

What are the Effects of Traditional Teaching Methods versus the Extended Teaching
Methods on the Acquisition of 8th Grade Science Content Vocabulary?

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Abstract

The purpose of this study is to examine the effectiveness of teaching science content vocabulary in a classroom setting by using various teaching methods. The students were provided with a list of the vocabulary words. The students were then paired off into groups of two to three students each in order to collectively define the science content vocabulary words. All the vocabulary words were defined using the standard teaching method, in which students define each word in their own words using a science text (BCPS Science Curriculum) or an internet source as a resource. A pretest (standard multiple-choice content vocabulary test) was administered to the entire class. Following the pretest, the class was divided into random groups for a second time. The class divided the vocabulary words into three types; those vocabulary words that could be clearly defined into a Greek/Latin prefix and/or suffix, and by those that would be defined by word origin. In this way the pretest would show the results of using the 'standard method' of teaching science content vocabulary, and the posttest would show the 'enhanced vocabulary method' or using the Greek/Latin prefix and/or suffix and by additionally defining vocabulary words by word origin. After the data was collected and analyzed from the students' summative assessment scores on their pretest and posttest, the null hypothesis was rejected due to the fact the $p\text{-value} = 00.0 < 0.05$, which indicated a statistical significance within the data. Lastly, due to both internal and external errors in terms of testing validity, it is recommended that this study be repeated to validate results.

CHAPTER I

INTRODUCTION

Overview

If a student is to be proficient within a specific educational discipline, the clear development and acquisition of specific content vocabulary is essential for academic success. According to researchers, one of the most important components in the development of strong reading comprehension is the understanding and correct usage of content vocabulary. It has also been shown that having a strong vocabulary will not only improve a students' reading comprehension, but also their fluency in writing and flow of thought, their listening skills, and overall speech as well (Weiser, 2013). Therefore, most importantly, if the above statements have been found to be true, then the very method of how the content vocabulary is disseminated or taught to the class must also be of vital importance. Traditionally, students would receive a list of content vocabulary words from their teacher, define them, study, and take some form of assessment which in turn would evaluate the level of the students' comprehension. Is it possible, that this "outdated" methodology may need to be improved? It may be time for newer and broader teaching methods to be used to in order to achieve greater levels of student achievement.

Statement of the Problem

The purpose of this study is to examine the effectiveness of teaching science content vocabulary in a classroom setting by using various teaching methods.

Hypothesis

The null hypothesis for this study states that the summative assessment scores of those students who have learned the traditional vocabulary teaching method (TVM) in order to take the pretest will not be higher than their summative assessment scores after having learned the extended vocabulary teaching method (EVM) which was used for the posttest.

Operational Definitions

Assessment Score: This dependent variable is the quantitative score obtained by a student on a multiple-choice science content vocabulary assessment both in pre-test and post-test form. The pre-test assessed the traditional vocabulary study method while the post-test assessed the extended vocabulary method.

Traditional Vocabulary Teaching Method (TVM): This independent variable is a teaching method which consists of the students' defining a list of science content vocabulary words in their own words, studying, and taking an assessment so that the teacher may assess the level of student understanding.

Extended Vocabulary Teaching Method (EVM): This independent variable is a teaching method which consists of the students' breaking down the science content vocabulary words into their Greek and Latin roots (prefix and/or suffix) and/or word origin in order to gain a deeper meaning and connection to the actual meaning of the word itself.

Scientific Content Vocabulary Word: Vocabulary words which are specific to the study and understanding of the subject of science.

CHAPTER II

LITERATURE REVIEW

The purpose of this study is to examine the effectiveness of teaching science content vocabulary in a classroom setting by using various teaching methods. The first section will cover the importance of learning academic content vocabulary. The second section will cover the various methods of teaching science vocabulary. Section three discusses vocabulary and conceptual development. Lastly, section four explains how studying science vocabulary leads to academic success. Section four is followed by a brief summary.

The Importance of Learning Academic Content Vocabulary

If a person is skilled in reading comprehension, communicating through the written word, and they also have a highly developed vocabulary library from which to draw from, this provides a strong foundation for high achievement in most of life's endeavors. For those who struggle with vocabulary acquisition, researchers have identified four basic levels: ELL (English language learners), SR's (struggling readers), BL's (breakthrough learners), and CL's (conceptual learners). These various types of readers may be found in every classroom throughout the country. These readers often struggle with reading comprehension and finding context clues, which requires enhanced, hands-on activities such as auditory, kinesthetic, and visual aids to help link vocabulary words and their overall meaning (Rupley & Slough, 2010). It should also be noted that early vocabulary development is also a predictor of future academic success. The more a person reads, the better he/she will tend to do in school (Guo, Wang, Hall, Breit-Smith, & Busch, 2016). Additionally, research shows that such early content vocabulary acquisition plays an important role in future academic success. Children of all ages like to feel smart by using

new ‘fancy words’; however, the overall goal of science (or any academic subject for that matter) is not simply to teach the meaning of a word or set of words, but to allow the student to use content vocabulary as a foundation for communicating new ideas. Yes, the meaning of the words can be learned; but if they cannot be used effectively in communicating and/or expressing new ideas or, in this case, new scientific theories, simply learning the meaning of a long list of science vocabulary words is pointless. Students must be able to use content vocabulary to explore, read, discuss, write, and ask (Gotwals & Wright, 2017). If this is truly so, the one great tool that is used to answer such a question once it is posed, is to have a full understanding of the content in question. This can only be done when one understands the language or the content vocabulary that will link one idea to the next.

Methods of Teaching Science Content Vocabulary

Teaching science occurs at many levels. First, a good teacher must have a strong grasp of the science content knowledge. This is especially true as teachers must reach a certain skill level before entering their Science Methods class as an undergraduate student. In addition, new teachers should be prepared to utilize several methods of instructional implementation not only for content vocabulary, but for any teaching endeavor within their specific field of study. Secondly, the teacher must be able break down complex ideas in a way that all students with various learning styles will be able to understand. This is especially true in today’s ever-growing ELL (English Language Learner) student population. Teachers must have a clear understanding of how to approach, teach, and evaluate student comprehension at various levels, especially when a student is trying to learn a new language on top of the ‘language of science’. This

presents a new level of difficulty as students attempt to learn English and are also expected to use words such as mitochondria or endoplasmic reticulum (Carrier, 2013).

There is a myriad of teaching methods that may be employed when teaching science content vocabulary. The standard vocabulary method and the extend vocabulary method has been described in the section above. Another teaching method that has been studied extensively is the peer-teaching method. In these cases, students work in group settings, some which allowed peer-teaching compared to other groups that do not. There was no significant difference between these two groups in terms of overall performance. Word mapping has also been successful with students. In this method, students write down the vocabulary word on a graphic organizer. Next, they list other words that they know from prior knowledge to try to establish a definition for the word. They may also draw a picture to aid in recalling the definition of the word (Jones, 2018). Word retirement is yet another teaching method. In this method, the words on the classroom word wall that have been mastered are taken down or 'retired' so no time is wasted in studying what is already known. Another teaching method is learning through touch. In this method students manipulate objects that have similar meanings in form or structure, in this way students can combine new learning while relating it to their own prior knowledge (Rule & Welch, 2008). It should be noted that any of these teaching methods may be applied, modified, and used as platforms for additional teaching and/or research.

The idea of students using word origins along with affixes (prefixes and suffixes) in order to increase word meaning has been of interest to researchers over the past several years. When students learn the Greek/Latin prefixes, suffixes, and the meaning of the word origins, this will better aid them in the acquisition of new words when reading (Hirsh, 2018).

Vocabulary and Conceptual Development

A trend that seems to permeate many teaching methodologies in terms of vocabulary development is in connecting science vocabulary acquisition to the students' prior knowledge. When students are able to connect science vocabulary and/or science content knowledge with their own lives, in the long run, this will have a transforming effect on their willingness to learn much more difficult material and not 'shut down' when the work gets really hard. One way that students are tied into a lesson is through vocabulary as a 'hook'. If teachers are able to catch students with a 'word', in this case a vocabulary word and it becomes part of the students' everyday usage, then they begin to speak science instead of just learning science (Young, 2005).

Learning Science Vocabulary Leads to Academic Success

If students are not able to learn to 'speak' science and/or learn to incorporate science content vocabulary at a fairly rapid pace, they are often 'left behind' those who can. Since the early 1960's, there has been a noticeable gap between African Americans, Latino's, ELL students, and students (regardless of race) who are lower on the socio-economic scale. Reformers are trying to close this gap by consistent increased vocabulary development. It is hoped that in time, this gap will close, and all will have an equal opportunity on the academic path to success (Lestermeringolo, 2008).

It should also be noted that students with learning disabilities scored near their general education classmates assessment target scores when peer-mediated group instruction was permitted in the classroom. Content specific vocabulary is crucial when assessing students with special needs. It is useful tool for teachers due to the fact that several science concepts can be discussed and defined through the use of only a few vocabulary words when for some special needs children what can be said in several sentences can be shortened into one 'catch all'

vocabulary word. The science content vocabulary words cannot only be used to define but can also simplify an explanation as well (Green, 2010).

Summary

Science content vocabulary is an essential learning tool that lays the foundation for reading comprehension, conceptual development, higher order thinking, and questioning within science and other academic disciplines. Among the many teaching methods currently in use, the research is telling us that it is now time to implement, teach, and test other methods of vocabulary acquisition in order to allow students to have greater fluency in the language, writing, expression, and thought processes of science.

CHAPTER III

METHODS

Problem Statement

The purpose of this study is to examine the effectiveness of teaching science content vocabulary in a classroom setting by using various teaching methods.

Design

The research design for this paper is called a pre experimental or 'ex post facto design'. 'Ex post facto' is a Latin phrase meaning "after the fact". In this type of design method, study subjects are not grouped randomly and are assigned based on a shared characteristic or collective trait in the form of the dependent variable. It is true that the researcher uses both independent and dependent variables; however, this type of study cannot be considered a true experimental design due to the fact there is a non-random selection of participants. The pretest and posttest that was used in this study is a standard multiple-choice vocabulary test.

Participants

The subjects in this study consist of 18 middle school (Grade 8) science students ranging in age from 13 years of age to 14 years of age. All the participants were born in 2005 or 2006. The achievement levels of the students are as follows. There are 18 academic science students. Of these, 1 student is on a 504 plan, 1 student has an IEP (Individualized Education Program), and 2 students are ELL, or ESOL students which means English is not their first spoken language (See Appendix D). All students attend a suburban school in The Baltimore County Public School system located in the northwest district of Baltimore County, Maryland. The

school is designated as a magnet school since August of 1996. The magnet categories from which a student may choose include Environmental Science, The Performing Arts, The Visual Arts, and World Languages – French, Spanish, and Japanese. The overall demographics and academic standing of the school are shown in the table below:

Table 1: School Demographics & Academic Achievement			
School Demographics			
Ethnicity	% of Total School Population	Ethnicity	% of Total School Population
Asian	8%	Black	63%
Hispanic	12%	White	13%
Academic Achievement			
	Math	English	Science
Students Proficient (All Ethnicities)	22.1%	51.3%	46.7%
Student Growth	45%	55%	_____
English Learners Making Progress	_____	48%	_____
Non-Academic Data			
Students not chronically Absent	87%	_____	_____
OVERALL SCORE	$\frac{\text{Earned Points}}{\text{Total Points}} = \frac{58.3}{96.5} = 60.41 = 60\%$		School Rating = 5 out 10 Points

Instrument

The instrument used for this study is a standard multiple-choice subject content vocabulary test. The vocabulary word defines, is left out (fill in the blank), or is a varied answer to an imbedded 'true / false'. Each selected response has four (4) choices of A, B, C, or D that complete the statement. A copy of the actual science content vocabulary list and a copy of the testing instrument are placed as attachments at the end of this (See Appendix B, C).

Procedure

The students were provided with a list of the vocabulary words. The students were then paired off into groups of two to three students each in order to collectively define the science content vocabulary words. All the vocabulary words would initially be defined using the normal teaching method, i.e. students would define each vocabulary word in the students' own words, by using a science text, by using the BCPS Science Curriculum vocabulary list, or an internet source as a resource. A pretest (standard multiple-choice content vocabulary test) would then be administered to the entire class. Following the pretest, the class would be divided into random groups for a second time. The class would then divide the vocabulary words into three types; those vocabulary words that could be clearly defined into a Greek / Latin prefix and / or suffix, and those that would be defined by word origin, and those that did not fit either of the previous categories. In this way the Pretest would show the results of using the 'standard method' of teaching science content vocabulary, and the posttest would show the 'enhanced vocabulary method or using the Greek/Latin prefix and/or suffix and by additionally defining vocabulary words by word origin.

CHAPTER IV

RESULTS

The purpose of this study is to examine the effectiveness of teaching science content vocabulary in a classroom setting by using various teaching methods. The results of this study are as follows. The data presented in this chapter provides a detailed breakdown of the students' pretest and posttest scores both in terms of descriptive data or qualitative observations of the resulting assessment scores and the raw quantitative statistical results of the assessment scores as well. Individual scores are not shown in the table below.

Table 2: Qualitative Descriptive Data						
Testing Instrument	No. of Students	Score Below 60%	Score Above 60%	Score Increased	Score Decreased	Score Remained the Same
Pretest (TTM)	18	9	9	---	---	---
Posttest (ETM)	18	4	14	15	1	2
				83% tested	0.05% tested	11% tested

Even though the data shows that 83% of the class did score higher on the posttest versus the pretest, this may be a statistically misleading outcome. This will be discussed in Chapter V. A little over 11% ($11.05\% = 11.1\%$) of the class' score either remained the same (2 students) or declined in value (1 student). The study subject who's score declined in value is also a very important trend that will affect the statistical analysis for this data set.

The statistical analysis for this study was completed using the dependent t or paired t analysis with measures of central tendency. The results for this analysis are found on Table 3 which is shown below:

Table 3: Measures of Central Tendency and Statistical Analysis of Data		
	Pre-Test	Post-Test
Mean	62.11	70.11
Variance	222.69	160.58
Observations	18.00	18.00
df	17.00	
t Stat	- 3.76	
p (t< = t) one-tail	0.00*	
t critical one-tail	1.74	
* p calculated is less than .05 and thus <u>statistical significance found</u> .		

The mean is simply an average for a multiple number of data points. The analysis shows that for the pretest, the mean or average score was 62.11 while the posttest was 70.11. The variance for the pretest was 222.69 and the variance for the posttest was 160.58, this indicates that the summative assessment scores for the posttest were closer to the mean score than that of the pretest thus indicating a tighter data set. The observations data simply indicates the number of study subjects. The df-value indicates the ‘degree of freedom’ or the amount of independent values (not variables) that may change in a statistical computation without breaking any constraints or are in direct opposition to the hypothesis presented. The t-Stat measures the size

of the difference between the mean for the data set and that for the hypothesis. The t critical one-tail has a value of 1.74 and indicates the “tail” or decreasing ending values of a data set. Most importantly, the p-value for this data set was 0.00 and was therefore < 0.05 . The p-value is an indicator of the probability of whether the null hypothesis is correct or is rejected. The implications for these resulting values will be discussed in Chapter V (Mills & Gay, 2019).

CHAPTER V

DISCUSSION

The purpose of this study is to examine the effectiveness of teaching science content vocabulary in a classroom setting by using various teaching methods. The null hypothesis for this study states that the summative assessment scores of those students who have learned the traditional vocabulary teaching method or TVM (pretest) in order to take the pre-test will not be higher than their summative assessment scores after having learned the extended vocabulary teaching method or EVM (posttest). Both teaching methods were implemented and the proper assessments were administered to subjects in question.

Implications of the Results

After the data was collected and analyzed from the students' summative assessment scores on their pretest and posttest, the null hypothesis must be rejected due to the fact the $p\text{-value} = 00.0 < 0.05$. This statement may seem contradictory. In Table 1, the statistics show that 83% of the students increased their scores between the pretest and the posttest. This may be true; however, it should be noted that the mean for both tests did not increase at a significant enough value to support the hypothesis. For example, if the mean values were converted into percentages and symbolized by letter grades, the mean for the pre-test was 62.11 or 62% = D, while the mean for the post-test is 70.11 or 70% or a C- for an overall grade. If the hypothesis were correct, the data should support a mean for the posttest to range from 85.00 to 100.00 or B+ to A+, this obviously did not occur. The data also indicated that two of the students' scores remained the same, while one students' score declined in value. This has a significant effect on the df-value and provides additional support for the hypothesis to be rejected.

Therefore, if the extended vocabulary teaching method or EVM was as an effective teaching method as predicted for this group of study subjects, the resulting data (especially the mean) in terms of the posttest would have a much higher overall value.

Threats to Validity

Threats to validity are a measure of how binding or meaningful are the results from the study itself. External validity refers to the generalization of the results. Can the same results be reproduced by other people, at other times, in other places? As any good researcher knows, if the experimental findings are not repeatable in another laboratory or other type of setting and/or condition, then the results are considered invalid. Also, experimental error must also fall within a range from 0% to 5% for an experiment to be considered valid. Internal validity refers to how the study was performed, or in other words, how was the experiment conducted? Another point to consider was whether the experiment set up properly in terms of sample size or did the procedure for administering both the pretest and the posttest occur in the same manner and so on (Cuncic, 2020).

External Validity

For this study, external validity was affected in two (2) ways. First, the size of the sample group or testing group was too small. Using a larger sample size may have had a greater positive effect on the resulting data since the more data points there are to work with the smaller the statistical shift will be due to outliers. Originally the plan was to use six eighth grade science classes, three would be taught the traditional vocabulary teaching method or TVM, and the remaining three classes would be taught using the extended vocabulary teaching method or

EVM and then both classes would be assessed having taken separate assessments. However, it was decided to use only one class with a pretest/posttest approach. The second factor that affected external validity was time. Due to curriculum restraints and county-wide standardized testing, having more time for students to engage in group work and study could have possibly produced a better outcome.

Internal Validity

For this study, internal validity was affected in two (2) ways. First, it may be possible that the instrument used for assessment, in this case a multiple-choice science content vocabulary test may not be suitable for some students in terms of their specific learning style. The three types of learning styles include audio learners, kinesthetic (manipulative), and visual. Each person usually has a particular learning style that is their strength, with a blend of the remaining two. Different students perform better on one type assignment versus others (multiple choice, essay, “hands on” project) in part due to their specific learning style. Secondly, after both assessments were given to the class, the students were asked about the amount of time they spent studying the material for the pretest versus the posttest. About half of the class admitted that they did not study or only studied the night before the assessments was to be administered.

Connections to Previous Studies or Existing Literature

Research has shown that early vocabulary development is an indicator of future academic success (Guo, Wang, Hall, Breit-Smith, & Busch, 2016). Readers who struggle with vocabulary acquisition also struggle with reading comprehension, finding context clues, and usually need additional enhancements added to the lesson by the teacher if learning is to take place

(Rupley & Slough, 2010). This is especially true for ELL students, bilingual students, and conceptual learners, and struggling readers (those students who read below their current grade level). Those students who do not have a developed vocabulary skill set are often left behind their peers and other classmates.

When students can “speak” the language of a specific content area, it makes the process of learning easier from the start. The science content vocabulary words cannot only be used to define but can also simplify an explanation as well (Green, 2010). This will not aid students in understanding various concepts, but may also increase achievement scores on classwork, homework, projects, and summative assessments. This is due to increased vocabulary development which also enables the student to have a clearer and more fluent flow of thought when writing which in turn enables students to be more efficient when completing assignments and therefore saves time.

The idea of students using word origins along with prefixes and suffixes in order to increase word meaning has interested researchers over the past several years. When students learn the Greek and Latin prefixes, suffixes, and the meaning of the word origins, this will better aid them in the acquisition of new words when reading (Hirsh, 2018). In one study, it was shown that by starting with a set of 82 roots and affixes in all; 27 roots, 32 prefixes, and 23 suffixes and having been taught via classroom instruction the proper meaning and context, it is possible to derive the meaning of approximately 100,000 words in the English language. “Students benefit from the study of roots and affixes while studying all their subjects. Explicit-Direct Instruction is also a teaching strategy which teaches students using clear objectives and breaking a lesson down step-by-step for students” (Goeke, 2008, p. 11). Furthermore, this technique has broader educational ramifications as well. Using this technique allows both native

and non-native speakers of English to possess a better command of the language (this also applies to specific content areas, namely – science). Using this idea as a springboard to other endeavors, it has also been shown that learning such techniques also allows students to more readily learn Latin based languages such as French, Spanish, and Italian (Yurtbaşı, 2015).

Implications for Future Research

In future studies, the research should consider using a larger sample size to minimize possible effects of the statistical outcome. In addition, the researcher may also wish to use a different instrument for the pre-test and post-test assessment that is geared more toward the learning styles of their students. This may include other types and/or styles of assessments such as essay, oral presentation, or a computer-based project that the student creates. Finally, the research may also wish to design an experiment which tests and compares how well students of various ability levels (standard versus Gifted and Talented) assimilate the meaning of word origins, prefixes, and suffixes into their existing vocabulary. This should be repeated under better conditions and/or circumstances to see if the original hypothesis is correct.

Conclusion

The researchers' purpose of this study is to provide a brief explanation on the effectiveness of teaching science content vocabulary in a classroom setting by using various teaching methods and then statistically analyzing assessment scores of both in order to determine which of the two methods worked best for students. As stated earlier, even though 83% of the overall summative assessment scores did increase, the p-value for the statistical analysis was 0.00 and thus lower than 0.05 which means that the null hypothesis had to be rejected. This may have ultimately been caused by various threats to both external and internal validity as described

earlier in this chapter, most likely it was due to an error in the fact that many students admitted to not allowing for the proper amount of time for study.

Having said this, this does not in any way preclude the fact that the teaching methods presented in this study in and of themselves, are in error. In contrast, prior research has shown statistically that using the extended vocabulary teaching method or EVM in theory can increase the vocabulary develop of students (Yurtbaşı, 2015). The question then becomes, which teaching pedagogy should be used in order to achieve the best overall result? Hopefully, future research may in time help answer this question.

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APPENDIX A: Traditional Vocabulary Teaching Method Word List

heredity - the passing of traits from parent to offspring

trait - a characteristic which is passed on to offspring through heredity.

inheritance – process by which traits are passed from parent to the offspring.

variation - any difference between individuals of the same species.

genetics - the scientific study of heredity.

species - organisms whose members are alike and successfully reproduce among themselves.

population - the total number of a species living in an ecosystem

chromosome - the part of a cell that contains the genes which control how an animal or plant grows and what it becomes

gene - a segment of DNA on a chromosome that codes for a specific trait

allele – different forms of the same gene

DNA - (or) deoxyribonucleic acid, is the hereditary material in humans and almost all other organisms

protein – a molecule produced by genes that is used for growth and repair of an organism.

mutation - the changing of the structure of a gene, resulting in a variant form that may be transmitted to subsequent generations, caused by the alteration of single base units in DNA, or the deletion, insertion, or rearrangement of larger sections of genes or chromosomes.

genotypes - all or part of the genetic constitution of an individual or group.

recessive trait – a trait that must be contributed by both parents

dominant trait – a trait that appears in the offspring contributed by one parent **phenotypes** - the observable properties of an organism that are produced by the interaction of the genotype and the environment.

heterozygous - two different alleles for the same trait.

homozygous - two identical pairs of alleles for any trait.

codominance - the condition where both alleles of a gene contribute to the phenotype and there is a blending of traits.

Punnett square – diagram showing the gene combinations that might result from a genetic cross.

probability - the relative possibility that an event will occur, as expressed by the ratio of the number of actual occurrences to the total number of possible occurrences; the relative frequency with which an event occurs or is likely to occur.

pedigree - chart that shows the relationships within a family.

asexual reproduction – process by which a single parent reproduces by itself.

sexual reproduction – process by which two parents reproduce

artificial selection - a process in the breeding of animals and in the cultivation of plants by which the breeder chooses to perpetuate only those forms having certain desirable inheritable characteristics.

selective breeding - selection for specific traits imposed by humans, either deliberately or otherwise, upon wild or domesticated plants and animals.

genetic modification - any alteration of genetic material, as in agriculture, to make them capable of producing new substances or performing new functions; examples include: genetic engineering, genetic manipulation, gene splicing.

gene therapy - the transplantation of normal genes into cells in place of missing or defective ones in order to correct genetic disorders.

adaptation - a characteristic, arising from natural selection, that improves a population's chance of survival and reproduction.

natural selection - The process by which forms of life having traits that better enable them to adapt to specific environmental pressures, as predators, changes in climate, or competition for food or mates, will tend to survive and reproduce in greater numbers than others of their kind, thus ensuring the perpetuation of those favorable traits in succeeding generations.

evolution - process by which the characteristics of a population change over time **extinction** - the elimination of a species (also applicable to levels other than species) due to natural processes or human activity.

NOTE: This vocabulary list was taken directly from the Baltimore County Public Schools Science Curriculum.

APPENDIX B: Extended Teaching Vocabulary Method Word List

heredity - the passing of traits from parent to offspring.
Word Origin = LATIN (heraditas) = To inherit as in to inherit money.

trait - a characteristic which is passed on to offspring through heredity.
Word Origin = LATIN (tractus) = As in a stroke of a pen or pencil in a drawing “particular to” or “unique”. Example in genetics = eye color, hair color, dimples etc.

inheritance – process by which traits are passed from parent to the offspring.

variation - any difference between individuals of the same species. Word
Origin = LATIN (variare) =To change or to go against – conflict.

genetics - the scientific study of heredity
Word Origin = GREEK (genesis) = origin or beginning.

species - organisms whose members are alike and successfully reproduce among themselves.
Word Origin = LATIN (specere) = To look, to see differently, each species looks different.

population - the total number of a species living in an ecosystem Word
Origin = LATIN (populus) = People as in community.

chromosome - the part of a cell that contains the genes which control how an animal or plant grows and what it becomes. Word Origin = GREEK (chroma) GREEK (soma) = ‘colored body’ or dark body.

gene - a segment of DNA on a chromosome that codes for a specific trait Word
Origin = GREEK (genos) Kind or offspring.

allele – different forms of the same gene. Word Origin = GERMAN (allel) = Alleomorph = different shape.

DNA - (or) deoxyribonucleic acid, is the hereditary material in humans and almost all other organisms Word Origin = acronym for chemical name only.

protein – a molecule produced by genes that is used for growth and repair of an organism.
Word Origin = GREEK (protos) = Primary or first = building block of cell parts used in cell repair.

mutation - the changing of the structure of a gene, resulting in a variant form that may be transmitted to subsequent generations, caused by the alteration of single base units in DNA, or the deletion, insertion, or rearrangement of larger sections of genes or chromosomes Word Origin = LATIN = mutatio = “To change” to mature.

genotypes - all or part of the genetic constitution of an individual or group Word Origin = GREEK = geno = “offspring” or race.

recessive trait – a trait that must be contributed by both parents Word Origin = ENGLISH = recess = to go or move, to slant back.

dominant trait – a trait that appears in the offspring contributed by one parent. The dominant trait will cover or mask the recessive trait. Word Origin = LATIN = dominari = to rule or govern.

phenotypes - the observable properties of an organism that are produced by the interaction of the genotype and the environment. Word Origin = GERMAN = phenotypes “To show” or showing.

heterozygous - two different alleles for the same trait Word Origin = GREEK = hetero = different

homozygous - two identical pairs of alleles for any trait Word Origin = GREEK = homo = same

codominance - the condition where both alleles of a gene contribute to the phenotype and there is a blending of traits. Both traits may be seen. Word Origin = LATIN = co = prefix meaning “shared”

Punnett square – diagram showing the gene combinations that might result from a genetic cross N/A

probability - the relative possibility that an event will occur, as expressed by the ratio of the number of actual occurrences to the total number of possible occurrences; the relative frequency with which an event occurs or is likely to occur. Word Origin = LATIN = probabilitatis = credible or provable.

pedigree - chart that shows the relationships within a family Word Origin = ANGLO-NORMAN = ped-de-grue = “crane’s foot” = a mark that can be seen and passed on.

asexual reproduction – process by which a single parent reproduces by itself Word Origin = LATIN = “a” = without, without two parents.

sexual reproduction – process by which two parents reproduce
Word Origin = LATIN = sexualis = sex, combine DNA from two parents.

artificial selection - a process in the breeding of animals and in the cultivation of plants by which the breeder chooses to perpetuate only those forms having certain desirable inheritable characteristics.

selective breeding - selection for specific traits imposed by humans, either deliberately or otherwise, upon wild or domesticated plants and animals. Word Origin = LATIN = scroupulus = to choose as by fitness.

genetic modification - any alteration of genetic material, as in agriculture, to make them capable of producing new substances or performing new functions; *examples include: genetic engineering, genetic manipulation, gene splicing*
N/A

gene therapy - the transplantation of normal genes into cells in place of missing or defective ones in order to correct genetic disorders
N/A

adaptation - a characteristic, arising from natural selection, that improves a population's chance of survival and reproduction
Word Origin = LATIN = adaptare = to join.

natural selection - The process by which forms of life having traits that better enable them to adapt to specific environmental pressures, as predators, changes in climate, or competition for food or mates, will tend to survive and reproduce in greater numbers than others of their kind, thus ensuring the perpetuation of those favorable traits in succeeding generations. Word Origin = LATIN = natura = birth, quality of = able to survive.

evolution - process by which the characteristics of a population change over time Word Origin = LATIN = evolvere = “to unroll”.

extinction - the elimination of a species (also applicable to levels other than species) due to natural processes or human activity Word Origin = LATIN = estinguere = to quench = extinguish = to put out.

APPENDIX C: Testing Instrument

Science Vocabulary Test
Unit 3: Designer Dogs
GENETICS

Directions: Completely shade in the letter of the correct answer for each question on the scantron sheet (A, B, C, or D).

- 1). _____ is the passing of traits from parent to offspring.
A). mitosis B). meiosis **C). heredity** D). Natural selection
- 2). _____ occurs when there are any differences between individuals of the same species.
A). Variation **B). Mutation** C). Adaptation D). Evolution
- 3). _____ The total number of a given species living in an ecosystem.
A). herd B). flock C). fauna **D). population**
- 4). A(n) _____ is a different form of the same gene.
A). protein **B). allele** C). chromosome D). base pair
- 5). _____ is the changing of the structure of a gene by deletion, insertion, or the rearrangement of protein sequences of that gene which in doing so alters the expression of that gene. A).
Modification B). Genetic alteration **C). Mutation** D). Cross Breeding
- 6). A _____ trait is a trait that appears in the offspring and is contributed by only one parent.
A). recessive B). incomplete C). dominant D). hidden
- 7). A _____ trait is when two identical pairs of alleles (genes) show expression for any trait.
A). homozygous B). heterozygous C). heterotrophic D). Homo sapien
- 8). _____ is the relative possibility in which an event may occur or is likely to occur.
A). Pitch B). Ratio **C). Probability** D). An actual occurrence
- 9). When an organism is born from the joining of two parents, this process is called _____.
A). asexual reproduction **B). sexual reproduction** C). transplantation D). binary fission
- 10). The process by which forms of life having traits that better enable them to adapt to specific environmental pressures, as predators, changes in climate, or competition for food or mates, will tend to survive and reproduce in greater numbers than others of their kind, thus ensuring the perpetuation of those favorable traits in succeeding generations is called _____.
A). natural selection B). genetic engineering
C). gene splicing D). selective breeding

- 11). A _____ is a characteristic that is passed on from parent to offspring. For example, stem height, seed color, or leaf shape in plants.
 A). gene **B). trait** C). mutation D). species
- 12). The study of heredity is called _____.
 A). biology B). ecology **C). genetics** D). probability
- 13). A double rod-shaped structure which contains genes and DNA that carries genetic information is called a _____.
A). chromosome B). nucleotide C). protein D). gene pair
- 14). DNA stands for: _____.
 A). ribonucleic acid B). nucleic acid
C). deoxyribonucleic acid D). diphenyl-nitrous-acetate
- 15). An organism's genetic make-up or complete allele combination is called its _____.
 A). phenotype B). pedigree **C). genotype** D). dominant trait
- 16). The expression of a gene that may be physically seen is called an organism's _____.
A). phenotype B). pedigree C). genotype D). dominant trait
- 17). The condition where both alleles of a gene contribute to the phenotype and there is a blending of traits is called _____.
A). codominance B). replica of fading C). genetic modification D). selective breeding
- 18). A _____ is a chart which shows the genetic relationship within a family.
 A). genome **B). pedigree** C). dichotomous key D). flow chart
- 19). _____ is the process by which humans control the breeding of animals and plants in which the breeder chooses certain desirable traits to be passed on from parent to offspring.
A). selective breeding B). inbreeding C). genetic engineering D). natural selection
- 20). _____ is the placement of normal genes into cells in order to replace missing or defective genes in order to correct genetic diseases.
 A). Genetic implantation **B). Gene therapy**
 C). Adaptation D). Selective breeding
- 21). The process by which genetic characteristics of a population change over time is _____.
 A). migration **B). evolution** C). extinction D). propagation
- 22). _____ is when only one parent reproduces or makes an exact copy of itself.
 A). sexual reproduction B). binary fission
 C). transplantation **D). asexual reproduction**

23). A _____ is a group of organisms that cannot breed or reproduce with any other organisms outside of their community.

- A). **species** B). colony C). herd D). flock

24). _____ a segment of DNA on a chromosome that codes for or expresses a particular trait.

- A). protein B). allele C). mutation **D). gene**

25). A _____ is a trait that must be linked to both parents.

- A). dominant trait B). chromosome C). segment of DNA **D). recessive trait**

26). A _____ is when two different alleles express the same trait.

- A). homozygous trait **B). heterozygous trait** C). heterotrophic D). Homo sapien

27). A diagram that is used to show the gene combinations from a genetic cross is a _____.

- A). Punnett square** B). dichotomous key C). Venn diagram D). quadrant graph

28). The process by which traits are passed on from one generation to the next is called _____.

- A). genetics **B). inheritance** C). artificial selection D). gene therapy.

29). A(n) _____ is a molecule that is produced by genes that is used for growth and repair of the cells, tissues, and organs of an organism.

- A). protein** B). amino acid C). carbohydrate D). sugar

30). The _____ of a species is the complete elimination of a group of organisms on the Earth as a result of natural processes or human activity.

- A). transplanting **B). extinction** C). regeneration D). culling

NOTE: This assessment was modified from texts and resources taken directly from the Baltimore County Public Schools Science Curriculum.

APPENDIX D:

Academic Science Class Demographics

Student No.	Age	Race	Gender	504	IEP	ELL
100	14	African American	Male			
101	14	African American	Female	X		
102	13	African American	Male			
103	13	African American	Female			
104	13	Caucasian	Male		X	
105	13	African American	Female			
106	14	African American	Female			
107	14	African American	Female			
108	13	African American	Male			
109	14	African American	Male			
110	13	Caucasian	Female			X
111	13	African American	Female			
112	13	Middle Eastern	Male			
113	13	Caucasian	Female			
114	13	African American	Female			
115	13	West African	Male			
116	13	African American	Female			
117	14	Hispanic	Female			X
	R = 1	African American = 12 Caucasian = 2 Hispanic = 1 Middle Eastern = 1	7 Male 11 Female			