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Filipino Students' Common Misconceptions in Biology: Input for Remedial Teaching

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ABSTRACT
Misconceptions are threats that impede successful learning of scientific concepts and phenomena. Correcting the students' misconceptions can lead to the development of inquisitive and scientific-minded students. This descriptive-survey research reports the common misconceptions in Biology among Filipino junior high school students in a public secondary school in Zambales, Philippines as an input in crafting a remedial teaching program. The study utilized a validated researcher-made tool which was answered by a total of 100 The Grade 10 students. The study revealed that the level of the misconception of students is high in genetics (55.00%); and moderate in ecology (43.50%), botany (44.10%), and zoology (38.30%). The crafted remedial teaching program contains suggested pedagogical techniques to correct students' misconceptions. The study recommends that Science teachers may gauge the prior understanding of the students in the important concepts in biology during the teaching-learning process so they can check the students' misconceptions and strengthen their conceptual understanding through fun and innovative approaches. Teachers may likewise integrate the proposed remedial teaching program in the actual delivery of the lesson or may conduct after-class remediation to the students who have held misconceptions in important concepts in biology. Future researchers may consider students from other grade levels as respondents in a parallel study which may also include other areas of biology.
Keywords: biology misconceptions, alternative conceptions, remedial teaching program, descriptive-survey research, science education

Filipinli Öğrencilerin Biyolojideki Yaygın Kavram Yanılgıları: Alternatif Öğretim İçin Girdiler

ÖZET
Kavram yanılgıları, bilimsel kavram ve olayların başarılı bir şekilde öğrenilmesini engelleyen tehditlerdir. Öğrencilerin yanlış anlamalarını düzeltme, meraklı ve bilimsel düşünen öğrencilerin gelişimine yol açabilir. Bu betimsel tarama araştırması, Filipinler'deki Zambales eyaletindeki bir devlet okulunda Filipinli ortaokul öğrencileri arasında, iyileştirici bir öğretim programının hazırlanmasında bir girdi olarak, Biyoloji'deki yaygın kavram yanılgılarını bildirmektedir. Çalışmada, toplam 100 10. sınıf öğrencisi tarafından cevaplandırılmış bir araç kullanılmıştır. Araştırma, öğrencilerin yanlış anlama seviyelerinin genetik konularında yüksek (% 55,00) ve ekoloji (% 43.50), botanik (% 44.10) ve zooloji (% 38.30) konularında orta düzeyde olduğunu ortaya koydu. Hazırlanmış düzeltici öğretim programı, öğrencilerin kavram yanılgılarını gidermek için önerilen pedagojik teknikleri içermektedir. Çalışma, Fen Bilgisi öğretmenlerinin, öğretme-öğrenme sürecinde biyolojideki önemli kavramlardaki öğrencilerin önceki anlayışlarını ölçebilmelerini, böylece öğrencilerin kavram yanılgılarını kontrol edebilmelerini ve eğlenceli ve yenilikçi yaklaşımlarla kavramsal anlamalarını güçlendirmelerini önerir. Öğretmenler de önerilen düzeltici öğretim programını dersin fiili teslimine entegre edebilir veya biyoloji ile ilgili önemli kavramlarda kavram yanılgısı olan öğrencilere ders sonrası düzeltme yapabilir. Diğer biyoloji alanlarını da içerebilecek paralel bir çalışmada yeni araştırmacılar için düşünebilirler.
Anahtar Kelimeler: Biyoloji kavram yanılgıları, alternatif kavramlar, iyileştirici öğretim programı, betimsel araştırma araştırması, fen eğitimi.

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INTRODUCTION

In a similar way that physics and chemistry vigorously influenced the course of civilization during the past centuries, it is now increasingly accepted that the 21st century is the turn of the science of biology (Javier as cited in Raymundo, 2008). Biology-driven technological advancements are significantly changing the manner by which people goes about its many concerns. Further, as Education 4.0 comes in, pedagogical practices of teachers must adapt to the changing educational landscape. However, several problems continue to hamper the advancement of biology education in the different parts of the globe. Concept learning in biology education is essential in increasing students' scientific literacy. As a matter of fact, several studies found out that out of all courses in science, biology is the most interesting among students (Baram-Tsabari & Yarden, 2005; Prokop, Tuncer, & Chuda, 2007; Sarwar, Naz, & Noreen, 2011). Hence, teachers have critical roles to play in teaching biology concepts among students, correcting their alternate conceptions and strengthening their conceptual knowledge and understanding.

Students' misconceptions are one of the problems which continue to beset the students' learning in science specifically in Biology. Misconceptions are threats that impede successful learning of scientific concepts and phenomena. A misconception is defined as an individual's discernment of occurrences happening in the mundane world which is not consistent with the scientific elucidation of the phenomena (Modell, Michael & Wenderoth 2005, p. 20). The students' misconceptions and alternative conceptions must be addressed immediately so that it will not be extended. As stressed by Eshach (2014), identifying prior knowledge and misconceptions is an indispensable pace in the instructional process that that may empower educators to structure viable learning situations that help reshape students' prior understanding into scientifically accepted understanding. The content should be mastered through innovative strategies, otherwise, the issues concerning the perpetuity of information will occur (Kinchin, David & Adams, 2000).

In the Philippines, errors and misconceptions have been found in some elementary science reference materials (Raymundo, 2008). A non-science teacher most likely cannot correct these misconceptions and thus, errors are proliferated. Philippines lags behind other countries as far as the quality of science education is concerned. According to the World Economic Forum (WEF, 2018) Global Competitiveness Report (2017-2018), the Philippines positioned 55th out of 137 participating countries in terms of higher education. Specifically, the country ranked 76th out of 137 countries in the quality of math and science education.

Several studies in students' misconceptions in biology have been done in several parts of the world. As cited in the study of Kumandas, Ateskan & Lane (2018), previous studies focused on the content and complexity of biological concepts (e.g., Bennett 2003; Brown & Schwartz 2009; Rotbain, Marbach-Ad, & Stavy 2008; Sesli & Kara 2012), strategies to identify misconceptions in biology (e.g., Kinchin, 2000; Liu & Lee, 2013; Pugh, Koskey, & Linnenbrink-Garcia, 2014), addressing and changing student alternative biology conceptions (e.g., Duit & Treagust, 2003; Kubisch & Heyne, 2016; Lucero & Petrosino, 2017).

A myriad of studies noted that educators may have misguided judgments that can be the reason for students' alternative conceptions (Larkin, 2012). When these misconceptions make perfect sense to students they are principally hard to change or shed (Allen, 2010). Hence, teachers are essential drivers in correcting students' misconceptions and addressing their alternative conceptions. A dearth of literature in Filipino students' misconceptions specifically in biology prompted the conduct of the study.

The Purpose of Study

To remediate appropriately the misconceptions of the students, the researcher explored the common misconceptions in Biology in the different areas in Biology including ecology, botany, zoology and genetics among science students of a government-run secondary school in Zambales, Philippines (Figure 1).

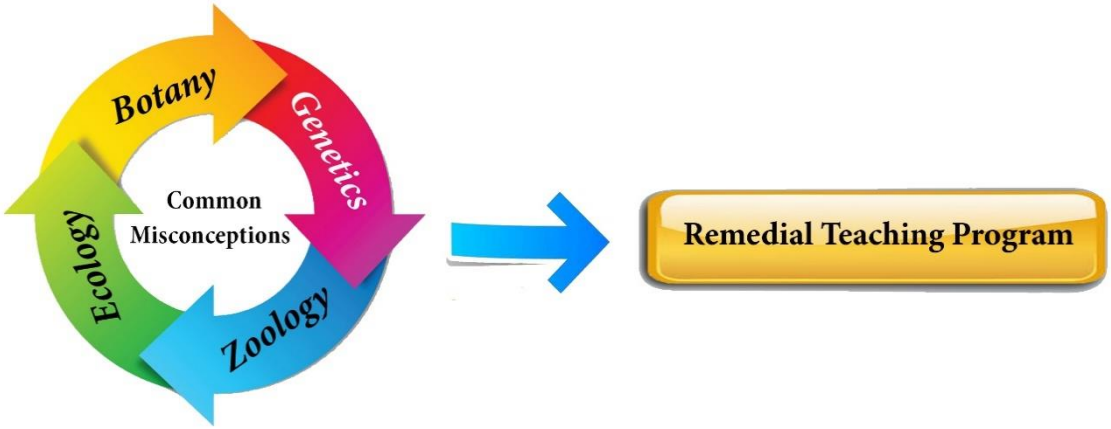

Figure 1. *Diagrammatical framework of the study*

Figure 1 shows the four subfields of biology included in the study, ecology, botany, genetics and zoology. The common misconceptions in these areas were determined among the junior high school students. The misconceptions posed by the students served as the baseline data to craft the proposed remedial teaching program with the use of innovative and engaging pedagogical strategies.

METHOD

Study Design

This study is descriptive-survey research that used a survey questionnaire as a primary data gathering tool. The study described the common misconception of Filipino students in biology along four different fields – ecology, botany, zoology, and genetics.

Study Group/Participants

The study involved 100 Grade 10 students of a public secondary school located in Subic, Zambales, Philippines. The study used a multi-stage sampling technique wherein the researcher selected 5 sections using any other probability sampling and choose 10 students per sections using simple random sampling.

Research Instrument

In order to gather reliable and valid data to determine the common misconceptions in Science among the Grade 10 students, the researcher used a survey questionnaire. The concepts were lifted from books, online lecture, and PowerPoint slides. Part 1 is the demographic profile of the students which includes age, sex, grade level and grade in science. Part 2 is comprised of true-false questions in the different areas in biology which includes ecology (10 items), botany (10 items), zoology (10 items) and genetics (10 items). The wrong answer to each question poses a misconception.

Data Collection

The development and validation of the misconception questionnaire were made prior to data collection. The survey tool was content validated by three experts in science education. After some revisions made, the researchers pilot-tested the tool for reliability. The instrument obtained a coefficient of 0.87 which indicates high reliability. Afterwards, the researchers secured approval from the school principal to conduct the study. Parental consent and participants' assent were likewise secured to ensure the protection of the Grade 10 respondents since they are minors (below 18 years old). Participants were given 15 to 20 minutes to answer. Then, the researchers collected the survey questionnaires afterwards. The study took place from November 2016 to January 2017 in a secondary school in Zambales, Philippines.

Data Analysis

The researchers employed descriptive statistics which include mean and percent to analyze the data. The data were coded and analyzed using the Statistical Package for Social Sciences (SPSS) version 22.

The percent of misconception (MC) is analyzed using the percent analysis (Table 1).

Table 1. *Interpretation of the percent of misconception*

Percent Range	Verbal Description (VD)
75.50 – 100.0	High Misconception (VHM)
50.50 – 75.49	High Misconception (HM)
25.50 – 50.49	Moderate Misconception (MM)
1.00 – 25.49	Low Misconception (LM)

Every wrong answer in the question poses a misconception. The total wrong answers in each set are divided into the total number of items (n=10) multiplied by 100. The corresponding percent was referred to the table for analysis.

RESULTS AND DISCUSSION

The study determined the common misconceptions of Science students in the field of biology as a basis for remediation teaching. The results are shown in tables and narratives to show the level of misconceptions of Grade 10 students in biology comprising the four subfields which include ecology, botany, zoology, and genetics.

Misconception in Ecology

Table 2 shows the students' level of misconception in the area of ecology. As gleaned from the table, students have moderate misconceptions in ecology as revealed by the overall percent of the misconception of 43.50%. In particular, students have a high misconception in the concept of species coexistence in the ecosystem (71.00%), decomposers' role in the ecosystem (64.00%), and prey and predator population sizes (63.00%). The rest of the concepts were found to be in moderate misconception while only the concept of the ecosystem was found to be in low misconception (23.00%).

This implies that the junior high school students are facing moderate difficulty in understanding the concepts of coexistence in the ecosystem including the concept of symbiosis or living together. Moreover, it is quite hard for the students to understand the important role of decomposers in the cycle of life as well as the bearing of the relative sizes of predators and prey that interact in the ecological sphere. Teaching these important concepts will enable students to better understand the ecosphere and eventually do something about its protection

and conservation. Rogayan (2019) stressed that the environmental stewardship must be developed in every student for them to contribute positively in the resolution of some, if not all, ecological dilemmas.

Table 2. *Respondents' level of misconception in ecology*

Concept	% of MC	VD	Rank
1. Plants have a range of defenses including external structures (sap, hairs, thorns, wax) and chemicals that either reduce digestibility or are toxic. (T)	32.00	MM	7
2. There are more herbivores than carnivores because of the decreasing amount of energy available at each level of the food web. (T)	49.00	MM	4
3. Food chains involve predator and prey, but not producers. (F)	29.00	MM	8
4. Decomposers release some energy that is cycled back to plants. (F)	64.00	HM	2
5. While some carnivores may be larger and require more food than some herbivores, they do not have more energy or power.(T)	37.00	MM	6
6. Varying the population size of a species may not affect an ecosystem because some organisms are not important.(F)	40.00	MM	5
7. Ecosystems include not just the organisms but also the interactions between organisms and between the organisms and their physical environment.(T)	23.00	LM	10
8. Species coexist in ecosystems because of their compatible needs and behaviors; they need to get along.(F)	71.00	HM	1
9. The relative sizes of predator and prey populations have no bearing on the size of the other.(F)	63.00	HM	3
10. Producers are an essential part of all food chains and webs.(T)	27.00	MM	9
Overall	**43.50**	**MM**	

Legend: VD-Verbal Description; MC-Misconception; T-True; F-False; VHM - Very High Misconception; HM-High Misconception; MM-Moderate Misconception; Low Misconception

Furthermore, Munson (1994) strengthened that there are several misconceptions in key ecological concepts. He infers that this discipline is fundamentally essential to ecology educators and researchers. Additionally, Sunggod (2016) reported that the use of intervention can lead to a better comprehension of biological concepts, particularly in ecology, taxonomy, and evolution. Rogayan & Nebrida (2019) pointed out that the schools must serve as the learning habitats of the students which can develop them to become stewards of the environment.

The results conform with several studies which stressed that misconceptions in ecological concepts are observed among biology students and pre-service teachers (Butler, Mooney Simmie, & O'Grady, 2015), science preservice teachers (Cardak, & Dikmenli, 2016), and in all levels of learning (Toman, 2018).

Misconception in Botany

Table 3 shows the students' level of misconception in the area of botany. As reflected from the table, the students registered moderate misconception in the field of botany based on the overall percent of the misconception of 44.10%. Interestingly, students have high misconceptions in the concepts of the role of chloroplast in photosynthesis (72.00%), oxygen intake and carbon dioxide release of plants (67.00%), plant as a living organism (63.00%), and plant's source of energy (54.00%).

Table 3. *Respondents' level of misconception in botany*

	Concept	% of MC	VD	Rank
1.	Plants take in air through their leaves.(T)	19.00	LM	9
2.	Plants get their energy from the soil through roots.(F)	54.00	HM	4
3.	Sunlight helps plants grow by keeping them warm.(T)	28.00	MM	8
4.	Some plants grow in soil-free environments. Plants take up water and minerals from the soil, but not "food."(T)	40.00	MM	6
5.	While people often care for plants (especially those indoors), plants as a whole are not dependent on people for their needs.(T)	33.00	MM	7
6.	Plants need "plant food" to eat.(F)	48.00	MM	5
7.	Plants breathe by inhaling carbon dioxide and exhaling oxygen.(F)	67.00	HM	2
8.	Energy from the sun allows the plant to carry out photosynthesis and produce sugars. Respiration breaks down these products and provides energy for the plant.(T)	17.00	LM	10
9.	Chloroplasts in the plant absorb the sun's energy for use in photosynthesis.(T)	72.00	HM	1
10.	Plants are not alive.(F)	63.00	HM	3
	Overall	**44.10**	**MM**	

Legend: VD-Verbal Description; MC-Misconception; T-True; F-False; VHM - Very High Misconception; HM-High Misconception; MM-Moderate Misconception; Low Misconception

This connotes that the biology students face slight difficulty in grasping the ideas of the primary role of chloroplasts which is to absorb sun's energy for use in photosynthetic process. Additionally, students think that plants really breathe but they actualy don't. Plants absorb and release gases through the stomatates or small pores in the leaves. Students also seem to think that plants are not alive like humans. This may be attributed to their hazy concept of the characteristics of life. Notably, students also have misconceptions that pant energy are obtained from the soil. Althopugh water and minerals are taken in through the roots, chloroplasts in the plant absorb the sun's energy for photosynthesis.

According to Hershey (2004), an alternate conception about plants in reading material, online platform, science book, journal article, or curriculum map can possibly misdirect a huge number of instructors and students. Teachers often cannot detect even glaring errors in light of the fact that new educators from collegiate institutions are inadequately prepared in basic botany.

Further, the findings conform with the study of Wynn, Pan, Rueschhoff, Herman, and Archer (2017) which analyzed the students' misconceptions in plant biology specifically photosynthesis, cellular respiration and alternate conceptions associated to plant nourishment, which fundamentally covers to some extent with photosynthesis.

Goldberg and Thompson-Schill (2009) have contended that the early perceptions of learners about living organisms establish a foundation which later teaching cannot remove, and which continues to impact how they perceive plants as adults.

Misconception in Zoology

Table 4 shows the level of students' misconceptions in zoology. As shown, students gained an overall percent of the misconception of 38.30% which is interpreted as a moderate misconception. The concepts of respiratory system discovery (65.00%), and the number of bones in the human body (65.00%) gained the highest misconception. The other concepts obtained low to moderate misconceptions. Notably, students have a low misconception in the concept of protein as body builders (22.00%), citrus fruit as a source of Vitamin C (22.00%) and ostrich as the largest living bird (21.00%).

Table 4. *Respondents' level of misconception in zoology*

Concept	% of MC	VD	Rank
1. Largest known vertebrate is whale. (T)	27.00	MM	7
2. Proteins are body builders. (T)	22.00	LM	8.5
3. William Harvey discovered the respiratory system of a man. (F)	65.00	HM	1.5
4. Ostrich is the largest living bird. (T)	21.00	LM	10
5. Ornithology is the study of fishes. (F)	50.00	MM	3
6. There are 235 bones in the adult human body. (F)	65.00	HM	1.5
7. The book origin of life was written by Charles Darwin.(T)	30.00	MM	6
8. Snake venom is used as medicine.(T)	33.00	MM	5
9. Citrus fruits are the source of vitamin C.(T)	22.00	LM	8.5
10. In man, the average weight of the heart is about 310 grams. (T)	48.00	MM	4
Overall	**38.30**	**MM**	

Legend: VD-Verbal Description; MC-Misconception; T-True; F-False; VHM - Very High Misconception; HM-High Misconception; MM-Moderate Misconception; Low Misconception

This implies that the high school students are having a hard time mastering the idea that William Harvey is attributed for the blood circulation discovery and not the respiratory system. Likewise, some students think that adult human body has 235 bones where in fact it has 206.

The results of the research conform to several studies (Mintzes, Trowbridge, Arnaudin, & Wandersee, 1991; Driver, Squires, Rushworth, & Wood-Robinson, 1994) that students' misconceptions are usually identified in fundamental biology concepts which are encountered by learners in real-world contexts prior to formal teaching, for example, the idea of living things, as well as understanding of animals and plants.

Misconception in Genetics

Table 4 shows the misconception level of students in genetics.

Table 5. *Respondents' level of misconception in genetics*

Concept	% of MC	VD	Rank
1. Genes are the sole determinants of traits. (F)	77.00	HM	1
2. Single genes code for most traits.(F)	59.00	HM	4
3. Dominant traits are the most common traits in a population. (F)	76.00	HM	2
4. The limiting factor to getting genetic information is the speed and/or cost of genome sequencing. (T)	28.00	MM	10
5. All mutations are harmful. (F)	49.00	MM	6
6. Once a mutation is discovered, it cannot be "fixed". (T)	43.00	MM	8.5
7. All genetic tests are not equally reliable and precise.(T)	43.00	MM	8.5
8. Only certain people have "disease genes". (F)	53.00	HM	5
9. If a couple has a "one-in-four" risk of having a child with a disease, and their firstborn has the disease, the next three children will have a reduced risk. (F)	66.00	HM	3
10. Only genetically modified food crops have genes. (F)	44.00	MM	7
Overall	**55.00**	**HM**	

Legend: VD-Verbal Description; MC-Misconception; T-True; F-False; VHM - Very High Misconception; HM-High Misconception; MM-Moderate Misconception; Low Misconception

It can be noted that the students registered a high misconception in genetics as revealed by the overall percent of the misconception of 55.00%. Specifically, students gained high misconceptions in the concept of genes as sole determinants of traits (77.00%), most common traits in a population (76.00%), probability of reduced risk in offsprings (66.00%), genes coding for most traits (59.00%) and the occurrence of "disease gene" among humans (53.00%).

This suggests that the students have the highest misconceptions in genetics. Genes are generally not the only determinants of traits which most students fail to grasp. Also, most traits are influenced both by genetic and enviornmental factors which counter the concept that the genes are the single detrminants of traits. Additionally, a dominant trait does not always mean it is the most popular in the population. The misconception in the use of punnett square is also noted among the students. Likewise, students fail to understand that multiple genes, not just a single gene, determine most traits in human genes, as well as the concept that all people have genetic diseases caused by mutations in genes.

A number of investigations conducted which reveal that students neglect to basically comprehend concepts in genetics and heredity taught by the teacher and this lack of understanding leads to an incapacity to apply fundamental knowledge to their everyday lives (Lewis & Wood Robinson, 2000; Lewis & Kattmann, 2004).

In addition, students can pose alternate conceptions about biological functions in genetics which include mitosis, meiosis, mutations (Kumandas et al, 2018) and to more advanced themes and new technologies like the fields of genetic engineering and bioinformatics (Tekkaya, Ozkan, & Sungur, 2001).

Table 6 summarizes the students' misconception level among the four fields of biology.

Table 6. *Summary of the respondent' level of misconceptions in biology*

Subfield	% of MC	VD	Rank
Ecology	43.50	Moderate Misconception	3
Botany	44.10	Moderate Misconception	2
Zoology	38.30	Moderate Misconception	4
Genetics	55.00	High Misconception	1

As shown, genetics got the highest overall percent of misconception in the areas of biology with 55.00% interpreted as a high misconception. It is followed by botany (44.10%), ecology (43.50%) and zoology (38.30%) which are all interpreted as a moderate misconception. It can be inferred that students find difficulties in some of the concepts in the four areas in biology most specifically in genetics. Asshoff and Hammann (2008) found that students' misconceptions in genetics, heredity, as well as ecology, are the most common picture in the previous studies.

Addressing students' misconception is a critical responsibility by the teacher. Failure to correct the misconception and alternative conception may aggravate the problem in learning a specific area such as biology. Furthermore, the use of innovative pedagogical tools and techniques may lead to an easier understanding of difficult concepts specifically in genetics and botany.

Remedial Teaching Plan to Correct Students' Misconceptions

The results of the survey guided the researchers to come up with a proposed remedial teaching program (See Appendix A). The program may be infused by the teacher in the actual learning process and/or be conducted after the regular class hours for at least 30 minutes to 1 hour per competency.

Table 7 shows the different remediation strategies included in the remedial teaching program.

Table 7. *Remediation strategies included in the remedial teaching program*

Remediation Strategies	Brief Description of the Strategy
Biodive Gallery Walk	Students will walk through the photo gallery about coexistence in the ecosystem.
Bee-buzz session	Allows students to engage in a short engaging sessions that are built into a larger group exercise to stimulate discussion and provide student feedback.
Smart Graphic Organizer	Students will create an electronic visual display that demonstrates relationships between facts, concepts or ideas in science using PowerPoint.
Virtual Laboratory	Students will engage in an interactive environment for creating and conducting simulated experiments.
Eco-video Making	Allows students to create a short video or film about environmental concepts.
Science Skit	Students are given the opportunity to immediately apply science content as they are put in a short dramatic performance.
Energy Pyramid Model Making	Allows students to create an energy pyramid model which depicts various animals in the different trophic levels.
Forming Fauna	Students classify or categorize animal pictures into desired grouping or phylum.
Video clip showing	Allows students to watch a short motion picture or film related to science then share their reflections and insights afterwards.
Virtual simulation	Students are exposed to the use of 3D objects and digital environment to create immersive and engaging learning experiences.
Mini Labwork	Students are given the chance to design simple experiments related to the topic.
Science Poster Making	Allows students to showcase their creativity through poster creation.
Facebook Profile Generator	Students are tasked to design a Facebook profile of a certain scientist or philosopher using a Facebook template and factsheet given.
Sketch-and-Label	Allows students to visually describe a certain body system and label its parts.
Science Electronic flashcard	Refers to a game-based strategy which involves the use of electronic flashcards that bear information related to science used as a classroom drill.
Detective Gene	A game-based strategy which allows students to solve a mystery about genetics and heredity.
Punnett Square Game	Allows student to accomplish a Punnett square and solve the mystery questions.
Science Jingle	Students are given the opportunity to compose a science jingle and perform it in front of the class.

The 18 strategies above can be directly implemeneted or may be customized by the Science teachers to correct students' misconceptions. Careful implementation of each instructional technique must be observed to really strengthen students' conceptual understanding.

CONCLUSIONS AND RECOMMENDATIONS

The study found out the common misconceptions of junior high school students in biology. The study found out that that the level of the misconception of students is moderate in zoology, ecology, and botany, while high misconception was found in genetics. This concludes that genetics has the highest misconception and alternative conception among the areas of biology. Further, this connotes that misconceptions are present in almost all areas of biology. Hence, the researchers crafted the proposed remedial teaching program which comprises of various suggested pedagogical strategies in order to correct the students' misconceptions. The 18 innovative, engaging and student-centered remediation strategies may be infused to remediate students' alternative conceptions.

The present study has important implications in pedagogical practices of teachers in the junior high school. The teachers have critical roles in correcting students' misconceptions in biology through the use of varied instructional practices. Checking the students' alternate conceptions is a critical way to better further the students' scientific literacy. Moreover, deepening students' conceptual understanding may be established with the use of a more student-centered, innovative, collaborative and inquiry-based pedagogical techniques. The proposed strategies may serve as springboard for the teachers to customize other pedagogical strategies in enhancing students' conceptual knowledge and understanding.

In light of the findings and conclusions drawn from the study, the following research possibilities are recommended: First, Science teachers can gauge the prior understanding of the students in the important concepts in Science during the teaching-learning process so they can check the misconceptions and strengthen the students' conceptual understanding through fun and innovative approaches. Teachers may likewise integrate the proposed remedial teaching program in the actual delivery of the lesson or may conduct after-class remediation to the students who have held misconception in important concepts in Science.

Since the study is limited only with four major fields of Biology – botany, zoology, ecology, and genetics, it is recommended that other areas in biology may be included to explore students' misconceptions. Moreover, since Grade 10 students were involved in the study, it is recommended that other grade levels in the junior and senior high school may be included for more valid results. Another limitation of the study is the nature of the questions which are binary in response, it is likewise recommended that qualitative method be used in further study.

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Appendix A
Proposed Remedial Teaching Plan to Correct Students' Misconceptions

Misconception	Learning Content	Learning Outcome/s	Remediation Strategies
Ecology			
Species coexist in ecosystems because of their compatible needs and behaviours; they need to get along.	Biodiversity	Describe the relationship of different organism in an environment	Biodive Gallery Walk Bee-buzz session
Decomposers release some energy that is cycled back to plants.	Food Chain and Food Web	Distinguish the role of organisms in the flow of energy.	Smart graphic organizer Virtual Laboratory
The relative sizes of predator and prey populations have no bearing on the size of the other.	Ecological relationships	Infer that the sizes of predator and prey populations influence each other.	Eco-video Making Science Skit
There are more herbivores than carnivores because of the decreasing amount of energy available at each level of the food web.	Classification of Animals	Sort and classify the different animals based on what they eat.	Energy Pyramid Model Making Forming Fauna
Varying the population size of a species may not affect an ecosystem because some organisms are not important.	Ecosystem	Determine the importance of organisms in an ecosystem	Video clip showing Science Skit
Botany			
Chloroplasts in the plant absorb the sun's energy for use in photosynthesis.	Photosynthesis	Identify the plant parts and organelles involved in photosynthesis	Video clip showing Virtual simulation
Plants breathe by inhaling carbon dioxide and exhaling oxygen.	Photosynthesis	Explain the process of photosynthesis	Virtual simulation Mini Labwork
Plants are not alive.	Photosynthesis	Explain that plants are living organism.	Eco-video Making
Plants get their energy from the soil through roots	Food Chain and Food Web Photosynthesis	Determine where the plants get its energy.	Video clip showing Science Poster making
Plants need "plant food" to eat.	Photosynthesis	Explain the process of photosynthesis	Virtual simulation Smart graphic organizer
Zoology			
William Harvey discovered the respiratory system of a man	Respiratory System	Identify who discovered the respiratory system	Facebook Profile Generator
There are 235 bones in human body	Human Anatomy	Discover the internal framework of our body	Sketch-and-Label Video clip showing
Ornithology is the study of fishes	Ecosystem	List down the different branches of zoology	Science Electronic flashcard

In man average weight of heart is about 310 grams	Circulatory System	Determine the size and weight of man's heart	Video clip showing Sketch-and-Label
Snake venom is used as medicine	Reptiles	Explain the use of animal venom	Film Viewing Video presentation
Genetics			
Genes are the sole determinants of traits	Heredity: Inheritance and Variation of Traits	Explain that traits are influenced by both heredity and environment	Virtual simulation Mini Labwork
Dominant traits are the most common traits in a population	Heredity: Inheritance and Variation of Traits	Distinguish dominant from recessive trait	Detective Gene Smart graphic organizer
If a couple has a "one-in-four" risk of having a child with a disease, and their firstborn has the disease, the next three children will have a reduced risk.	Heredity: Inheritance and Variation of Traits	Predict phenotypic expressions of traits following simple patterns of inheritance	Punnett Square Game
Single genes code for most traits	Heredity: Inheritance and Variation of Traits	Explain that multiple genes are code for most traits	Detective Gene Mini Labwork
Only genetically modified food crops have genes	Heredity: Inheritance and Variation of Traits	Infer that all food crops, whether genetically modified or not, have genes.	Video clip showing Science Jingle