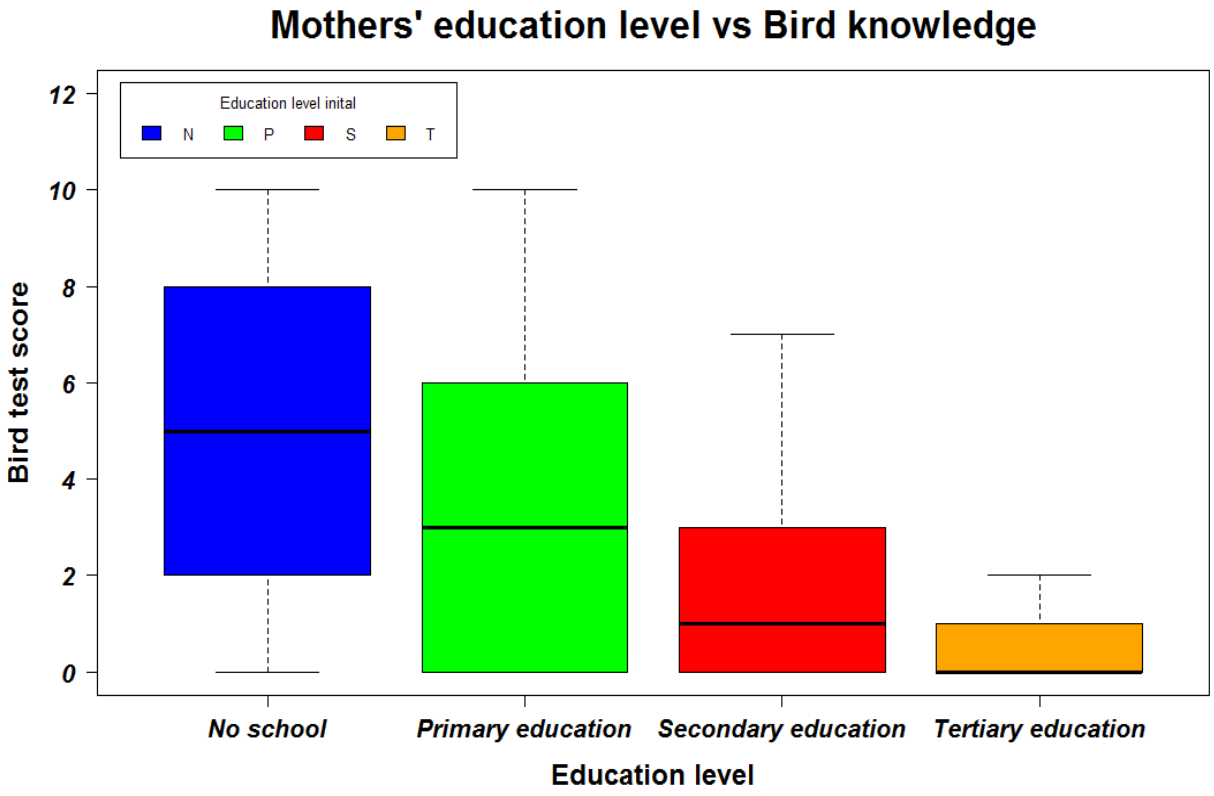


Figure 12 The influence of mothers' education level on bird knowledge test of the student

4.1.4 The influence of parental language fluency on students' language skills and ethnobiological knowledge

Mothers' language fluency and students' language skills were significantly correlated, $r = 0.2$, $p = 2.2e\text{-}16$ (Figure 13). Similar result was observed for fathers' language fluency and students' language skills, $r = 0.2$, $p = 2.2e\ 16$. Students who did well in the language skills test were the ones who had their parents speaking fluent in their languages.

Equally, Spearman's rank correlation computed to assess the relationship between mothers' language fluency and students' bird knowledge had shown significant correlation, $r = 0.11$, $p = 6.396e\text{-}12$. Similar results observed for fathers' language fluency and students bird knowledge, $r = 0.10$, $p = 1.791e\text{-}09$

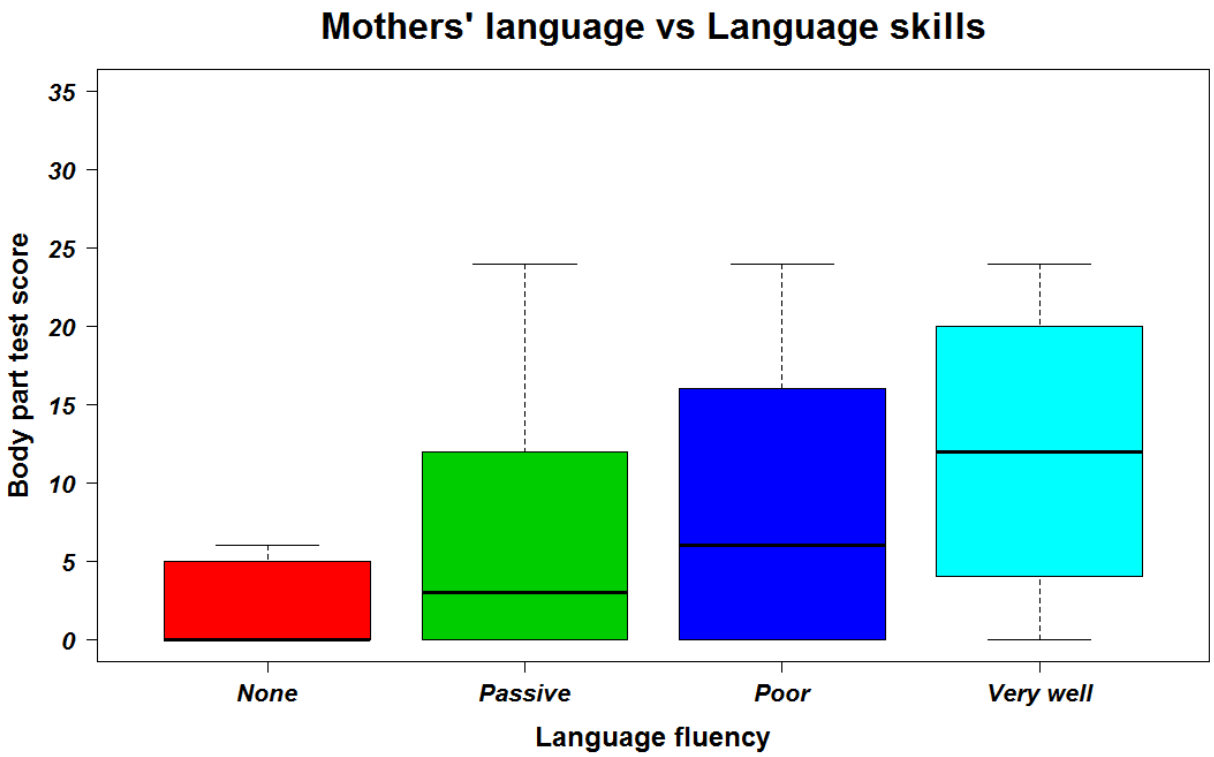


Figure 13 The effects of mothers' language fluency on language skills of the student

4.1.6 The influence of parents speaking same/different language at home on language skills and ethnobiological knowledge.

Result of the independent samples t-test indicated that there was a significant difference in language skills test scores between parents speaking same language and parents who do not speak the same language at home (t(84.578)= 4249.4, p=2.2e-16). The average language skills score of students with parents who speak the same language (M=14.36, SD=7.76) is higher than the score of students with parents not speaking the same language (M=8.50, SD=7.99).

Similarly, an independent samples t-test was conducted to see whether parents speaking same/different language influence the results of bird knowledge of the participants. Results showed a significant difference (t (47.091) = 4422.9, p=2.2e-16) (Figure 14). Students whose parents speak the same language at home scored higher in bird test (M=3.66, SD=3.40) than those whose parents speaking different language at home (M=2.07, SD=2.84).

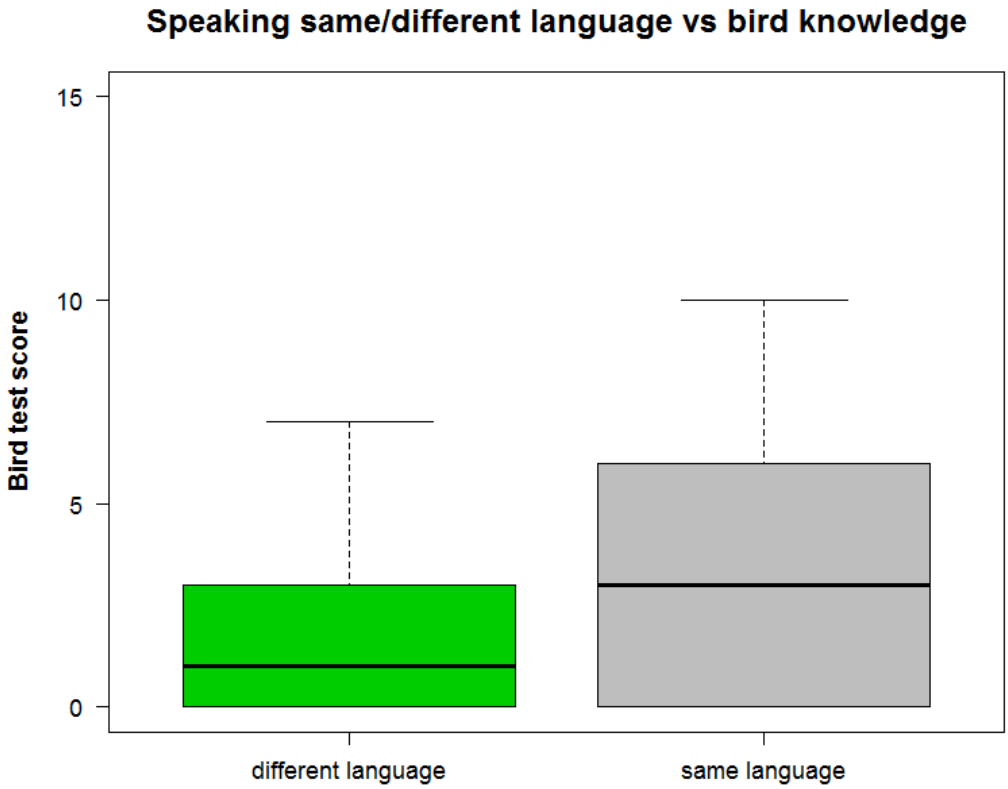


Figure 14 The student's bird knowledge in families where the parents speak the same or different language

4.2 Relationship between language skills and ethnobiological knowledge

In order to establish the relationship between language skills and ethnobiological knowledge, I used language skills as a continuous independent variable to predict bird and plant knowledge using Pearson product-moment correlation coefficient.

4.2.1 Correlation of language skills and bird knowledge

The Pearson product-moment correlation coefficient computed to assess the relationship between the participant's bird knowledge and language skills score showed a positive correlation between the two variables, $r(51.63)=4218$, p=2.00E-16 (Table 2.3) . A scatterplot with regression line summarizes the results (Figure 15). Over all, there was a strong, positive correlation between language skills score and

bird knowledge, hence 39 % of variation in bird knowledge was explained by language skills. Participants who were able to identify and name body parts well had better knowledge of birds.

Table 2. 3 ***Correlations between language skills and ethnobiological knowledge***

Body part test	Mean	Std.Dev.	*r*	r^2	*p*
Bird test score	2.883175	3.242268	0.6222909	0.3871	2.00e-16
Plant test score	2.502607	3.027604	0.3906663	0.1524	2.00e-16

Significant ($p<0.05$)

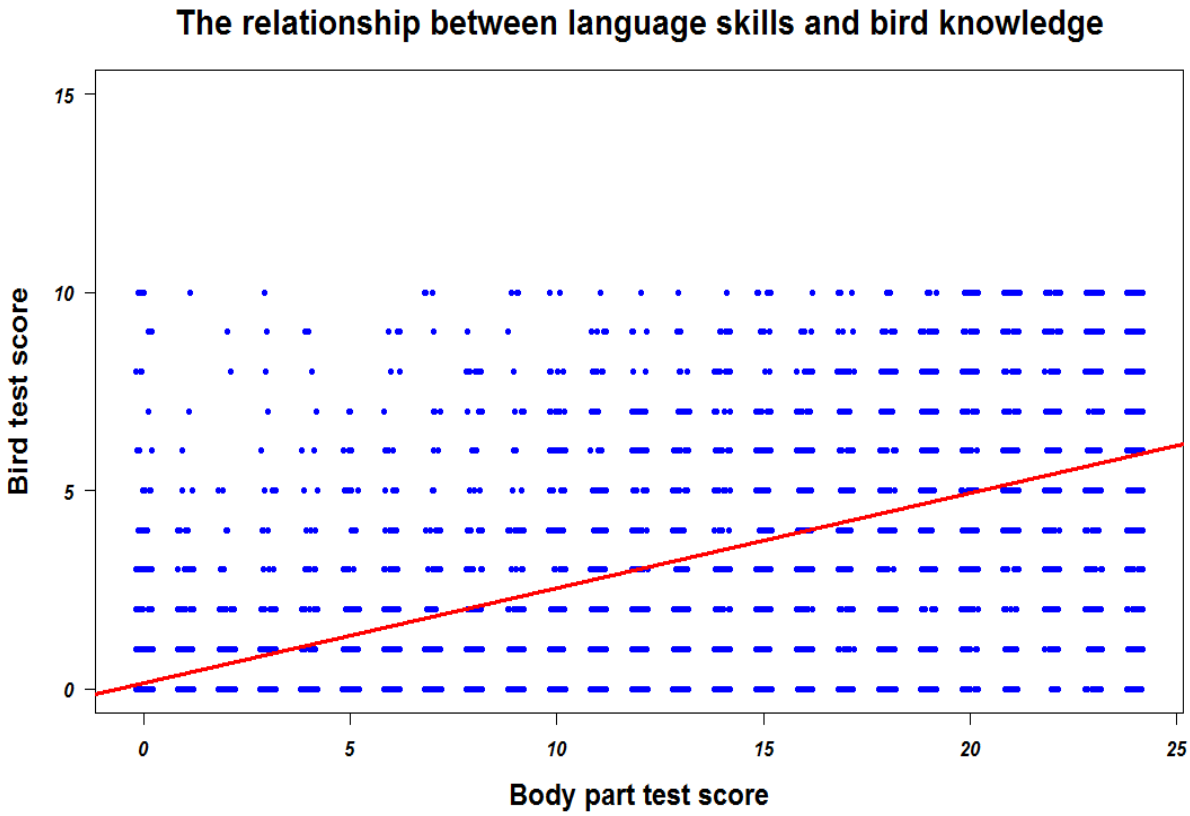


Figure 15 Correlation between language skills test score and bird knowledge test score

4.2.2 Correlation of language skills and plant knowledge

Similarly, Pearson's product-moment also showed a positive correlation between language skills score and plant knowledge of the participants, *r* (27.563) =4218, p=2.00E-16, hence 15 % of the variation in

plant knowledge was explained by language skills (Table 2.3). Participants scoring high in language skills had more knowledge about plants (Figure 16).

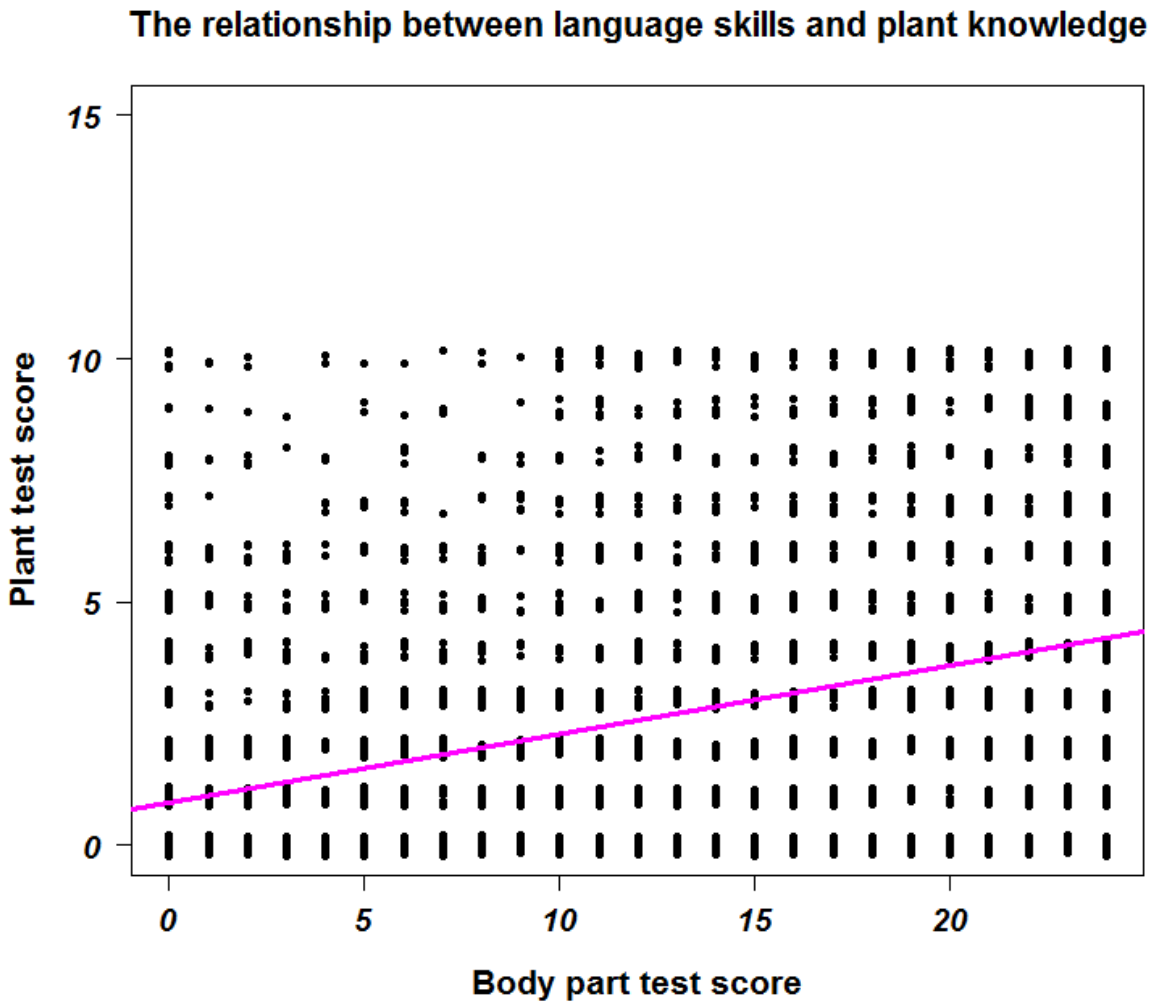


Figure 16 Correlation between language skills test score and plant knowledge test score

4.3 Relationship between student's language fluency and demographic characteristics.

Language fluency, obtained by self-assessment of students, represents another measure of language knowledge, independent from language skills based on the body parts test. A general linear model was conducted to elucidate the factors that predict students' language fluency (mother's language) from the demographic variables. The variables preschool years, home language, mother's vernacular, and parents speaking same/different language were significant ($p<0.05$) predictors for language proficiency of the students. Variables gender and mothers' education were not significant (Table 2.4).

Table 2. 4 *Predicting students' language skills (for mother's language) from demographic variables*

Variable	Estimate	Std.Error	*t*	*p*
Intercept	0.050155	0.045	1.118	0.26381
Preschool years	0.052326	0.017	3.179	0.00149
Gender	0.026394	0.016	1.692	0.09068
Home language	0.247552	0.02	12.385	2.00e-16
Mothers' education	-0.00872	0.001	-1.002	0.31643
Mothers' vernacular	0.357787	0.027	13.187	2.00e-16
Same/different vernacular	0.244696	0.016	15.133	2.00e-16

Significant (P<0.05), GLM analysis

Similarly, results from general linear model showed all demographic variables to be significant predictors for students' language fluency in fathers' language (p<0.05) (Table 2.5).

Table 2. 5 *Predicting students' language skills (for father's language) from demographic variables*

Variable	Estimate	Std.Error	*t*	*p*
Intercept	0.115524	0.045363	2.547	0.01092
Preschool years	0.130096	0.016525	7.873	4.60e-15
Gender	0.048723	0.015513	3.141	0.0017
Home language	0.24932	0.019747	12.626	2.00e-16
Father's education	0.026659	0.008757	-3.044	0.00235
Father's vernacular	0.292526	0.026143	11.189	2.00e-16
Same/different vernacular	0.286819	0.015896	18.044	2.00e-16

Significant (P<0.05), GLM analysis

4.3.1 Preschool years vs students' language fluency

An independent samples t. test was conducted to see whether or not preschool years influence students' language fluency (father's language). A significant difference was observed between the rural and urban areas, t (17.235) = 3825.5, p=2.2e-16 (Figure 17). Preschool years spent in the rural areas were

associated with higher language fluency (*M*=0.72, *SD*=0.49) than years spent in town or city (*M*=1.00, *SD*=0.50).

Analysis of students' language fluency (mother's language) also showed significant effect of preschool years environment, *t* (-10.982) = 3847.9, *p*=2.2e-16. Students from rural areas had greater language fluency (*M*=0.94, *SD*=0.51) than students from urban areas (*M*=0.76, *SD*=0.48).

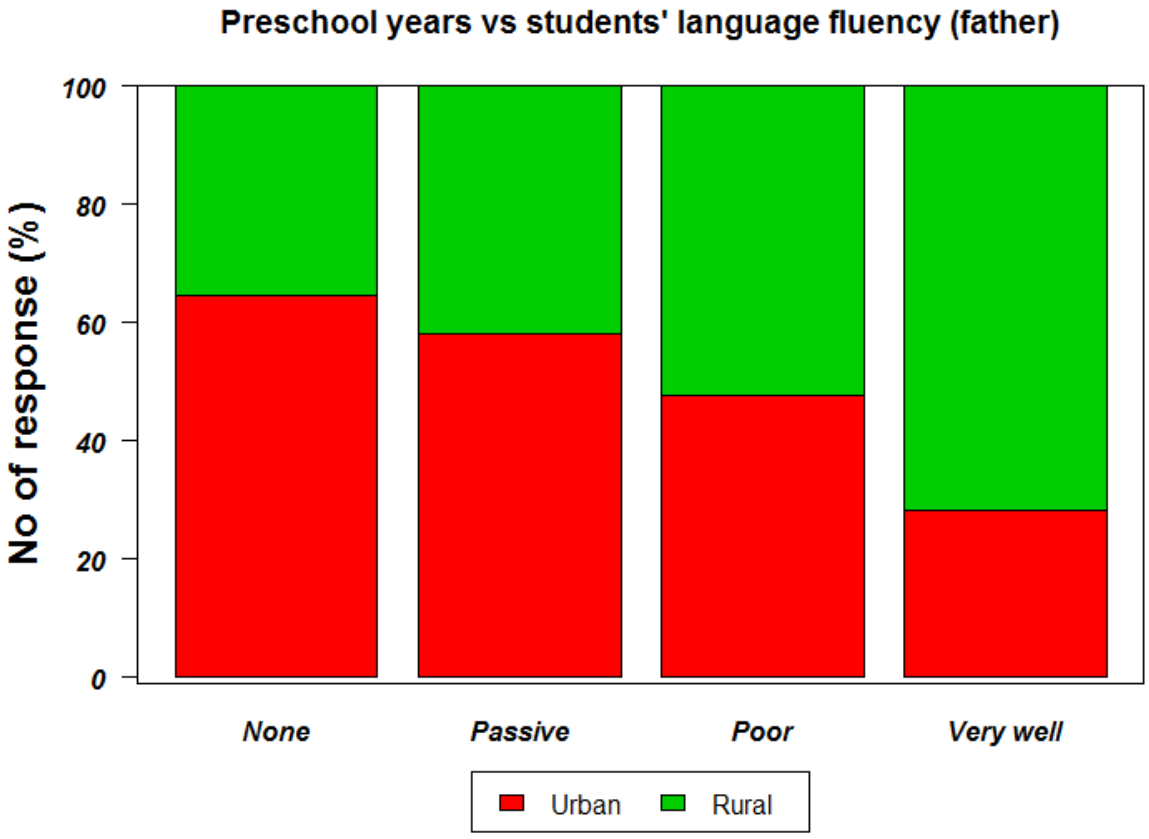


Figure 17 Comparing the influence of rural and urban preschool environment on students' language fluency (for father's language)

4.3.2 Gender and students' language fluency

An independent samples t-test was conducted to compare how well males and females could speak their fathers' language. There was a significant difference in the scores between males (*M*=0.93, *SD*=0.51) and females (*M*=0.78, *SD*=0.51); *t* (26.1) =8189.4, *p*= 2.2e-16.

Our results (Figure 18) showed that the proportion of males who could speak their fathers' language very well is approximately 60% higher than corresponding proportion of females.

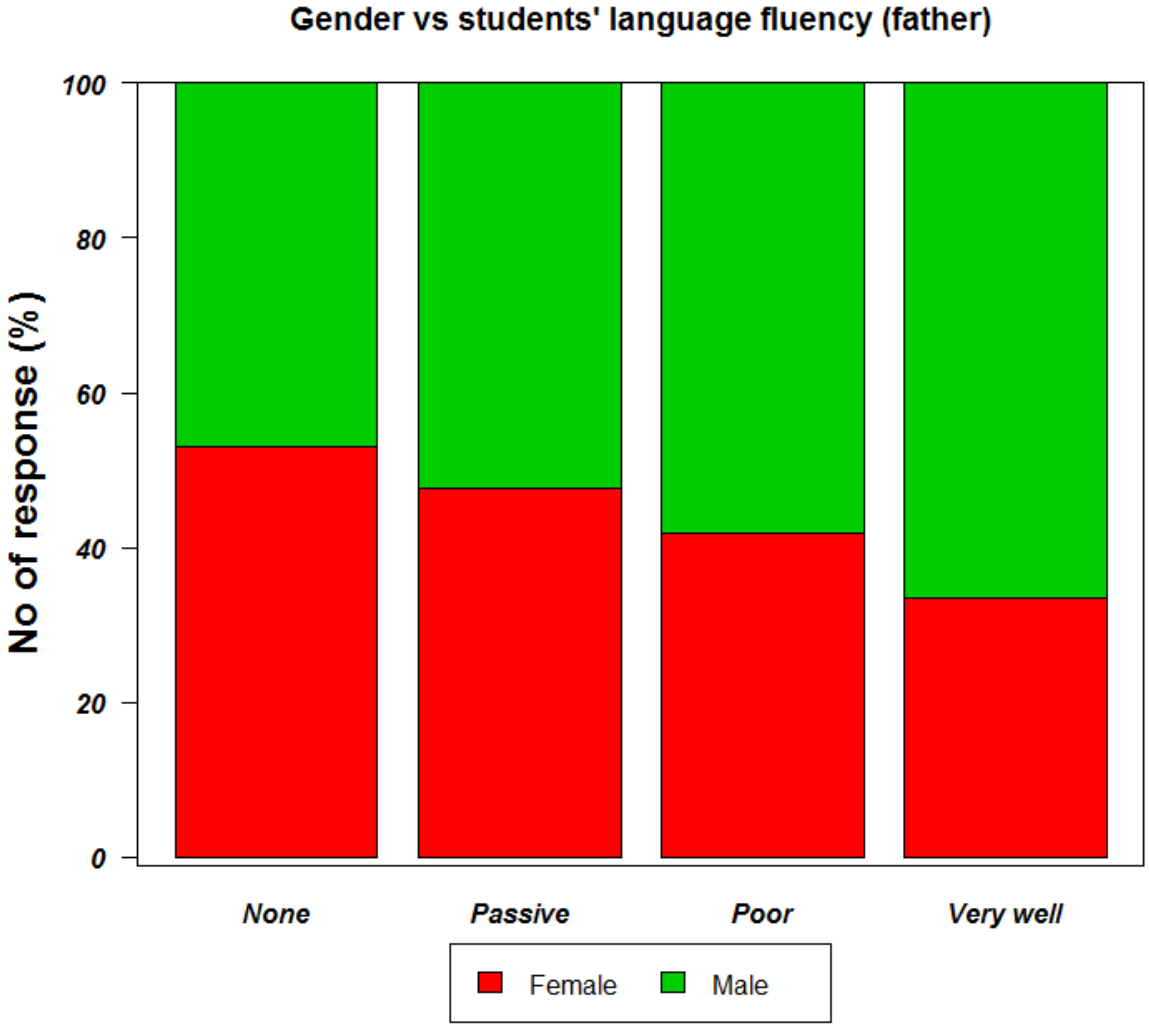


Figure 18 Comparison of students' fluency speaking their fathers' language between girls and boys

4.3.3 Home language and students' language fluency

An ANOVA was performed to see whether or not the four home languages affect the fluency of students in their mothers' language. The result showed a statistically significant difference; F (3, 4102) = 147.4, *p*=2e-16. Post hoc comparisons using the Tukey HSD test indicated the mean score for language group 4 (Vernacular) (*M*=1.23, *SD*=0.45) was significantly different from group 1 (English) (*M*=0.80, *SD*=0.49), group 2 (Pidgin) (*M*=0.79, *SD*=0.48), and group 3 (Mixed language) (*M*=0.89, *SD*=0.53). The result indicated that Pidgin is the language that is used most of the time at home (Figure 19). It is

to be noted that the high number of passive speakers (41%) of the mothers' languages are also the Pidgin language speakers. Furthermore, 68% of students could speak very well in their mothers' languages.

Similarly, analysis of variance showed a statistically significant difference at the $p<0.05$ level in students' language skills of the father's language for the four home language groups: $F(3, 4097) = 180.3$, $p = 2e\text{-}16$. Post hoc comparisons using the Tukey HSD test indicated the mean score for language group 4 (Vernacular) ($M=1.28$, $SD=0.42$) was significantly different from group 1 (English) ($M=0.75$, $SD=0.51$), group 2 (Pidgin) ($M=0.80$, $SD=0.49$), and group 3 (Mixed language) ($M=0.87$, $SD=0.56$). The result indicated that Pidgin is the language that is commonly used at home.

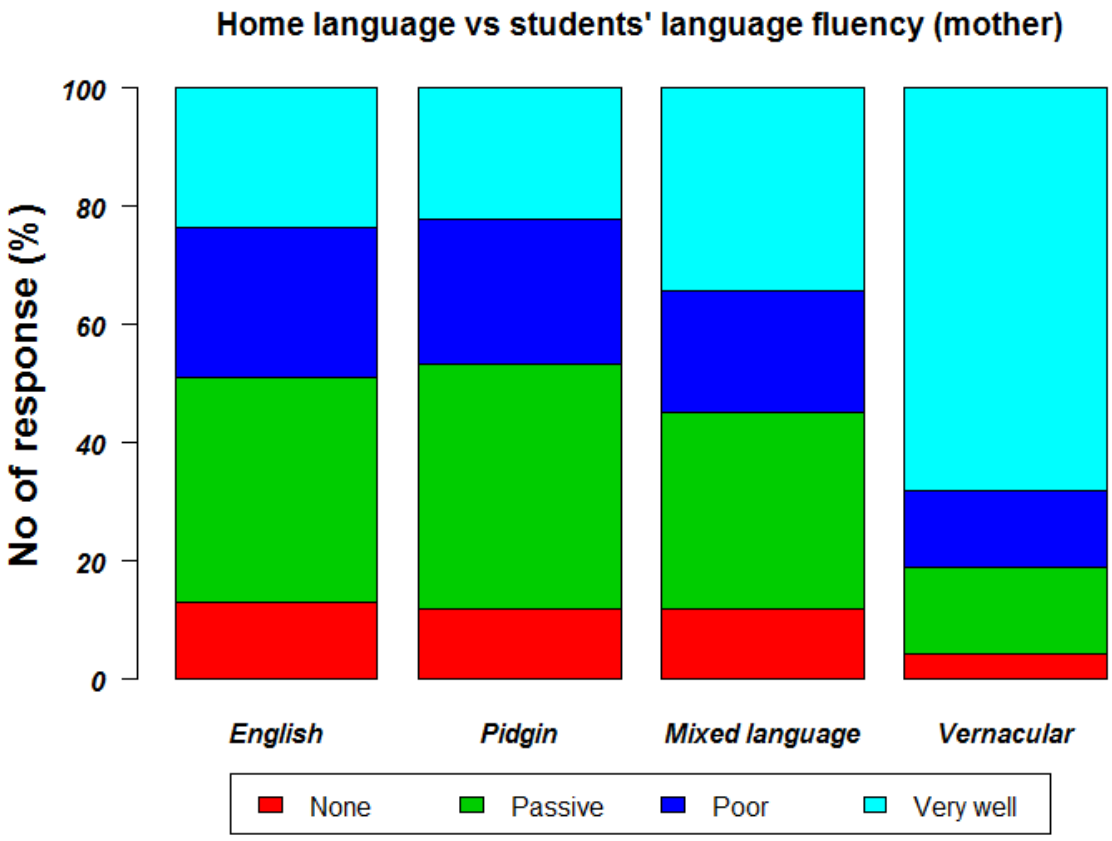


Figure 19 Fluency on their mothers' language for students with different prevailing language spoken at home

4.3.4 Parental education level and students' language fluency

It was assumed that parental education level would influence language fluency of the students. Spearman's rank correlation coefficient was computed to assess the relationship between mother's education level and fluency of students speaking their mothers' languages. There was a significantly negative correlation between the two variables, r = -0.2, p = 2.00e-16. A similar relationship was observed between fathers' education level and the fluency of students speaking their fathers' languages, r = -0.24, p =2.00e-16.

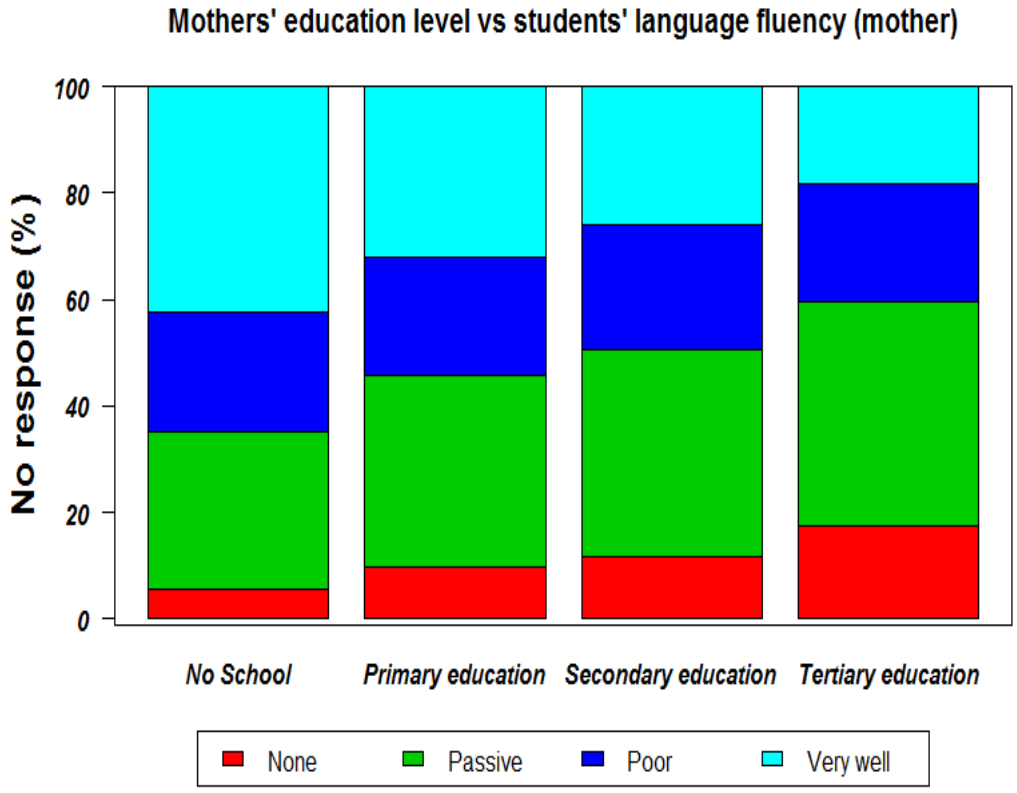


Figure 20 The effect of mothers' education level on the students' ability to speak their mothers' language

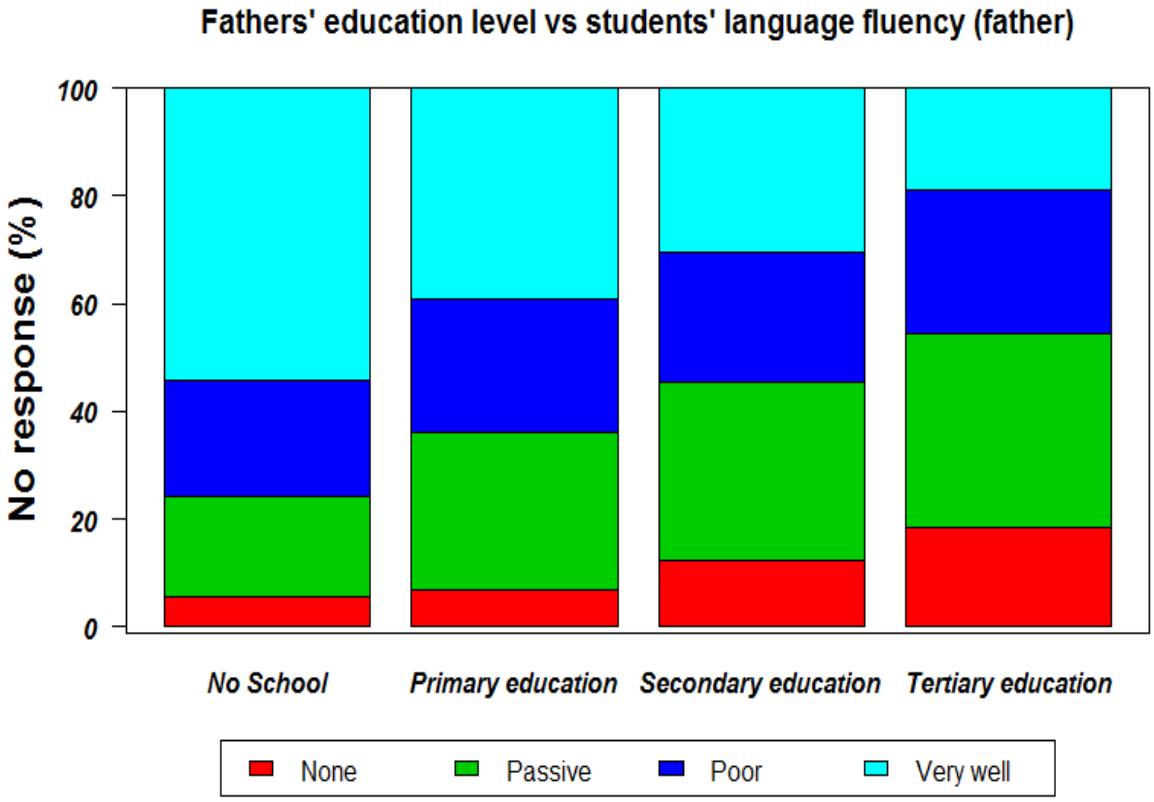
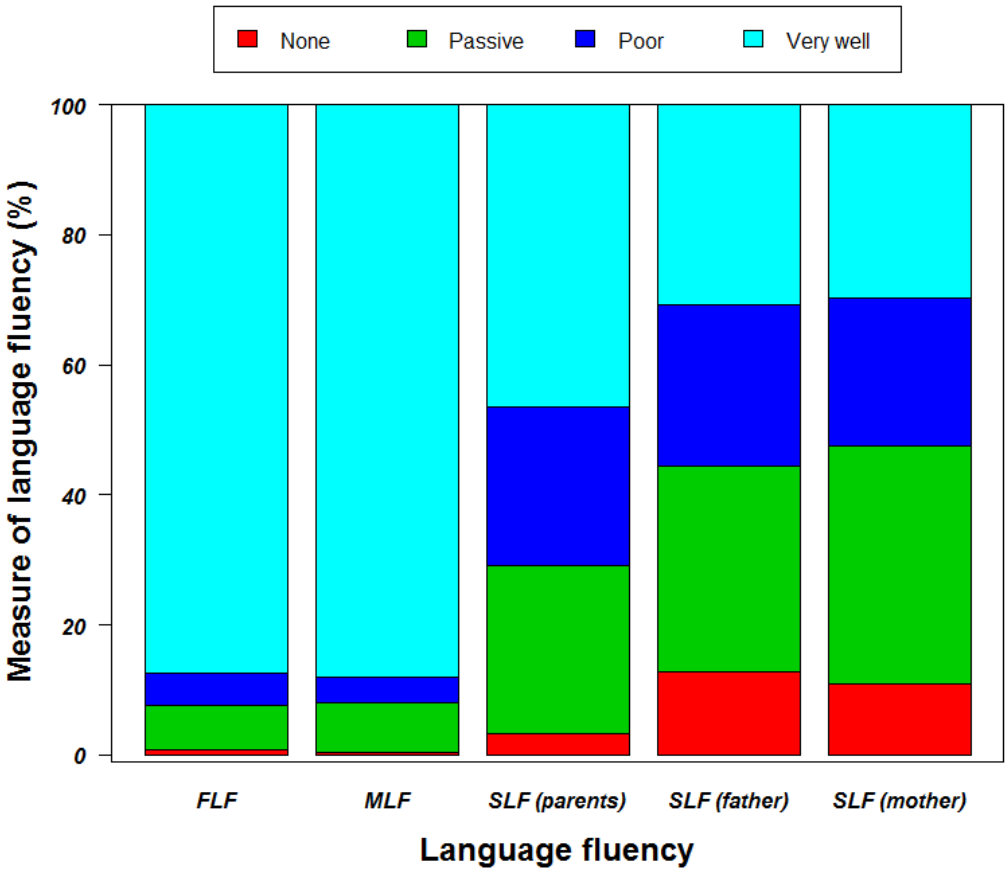


Figure 21 The effect of fathers' education level on the students' ability to speak their fathers' language

4.3.5 Language skills of students and their parents (self-evaluation)

Results showed that about 47% of monolingual students spoke their parents' languages very well (*SLF (parents)* in Figure 22). However, bilingual students spoke only 31% and 30% of their fathers' (*SLF (father*)) and mothers' (*SLS (mother)*) languages respectively. Interestingly, 88% and 87% of their fathers (*FLS*) and mothers (*MLS*) respectively spoke their languages very well. Compared to their parent's language skills, students had higher number of speakers who were poor or passive speakers or did not speak their languages at all. Worryingly, there is already a 50% decline in good language skills between students and their parents.



Key: ***FLF***= Fathers' Language Fluency, ***MLF***= Mothers' Language Fluency, ***SLF*** = Students' Language Fluency in their parents's language or, in case they are different, in their father's and mother's language.

Figure 22 Language skills of students and their parents

4.4 Predicting Relationship between participant's computer and phone use skills and bird knowledge

Significant multivariate effects were found for all the independent variables (Table 2.6) as predictors of plant and bird knowledge. Hunting skills were positively associated with ethnobiological knowledge (Figure 23). In contrast, phone and computer skills were associated negatively (Figure 24).

Spearman's rank correlation coefficient computed to establish the relationship between phone use skills and bird knowledge had shown significantly negative correlation r = -0.3, p= 2.2e-16. Similar relationships were found between computer use skills and bird knowledge, r = -0.4, p = 2.2e-16;

phone use skills and plant knowledge, r = -0.21, p = 2.2e-16; and computer use skills and plant knowledge, r = -0.31, p = 2.2e-16. On the other hand, hunting skills was positively correlated with plant (r = 0.2, p = 2.2e-16) and bird knowledge (r = 0.4, p = 2.2e-16).

Table 2. 6 Multivariate effects of ethnobiological knowledge (Bird and Plant knowledge test)

Variable (s)	Pillai's Trace	*F*	*df*	Error *df*	*p*
Phone use skills	**0.093699**	**189.88**	**2**	**4053**	**2.20e-16**
Computer skills	**0.114218**	**231.463**	**2**	**4053**	**2.20e-16**
Hunting skills	**0.155182**	**314.476**	**2**	**4053**	**2.20e-16**
Phone use skills: Computer skills	**0.005965**	**12.089**	**2**	**4053**	**5.83e-06**
Phone use skills: Hunting skills	**0.001423**	**2.884**	**3**	**4053**	**5.60e-02**
Computer skills: Hunting skills	**0.003714**	**7.526**	**2**	**4053**	**0.0005467**
Phone use skills: Computer skills: Hunting skills	**0.004106**	**8.321**	**2**	**4053**	**0.0002474**

Significant (p<0.05), Manova analysis

Figure 23 Predicting bird knowledge from hunting skills. The mean number of bird species named is shown for the respondents with none, little and good hunting skills.

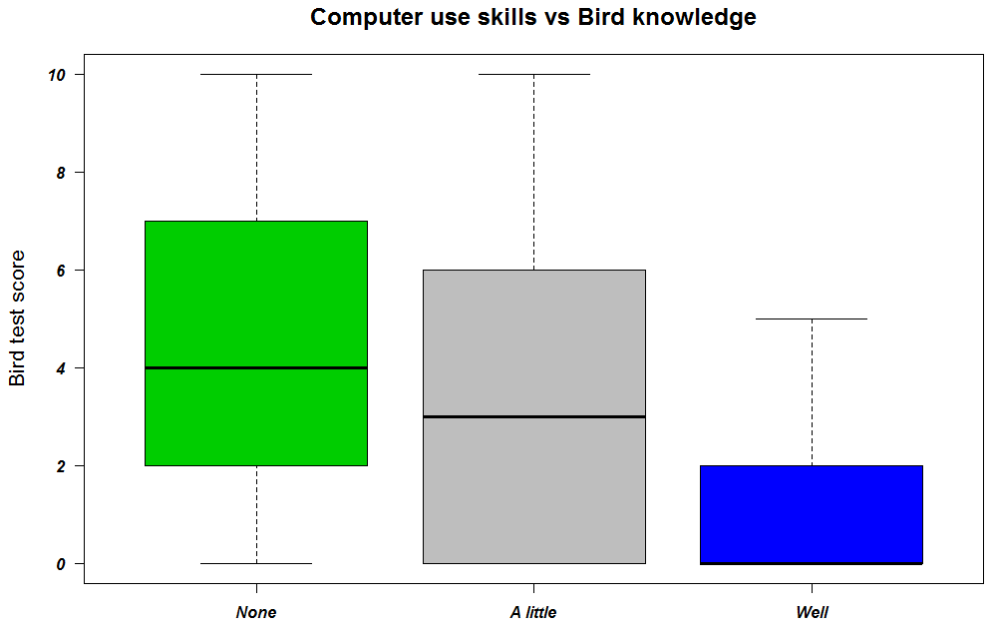


Figure 24 Predicting bird knowledge from computer skills. The mean number of bird species named is shown for the respondents with none, little and good computer use skills.

CHAPTER FOUR: DISCUSSION

5.1 The influence of demographic variables on students' language skills and ethnobiological knowledge

5.1.1 Preschool years

Preschool years and students' language skills

An investigation was undertaken to compare the differences in the level of language skills between students who spent their preschool years in urban areas and those in the rural areas. Our findings confirm that the best preschool environment that supports effective language skills acquisition is the rural environment (Figure 5). This finding is in line with earlier works on comparing effective language skills acquisition between rural and urban environments. For instance, Baro (2015) found that village environment plays a significant role in vernacular language skills acquisition than towns and cities. The finding equally corroborates well with Wakizaka (2009), which indicates the consistency in our results.

Active language skills acquisition happens during the early childhood years when children instinctively acquire the language skills without parents teaching them (Hutauruk, 2015). In order for children to obtain the skills of a particular language, they have to be exposed to that language before they reach age 7 years (Gleitman & Newport, 1995), and the environment that they live plays an important role in the acquisition of the language skills (Elman, 1993; Marinova-Todd, Marshall, & Snow, 2000). This was also confirmed by Pullen and Justice (2013) that preschool years are critical to the development of oral language skills.

Most of the languages spoken around the world are in the rural areas (Sepulveda, 2011) and PNG is no exception. The 87 % of people living in the rural areas of the country speak more than 800 languages which means that everyday language use in homes is mostly vernacular. This provides a better environment for effective language skills acquisition by the children. As such preschool students who

attend schools in the rural areas maintain a high level of language skills as shown in the results from this study. Furthermore, students in the rural schools still speak their vernacular languages in their respective language groups outside the classroom even though they are taught in English in the classroom (Aikhenvald, 2014), unlike students in the urban schools who speak English inside the classroom while Pidgin and English are commonly used outside the classroom. There is high number of older or elderly people (who are the main drivers of effective language skills transmission) (Harrison, Anderson, & Mathieu-Reeves, 2010; Sepulveda, 2011) in the rural areas of PNG than in the urban areas, which further strengthens and maintains effective language skills transmission.

On the other hand, the decline in language skills of students who attended preschool in the urban areas could be explained by the regular use of lingua franca, mostly the Melanesian Pidgin and English (Devette-Chee, 2013). Due to increased mix of students from various ethnic groups with different languages in the urban schools, students inevitably choose a common language to communicate meaningfully across language barriers (Sepulveda, 2011). This is a similar situation reported by Luykx (2005) where Bolivian preschool children who migrated to urban settings experienced the pressure to acquire and use Spanish as the dominant language on a regular basis while abandoning their primary language. English and Melanesian Pidgin are practical alternatives for effective communication (Aikhenvald, 2014; Wakizaka, 2009), which Fontaine (2012) described as languages of greater mental flexibility, enhanced abstract thinking skills, the ability to think independently of words, and superiority in concept formation. This leads to homogenizing linguistic diversity and a stagnation or decline in their vernacular language skills (Allen, Crago, & Pesco, 2006) as well as from this study.

Preschool years and students' language fluency

Results of assessment done to compare whether or not preschool years determine the fluency of students speaking their parents' languages suggest that spending preschool years in the rural areas is the best option in order to maintain a high level of language fluency than in the urban areas (Figure 22). This corresponds well with the finding of this study about high language skills in preschool years in rural settings. This is a clearer indication of parents using vernacular languages at homes in the rural areas

which positively encourage students to regularly speak their parents' languages hence an increased level of fluency is evident. On the other hand, parents in urban areas do not speak their vernacular language as regularly as they do in their villages because they want to fit into the urban lifestyles, and instead use urban dialects such as Pidgin. Pidgin is considered a prestige language as it ties well with the contemporary, modern, western lifestyle (Romaine, 2015; Sepulveda, 2011). Often they have the usual perception that other ethnic groups in the towns or cities would refer them as inferiors or old-fashioned and backward if they speak their vernacular languages, hence they are forced to use the more commonly spoken languages that suit their urban environment (Sepulveda, 2011). This situation is similar to a phenomenon described by Lambert (1981) as "subtractive bilingualism" meaning those who acquire majority language such as English or Pidgin result not in bilingualism but in the erosion or loss of primary language and a decrease in fluency. Sadly, it is totally impossible for the urban preschool students to be fluent in their parents' language if their parents do not practice using the language in the homes.

Also noted in this finding is the alarming increase of passive speakers (those who can understand the languages but cannot speak), an increase of non-speakers (those who do not speak or understand at all), but a substantial drop in fluent speakers (those who speak their parents' language very well) in urban preschools. This again indicates the lack of parents actively speaking to their children in their vernacular languages on a regular basis or encourage them to speak the languages themselves on a daily basis (Marmion et al., 2014). Marmion, Obata and Troy (2014) found that the active use and transmission of languages appeared to be the key to strengthening or maintaining indigenous language, and further confirm that the lack of opportunities prevents respondents from learning vernacular languages. It is noted that the increase in passive and non-speaking vernacular language among these groups will not foster a better position for them to teach vernacular language to their next generation. In other words, this trend is portraying a bigger picture of the threat to linguistic diversity among the youths in the country.

Preschool years and students' bird knowledge

Our results regarding bird knowledge showed clearly the importance of schools located in the rural settings in maintaining high ethnobiological knowledge. This result is well correlated with the high level of language skills and language fluency in students who spent preschool years in the rural areas. This is expected because according to Franco et al. (2015), indigenous language and ethnobiological knowledge are mutually reinforcing that they both contribute to the classification, recognition and transmission of life forms. The result of high bird knowledge in rural preschool students could be explained by the high exposure to natural world vegetation in the rural areas. Unlike the urban preschool students who constantly seat before the TV or with mobile phones, or participating in sporting events to occupy their leisure time, the rural preschool students have high chances of making regular contacts with the nature hence a-well-versed ethnobiological knowledge. For instance, preschool students from the rural areas know the general information about birds such as the number of different species of birds existing in the local environment, their ecology, how to identify them with correct local names, the taste of different species, and so forth. On the other hand, the urban preschool students do not know much about this information due to lower contact with the nature. They are not in a position to at least know the local name of a bird in their parents' vernacular languages. Instead, in most cases, they generalize the name of any bird as "pisin' (Pidgin language). Nevertheless, they may have more theoretical knowledge about birds from school, TV and internet than their rural counterparts.

All in all, our study reveals the importance of maintaining a high level of language proficiency and ethnobiological knowledge in the rural settings than in the urban settings. The environment one choses to live is critical in shaping language skills (Scheele, Leseman, & Mayo, 2010) and ethnobiological knowledge.

5.1.2 Gender

Gender differences in language skills and bird knowledge test

The results from this study confirm that gender is not an important predictor of language skills. This finding is in agreement with Baro (2015) that gender had no significant effect on the language skills. This finding is expected because male and female have equal exposure in learning and familiarizing body parts unlike specific roles they (males and females) perform at home. However, gender differences in bird test indicate that males have better knowledge about birds than females. These findings also confirmed Baro's (2015) findings that males have better knowledge of birds than females. This reflects the natural habit of males (boys) acquiring the knowledge and skills to hunt birds for protein and feathers for decoration (Takako, 2004). On the other hand, females have vast knowledge and practises about traditional medicine (Baro, 2015; Olatokun Wole & Ayanbode, 2009).

Gender and students' language fluency

An evaluation done to compare how well students speak their fathers' language with regard to gender indicated that males speak better their father's language than their female counterpart. This may be due to the fact that boys spend more time with their fathers than girls (Raley & Bianchi, 2006). On the other hand, there was no gender difference in the mothers' language thus, suggesting that both males and females have the equal opportunity to learn their mothers' language. This makes sense because during childhood (critical time for effective learning) kids, regardless of gender, spend most of their time with their mothers (Raley & Bianchi, 2006).

Our study also reveals a worrying trend that, for both males and females, there are more passive and poor speakers who are currently speaking their parents' languages. This is a clear indication of a threat to these languages, and therefore the future of these languages is at stake as PNG enters into the flood of globalization.

5.1.3 Home language

Students' home language and students' language skills

The type of language that is used at home determines ones language proficiency hence home is a critical environment (Scheele et al., 2010). Our results suggested that the most important language that can be used at home to maintain a high level of language proficiency is the vernacular language. On the other hand, our results also indicated that speaking English as a home language shows the largest negative effect on language skills. This could also mean English contributes to language loss (Donlay & Harrison, 2008; Fillmore, 1991). Students who are currently speaking the language have a greater chance of losing their mother tongue. This claim is based on the study by Anderson and Goldstein (2012) who revealed that when first language speakers are in contact with a second language, the first language skills are affected. Likewise, Pidgin and mixed languages used at home also contribute to language skills decline.

In PNG today, English is mostly spoken by well educated people and expatriates living in the urban areas while Pidgin and mixed languages are spoken both in the urban and rural areas. Generally speaking, in homes today in PNG many parents are using vernacular languages but their children often choose to speak Pidgin (Lindström, 2005) and mixed languages. This places the vernacular languages at risk such that in a not too distant future, Pidgin would likely be the dominant language. Already, the current results (Figure 22) are indicating that Pidgin is the most prevalent language used in most homes today. This situation was already identified by Smith in 1995 (twenty-three years ago), where he noted that a considerable number of young people spoke Melanesian Pidgin as their first language. In determining whether home languages influence students' language fluency, this study has clearly indicated that Pidgin and English languages are leading to increasing numbers of passive and poor speakers of their parents' language. Further, it is noted that the number of vernacular language speakers maintain a high level of language fluency in their parents language has declined dramatically compared to Pidgin language speakers.

The expansion of schools in PNG today with increased English literacy levels (Sepulveda, 2011), and the strict education policies restricting students from speaking vernacular languages (Devette-Chee, 2013), are examples of factors that are undoubtedly driving the heritage languages into obsolesce (Kulick, 1997).

Parents' home language and students' language skills

From the investigation undertaken to determine whether parents speaking the same or different language at home has an influence their children's language skills illustrate a confirmation of the importance of speaking the same language at home which maintains a high level of language skills transmission to their children. This result is expected because monolingual children master their parents' language much better than the bilingual and multilingual children as shown by (Allen et al., 2006; Genesee, 2008; Pearson, Oller, & Eilers, 2002; Wagner, 2008). Scheele, Leseman, and Mayo (2010) also showed a similar finding that early language skills of children are strongly related to their experiences with language input in the home context. In monolingual environment, effective language acquisition starts at the age of 2 years which sets a strong foundation for mastering the language (Waxman, 2006).

On the other hand, students whose parents speak different languages at home have shown low level of language skills, indicating less effective transmission in language skills. Among many reasons responsible for the language skills decline is the inter-language marriage as identified by Baro (2015). Having increased road links, urbanization, increased economic activities, increased communication such as the use of mobile phones, and with high linguistic diversity in PNG, there is now an increasing possibility of inter-language marriages with the potential outcome of having high number of bilingual children. According to Genesee (2008), young bilingual children struggle in vocabulary and only know fewer words in one or both languages in comparison with monolingual children at the same age (Anderson & Goldstein, 2012; Lambert, 1981).

There is evidence that increasing integration of students speaking different languages in schools, at work and in urban settlements will increase the proportion of mixed language marriages. Already the respondents surveyed in this study have indicated that 57% are from mixed language families, but that 77% of them reported that their best friends speak different vernacular languages from them - an indication that the future proportion of mixed language marriages in their generation will definitely increase.

Parents' home language and students' language fluency

An attempt was made to compare whether parents speaking the same or different languages influence the fluency of students speaking their parents' language had shown clearly showed that only 47 % (Figure 22) of students could speak their parents' language very well in monolingual environment (parents speaking same language), while about 31 % of students could speak very well in their parents' languages in a bilingual environment (each parent speaking different language), indicating a drop by about 50% from more than 87% of parents who speak their languages very well. Knowing that children start learning to speak their languages at age 2 years, the tested students should already be fluent in their languages. However, it appears that the highly noticeable drop in language fluency is indicating a phase of language attrition. This is high language attrition is based on the findings of Anderson and Goldstein (2012) who described language attrition as an individual who does not lose the ability in his or her language, but does not use it the most. A language that remains inactive or not used regularly over time would result in the decline of language skills of that language. This leads to a noticeable phenomenon in the outcomes of this study where a seemingly high number of passive speakers of bilingual students for both mothers' (37%) and fathers' (32%) languages, clearly indicating that bilingual students are unable to master and speak effectively any of their parents languages and instead use a lingua franca like the Melanesian Pidgin to communicate efficiently with their parents. An important question to pond over "what would be the future of these languages in the next generation"?

5.1.4 Education level

Parental education level and students' language skills

There is a general assumption that parental education level would have a great influence on language acquisition and proficiency by their children. In fact, the results from this study indicated clearly the importance of parents' education level, in particular at the rural environment where it was noted that parents with no formal education played an active role in transmitting the language skills to their children. On the other hand, parents' with tertiary education level appears not to support vernacular language skills transmission and is a factor to influencing the decline in language acquisition and proficiency. A similar trend was reported earlier by Force (1992) in a survey on education in Nunavik which revealed a progressive decline in students' primary languages as they proceed from grade to grade. The study by Allen et al. (2006) also showed similar outcomes indicating that the students' native language skills decreased as they enter majority language classes in school. The results from this study also showed that as the education level increases, the level of language skills declines. Such a trend may suggest that in PNG, people with no formal education use most of their time in their villages where they were born and speak their own language. This creates an efficient environment for effective language transmission. Further, those with no formal education use their own vernacular language to adapt themselves to their surrounding rural environment. They develop vocabularies known as 'cultural genes' that carry precise knowledge regarding ecosystems which further strengthens and supports effective language transmission (Franco et al., 2015).

According to Fillmore (1991) who conducted a study of a large group of immigrant families in the US suggested that the younger a child is when he or she is immersed in English, the more dramatic the child's mother tongue loss will be (Force, 1992). In addition, the school environment also does not encourage vernacular language to be spoken and when students are caught speaking their vernacular language, they are punished. Nevertheless, since primary schools are located within the communities and are easily accessible, the students who live in such communities remain active in speaking their vernacular languages.

In many parts of PNG, most secondary schools are boarding schools and so parents who attended secondary schools had to leave their communities for a good amount of time. Inevitably, this means that the vernacular language is not often used by those parents and even their children who also attend boarding schools that are far away from their communities. Students in such situations find themselves interacting with different other groups of students with different language background and therefore must use a common language in order to communicate with each other. This is also re-enforced by schools' policy (Fontaine, 2012) restricting students from speaking their vernacular languages or severe corporal punishments will be applied. These factors explain why students whose parents with secondary education level score a mean that is less than those from parents who only attained primary education level as well as those with no formal education.

It is also not surprising to find that students whose parents have attained tertiary education level also scored low in language skills test. Further, in most cases those who reach this level usually live in urban areas with improved living standards and seemed to use English and Pidgin languages which are most commonly used in such environments (Klaus, 2003) and obviously their children who grow up in such environment also wish to attain higher levels of schooling (Dickson, Gregg, & Robinson, 2016). As a consequence, the children's perception of vernacular language as an impediment in education success has resulted in the decline of their heritage languages.

Parental education level and students' language fluency

Investigation into the fluency of students speaking their parents' languages was compared against the parents' education levels and it indicated that students' language fluency increased from parents who had no formal education to primary education level, and then decreased rapidly from secondary education level to tertiary education level (Figure 21). This clearly indicates that parents who had no formal education and those who had primary education level still have a greater influence in shaping their children's language fluency and that this practice decreases as parents move into higher education levels. This finding is similar to Luykx (2005) who found that pre-school-aged children and older adults who grew up with little or no formal schooling were highly fluent in their vernacular language than

those with formal schooling. In Addition, the increase in education level also adds to a steady increase for poor, passive and non- speakers. This is because an increase in education also means having more exposure to urban environment and speaking the common languages used in such an environment to ease communication barriers and thus affecting ethnic language fluency.

5.2 The relationship between language skills and ethnobiological knowledge

The results from this study clearly highlight language as an important predictor of ethnobiological knowledge, as both bird knowledge test and plant knowledge test had shown positive correlation with language skills test. This finding is consistent with Baro (2015) who in a similar study found that all ethnobiological knowledge variables tested had shown positive relationships with language skills. The finding further agrees with Franco et al., (2015) who stressed that language is an important carrier of traditional ecological knowledge (TEK) and also with Maffi (2007) who also found that TEK is dependent on languages, and that the loss of languages would lead to the loss of TEK.

Although the finding may not be new, it is of significant importance to the whole issue of language as it is the repository of ethnobiological knowledge. It is through language that the names and scientific information related to ecology, morphology or utility of lifeforms are known, articulated and transmitted (Onditi, 2016). This has prompted Unasho (2013) to describe language as genes of environment, while Pilgrim et al (2008) have promoted the idea for cultural and biodiversity conservation. Hence, it is important to note that there is a link between language, culture, ethnobiological knowledge and conservation. It is because of this link, Settee (2008) appealingly stressed that the loss of language would mean the loss of human diversity and all the knowledge contained therein.

The test on the influence of modern technology, especially that of phone use skills and computer skills on students' bird knowledge had clearly shown a negative correlation (Figure 24) indicating that the chance of losing ethnobiological knowledge as a result of spending more time on the usage of computer and phone is quite obvious. This finding is also in agreement with Ibrahim et al. (2011) who found that

the contemporary technological advancements is the most effective modern trend, but that for any social setups to advance they will have to give way to these changes overtime. Modernization is a noticeable driving force for changes in PNG societies today resulting in changes to the priorities and aspirations of people that affects their close relationship with the nature. For instance, the rampant use of mobile phones by young generation today is robbing much of their precious time and leaves less time for contact with the nature, a practice that was unknown even 10 years ago. Due to increases in the establishment of new schools with improved education standards, increased business venturing opportunities, coupled with increased access and use of modern technologies including internet services have been shown to cause a decline in ethnobiological knowledge (Ibrahim, Abbasi, Adnan, & Bhatti, 2011) and as evident in this study. The findings from the assessment of whether or not hunting skills of students determine bird knowledge had shown a positive correlation (Figure 23). It basically reaffirms the results about computer and phone use skills that the more time spent on such technologies decreases hunting skills and bird knowledge. These finding also confirmed what Baro (2015) had found where male participants in his study who go for hunting regularly had shown high level of bird knowledge. Regardless of gender, it is important to note in his study that the regularity of hunting increases bird knowledge. Thus, when comparing computer skills, phone use skills, and hunting skills with bird knowledge, it clearly demonstrates a clearer trend of how modernization affects ethnobiological knowledge in PNG.

CHAPTER FIVE: GENERAL DISCUSSION AND CONCLUSION

This study was conducted to assess whether or not language skills and ethnobiological knowledge decline among the youths in PNG. Language skills and ethnobiological knowledge investigations were combined, and assessed in accordance with the research questions. From the findings of the study, it can be concluded that socio-demographic factors influence language skills and ethnobiological knowledge. Prominent among the socio-demographic factors include rural/urban preschool years, gender, home language and education level of parents.

Spending preschool years in a rural environment has the advantage of acquiring a high level of language proficiency and ethnobiological knowledge. The high language proficiency is due to the high exposure to vernacular languages in the rural settings than the urban areas, while the high ethnobiological knowledge is due to having high chance of regular contact with nature.

Gender had no significant effect on language proficiency but a noticeable difference is found about the bird knowledge where males had shown high level of bird knowledge than females, which is a reflective of the males' instinctively advanced hunting skills. However, in respect to human body parts, it appeared that both males and females have similar knowledge and understanding due to equal their respective familiarity with human body parts.

In a home environment, it was found that students who speak vernacular language daily at home had higher level of language proficiency and ethnobiological knowledge. However, speaking English was found to be associated with the lowest vernacular language scores. Further, it was found that where parents speak the same language at home the result showed higher positive influence on language proficiency and ethnobiological knowledge compared to linguistically mixed families. This is reflective of the language environment and the mutually reinforcing nature of language and ethnobiological knowledge in which language is seen as the repository of ethnobiological knowledge.

A comparison of parents' language fluency with students' language fluency had shown that almost half of the students cannot speak fluently their parents' languages, compared to their parents who are fluent speakers in a bilingual situation (`- 87%). Thus, students from families where each parent speaks a different language performed particularly poorly unlike students from monolingual families who had better language skills. A consistently high number of passive speakers was evident in language skills and language fluency assessments, while a correspondingly high number of Pidgin speakers was also observed. These trends are clear indications of language skills declining in the younger generation and placing a noticeable threat to PNG's linguistic diversity, especially in regard to high number of Pidgin language speakers influencing vernacular languages going into obsolescence.

Parents' education level, generally had a negative correlation with students' language proficiency and ethnobiological knowledge. This is due to a number of factors including increased exposure to outside world as education level increases, speaking lingua franca to homogenize with different ethnic language groups in multicultural settings, and students coming from educated families wishing to attain higher levels of schooling and seeing vernacular language as an impediment to education success. The importance of language as the repository of ethnobiological knowledge was also confirmed through this study where language skills were a significant predictor for ethnobiological knowledge of bird and plants.

PNG is currently experiencing rapid cultural, social, and economical changes on the scale never experienced before. As a developing country and being part of the global community, these changes are unavoidable. As changes are underway, traditional communities will become less reliant on local resources and begin to adapt to modern lifestyles. Young people are migrating into towns and cities looking for better life and speaking dominant languages, particular the Pidgin language in order to survive in the multicultural environments. Improved education systems, technological advancements, and improved communications systems facilitated by mobile phones and internet services are some of the factors that greatly influence the loss of ethnobiological knowledge and language skills. Many of the socio- demographic variables identified in this study are indicators of change, particularly education

level, preschool years, and home languages have already shown a decline in language skills and ethnobiological knowledge in the current generation. The loss of indigenous language is a loss in ethnobiological knowledge and a constraint on cultural and biological diversity conservation. Perhaps the most notable outcome of the study is not only about the direction of the change towards decline in language skills and ethnobiological knowledge, but the magnitude of the change. The loss of language skills in a single generation has been remarkable, but to "what extent will such change have on PNG languages and ethnobiological knowledge in the next generation?"

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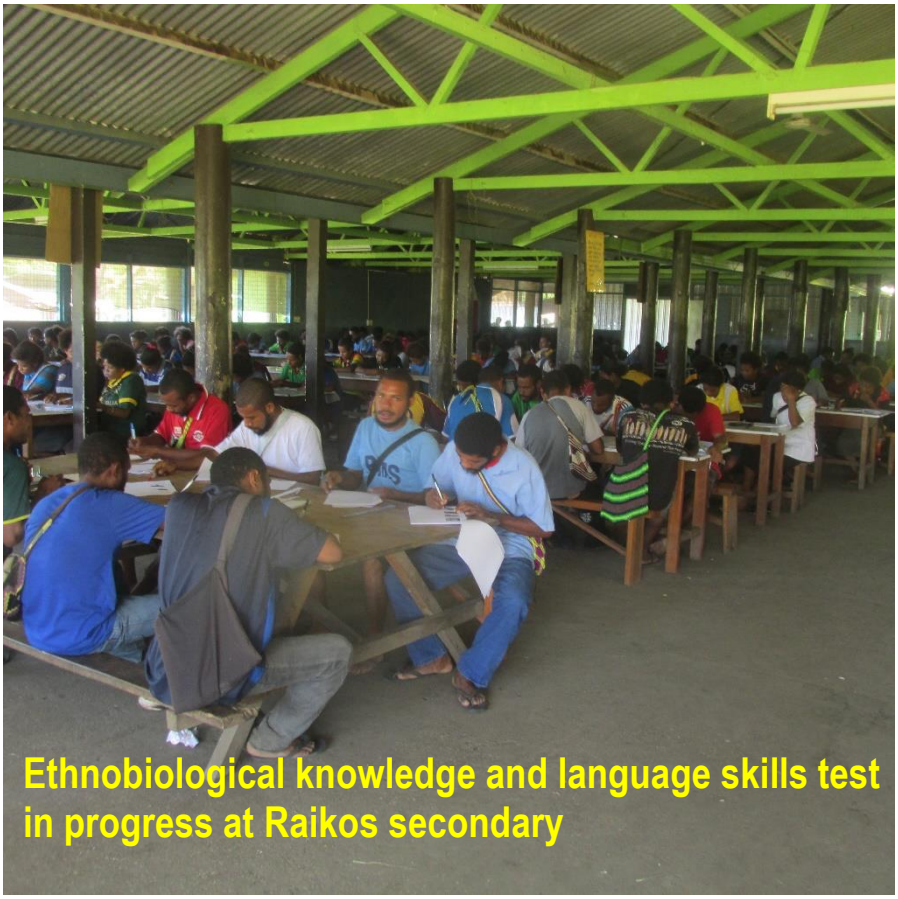
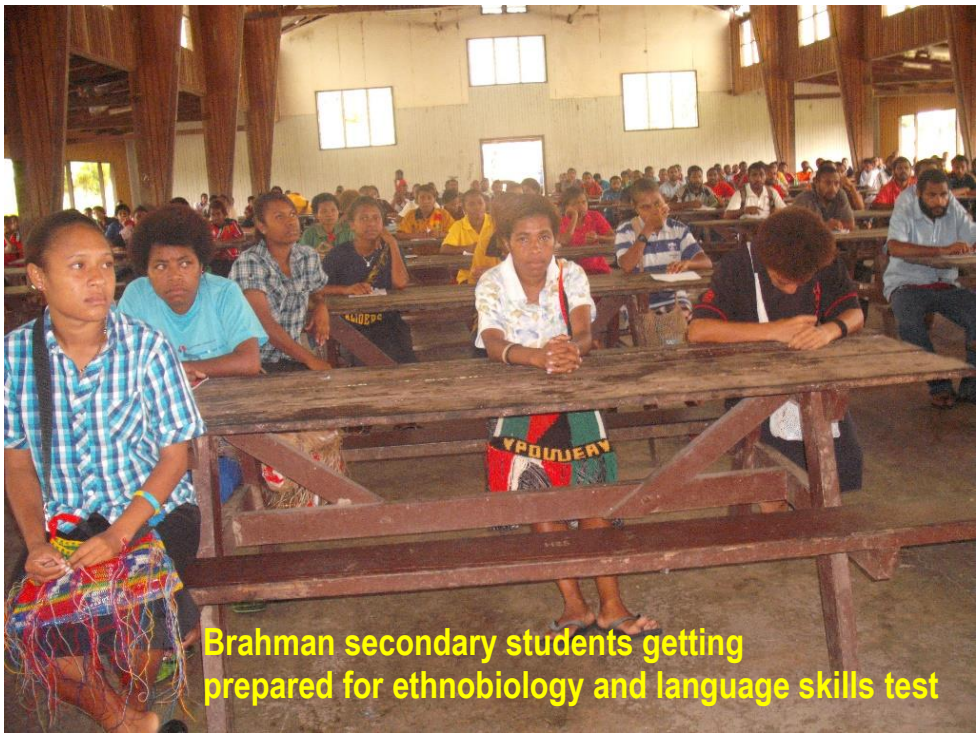
APPENDICES

Appendix A: Ethnobiological knowledge and language skills tests were conducted in secondary schools





Brahman secondary students getting prepared for ethnobiology and language skills test

Appendix B: Divine Word Students were hired for data entry

Appendix C: Presentation of gifts to schools

Appendix D: Questionnaire sample

Welcome to the survey of tokples (vernacular) language skills and ethno-biological knowledge in the Madang Province

Thank you for taking part in the survey

Papua New Guinea has the highest number of languages in the world. However, nobody knows how these languages are passed on the new generation of Papua New Guineans. Please, take a short test and help us find out! This study is an MSc project by **Alfred Kik**, based at the New Guinea Binatang Research Center in Madang and the University of PNG in Port Moresby.

Please circle one or several correct answers to each question, or fill the information needed on dotted line: Example: are you a student? (yes) [no]

YOUR PERSONAL INFORMATION (all information is anonymous, without your name)

1. I am a **[boy] [girl]** (circle correct answer)

2. My year of birth..... or my age in years..... (make a guess if you are not sure)

3. I am now in **[11th] [12th]** grade (circle correct grade) at..... school

4. I was born in the village or town: **.....**District..... Province.....

5. I spent most of my pre-school years in the village or town: **.....** It is (circle one answer): **[my parent's village] [my mother's village] [my father's village] [another village] [government station] [provincial town or city] [overseas]**

6. If you spent pre-school years in a village or a government station, did it have: (circle correct answer) road **access by car: [yes] [no] airstrip: [yes] [no] boat access by river/sea: [yes] [no] access ONLY by walking: [yes] [no] electricity: [yes] [no]**

7. My family is now living in the village or town (circle one): Name of the village/town**.....**. It is: **[my parent's village] [my mother's village] [my father's village] [another village] [government station] [provincial town or city] [overseas] **

8. Does your family own land? **[yes] [no]** If yes, do you own land with: **undisturbed forest – big bush: [yes] [no], logged forest: [yes] [no]**, **cash crop plantation (coffee, coconut, cocoa, oil palm): [yes] [no]**, **food gardens: [yes] [no]**, **grassland/kunai: [yes] [no]**, **settlement area: [yes] [no]**

9. I have **.....** sisters and **.....** brothers (sharing at least one parent, including adopted ones)

10. My grade 10 results (circle your grade for each subject): **English: [distinction] [credit] [upper pass] [pass] [fail]**, **Mathematics: [distinction] [credit] [upper pass] [pass] [fail]**, **Science: [distinction] [credit] [upper pass] [pass] [fail]**, **Social science: [distinction] [credit] [upper pass] [pass] [fail].**

11. Do you know how to: **hunt animals in forest: [well] [a little] [no] ,catch fish: [well] [a little] [no]**, **plant gardens: [well] [a little] [no]** , **build village house: [well] [a little] [no]**, **make a mumu: [well] [a little] [no]**, **use plants to treat fever: [well] [a little] [no]**, **use mobile phone: [well] [a little] [no]**, **use computer: [well] [a little] [no]**

12. What language do you use most of the time in your home? **[English] [Tok pisin] [Tok ples]**

13. Is your best friend speaking the same tokples as you? **[same] [different] [one of us do not speak any tokples] [both of us do not speak any tokples]**

14. What field have you streamed into? **[Science] [Social science]**

YOUR MOTHER'S INFORMATION

1. She was born in the village (her asples): **.....**

District..... Province.....

2. The name of her tokples (or the name of the village where it is spoken): ----------or circle: **[do not know]**

3. She speaks tokples (circle one answer): **[very well] [poorly] [does not speak it but can understand] [does not speak or understand it at all]** 4. Her highest completed education (circle one answer): **[no school]** [**elementary school up to grade .....] [primary school up to grade .....] [secondary school up to grade .....] [university certificate] [university diploma] [BSc] [postgraduate]**

5. Her present or past jobs (circle one or several answers): **[caring for family/subsistence farming] [cash crop farming] [salaried job (write what job): .....] [own business (write what business): .....]**

YOUR FATHER'S INFORMATION

1. He was born in the village (his asples):**.....d**istrict**.....** Province **.....**

2. The name of his tokples (or the name of the village where it is spoken): **....** or circle: **[do not know]**

3. He speaks tokples (circle one answer): **[very well] [poorly] [does not speak it but can understand] [does not speak or understand it at all]**

4. His highest completed education (circle one answer): **[no school] [elementary school up to grade .....] [primary school up to grade .....] [secondary school up to grade .....] [university certificate] [university diploma] [BSc] [postgraduate]**

5. His present or past jobs (circle one or several answers): **[caring for family/subsistence farming] [cash crop farming] [salaried job (write what job): .....] [own business (write what business): .....]**

YOUR LANGUAGE SKILLS:

1. Does your mother and father speak the same tokples? **[yes] [no]**

2. I speak my mother's tokples (circle one answer): **[very well] [poorly] [do not speak it but can understand] [do not speak or understand it at all]**

3. I speak my father's tokples (circle one answer): **[very well] [poorly] [do not speak it but can understand] [do not speak or understand it at all]**

4. I speak also another tokples: **[yes] [no]** If yes, then:

Tokples name or the name of the village where spoken: **.....**

I speak it: **[very well] [poorly] [do not speak it but can understand] [do not speak or understand it at all]**

5. Will you teach tokples to your children? (circle one or several answers) **[no because I do not speak it myself] [no because it is not a useful skill for my children] [no because it belongs to an old culture that is now out of date] [yes because everybody in my village/town area does it] [yes because it is a useful skill for my children] [yes because it is part of my culture]**

LANGUAGE TEST

We will show you 24 body parts. See how many of them you can name in tokples!

If you speak more than one tokples, use the tokples language you know best. If you do not speak any tokples, circle **[I do not know]** in all cases.

The name of the tokples language used (or the name of the village where it is spoken):

..... or circle: **[do not know]**

Body part No 3

English: Eye

Tokples name:…….or circle [do not know]

BIRD TEST

We will show you 10 species of PNG birds from lowlands (nambis), and 10 species from the Highlands. You can choose either **lowland** or **highland** species, depending on which birds you know better. You can also try both groups and we will use the results from the group where you achieved better results.

Please write tokples name for each bird species (or circle [I do not know] option).

Use the same tokples language as you used for the language test.

If you do not know tokples name, try at least Tok Pisin or English

Bird species No. 3

Scientific name: *Paradisaea minor*

Tokples name: ..... or circle: [do not know]

Tok Pisin or English name .....

PLANTS TEST

List up to 10 plant species which you know and can use for medicinal, sorcery, or other traditional use. Write the tokples name of each plant (or at least Tok Pisin or English if you do not know tokples name), and describe its use.

	Tokples plant name	**Tok Pisin/English name**	**Plant use (medicinal, sorcery, other traditional, but not food)**
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Highlands bird species used in the test

Scientific name: *Aepypodius arfakianus*

Scientific name: *Astrapia stephaniae*

Scientific name: *Peltop montanus*

Scientific name: *Alisterus chloropetrus*

Scientific name *Ptilinopus pulchellus*

Scientific name: *Rhipidura albolimbata*

Scientific name: *Chaetorhynchus papuensis*

Scientific name: *Pachycephala modesta*

Lowland bird species used in the test

Scientific name: *Casuarius unappendiculatus*

Scientific name: *Paradisaea minor*

Scientific name: *Lorius lorry*

Scientific name: *Dicrurus bracteatus*

Scientific name: *Rhipidura threnothorax*

Scientific name: *Microeca flavigaster*

Scientific name: *Ptilinopus ornatus*

Scientific name: *Pachycephala griseiceps*

Appendix E: Body parts used in the survey

Source: Baro (2015)

Appendix F: Letter of permission

Madang Provincial Administration

Office of the Director Education

P.O. Box 2070, **MADANG 511**, Madang Province, Papua New Guinea.
Tel/Fax: 422 1652

15th May, 2015

Mr Alfred Kik
New Guinea Binatang Research Centre
Nagada
MADANG
Madang Province

Dear Mr KKik

REF: REQUESTED PERMISSION TO CONDUCT RESEARCH IN 5 SECONDARY SCHOOLS

Your letter in reference to the above (dated 9th March,2015) received and acknowledged.

You are granted the permission to proceed with the arrangements to visit the 5 secondary schools to conduct the research.

The copy of this letter will be selected to the respective schools. Please further confirm your arrangements and then proceed with the research.

For your information, confirmation and approval granted.

.....
Moses Sariki
Director Education

Principals, Tusbab Secondary, Malala Secondary, Karkar Secondary, Brahman Secondary and Raikos