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THE FILIPINO STUDENTS' USE OF TWO COMMUNICATION STRATEGIES IN UNDERSTANDING BIOLOGY CONCEPTS

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ABSTRACT

This study determined the usefulness of two (2) communication strategies in secondary Filipino students' understanding of 10 biology concepts. Using a mixed method design (quantitative and qualitative), it involved 122 incoming third year students from a public high school who expressed their understanding on homeostasis, autotrophs, cell division, replication, sexual reproduction, diversity, evolution, inheritance, fertilization, and mutation. English was more commonly used with also more correct responses while code-mixing was the more commonly used speech pattern. The Z-test on two-population proportion showed significant difference between the proportions of correct responses both in using English and Filipino, and, in using code-mixing and code-switching. The Fisher's exact test showed a relationship between the language used by the students and the correct answer given by the students on sexual reproduction (p-value = 0.0462, α=0.05). The result of the test implies that except for the concept on sexual reproduction which has to be explained in English, the students may use either English or Filipino in explaining the other concepts. The reasons for the students' use of the two strategies were the science teacher and familiarity with the language/speech pattern.

Keywords: Bilingual, code-mixing, code-switching, Filipino, language

INTRODUCTION

The basic science education emphasizes the importance of understanding and not just simple reproduction of information. In the context of language, understanding means that students learn best in the language they are most familiar with. The pattern involves development of understanding followed by technical vocabulary. For a meaningful understanding and learning of science, there should be meaningful science teaching. A lot of experts in the basic education have been trying to provide a better education to the youth for a better future. A better education lies in motivating students and involving them in the process of learning. Cobb (2012) defines learning as "the lifelong process of transforming information and experience into knowledge, skills, behaviors, and attitudes." However, the problem with understanding science concepts among students lies on the medium of instruction and the importance of language in the learning and teaching of science has long been recognized.

Students use different communication strategies in the expression of their thoughts, ideas and opinions. One important strategy is the choice of language. Oyoo (2015) reported that a teacher's language is vital in teaching science. According to the author, when used as science terms, every day words attain new meanings. There are two main aspects of language and science learning - learning to speak and write the language of science and meeting the demands of learning science in languages other than the home languages (Tang, 2010). Further, scientific

language demands that students learn an extensive vocabulary. Early work in science education research often focused on the language demands of learning science. For instance, in the study of Williams in 2009, results showed that the vocabulary demands of some secondary school science programmes are greater than those of second-language programmes. This means that there is too much expectation from secondary science programmes particularly if the language of instruction is not the same as the students' home language. Language, thus, plays an important role in learning science particularly biology. Noordin & Yong (2009) pointed out that since biology is descriptive in nature, students need to have sufficient language proficiency in order to constitute meaning of biology concepts.

In the Philippines, there are two (2) official languages that are used in education - English and Filipino. Any particular language is a repository of knowledge and English is just one of these languages. With the growing demand of the English language in the field of science and technology, it is imperative to learn science in English to maintain the country's competitive edge in the global marketplace. However, it must not be treated as the sole key in gaining access to the unlimited wealth of world knowledge. In fact, sometimes our emphasis on English limits the scope of what we can use from the major languages of the world like German, Spanish, Japanese, French, Russian, Chinese, and others (NCLT and NCCA, 2005). On the other hand, students being exposed to the Filipino language at their early years of education have the option to use the home language (Filipino, in this case) in explaining the meaning of specific science concepts. Just like English, Filipino language also has the power to become a repository of knowledge. The continuous development and popularization of Filipino as an academic language plays a major part in making ourselves intellectually independent. Indeed, the home language plays a very important part in a child's identity and self-esteem and provides the basis for the child's ability to learn. The child finds it easier to learn their second language and other school subjects if they are familiar with the home language. Reyes (2010) added that the use of a language the pupils know is significant in order to encourage active participation among the pupils.

Another form of communication strategy among students is the use of a particular speech pattern, namely, code-switching and code-mixing. A code is the particular dialect or language one chooses to use on any occasion, and a system for communication between two or more parties. Moreover, a code is a system of speech whose elements of language have special characteristic, and it is proper to the background of the speaker, the relation of the speaker to address and the situation. Code-switching and code-mixing are natural phenomena in bilingual and multilingual communities such as the Philippines (Gocheco, 2013). For many people or communities, the use of two or more languages in a conversation is not an extraordinary phenomenon but a norm. Code-switching and code-mixing are well-known traits in the speech pattern of the average bilingual in any human society the world over (Ayeomoni, 2006). Code mixing is used when the conversant uses both languages together to the extent that they change from one language to the other in the course of a single utterance. This means that in one single statement, there might have two languages that mix together. On the other hand, code switching is switching situation from one code to another. For example, if a speaker firstly uses code A (for example Indonesian Language) and he changes his code to code B (Chinese Language), this situation is called code switching.

Little research effort has been devoted to exploring secondary students' language choice in biology learning as well as speech pattern choice. Although some studies have emphasized the importance of language proficiency in the teaching of elementary science (e.g. Reyes, 2010; Carale, 2003), very little research has investigated on secondary students' language choice in

understanding biology concepts. Similarly, not much studies have been done both on code-switching and code-mixing although Borlongan (2012) has pointed out in his study that code-switching may be used as a resource for attaining the various goals of formal education. Meanwhile, a recent study by Ginanti (2017) indicates that the code mixing phenomenon appears among Filipinos when the author analyzed Instagram captions and comments. However, as used in biology teaching, a specific study on the speech pattern choice appears to be limited.

In the light of such observations, this study was designed to address the following research questions:

1. What are the communication strategies used by students in defining or describing 10 high school biology concepts?
2. In terms of correctness/incorrectness, what is the percentage of use when the 10 biology concepts are defined or described by the students.
   a. when English or Filipino is used?
   b. when code-mixing or code-mixing is used?
3. Is there a significant difference in terms of the percentage of students who correctly define or describe 10 high school biology concepts
   a. between English and Filipino?
   b. between code-mixing and code-switching?
4. Is there a relationship between the choice of language used and correctness of the answer in defining or describing 10 high school biology concepts?
5. What are the students' reasons for their responses based on the use of the two communication strategies?

The answers to the research questions are significant in attempting to help teachers make adjustment on the discussion of biology processes and concepts where students use the two (2) communication strategies. This study will also provide an evidence that learning science is based on such strategies as well as good science teaching.

The determination of high school students' understanding of 10 biology concepts involved only the first and second quarter topics of the high school biology syllabus. This was done in order to give more focus on the identified concepts for at least two quarters only. If the study involved the topics for the third and fourth quarters, there would be more concepts to be defined or described by the students. This would mean longer time to be able to complete the study.

LITERATURE REVIEW

Historical Context on the Choice of Language

According to the Philippine Constitution, the national language of the Philippines is Filipino and as it evolves, it shall be further developed and enriched on the basis of existing Philippine and other languages. The Constitution also urges the Philippine Government to take steps in initiating and sustaining the use of Filipino as a medium of official communication and as language of instruction in the educational system. Further, for purpose of communication and instructions, the official languages of the Philippines are Filipino and, until otherwise provided by law, English (NCLT and NCCA,2005). The use of English as a Medium of Instruction (EMI) in science teaching in the Philippines is to combine conventional medium of instruction of content-area subjects with English as a tool for communication in different subjects. As a widely-spoken language in the Philippines, being that it is an official language, EMI has been

used in the educational system, alongside the official Filipino language for specific subjects like Character Education, Social Studies and Filipino (DepEd, 2012). Thus, this implies that the Philippine government recognizes the use of Filipino and English in the educational system, a program called Bilingual Education Program (BEP). The BEP was implemented as early as 1974 to promote Filipino competency in both official languages. This was reinforced by the Department of Education, Culture and Sport (DECS) in 1987. The guidelines stated that English and Filipino were to be taught in all grades of elementary and secondary schools while Filipino was to be the medium of instruction in Social Studies/Social Science, Character Education, Work Education, Health Education, and Physical Education; English was to be the medium of instruction in all other areas, in particular, Science and Mathematics. However, based on DECS, the BEP has not proven quite as effective as hoped. English proficiency among Filipinos has been deteriorating, a serious problem for people who regard English as the language of upward mobility and technology. The country takes pride and relies heavily on its fluency in English for competitiveness in the global economy. Furthermore, judging from the comments of some language experts, the BEP has not improved language proficiency in Filipino either (Sawikaan, 2003).

Llaneta (2010) reported that reviews of the country's educational system tend to lead to painful discussions of the downward slide of the academic performance of Filipino students in English, Science, and Math. In his Primer on Mother Tongue-Based Multilingual Education and other Issues on Language and Learning in the Philippines, Nolasco (2008) cited the high functional illiteracy of Filipinos and the high drop-out and non-completion rates of students as the problems the mother tongue-based MLE seeks to address. As Cruz (2009) reported, on July 14, 2009, the DepEd issued Order No. 74 series of 2009, the program entitled "Institutionalizing Mother Tongue-Based Multilingual Education (MLE)."

Replacing the 35-year-old BEP, DepEd Order No. 74 took effect in preschool education on June 2010. Asserting that "the lessons and findings of various local initiatives and international studies in basic education have validated the superiority of the use of the learner's mother tongue or first language in improving learning outcomes and promoting Education for All," Order No. 74 institutionalizes Mother Tongue-Based MLE-that is, the use of more than two languages for literacy and instruction-as a fundamental policy and program in the whole stretch of formal education, including preschool. The DepEd Order indicates that the learner's first language (L1) will be used as the primary medium of instruction from preschool to at least Grade 3, and as the main vehicle to teach understanding and mastery of all subject areas like Math, Science, Makabayan, and language subjects like Filipino and English. According to Nolasco (2009), MLE starts from where the learners are, and from what they already know. This means learning to read and write in their first language or L1, and also teaching subjects like mathematics, science, health and social studies in the L1. UNESCO (2007) defines the first language as the language that a person (a) has learned first; (b) identifies with or is identified as a native speaker of by others; (c) knows best; or (d) uses most. Any language which is not an L1 is a second language (L2) or a third language (L3). In the Philippines, the L1 can be Tagalog/Filipino, Cebuano, Ilokano, Hiligaynon, Bikol, Kapampangan, Pangasinan, Waray, Maranao, Tausug and the like. Further, it may even be English or Chinese, if that is what the children learned first or uses most.

Factors that Influence Choice of Language

Riasatii and Zare (2010) emphasized that textbooks play a crucial role in the realm of language teaching and learning. They added that textbooks are considered to be the second important

factor in the second/foreign language classroom compared to the teacher. Textbooks, in fact, serve as guides that teachers can refer to in order to make teaching and learning more effective. In the classroom, the science teachers' way of talking interacts with those of their students to channel, and develop, the ability to engage in, and share, scientific discourse (Jones, 2000). In addition, if teachers proficient in English are allowed to use the language as a medium of instruction, students will be exposed to more than satisfactory kind of English. In effect, students all the more learn English and learn the lessons taught in the language.

The Philippine Constitution recognized the importance of Filipino as an official language as it has declared Filipino as a language of the educational system (Philippine Constitution, 1987). As Filipino is used as the medium of instruction, students learn the language, and at the same time get to know the richness of their own culture. Balce (2010) added that in science education, the communication of science concepts demands linguistic and conceptual knowledge which means that both teachers and students should communicate in their mother tongue, the language wherein they are comfortable and at ease in clearly expressing their ideas. Thus, Filipino should be used as the medium of instruction in the educational system because students learn best in this language. As pointed out by Ritchie and Bhatia (2005), it is often observed that bilinguals can switch from one language to another with as much ease and competence. Filipino students being bilingual, are expected to mix languages.

Code- mixing vs. Code-switching

Ugot (2010) examined language choice and the twin phenomena of code-switching and code-mixing in a multilingual Biase Local Government Area in Cross River State, Nigeria. Leung (2010) pointed out that members of the same society always share common linguistic habits. He added that the mixing of the two language codes is like a common practice among local populations. The code-mixing phenomenon cannot be separated from the fact that many people these days are bilingual, trilingual, or even multilingual. The advancement of transportation and communication increases local diversity and global connectedness. People of different languages and different cultures come into contact constantly. Managing linguistic and cultural variations has now become vital to our lives. Apparently code-mixing has become socially and communicatively unavoidable and it helps us to develop and improve relationship and enables us to adjust and adapt to the environment we are in. Since the late 1970s, an increasing number of studies have appeared in professional linguistics journals and as monographs on such phenomenon. A research by Asy'ari (2009) was conducted to analyze and describe the forms, meanings, and the reasons of using code mixing in Islamic printed media. In order to determine which structural pattern of code-mixing is predominant, Deuchar (2005) reported on the results of some preliminary analysis of Welsh-English code-mixing data.

Leung (2010) defines "code-mixing" as a term that refers to mixing of two or more languages within a sentence while "code-switching" refers to the alternative use of two or more languages in the same conversation. In short, code-mixing is changing languages within a sentence while code-switching is changing languages between sentences. Muysken in Kampar (2012) explained that based on intra-sentential, contextual, and situational conversation, code mixing is expressively purposing languages that are combined to increase social statue or to keep the speaker's prestige in the society. Moreover, code-mixing is the embedding of various linguistic units such as affixes (bound morphemes), words (unbound morphemes), phrases and clauses from a cooperative activity of the participants, in order to infer what is intended, must reconcile what they hear with what they understand. Then, code mixing is a situation, which language parts come into another language. In formal situation, it infrequently happens. However, if it

happens, it is just caused of no proper expression to the language being used. Thus, it is necessary to use other language. Generally, with several motives, code mixing performs in daily life. Professions, social class, economy level, age, and sex and the like are certain motives for people to have code mixing communications. For example, when students explain something to another one, there are parts of language – words, phrases and clauses - that suddenly come from their own language into Filipino or English into Filipino. After analyzing code switching using email messages, the study of Bautista (1999) noted that communicative efficiency or the fastest, easiest, most effective way of saying something was an essential factor in code switching. She also pointed out that competence of educated Filipino bilinguals and communicative efficiency were two important factors in Filipino code switching. In a study of Pascasio (1996) who investigated the socio-cultural factors affecting code switching, he found out that individuals who engaged in business negotiations used communicative strategies that not only relied on a good command of English but also on code switching based on an awareness of socio-cultural factors such as role-relationships, speech functions, and topics.

METHOD

Research Design

The appropriate design used in the study was a mixed method design. A mixed method design combines quantitative and qualitative research techniques, methods, approaches, concepts, or language into a single study (Johnson & Onwuegbuzie, 2004). As such, in order to conduct a mixed methods research, there is a need to collect, analyse, and interpret quantitative and qualitative data in one study, or a number of studies, where an investigation of the same phenomenon is under consideration. Johnson and Onwuegbuzie (2004) further noted that the logic of inquiry encompasses the use of "induction (or discovery of patterns), deduction (testing of theories and hypotheses), and abduction (uncovering and relying on the best of a set of explanations for understanding one's results)."

The qualitative part involved a survey where a general question on the definition of the 10 biology concepts was asked to each member of the whole population (N=122). Likewise, a question on the reasons for the choice of strategy was also asked. The quantitative design involved the use of the Z-test on two-population proportion to show significant difference between the proportions of correct responses in English and Filipino, and, code-mixing and code-switching. Moreover, a Fisher's test was used to find out the relationship between the language used and the correct answer given by the students. A mixed method approach, therefore, presents a logical and intuitive appeal hence provides a platform for bridging the divide between qualitative and quantitative paradigms. This attribute, consequently, makes an increasing number of researchers to utilise mixed method designs in undertaking their studies (Onwuegbuzie & Leech, 2005).

A mixed method design combines the strength of both quantitative and qualitative research approaches. On their own though, quantitative, and qualitative methods have some strengths, but more benefits are realised when they are brought together. This point is further highlighted by Connelly (2009) who wrote that "the goal of mixed methods research is to draw on the strengths and minimize the weaknesses of both types of research".

Sampling Procedure and Participants

A total of 122 incoming third year high school students were considered for the study. Seventy-five (75) students came from the urban areas of the province while 47 came from the rural

areas. These students were from three (3) class sections of the third-year level whose ages ranged from 14 to 15 years old. Each student was given a questionnaire where the 10 biology concepts were asked to be defined or described. The number of participants corresponded to the total number of incoming third year high school students who have taken biology. This means that the students had already prior knowledge of biology. This was necessary so that they could easily organize their thoughts when they define or describe biology concepts. The study was conducted at the end of the school year in 2018, a week before the fourth quarterly examination was taken.

The selection of the concepts was based on the topics in the first and second quarters of the high school biology syllabus. For the first quarter, the topics included the chemical basis of life and cell structures and functions while for the second quarter, the topics were genetics and energetics. To identify the concepts, the researcher made a survey asking all of the incoming third year students about the important concepts they learned in biology. The top 20 in the ranking served as the initial number of concepts to be defined/described by the students in the study.

The researcher re-examined the current syllabus in biology to check if the general topics for the two quarters were represented in the 20 topics identified initially by the third-year students. This was needed to limit the number of topics. The researcher came up with a list of 15 items, which comments of three validators reduced the number of items to 10. The identified concepts were homeostasis, autotrophs, cell division, replication, sexual reproduction, diversity, evolution, inheritance, fertilization, and mutation. This list was part of the competencies in the DepEd high school biology syllabus.

Instruments

Survey questionnaire 1 involved the general instruction, "Write down your understanding by defining or describing each of the concepts below. Think of your own way to be able to express your definition of a particular concept." The participants were asked to write their answers on one or two sheets of pad paper. Survey questionnaire II involved the general question, "What are your reasons why you answered in English, Filipino, code-mixing and code-switching? Check the reasons (textbook, teacher factor, comfort zone, familiarity with the strategy, personal choice, parent's choice, part of school policies, media, peer pressure and type of school) that apply to you. You may have two (2) or more answers."

Data Collection

Information sheet. The students were given an information sheet regarding their name, age and the grade school where they graduated. This was collected prior to the survey.

Survey I. After giving the instructions to the students, the general question was posted on the board. The three (3) class sections took turns in answering the question based on their science class schedule. The participants answered the question in one (1) or two (2) sheets of paper for one hour and 30 minutes which was the regular time period for all science subjects in the school where the study was conducted. Before the students answered, they were informed that their output would be equivalent to one (1) quiz worth 20 points. This served as a motivation so that they would submit their output with complete answers. The participants were given a maximum of nine (9) minutes to describe or define each concept. The students were not supervised on how to arrive at their answers but they were not limited to the use of drawings/illustration if

they wanted to emphasize their answers. The researcher used a rubric for checking the participants' answers after which a table was made to present the data collected. The 122 responses of the participants were distributed under responses in English, in Filipino, use of code-mixing and use of code-switching.

Survey II. Right after the first survey, a second survey questionnaire was given to the students in order to summarize the reasons why they resorted to use English, Filipino, code-mixing and code-switching. The questionnaire consisted of 10 possible reasons (previously mentioned) for the students' preferences after which, ranking of the top 5 by the researcher followed. The 10 possible reasons were obtained from consultation with two (2) high school Language teachers and an expert from the state university of the country. The ranking of the students was limited to five (5) only because not all the reasons may apply to the use of English, Filipino, code-mixing and code-switching.

Informal interviews/conversations. Informal interview was conducted two (2) days after the administration of the second questionnaire among 50 randomly selected students. This was done in order for students to elaborate their reasons on their understanding of the concepts using English, Filipino, code-mixing and code-switching. Documentation of such informal conversations was done using an audiotape recorder.

Data Analysis Framework

Descriptive and inferential statistics were used to analyze the data for this study. The descriptive statistics were percentages. This statistics was used to describe the population and the general performance of the population. The inferential statistics were Z-test and Fisher's Exact test. These statistics were used to test the hypotheses involved for research questions 3 and 4. Z-test on two-population proportion was used to answer the hypothesis involved in research question no. 3 which was to determine if there is a significant difference on the percentage of students who correctly defined or described using either English or Filipino as well as using either code-mixing or code-switching. Fisher's Exact Test was used to answer research question no. 4 which was to determine the relationship between the language used as well as the type of speech pattern used, and correctness of the answer in defining or describing 10 high school biology concepts. The Fisher's Exact test was used by creating two-way tables for each of the 10 concepts. The hypothesis involved in research question no. 4 was tested at alpha 0.05 level of significance.

The interview analysis focused on capturing the students' reasons in answering using English, Filipino, code-mixing and code-switching. The interview was transcribed for analysis.

RESULTS

The answers of the students were distributed into four (4) categories (Table 2). The choice of language used consisted of students' answers using English and Filipino. On the other hand, the type of speech pattern consisted of students' answers using code-mixing and code-switching. For the choice of language, it can be observed that most of the students opted to use English in answering the question about the 10 high school biology concepts. For the type of speech pattern, results indicate that more students preferred to use code-mixing than code-switching. Calculation of the total number of responses, number of correct responses and percentages of correct responses revealed more responses in English than in Filipino, as well as more responses using code-mixing than code-switching.

A modified rubric system adopted from the International Reading Association was used to score the students' answers as follows.

Table 1. A Modified Rubric for giving Scores to Students' Answers

0 point **No Understanding**	**1 point** **Partial Understanding**	**2 points** **Full Understanding**
Student appears to have no understanding of the word. The student may have provided an incorrect definition or example.	Student appears to have partial understanding of the word. The student has provided an example *or* a definition of the vocabulary word. The example and/or definition may be incomplete.	Student appears to have full understanding of the word. The student has provided an example *and* a definition of the word. The example and definition correctly explains the meaning of the word.

For No Understanding, a zero point was given. The students' answers had Partial Understanding for one (1) point and had Full Understanding for two (2) points. However, Partial and Full Understanding were considered generally as With Understanding. Thus, the general scoring used was With Understanding for 1 point and No Understanding for 0 point. This scheme was used to determine the total number of correct responses, percentages of correct answers when students opted to answer in English and in Filipino as well as when code-mixing and code-switching were used.

Table 2. Percentages of Correct Responses using Filipino, English, Code-mixing and Code-Switching (n=122)

	Choice of Language						**Type of Speech Pattern**						**Total Number of Respondents**	**No Response**
	Use of English			**Use of Filipino**			**Use of Code-mixing**			**Use of Code-switching**				
Concept	**Total No. of Responses**	**No. of Correct Responses**	**% of Correct Responses**	**Total Number of Responses**	**Number of Correct Responses**	**% of Correct Responses**	**Total No. of Responses**	**No. of Correct Responses**	**% of Correct Responses**	**Total Number of Responses**	**Number of Correct Responses**	**% of Correct Responses**		
1. Homeostasis	39	35	90%	2	1	50%	10	9	90%	1	1	100%	52	70
2. Autotrophs	65	62	95%	1	1	100%	12	10	83%	1	1	100%	69	53
3. Cell division	71	69	97%	0	0	0%	19	19	100%	0	0	0%	90	32
4. Replication	68	61	90%	9	9	100%	22	20	91%	1	1	100%	100	22
5. Sexual Reproduction	84	80	95%	2	2	100%	23	23	100%	0	0	0%	109	13
6. Diversity	83	69	83%	9	9	100%	24	21	88%	1	1	100%	117	5
7. Evolution	88	75	85%	5	5	100%	17	14	82%	2	2	100%	112	10
8. Inheritance	82	81	99%	8	8	100%	26	25	96%	2	2	100%	118	4
9. Fertilization	86	85	99%	0	0	0%	20	20	100%	0	0	0%	106	16
10. Mutation	66	55	83%	0	0	0%	27	20	74%	0	0	0%	93	29

Out of 122 students, results showed a variation in the number of correct students' responses when they expressed their understanding on the 10 biology concepts. For the concept of homeostasis, only 52 (42.62%) responded while 70 students (57.38%) did not respond. Out of 39 responses, there were 35 correct responses when English was used compared to only one (1) correct out of two (2) responses when Filipino was used. Nine correct responses were obtained for using code-mixing than only one correct response for the use of code-switching. Sixty nine students (56.56%) gave their responses on their understanding about autotrophs while 53 students (43.44%) did not respond. Of the 65 responses, there were 62 correct

responses when English was used compared to only one response when Filipino was used. In terms of code-mixing, of the 12 responses, there were 10 correct responses compared to only one correct response when code-switching was used. There were 90 students (73.77%) who gave responses on cell division while only 32 students (26.23%) did not respond. From the 71 responses made by the students, there were 69 correct responses when English was used while there was no response for the use of Filipino. All 19 responses showed the use of code-mixing while there was no response for the use of code-switching. For the concept on replication, there were 100 students (81.97%) who responded while 22 students (18.03%) did not respond. Sixty one out of 69 responses were correct as English was used while all 9 responses were correct as Filipino was used. Twenty out of 22 responses were correct when code-mixing was used compared to only one (1) correct response when code-switching was used.

There were 109 students (89.34%) who gave their responses on the concept of sexual reproduction while there were 13 students (10.57%) who did not respond. Eighty out of 84 responses showed responses in English while only two (2) responses were expressed in Filipino. There were 23 students whose responses were correct as they used code-mixing while no response was recorded for the use of code-switching. Students' understanding on diversity showed responses of 117 students (95.90%) while only 5 students (4.10%) did not reply. Sixty nine correct out of 83 total responses indicated the use of English while all 9 responses indicated the use of Filipino. Twenty one correct out of 24 total responses indicated the use of code-mixing while only one (1) response indicated the use of code-switching.

There were 112 students (91.80%) who gave responses about evolution while 10 students (8.20%) did not give their responses. Seventy five correct out of 88 responses showed the use of English while only nine (9) responses showed the use of Filipino. Fourteen correct out of 17 responses showed the use of code-mixing while only responses showed the use of code-switching. For the concept of inheritance, a total of 118 students (96.72%) showed responses while only four (4) students (3.28%) did not respond. Almost all the 82 (81/82) students expressed their understanding in English compared to only eight (8) students who expressed it in Filipino. Similarly, almost all the 26 students (25/26) answered using code-mixing while only two (2) students answered using code-switching.

In terms of the concept of fertilization, there were 106 students (86.89%) who responded while 16 students (13.11%) did not respond. Eighty five correct out of 86 responses was expressed in English while there was no response for the use of Filipino. A total of 10 responses were recorded for the use of code-mixing while there was no response for the use of code-switching. Finally on the concept of mutation, a total of 93 (76.23%) students gave their responses while 19 students (23.77%) did not respond. Fifty five correct out of 66 responses was in English while there was no response for the use of Filipino. Twenty correct out of 27 responses showed the use of code-mixing while there was no response for the use of code-switching.

Table 3 shows the use of Z-test for two-population proportions using independent samples when English and Filipino were used as well as when code-mixing and code-switching were used. It can be noted that for the concepts on autotrophs, replication, sexual reproduction, diversity and evolution, the percentages of students who correctly described or defined such concepts are different between English and Filipino. No difference was observed on the languages used for the concepts on homeostasis and inheritance.

Table 3. Use of Z-test for two-population proportions using independent samples when English and Filipino were used as well as when code-mixing and code-switching were used

Concept	Choice of Language		Test Statistic Value	Conclusion	Type of Speech Pattern		Test Statistic Value	Conclusion
	English	Filipino			Code-mixing	Code-switching		
1. Homeostasis	0.89	0.5	1.113654202	No difference	0.90	1	-1.054092553	No difference
2. Autotrophs	0.95	1	-1.773460259	Different	0.83	1	-1.567747213	No difference
3. Cell division	0.97	0	49.49242366	No conclusion	1.00	0	NA	No conclusion
4. Replication	0.90	1	-2.793434926	Different	0.91	1	-1.475067516	No difference
5. Sexual reproduction	0.95	1	-2.049390153	Different	1.00	0	NA	No conclusion
6. Diversity	0.83	1	-4.103727538	Different	0.88	1	-1.809068067	Different
7. Evolution	0.85	1	-3.905551604	Different	0.82	1	-1.931762749	Different
8. Inheritance	0.99	1	-1.006153904	No difference	0.96	1	-1.040833	No difference
9. Fertilization	0.99	0	85.498538	No conclusion	1.00	0	NA	No conclusion
10. Mutation	0.83	0	18.16590212	No conclusion	0.74	0	8.766193806	Different

With regard to the type of speech pattern used, results showed that for the concepts on diversity, evolution and mutation, the percentages of students who correctly described or defined the 10 high school biology concepts are different between code-mixing and code-switching. On the other hand, there was no difference on the use of code-mixing and code-switching for the concepts on homeostasis, autotrophs, replication and inheritance. Initially, chi-square test of independence was used on the data set, however, it was found out that more than 20% of the cells in the two-way tables for each concept contained expected frequencies of less than 5 which led to the use of Fisher's Exact Test. Analyses were conducted for each concept and based on results, it was found out that only concept 5 (on sexual reproduction) (p-value = 0.0462, α=0.05) showed association between the choice of language used and the correctness of answer given by the students (Appendix A). Table 4. summarizes the students' ranking of the reasons why they needed to choose English, Filipino, code-mixing and code-switching in expressing their understanding of the 10 high school biology concepts.

Table 4. Top Five Reasons of the Students based on the (a) Choice of Language and (b) Type of Speech Pattern (n=122)

	Why students used English			Why students used Filipino			Why students used Code-mixing			Why students used Code-switching		
	No. of Respondents	%	Rank	No. of Respondents	%	Rank	No. of Respondents	%	Rank	No. of Respondents	%	Rank
Textbook	30	**24.6**	**2**	10	**8.2**	**5**	0	Reasons		0	**0.0**	
Teacher Factor	42	**34.4**	**1**	40	**32.8**	**1**	50	**41.0**	**1**	48	**39.3**	**1**
Comfort zone	2	1.6		15	**12.3**	**4**	10	**8.2**	**4**	3	**2.5**	**5**
Familiarity	20	**16.4**	**3**	20	**16.4**	**3**	35	**28.7**	**2**	24	**19.7**	**3**
Personal Choice	2	1.6		35	**28.7**	**2**	22	**18.0**	**3**	28	**23.0**	**2**
Parent's choice	10	**8.2**	**5**	0	0.0		0	0.0		0	**0.0**	
Part of school's policies	15	**12.3**	**4**	0	0.0		0	0.0		0	**0.0**	
Media	0	0.0		1	0.8		5	**4.1**	**5**	18	**14.8**	**4**
Peer pressure	1	0.8		1	0.8		0	0.0		1	**0.8**	
Type of school	0	0.0		0	0.0		0	0.0		0	**0.0**	

For the top five (reasons) on why students used English when they described/defined the 10 biology concepts, rank 1 was the teacher factor, rank 2 was the textbook, rank 3 was familiarity, rank 4 was part of school policies and rank 5 was parent's choice. For the choice of Filipino, rank 1 was the teacher factor, rank 2 was personal choice, rank 3 was familiarity, rank 4 was comfort zone and rank 5 was textbook. Teacher factor was the number one reason why students used code-mixing. The second was familiarity, third was personal choice, fourth was comfort zone and the last was media. The students used code-switching due to teacher factor (rank 1), personal choice (rank 2), familiarity (rank 3), media (rank 4) and comfort zone (rank 5).

DISCUSSION

As the students defined/described the 10 high school biology concepts, it was found out that the students answered using the two communication strategies - choice of language (English and Filipino) and type of speech pattern (code-mixing and code-switching).

The results of the study show that generally, the number of correct responses was more in using English than in using Filipino. Among the concepts defined/described in English, it was fertilization with the highest number of responses (85) followed by inheritance (81) and lastly by sexual reproduction (80). In Filipino, the concepts with the highest number of responses were replication and diversity (both at 9) followed by inheritance (8) and the last was evolution (5). More concepts were described/defined in English as supported by Rollnick (2000) who emphasized that the use of English is indispensable for communication, especially as a means to explain scientific concepts clearly. As indicated in the student profile, 61.5% (75/122 students) came from the urban areas and it was expected that most of the students came from private schools where the students are exposed to English as a means of communication. This finds support to what Hernandez (2015) had reported that exposure to the language is so great that those who do speak it can communicate quite fluently. However, though more exposed to the English language, the students were also able to answer correctly using the Filipino language. Based on the results, the students described or defined differently the concepts on autotrophs, replication, sexual reproduction, diversity and evolution using English and Filipino. This was confirmed by the Z-test on two-population proportion which generally shows differences in describing/defining some biology concepts (autotrophs, replication, sexual reproduction, diversity and evolution) in both English and Filipino (Table 3) though there was no difference on the language used for the concepts on homeostasis and inheritance.

Results of the study also show that the number of correct responses was more in using code-mixing than in using code-switching. For the use of code-mixing, the top three (3) correctly defined or described concepts were inheritance (25), sexual reproduction (23) and diversity (21). Only few students answered correctly using code-switching and the highest number with two (2) correct responses were evolution and inheritance. Based on these findings, the students seemed to find code-mixing more useful than code-switching. According to Sudarsi (2017), students find code-mixing useful in daily conversation because they tend to insert words that will make them express their thoughts and ideas more easily. However, as confirmed by the Z-test on two-population proportion, results show differences in describing/defining the concepts on diversity, evolution and mutation, using code-mixing and code-switching. This means that the students were still able to use both code-mixing and code-switching in describing/defining the concepts. Moreover, there was no difference on the use of code-mixing and code-switching for the concepts on homeostasis, autotrophs, replication and inheritance. This implies that

whether using code-mixing or code-switching, a student was able to give a correct definition of the concepts.

Based on the researcher findings and discussion in the previous chapter, researcher finally extends the conclusion that code-mixing in students daily conversation at English department of UKI Toraja based on the types of insertion. The dominant types of insertion used by the students in their daily conversation in mixing code, namely are: insertion of word, although the others such as insertion of phrase, insertion of word repetition and repetition of shape baster also available. From the conclusion above, the researcher found that one type of insertion was not available in all utterances among six extract that he observed and recorded that was insertion of idiom and in contrast, insertion of word become the dominant type which was used in students' daily conversation at English department of UKI Toraja. And in spite of mixing some other codes, the topic commonly was not changed during the conversation. Based on the researcher findings and discussion in the previous chapter, researcher finaly extends the conclusion that code-mixing in students daily conversation at English department of UKI Toraja based on the types of insertion. The dominant types of insertion used by the students in their daily conversation in mixing code, namely are: insertion of word, although the others such as insertion of phrase, insertion of word repetition and repetition of shape baster also available. From the conclusion above, the researcher found that one type of insertion was not available in all utterances among six extract that he observed and recorded that was insertion of idiom and in contrast, insertion of word become the dominant type which was used in students' daily conversation at English department of UKI Toraja. And in spite of mixing some other codes, the topic commonly was not changed during the conversation.

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relationship between the choice of language used and the correctness of answer given by the students (Appendix A). The rest of the questions indicated no relationship. This means that the concept on sexual reproduction has to be defined or described in English only, while either English or Filipino can be used in explaining the other biology concepts. This highlights the importance of careful and critical teaching of sex education (Oerton & Bowen, 2014; DepEd, 2018).

The most common reason for using English, Filipino, code-mixing and code-switching in defining/describing the 10 biology concepts was teacher factor. For those students whose preference to use was English, they said that most of their teachers in their grade school were "very proficient in English", thus, they tend to be proficient, too. For those who preferred to use Filipino, few students said that their grade school science teacher allowed them to answer in Filipino since they discuss science concepts in Filipino. Others said that "since our teachers consider our answers in Filipino, then we will always use this language." For students who answered using code-mixing, they said that their science teacher emphasized that if "we know how to use the English and Filipino languages, then it is alright to mix the languages." Similarly, for the use of code-switching, their teacher in grade school emphasized that code-switching is accepted in any learning situation, so we used it." Empirical research on the education production function traditionally has examined how teachers and their background characteristics contribute to students' learning (Hanushek & Rivkin, 2010). High-quality teachers are thought and expected to affect students' social and emotional development, deliver accurate content, and support critical thinking (Cohen 2011; Lampert, 2001; Pianta & Hamre, 2009). Blazar and Kraft (2016) highlighted the relationship between teaching practice and student learning of concepts as "teaching effects" and this must be the reason why the students in the study seemed to always remember what their teachers told them previously.

Another reason which is common to the use of English, Filipino, code-mixing and code-switching was familiarity with the language. For those who answered in English, few students said that they are more familiar to use English because "we speak English at home". Some students who answered in Filipino said that they are more familiar to use Filipino because "we use it every day." The students also said "we could not express completely in English so we use Filipino because we are more familiar with the language." Students who resorted to use code-mixing said that they are familiar to use this because it is very easy to use. Similarly, the familiarity of few students to use code-switching was due to the ease in using the said communication strategy. This finds support to the study of Machinyise (2019) who revealed that students become familiar to a local language as they apply it to real life situations which is a positive aspect for the promotion of student's learning. Likewise, Beka (2016) pointed out that familiarity with the language enables the students to become more confident in expressing what is in their minds.

CONCLUSION AND RECOMMENDATION

This study reveals that the incoming second year students' understanding of 10 biology concepts depended on how they answered in English or Filipino, and, using code-mixing and code-switching. Hence, whether it is English or Filipino or using code-mixing and code-switching, the students' understanding differed significantly in some, though not all, of the high school biology concepts presented in the study. It is believed that the language commonly used by the students is their choice in which they feel most comfortable. As the students found English as the common language and code-mixing as a common speech pattern used in defining or describing high school biology concepts, it is a challenge among science teachers to discuss

biology concepts in English or if the use of English complicates the understanding of the concepts, code-mixing may be used as an alternative. It is difficult, however, to impose the use of English in science teaching especially when some students become exposed to the Mother tongue or to the first language. In addition, the ability of the students to express their ideas in English seemed to occupy a significant position on the teachers' effective teaching.

Special concern should be given by the teachers when they discuss about sexual reproduction. The study indicates that only the English language is useful in explaining the concept of sexual reproduction. Because only the students' names, ages and type of school where graduated were documented as part of the survey, factors such as ethnic, social and cultural background are equally important to influence student preferences in using a specific language when they explain biology concepts. Therefore, for future studies, it is recommended to consider such factors.

REFERENCES

Asy'ari, Rodli (2009). A Descriptive Study on Indonesian-English Code-Mixing used in Islamic Printed Media. Retrieved from: http;//judul skripsi.html. (Accessed: January 31, 2013).

Ayeomoni, M. O. (2006). Code-switching and code-mixing: Style of use in childhood in Yoruba speech community.Nordic Journal of African Studies, 15(10),90-99.

Balce, Marina E. (2010). Teaching Quality Science Education in Filipino. *(Presented at the 1st Philippine Conference-Workshop on Mother Tongue-based Multilingual Education held at the Capitol University, Cagayan de Oro City, Philippines, on Feb .18-20, 2010.)*

Bautista, M. L.,& Tan, G. (1999). The Filipino bilingual: A multidisciplinary perspective. In A. A. Tagalog-English, The Filipino Bilingual: A Multidisciplinary.

Beka M. (2016). Mother Tongue as Medium of Instruction: Benefits and Challenges. International Journal of Innovative Languages, Literature and Art Studies, 4(1), 16-26.

Blazar, D & Kraft, MA. (2016). Teacher and Teaching Effects on Students' Attitudes and Behaviors. Educ Eval Policy Anal,39(1):146–170.

Borlongan, A. M. (2012). Reflecting on the Use of Code-Switching in Philippine Education Today. TESOL Journal, 7, 78-80.

Carale, L. R. & P.C. Campo. (2003). Concept Development in Filipino Children: The Circulatory System. National Institute for Science and Mathematics Education Development.

Cobb, Jeff. (2012), A Definition of Learning. Retrieved from http://www.missiontolearn.com/2009/05/definition-of-learning/.(Accessed:January 15, 2013).

Cohen DK. Teaching and its predicaments. Cambridge, MA: Harvard University Press; 2011.

Connelly, L.M (2009) Mixed Methods Studies. MEDSURG Nursing. Vol. 18, No.1

Cruz, I. "Mother Tongue Education (parts 1 and 2)." The Philippine Star. July 23 & 30, 2009. Retrieved from http://www.philstar.com/article.aspx?articleid=489283 and http://www.philstar.com/Article.aspx?articleId=491414&publicationSubCategoryId=442. (Accessed December15, 2013)

Department of Education. (2012). DepED No. 74 s. 2009. "Institutionalizing Mother Tongue-Based Multilingual Education (MLE). Department of Education. Republic of the Philippines.

Deuchar, Margaret. (2005). ISB4: Proceedings of the 4th International Symposium on

Bilingualism, ed. James Cohen, Kara T. McAlister, Kellie Rolstad, and Jeff MacSwan, 608-620. Somerville, MA: Cascadilla Press

Hanushek EA, Rivkin SG.(2010). Generalizations about using value-added measures of teacher quality. American Economic Review, 100(2), 267–271.

Hernandez, B. (2015). English proficiency as a competitive edge. Retrieved from: https://opinion.inquirer.net/86602/english-proficiency-as-a-competitive-edge#ixzz6cRldsWIV (Accessed: September 15, 2020)

Ginanti, E. (2017). Code Mixing and Code Switching Analysis in Filipino's Instagram Accounts Captions and Comments. Retrieved: https://core.ac.uk/download/pdf/162025179.pdf

Gocheco, P. M. (2013). Code-switching in Television-mediated Political Campaign Ads in the Philippines. Philippine ESL Journal, 10, 30-56.

Jones, C. (2000). The role of language in the learning and teaching of science, in M.Monk, and J. Osborne (eds).Good Practice in Science Teaching: What Research has to Say. Open University Press, Buckingham.

Johnson, R. B. & Onwuegbuzie, A. J.(2004). Mixed methods research: A research paradigm whose time has come. Educational Researcher, 33(7), 14-26.

Kampar, Koto. (2012). An Analysis of Code Mixing in Conversation of the Students at State

Junior High School. Retrieved from http://amsalalfarezh.blogspot.com/p/analysis-of-code-mixing-in-conversation.html. (Accessed: January 31, 2013).

Lampert M. Teaching problems and the problems of teaching. Yale University Press; 2001

Llaneta. Celeste Ann C. (2010).The Language of Learning: Mother Tongue-based Multilingual Education in the Philippines. The Forum. (11)2.

Leung, Chi-hong. (2010). Code-Mixing in Print Advertisement and its Cultural Implications in Hong Kong. European Journal of Social Sciences, 12(3).

Machinyise E (2019) The Impact of Familiar Local Language Medium of Instruction on zambian Primary School Pupils' Academic Performance: A Case Study of Mumbwa Primary Schools. Int J Fam Busi Manag 3(1): 1-3.

National Committee on Language and Translation (NCLT) and National Commission on Culture and the Arts (NCCA)..(2005). On the Filipino Language as a Language of Education. Retrieved from:

http://sentrofilipino.upd.edu.ph/programa_at_proyekto/download/uswagan_kartila_eng.pdf (Accessed:January 4, 2014).

Noordin, Mohidin Bin Haji and Bob CS. Yong (2009). Retrieved from: http://www.recsam.edu.my/cosmed%202013/cosmed09/AbstractsFullPapers2009/Abstract/Science%20Parallel%20PDF/Full%20Paper/S13.pdf (Accessed: January 18, 2013).

Nolasco, R.M. (2008).The Prospects of Multilingual Education and Literacy in the Philippines. Retrieved from: http://seameo.org/_ld2008/doucments/ Presentation document/pdf (Accessed: January 4, 2019).

Nolasco, R.M. (2009). 21 Reasons why Filipino children learn better while using their Mother Tongue. A PRIMER on Mother Tongue-based Multilingual Education (MLE) & Other Issues on Language and Learning in the Philippines. Retrieved from: mothertongue-based.blogspot.com/2009_01_01_archive.html (Accessed: January 4, 2014).

Onwuegbuzie, A.J & Leech, N.L (2005) The Qualitative Report Volume 11 Number 3 pp. 474-498.

Oyoo, S. O. (2015). Why language is so important in science teaching. Retrieved from: https://www.weforum.org/agenda/2015/06/why-language-is-so-important-in-science-teaching.

Oerton, S. & Bowen H. (2014). Key Issues in Sex Education: reflecting on teaching, learning and assessment. Journal of Sex Education, 14(6), 679-691. Pascasio E. M. (1996).

Dymanics in code switching in the business domain. In M. L. Bautista (Ed.), Readings in Philippine sociolinguistics.(pp. 76-87). Manila: De La Salle
University Press, Inc..

Pianta RC, Hamre BK. Conceptualization, measurement, and improvement of classroom processes: Standardized observation can leverage capacity. Educational Researcher. 2009;38(2):109–119.

Reyes, Risa L. (2010). Using Filipino in the Teaching of Science. (Presented at the 1st Philippine Conference-Workshop on Mother Tongue-based Multilingual Education held at the Capitol University, Cagayan de Oro City, Philippines, on Feb. 18-20, 2010.)

Riasati, Mohammad Javad and Pezhman Zare. (2010). Textbook Evaluation:EFL Teachers' Perspectives on "New Interchange". Studies in Literature and Language, 1(8), 54-60.

Ritchie, W. C and Tejk Bhatia. (2005). Social and Psychological Factors in Language Mixing. The Handbook of Bilingualism.

Sawikaan (2003). Filipinas Institute of Translation. "Primer on the Filipino Language as a Language of Instruction." Retrieved from: http://www.sawikaan.net/primer_on_the_filipino_language.html. (Accessed January 15, 2019).

Sudarsi,E. T. (2017).Code-Mixing Used By The Students In Daily Conversation. ICOEFLTR UKIT, 110-116.

Tang, Quian. (2010). Current Challenges in Basic Science Education. UNESCO. Education Sector.

Ugot, Mercy. (2010). Language Choice, Code-switching and Code-mixing in Biase. Global Journal of Humanities, 8(2),27-35.

UNESCO. (2007). Advocacy kit for promoting multilingual education: including the excluded. Bangkok:UNESCO Bangkok.

Williams, D. (2009). Words in science: all the words you need to know for KS3 and beyond, Histon, Small Words.

APPENDIX A

I. For the test of hypothesis about association of language used and correctness of the answer, either Chi-square test of association or Fisher's exact test will be used.

Condition: If more than 20% of the cells have expected frequency less than 5, do not use Chi-square, therefore use Fisher's Exact Test

Ho: The language being used for answering is not associated (not related) to whether the student will correctly explain the concept or not. **No association/**

Ha: The language being used for answering is associated (related) to whether the student will correctly explain the concept or not.

Decision Rule: If prob (Pr<=P) <0.05, reject Ho then accept Ha.

FOR Q1:

WARNING: 50% of the cells have expected counts less
than 5. Chi-Square may not be a valid test.

Fisher's Exact Test
ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
Table Probability (P) 0.0647
Pr <= P 0.8583

CONCLUSION: No association since 0.8583 >0.05

FOR Q2:

WARNING: 63% of the cells have expected counts less
than 5. Chi-Square may not be a valid test.

Fisher's Exact Test
ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
Table Probability (P) 0.2048
Pr <= P 0.7460

CONCLUSION: No association since 0.7460 >0.05

FOR Q3:

WARNING: 63% of the cells have expected counts less
than 5. Chi-Square may not be a valid test.

Fisher's Exact Test
ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
Table Probability (P) 0.1281
Pr <= P 0.5299

CONCLUSION: No association since 0.00002693 <0.05

FOR Q4:

WARNING: 63% of the cells have expected counts less
than 5. Chi-Square may not be a valid test.

Fisher's Exact Test
ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
Table Probability (P) 0.0761
Pr <= P 0.6409

CONCLUSION: No association since 0.6409 >0.05

FOR Q5:

WARNING: 75% of the cells have expected counts less
than 5. Chi-Square may not be a valid test.

Fisher's Exact Test
ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
Table Probability (P) 0.0138
Pr <= P 0.0462

CONCLUSION: Language and ability to correctly explain are related since 0.0462 <0.05

To determine the strength of relationship, we need to compute for a measure of degree of association.

Phi Coefficient 0.5004

Interpretation: There is a moderate relationship between language used by the student in correctly explaining the concept asked.

FOR Q6:

WARNING: 50% of the cells have expected counts less
than 5. Chi-Square may not be a valid test.

Fisher's Exact Test
ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
Table Probability (P) 0.0888
Pr <= P 0.7975

CONCLUSION: No association since 0.7975 >0.05

FOR Q7:

WARNING: 63% of the cells have expected counts less than 5. Chi-Square may not be a valid test.

Fisher's Exact Test
ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
Table Probability (P) 0.1202
Pr <= P 0.5138

CONCLUSION: No association since 0.5183 >0.05

FOR Q8:

WARNING: 63% of the cells have expected counts less than 5. Chi-Square may not be a valid test.

Fisher's Exact Test
ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
Table Probability (P) 0.3584
Pr <= P 0.5800

CONCLUSION: No association since 0.5800 >0.05

FOR Q9:

WARNING: 67% of the cells have expected counts less than 5. Chi-Square may not be a valid test.

Fisher's Exact Test
ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
Table Probability (P) 0.2725
Pr <= P 0.3332

CONCLUSION: No association since 0.3332 >0.05

FOR Q10:

WARNING: 50% of the cells have expected counts less than 5. Chi-Square may not be a valid test.

Fisher's Exact Test
ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
Table Probability (P) 0.0144
Pr <= P 0.2024

CONCLUSION: No association since 0.2024 >0.05

II. Test of hypotheses to determine association between the correctness of answer and language used.

Ho: The language being used for answering is not associated (not related) to whether the student will correctly explain the concept or not.

Ha: The language being used for answering is associated (related) to whether the student will correctly explain the concept or not.

III. Test of Hypothesis for two-population proportions using independent samples on language used:

Ho: $P_1 = P_2$;The proportion of students who correctly defined/described the concept using English is equal to the
proportion of students who correctly defined /described the concept using Filipino.

Ha: $P_1 \neq P_2$; The proportion of students who correctly defined/described the concept using English is greater than
the proportion of students who correctly defined /described the concept using Filipino.

$$Z_c = \frac{p_1 - p_2}{\sqrt{\frac{p_1(1-p_1)}{n_1} + \frac{p_2(1-p_2)}{n_2}}}$$

Test Procedure: Z-test Test Statistic Formula:

Decision Rule: Reject Ho if $|Z_c| > 1.645$; otherwise, fail to reject Ho.

Computations:

Concept	Language Used		Test Statistic Value	Conclusion
	English	Filipino		
1. Homeostasis	0.89	0.5	1.113654202	No difference
2. Autotrophs	0.95	1	-1.773460259	Different
3. Cell division	0.97	0	49.49242366	No conclusion
4. Replication	0.90	1	-2.793434926	Different
5. Sexual reproduction	0.95	1	-2.049390153	Different
6. Diversity	0.83	1	-4.103727538	Different
7. Evolution	0.85	1	-3.905551604	Different
8. Inheritance	0.99	1	-1.006153904	No difference
9. Fertilization	0.99	0	85.498538	No conclusion
10. Mutation	0.83	0	18.16590212	No conclusion

IV. Test of Hypothesis for two-population proportions using independent samples on code-switching and code-mixing:

Ho: $P_1 = P_2$;The proportion of students who correctly defined/described the concept using code-mixing is equal to
the proportion of students who correctly defined /described the concept using code-switching.

Ha: $P_1 \neq P_2$; The proportion of students who correctly defined/described the concept using code-mixing is different
from the proportion of students who correctly defined /described the concept using code-switching.

$$Z_c = \frac{p_1 - p_2}{\sqrt{\frac{p_1(1-p_1)}{n_1} + \frac{p_2(1-p_2)}{n_2}}}$$

Test Procedure: Z-test Test Statistic Formula:

Decision Rule: Reject Ho if $|Z_c| > 1.645$; otherwise, fail to reject Ho.

Computations:

Concept	Code		Test Statistic Value	Conclusion
	Mixing	Switching		
1. Homeostasis	0.90	1	-1.054092553	No difference
2. Autotrophs	0.83	1	-1.567747213	No difference
3. Cell division	1.00	0	NA	No conclusion
4. Replication	0.91	1	-1.475067516	No difference
5. Sexual reproduction	1.00	0	NA	No conclusion
6. Diversity	0.88	1	-1.809068067	Different
7. Evolution	0.82	1	-1.931762749	Different
8. Inheritance	0.96	1	-1.040833	No difference
9. Fertilization	1.00	0	NA	No conclusion
10. Mutation	0.74	0	8.766193806	Different