Lesson Planning

Educators must refer to the appropriate educator discipline RUBRIC for completing your lesson plan/pre-observation questionnaire. Only answering the questions in PAETEP will not meet a proficient rating.

Lesson Plan Samples

The sample lesson plans are examples of lesson plans that meet a proficient rating.

High School Sample

1a. Demonstrating Knowledge of Content and Pedagogy:

All living things contain DNA. Cells, which are the fundamental units of life, are composed of various combinations of organic macromolecules: carbohydrates, lipids, proteins, and nucleic acids (DNA). The purpose of this interactive laboratory exercise is for students to extract DNA from their own cheek cells as well as from a strawberry and to compare the two molecules. This lab provides an opportunity for the development of skills involved in testing for these compounds using an extraction buffer and isopropyl alcohol as chemical detection tools. Typically, individual strands of DNA are too small to be visible to the eye. The reason why we are able to see DNA in this activity is that there are so many of them, clumped together.

Prior to the lesson students were introduced to the concept of the DNA molecule storing all of our genetic information through direct and independent instruction as well as cooperative group learning using multimedia aids.

To provide the background needed for the activity, students reviewed the characteristics of living things and were able to identify genetic information or encoded genetic instructions an essential component of living things. Both prokaryotic and eukaryotic cells must contain genetic information to carry out cellular and metabolic activities to sustain life. At a cellular level our body is always busy. It is breaking down molecules and compounds to meet the demands of the cells' needs. In order to do this, DNA needs to copy its self through a process called DNA replication, and construct proteins through transcription and translation. Throughout this unit, students have worked to recognize that in order to maintain cellular homeostasis; cells must replicate their DNA prior to cellular division and our genes are expressed through decoding the information in DNA and translating it to the formation of a protein. This concept will serve as a precursor to subsequent units on cellular division and genetic variation in the genetics unit.

The lesson is associated with the following Pennsylvania State Standards for Biology:
Academic:
3.1.10.B3. Describe the basic structure of **DNA** and its function in **genetic** inheritance. Describe the role of
DNA in **protein synthesis** as it relates to **gene expression.** .
3.1.B.B1. Explain that the information passed from parents to offspring is transmitted by means of genes which are coded in **DNA** molecules. Explain the basic process of **DNA** replication. Describe the basic processes of transcription and translation. Explain how crossing over, jumping genes, and deletion and duplication of genes results in genetic variation. Explain how **mutations** can alter genetic information and the possible consequences on resultant cells.
3.1.B.B3. Describe the basic structure of **DNA**, including the role of hydrogen bonding. Explain how the process of **DNA** replication results in the transmission and conservation of the genetic code. Describe how transcription and translation result in gene expression. Differentiate among the end products of replication, transcription, and translation. Cite evidence to support that the genetic code is universal.
3.1.B.B5. CONSTANCY AND CHANGE Explain how the processes of replication, transcription, and translation are similar in all organisms. Explain how gene actions, patterns of heredity, and reproduction of cells and organisms account for the continuity of life. SCALE Demonstrate how inherited characteristics can be observed at the molecular, cellular, and organism levels

PACCS:

CC.3.5.B. Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in a simpler but still accurate terms

CC.3.5.C. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

CC.3.5.I. Synthesize information from a range of sources into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

CC.3.6..B. Write informative/explanatory texts, including the narration of historical events scientific procedures/experiments, or technical processes.

1b. Demonstrating Knowledge of Students:

Given the amount of diverse learners in my classroom, I have separated the class into heterogeneous learning groups. There are a total of 21 Biology students in this class. The class is composed of 21 sophomores; with 13 boys and 8 girls. Additional contextual information regarding these diverse learners in this class includes that I have 4 students who have individualized education programs and 3 students with other health impairment accommodations (CH 15). Early effective communication with my students and establishing classroom norms and procedures in the start of the school year have helped our class to create an effective learning environment. This has allowed me to develop differentiated lessons for this class that are aimed toward their learning styles. The students will be placed in teacher selected partners based upon informal observations, assessments and conversations with students in regard to their preferred learning styles. Additionally, students were placed in groups based upon various skills and strengths that they have demonstrated during other lab activities throughout the beginning activities of the course.

To differentiate the lesson to meet the learning goals of the students in the class, each partner will have a specific task to fulfill and contribute to ensure that their group has successfully measured, recorded and explained the sequence of events that will occur during the DNA extraction. This laboratory activity requires a fair amount of kinesthetic activity while also encouraging strong communication skills between lab partners and lab groups. The activities may be modified to expand testing using more sophisticated chemical tests and expansion on direction handling and microscopic examination of the DNA molecule.

1c. Selecting Instructional Outcomes:

As a result of this lesson, students will be able to work cooperatively with others as a productive member of a team. Students will also be able to work directly from a listed procedure with little guidance from the teacher. This will allow me to serve as a facilitator rather than the direct source of information for the activity.

Students will be able to understand the central dogma of biology; that DNA controls all cellular activities by identifying major molecules that are found in all living things and the factors that can affect the structure and function of such molecules.

Students will be able to relate previous concepts learned in units like cellular structures and their function as well as studying the structure and function of organic compounds like macromolecules

Students will be able to record and interpret their results in a cohesive lab analysis report and will be able to draw connections between previously studied concepts of characteristics of living things, cells, and macromolecules. Additionally, students will apply the concepts of how organisms need genetic instructions for cell growth, repair, and the development of new cells.

Each of these learning outcomes is directly tied to the following PA State Standards in Biology:

Academic:
3.1.10.B3. Describe the basic structure of **DNA** and its function in **genetic** inheritance. Describe the role of **DNA** in **protein synthesis** as it relates to **gene expression.**
3.1.B.B1. Explain that the information passed from parents to offspring is transmitted by means of genes which are coded in **DNA** molecules. Explain the basic process of **DNA** replication. Describe the basic processes of transcription and translation. Explain how crossing over, jumping genes, and deletion and duplication of genes results in genetic variation. Explain how **mutations** can alter genetic information and the possible consequences on resultant cells.
3.1.B.B3. Describe the basic structure of **DNA**, including the role of hydrogen bonding. Explain how the process of **DNA** replication results in the transmission and conservation of the genetic code. Describe how transcription and translation result in gene expression. Differentiate among the end products of replication, transcription, and translation. Cite evidence to support that the genetic code is universal.
3.1.B.B5. CONSTANCY AND CHANGE Explain how the processes of replication, transcription, and translation are similar in all organisms. Explain how gene actions, patterns of heredity, and reproduction of cells and organisms account for the continuity of life. SCALE Demonstrate how inherited characteristics can be observed at the molecular, cellular, and organism levels

1d. Demonstrating Knowledge of Resources:

Given the variety of learners and personalities in my class, I wanted to engage them in a lesson that was more kinesthetic and allowed them to work both individually and as a contributing member of a cooperative partnership. The students in this class have previously enjoyed and performed well participating in more kinesthetic and spatial activities. After researching a couple different online activities and animations to help illustrate and explain these abstract concepts, I decided to adapt an advanced DNA extraction lab activity make it a little bit more engaging and motivating to students to visually experience the first hand identification of these organic structures while building upon and reinforcing the concepts that were presented in the previous day's lesson. I also wanted students to experience working with different glassware in a lab setting giving them hands on experience for future upper level science courses like chemistry.

In preparation for this activity, I also consulted with students regarding any allergies to samples being tested that could prevent them from participating. Additionally, I consulted with a couple colleagues regarding my intended approach to the lesson and asked if they would be able to review it to see if there were any other concerns or. recommendations to enhance the lab that I should be made aware of.
During the introductory activity of the lesson I will use the smart board to model how students should conduct their chemical testing. We will review the different types of glassware and materials being using in this experiment. We will also review key terminology and structures using a graphic organizer. Students have previously studied key terms associated with this unit and are encouraged to use them in their discussion of the during the construction of their answers to the lab analysis questions. This will help to reinforce the use of key terms not only in their verbal explanation but also in their constructed responses on future written questions. The graphic organizer will help students arrange and organize their ideas on the topic and the structures associated with these complex molecules. The use of the graphic organizer is also a key component of Brain Based Learning in which the brain has a need to group, make categories, and create structure to learn. This activity will help the students organize their thoughts and reconnect to the previous day's lesson while being introduced to a new activity. Additionally, every student can benefit from this organizational and instructional strategy. A stronger understanding and use of vocabulary will also aid students in strengthening their ability to decode scientific articles and text in upcoming assignments.

Students will receive the lab and will complete the pre-lab discussion activities. The pre-lab analysis questions will allow students to review the safety concerns and steps of the lab prior to starting the activity. The pre-lab analysis will also serve as an informal assessment of connecting the concept of complex structures of DNA to the intended laboratory activity.

The anticipatory set initiating the lab will be about mutations and how they arise in organisms. The typical negative connotations of mutations will be addressed as well as the idea of mutations being advantageous. This will actively engage the students in the lesson and present the material in more interactive and engaging manner.

1e: Designing Coherent Instruction:

Day 1:

1. Students will enter the classroom and will work to complete the opening warm up question reviewing concepts that will tie into today's lesson.
2. Teacher will model how to fill out graphic organizer that was previously provided to students and will review the content of the organizer with students.
3. Students will receive the laboratory activity hand out and will be placed in teacher selected pairs.
4. Students will review the materials and procedure with their lab partner, identifying the supplies needed and the safety concerns of performing the lab experiment.
5. Students will work individually on the pre-lab analysis questions reviewing the concepts of biological molecules connecting to their lab experiment and well as the procedure and safety concerns of the lab.

Day 2:

6. Teacher and students will review the pre-lab analysis questions and address the safety concerns for the lab. The teacher will model appropriate use and disposal of materials and will remind students of proper conduct in the lab setting.
7. Students will gather the materials needed to conduct the lab as listed in their laboratory handout. Working with their partner, students will set up their lab station with their selected materials.
8. Students will review the lab procedure with their partner prior to the start of the experiment to ensure that they will know what each of them is responsible for during the experiment to get the best results.
9. Students will work to filter and extract the DNA out of their strawberries.
10. Students will take the filtered sample strawberry juice and will add ice cold isopropyl alcohol to the sample to view the DNA of the strawberry.

Day 3:

11. Students and Teacher will review results of the previous day's extraction.
12. Students will extract the DNA out of the test tube and will try and observe the molecule underneath the microscope.
13. If time permits, students will use similar procedure to extract DNA out of their own cheek cells.
14. Teacher will be observing the partner work informally and will ask informal questions regarding the samples collected from each partner. Upon successful completion or if satisfied answers assessed by the teacher, students may continue their activity and clean up their area and start working on the lab analysis questions.

1f: Designing Student Assessments:

Students will be assessed informally through teacher observations of group interaction as they progress through the different phases of the activity. Students will also be formally assessed by a rubric indicating all of the components necessary to successfully complete the cooperative activity.

Successful completion of this lesson should include engaged, excited and motivated students working constructively in groups with the teacher acting as the facilitator gently guiding and observing the lab activity.

Completion of the lab should yield a large amount of DNA in the test tube with students properly handling the equipment. Additionally, successful comprehension will be assessed in student constructed responses to activity analysis questions with limited grammatical errors and the use of appropriate key terms which will provide an assessment of the understanding of the concept being presented to students.