

LESSON 1: MONOHYBRID CROSSES			
Learning Objectives			
Purpose of the Lesson: Central Focus	1. How are Mendel’s Laws related to patterns of inheritance? 2. How are Punnett Squares used as mathematical models? (District Schools Units, 2017-2018)		
Learning Objective(s)	1. SWBAT create a Monohybrid Punnett Square IOT to predict the mathematical outcomes of their offspring regarding patterns of inheritance of one trait.		
GSE - Georgia Standards of Excellence	SB3. Obtain, evaluate, and communicate information to analyze how biological traits are passed on to successive generations. a. Use Mendel’s laws (segregation and independent assortment) to ask questions and define problems that explain the role of meiosis in reproductive variability. b. Use mathematical models to predict and explain patterns of inheritance. (Clarification statement: Students should be able to use Punnett squares (monohybrid and dihybrid crosses) and/or rules of probability, to analyze the following inheritance patterns: dominance, codominance, incomplete dominance.) (GSE)		
Formal and Informal Assessment			
Describe both the formal AND informal assessments. Both assessments must provide evidence of student achievement for (each of) the lesson’s learning objective(s).	Evidence of Student Learning (audio/video responses, written paper, project, visual representation)	Describe how evidence aligns with learning objective(s)	Evaluation Criteria (rubric, scoring guide)
	1. Clickers check. 2. Celebrity/characters Child Mini-Poster 3. Exit ticket.	1. Formative, informal; LO1 2. Summative, informal: LO1 3. Formative, formal; LO1	Students can earn up to... 1. 10 points towards their classroom grade, 2 points per question. 2. 100 points for Classroom Activity grade; students received a grading rubric. 3. 5 points towards their classroom grade.
Facilitation & Safety	I consider that for this age, it is appropriate to learn how to focus and work individually or in groups. “Working in groups it is proven to increase motivation” Christoforos (2017) This is a big class and students seem to already divide themselves in groups, based on previous friendships or new ones. The desks were arranged since the beginning to facilitate groups of 4-6 students that can work together when necessary. I also made sure to have enough space to go around the groups of desks in order to assess and help the students. To maximized time, I already have a slide show that explains to the students what they supposed to be working on always. Normally students pick up the worksheets needed for the class from a table situated in front of the class. The Chromebooks are already on the desks. On the board they will have enumerated all the materials they need to gather before class starts (notebooks, primetime folders, pencils, handouts, etc.). To ensure smooth transition, I will give verbal instructions always to accompany the slide show on the board, and a watch countdown that will let students know how much time they have		

	<p>left to work on different assignments so they know how to utilize their time for their best interest. This class doesn't require any lab safety measures. I don't expect any interruptions during this class. If the volume gets too high, students will reorient themselves on task at the first verbal warning. If not, they need to first change seats, usually going in the back of the classroom, and if they are still not able to focus, and distracting the class, they need to walk outside until they calm down. In extreme situations I need to send them to the hallway coach where they will stay for the remainder of the class.</p>
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	Vocabulary	Allele, Crossing over, Dihybrid cross, Dominant, Gamete, Genetic Recombination, Genotype, Haploid Number, Heterozygous, Homologous Chromosomes, Homozygous, Law of Independent Assortment, Mitosis Monohybrid cross, Phenotype, Punnett Square, Inheritance, Recessive. Students will see, listen, read, speak and write the vocabulary words during this lesson.
	Syntax or Discourse	Syntax: Students will predict patterns of inheritance, using Punnett Square as mathematical models. (APS, Unit of Study 3: Genetics and Inheritance, 2017-2018)
<i>Instructional Strategies & Learning Tasks that Support Diverse Students' Needs</i>	Introduction (10 minutes)	Lesson will start by reading and discussing the learning objective. A Beginner's Guide to Punnett Squares Video . (video will be stopped at 4:35) In this video students will see and listen how to use a Punnett Square for a Monohybrid Cross. Students will learn that the two sides of the Punnett Square represent the result of meiosis: the gametes of the parents, and inside the Punnett square boxes we find possible results of fertilization: genotype and phenotype of offspring.
	Body (75 minutes)	I do: 1. Math review of percentage, ratios, probability. Connection of Math concepts with finding out the percentage and ratio of genotype and phenotype of the possible offspring. Students will answer questions and write down the examples from the erase board. (5 min) 4. Mini Lecture and Notes: -definitions/check for prior knowledge of Punnett Square, Monohybrid Cross, Phenotype, Genotype. -steps of using a Punnett Square to predict the patterns of inheritance in offspring. (10 min) Clickers check: Students will use the clickers to answer 5 questions on Mini Lecture and Notes. Instant feedback will allow teacher to check for understanding and give clarifications if necessary. (5 min) We do: Genetic problems. 2 Genetic problems are on the Promethean board. One student will come to the erase board and with the help of the other students and teacher will solve those problems. Students will write and solve the problems in their notebooks. (15 min) You do: 1. Worksheet with 10 genetic problems. Students will solve different kind of genetic problems: indicating if a genotype is heterozygous or homozygous; what phenotype is possible for each genotype; filling Punnett Squares and finding percentage of the offspring. Students and teacher will check the results in the last 5 minutes and if necessary teacher will give explanations. (25 min) 2. Celebrity Child Mini-poster: Students will work in groups of two. First, students will decide on a trait (having in mind the traits they saw in the Human Traits Bingo.) Students will pick two celebrities and assign genes of the trait (recessive, dominant). On a A4 colored piece of paper, students will write a little scenario that tells the genetic trait problem they chose and they will fill a punned square and determine the possibility of the offshoring to have that trait. (25 min) For students who finish the assignments early I have Max Axiom Graphic Novels: The Basis of Cells and Decoding Genes, and an interactive computer games that help students practice Monohybrid Crosses.

	Closure (5 minutes)	Students will answer on padlet.com the following question: "Punnett Square allows you to predict which of the following?": A. phenotype, B. genotype, C. phenotype and genotype, D. neither phenotype nor genotype.
	Differentiation, Modification(s), & Accommodation(s)	<p>For both IEP and Struggling Students I will have Guided Notes with the new definitions of Punnett Square, Monohybrid Cross and Probability, so they can keep up.</p> <p>IEP Students will only have to complete 5 problems from Genetic Problems Worksheet, and teacher will give one on help if necessary.</p> <p>Struggling Students will be asked to work in pairs with students that understood the concept. If they still can't do it, they will receive individual help if possible or they will be asked to come to tutorial, after school or during lunch.</p> <p>I will be available for help for the Celebrity Child Mini-poster.</p>
	Materials	<ul style="list-style-type: none"> • A Beginner's Guide to Punnett Squares Video: https://www.youtube.com/watch?v=Y1PCwxUDTl8&feature=youtu.be • Colored paper X 13 • Colored Pencils • Notebooks, pencils • Worksheet (10 problems) X 26 • Genetic problems (2 problems) X 26 • Google Slide Presentation of Lesson 1: https://docs.google.com/presentation/d/1yk9TJBPRXCS3llul-uB4uV9TUiWDJpscN1nvBpvlupY/edit?usp=sharing • Promethean board, computers • Padlet: https://goo.gl/mJwNhn • Online games: http://sciencereviewgames.com/srg/games/hs.php?id=136 https://reviewgamezone.com/games3/taxi.php?test_id=61&title=Punnett%20Squares

LESSON 2: DIHYBRID CROSSES			
Learning Objectives			
Purpose of the Lesson: Central Focus	1. What is the difference between the Law of Independent Assortment and Segregation? 2. How are Mendel's Laws related to patterns of inheritance? 3. How are Punnett Squares used as mathematical models? (Schools District, Unit of Study 3: Genetics and Inheritance, 2017-2018)		
Learning Objective(s)	1. SWBAT create a dihybrid Punnett Square IOT determine the mathematical outcome of their offspring involving two traits. (School District, Unit of Study 3: Genetics and Inheritance, 2017-2018)		
GSE - Georgia Standards of Excellence	SB3. Obtain, evaluate, and communicate information to analyze how biological traits are passed on to successive generations. a. Use Mendel's laws (segregation and independent assortment) to ask questions and define problems that explain the role of meiosis in reproductive variability. b. Use mathematical models to predict and explain patterns of inheritance. (Clarification statement: Students should be able to use Punnett squares (monohybrid and dihybrid crosses) and/or rules of probability, to analyze the following inheritance patterns: dominance, codominance, incomplete dominance.) (GSE)		
Formal and Informal Assessment			
Describe both the formal AND informal assessments. Both assessments must provide evidence of student achievement for (each of) the lesson's learning objective(s).	Evidence of Student Learning (audio/video responses, written paper, project, visual representation) 1. Informal questioning, frequent checks for understanding. 2. Exit ticket.	Describe how evidence aligns with learning objective(s) 1. Formative, informal; LO1 2. Formative, informal; LO1	Evaluation Criteria (rubric, scoring guide) Students can earn up to... 1. 10 points towards their classroom grade. 2. 10 points towards their classroom grade.
Facilitation & Safety	I consider that for this age, it is appropriate to learn how to focus and work individually or in groups. "Working in groups it is proven to increase motivation" Christoforos (2017) This is a big class and students seem to already divide themselves in groups, based on previous friendships or new ones. The desks were arranged since the beginning to facilitate groups of 4-6 students that can work together when necessary. I also made sure to have enough space to go around the groups of desks in order to assess and help the students. To maximized time, I already have a slide show that explains to the students what they supposed to be working on always. Normally students pick up the worksheets needed for the class from a table situated in front of the class. The Chromebooks are already on the desks. On the board they will have enumerated all the materials they need to gather before class starts (notebooks, primetime folders, pencils, handouts, etc.). To ensure smooth transition, I will give verbal instructions always to accompany the slide show on the		

	<p>board, and a watch countdown that will let students know how much time they have left to work on different assignments so they know how to utilize their time for their best interest. This class doesn't require any lab safety measures. I don't expect any interruptions during this class. If the volume gets too high, students will reorient themselves on task at the first verbal warning. If not, they need to first change seats, usually going in the back of the classroom, and if they are still not able to focus, and distracting the class, they need to walk outside until they calm down. In extreme situations I need to send them to the hallway coach where they will stay for the remainder of the class.</p>
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<i>ACADEMIC LANGUAGE</i>	Language Function	Predict
	Vocabulary	Allele, Crossing over, Dihybrid cross, Dominant, Gamete, Genetic Recombination, Genotype, Haploid Number, Heterozygous, Homologous Chromosomes, Homozygous, Law of Independent Assortment, Mitosis Monohybrid cross, Phenotype, Punnett Square, Inheritance, Recessive. Students will see, listen, read, speak and write the vocabulary words during this lesson.
	Syntax or Discourse	Syntax: Students will predict patterns of inheritance, using Punnett Square as mathematical models. (School District, Unit of Study 3: Genetics and Inheritance, 2017-2018)
<i>Instructional Strategies & Learning Tasks that Support Diverse Students' Needs</i>	Introduction (10 minutes)	Students will read the lesson's objective. Students will watch on the Promethean board a video of Amoeba Sisters that has an entertaining way of talking about two different traits, and how they don't influence each other, and also shows a practice of a Dihybrid Cross .
	Body (70 minutes)	I do: Teacher will teach Mini lecture to explain the dynamics of the Dihybrid Cross. Students will take notes . Teacher will ask questions about Mendel's Law of Independent Assortment IOT connect students' prior knowledge. Teacher will explain how to pair the alleles of the two traits, after the model FOIL (first, outer, inner, last). (10 minutes) We do: Teacher and students will show all the possible combination of the alleles of the two traits. Students will complete the Dihybrid cross by themselves for 5 minutes then one student will fill the 16 squares on the Promethean board, with the help of teacher and the other students. (15 minutes) You do: Students will work individually or in groups on different assignments: Station 1: Students will go online on their computers to practice and solve a Genetic Inheritance/Dihybrid Cross problem . A pea plant that is heterozygous for two dominant traits, tall and yellow, will self-fertilize. Students will answer questions about the possible types of gametes that the heterozygous plant will produce, and about the ratios of the possible phenotypes. (15 minutes) Station 2. Students will work as a group to complete a Dihybrid Cross Problem on the big laminated poster. The Problem tells the students that the parents are heterozygous and we are studying two traits. Students are requested to fill with erasable markers on a big 16 squares grid the possible combinations of the parental alleles, and to determine the ration of the recessive offspring. (15 minutes) Station 3. Students will solve individually two dihybrid crosses problems on a worksheet. (15 minutes)
	Closure (10 minutes)	In groups of two, students will create their own dihybrid crosses problem on a shared google slide.
Differentiation, Modification(s), & Accommodation(s)		For the students with IEP: Teacher will give individual assistance. Students will only have to complete first page of the Monohybrid Cross during station Students will have frequent monitored breaks. Students will have more time for solving the two Dihybrid problems. For students that are struggling: Teacher will create a slide show providing instructions and integrating many pictures into the lectures and activities. The instructions will be large font and not too many on a slide.

	<p>Teacher or other students will read out loud all the instructions of the board or the activities. Teacher will ask often if students needs clarifications or if students have questions.</p>
Materials	<ul style="list-style-type: none">• Promethean board X 1• Link to Lesson's Slide Show: https://docs.google.com/presentation/d/1E192UfhWgj8_Edlq_l0ueaCDf8TLDqBm3XezGNpkaRU/edit?usp=sharing• Computers X 27• Notebooks, pencils X 27• Online Genetic Inheritance/Dihybrid Cross Practice: http://dnaftb.org/5/problem.html• Amoeba Sisters video: https://www.youtube.com/watch?v=qIGXTJLrLf8• Worksheet packets X 27• Online Monohybrid Cross games: https://goo.gl/Jq8ZQ6 (high) https://goo.gl/67QaZc (medium)

LESSON 3: PEDIGREES			
Learning Objectives			
Purpose of the Lesson: Central Focus	1. How can we trace genetic disorders down a family tree by using pedigrees? 2. How can we trace genetic traits down a family tree by using pedigrees? (School District, Unit of Study 3: Genetics and Inheritance, 2017-2018)		
Learning Objective(s)	1. SWBAT create Pedigrees as mathematical models IOT analyze and predict the patterns of inheritance. (School District, Unit of Study 3: Genetics and Inheritance, 2017-2018)		
GSE - Georgia Standards of Excellence	SB3. Obtain, evaluate, and communicate information to analyze how biological traits are passed on to successive generations. a. Use Mendel’s laws (segregation and independent assortment) to ask questions and define problems that explain the role of meiosis in reproductive variability. b. Use mathematical models to predict and explain patterns of inheritance. (Clarification statement: Students should be able to use Punnett squares (monohybrid and dihybrid crosses) and/or rules of probability, to analyze the following inheritance patterns: dominance, codominance, incomplete dominance.) (GSE)		
Formal and Informal Assessment			
Describe both the formal AND informal assessments. Both assessments must provide evidence of student achievement for (each of) the lesson’s learning objective(s).	Evidence of Student Learning (audio/video responses, written paper, project, visual representation) 1. Informal questioning, frequent checks for understanding. 2. Family Pedigree Project 3. Post Assessment Mendelian Genetics	Describe how evidence aligns with learning objective(s) 1. Formative, informal, LO1 2. Formative, formal, LO1 3. Summative, formal. Lesson 1-3	Evaluation Criteria (rubric, scoring guide) 1. 10 points toward their classroom grade 2. 100 points, according to the grading rubric students received. 2. 100 points, according with scoring criteria students received.
Facilitation & Safety	I consider that for this age, it is appropriate to learn how to focus and work individually or in groups. “Working in groups it is proven to increase motivation” Christoforos (2017) This is a big class and students seem to already divide themselves in groups, based on previous friendships or new ones. The desks were arranged since the beginning to facilitate groups of 4-6 students that can work together when necessary. I also made sure to have enough space to go around the groups of desks in order to assess and help the students. To maximized time, I already have a slide show that explains to the students what they supposed to be working on always. Normally students pick up the worksheets needed for the class from a table situated in front of the class. The Chromebooks are already on the desks. On the board they will have enumerated all the materials they need to gather before class starts (notebooks, primetime folders, pencils, handouts, etc.). To ensure smooth transition, I will give verbal instructions always to accompany the slide show on the		

	<p>board, and a watch countdown that will let students know how much time they have left to work on different assignments so they know how to utilize their time for their best interest. This class doesn't require any lab safety measures. I don't expect any interruptions during this class. If the volume gets too high, students will reorient themselves on task at the first verbal warning. If not, they need to first change seats, usually going in the back of the classroom, and if they are still not able to focus, and distracting the class, they need to walk outside until they calm down. In extreme situations I need to send them to the hallway coach where they will stay for the remainder of the class.</p>
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<i>ACADEMIC LANGUAGE</i>	<i>Language Function</i>	Predict
	<i>Vocabulary</i>	Allele, Crossing over, Dihybrid cross, Dominant, Gamete, Genetic Recombination, Genotype, Haploid Number, Heterozygous, Homologous Chromosomes, Homozygous, Law of Independent Assortment, Mitosis Monohybrid cross, Phenotype, Punnett Square, Inheritance, Recessive. Students will listen, read, speak and write the vocabulary words during this lesson.
	<i>Syntax or Discourse</i>	Syntax: Students will predict patterns of inheritance, using Pedigrees as mathematical models. (School District, Unit of Study 3: Genetics and Inheritance, 2017-2018)
<i>Instructional Strategies & Learning Tasks that Support Diverse Students' Needs</i>	<i>Introduction (10 minutes)</i>	Students will be hooked up with a story about a woman, Anastasia, who said she was a Russian princess, that was known dead after the entire family was executed. After DNA testing in 1991, she was declared a fake. This story uses the Russian and England royal families' pedigree as an example of pedigree and how mitochondrial DNA is transmitted transgenerational.
	<i>Body (70 minutes)</i>	I do: Teacher will explain the purpose of a pedigree and how it is made and interpreted. Teacher will show examples on the Promethean board and students will take key notes. (10 min) We do: Practice reading pedigrees. Students will complete three pedigree problems on the Promethean board and on their provided practice pedigree worksheets: one autosomal dominant, one autosomal recessive, one sex-link recessive. Students will practice this together with the teacher. (15 minutes) You do: 1. Students will create a family pedigree project of three generations (using hand drawings on colored A4 papers) and will pick either a genetic disorder or a trait and specify if it is dominant or recessive. Students will label the pedigree accordingly. (15-25 minutes) Students will receive a grading rubric that will also have instructions on it. 2. Posttest Assessment on Mendelian Genetics. Students will take on paper, a three parts test: vocabulary, identification, and genetics problems. (20 minutes) 3. Students who finished their family pedigree will have the option to either play a pedigree game or practice solving pedigree problems individually. (10 min)
	<i>Closure (10 minutes)</i>	Students will research for 5 minutes recessive or dominant diseases and share with the class for the next 5 minutes.
<i>Differentiation, Modification(s), & Accommodation(s)</i>		For the students with IEP: Teacher will give individual assistance on the family pedigree project. Teacher will reduce the number of questions that need to be answered in the quiz. Students will have frequent monitored breaks. For students that are struggling: Teacher will create a slide show providing instructions and integrating many pictures into the lectures and activities. The instructions will be large font and not too many on a slide. Teacher or other students will read out loud all the instructions of the board or the activities. Teacher will read the quiz out loud for the whole class.

	Teacher will ask often if students needs clarifications or if students have questions. For the pedigree project, if students are not comfortable to create their family pedigree they can chose characters from movies or cartoons.
Materials	Promethean board X 1 <ul style="list-style-type: none">• Link to Lesson's Slide Show: https://goo.gl/eiHqjT• Computers X 27• Notebooks, pencils X 2• Genetics Worksheet Packets X 27• Online Pedigree game• 27 colored A4