**Lesson Plan**

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**Subject:** Biology                          **Grade/Class:**  SBI3U, Grade 11 Biology

**Duration:** 75 minutes

**Lesson Topic:** Evolution

**BIG IDEAS:**

* Evolution is the process of biological change over time based on the relationship between species and their environments.
* The theory of evolution is a scientific explanation based on large accumulation of evidence

**OVERALL EXPECTATIONS:**

* C3. Demonstrate an understanding of the theory of evolution, the evidence that supports it, and some of the mechanisms by which it occurs

**SPECIFIC OBJECTIVES OR EXPECTATIONS:**

* **C2.1**use appropriate terminology related to evolution, including, but not limited to: *extinction, natural selection, phylogeny, speciation, niche, mutation, mimicry, adaptation, and survival of the fittest [C]*
* **C3.1**explain the fundamental theory of evolution, using the evolutionary mechanism of natural selection to illustrate the process of biological change over time
* **C3.4**describe some evolutionary mechanisms (e.g.,natural selection, artificial selection, sexual selection, genetic variation, genetic drift, biotechnology), and explain how they affect the evolutionary development and extinction of various species (e.g., Darwin’s finches, giraffes, pandas)

**TEACHING LEARNING RESOURCES:**

Teachers will use:

* Coloured cardboard cards
* Game tokens – 6 colours
* Rolling dice – 1 regular, 1 with each face a different colour, matching game tokens
* Data sheets for each player to record their genotype frequencies
* One copy of the game rules for each group (or projected for entire class to see)
* Anticipation guide worksheets with true/false questions
* Textbooks

**LESSON SEQUENCE:**

**Introductory Activity: (20 minutes)**Teachers will test the students’ knowledge about Evolution prior to playing the game. For that purpose, they will use an anticipation guide; a questionnaire on Evolution and the associated misconceptions. The questionnaire consists of about 10 true/false questions, and is printed double-sided where one side is titled Prior-knowledge and the other one is titled Post-Knowledge. Teachers will ask the students to do the Prior-Knowledge questionnaire and hold into it until the end of the game. After presenting the game, teachers will ask students to do the Post-game questionnaire and to make appropriate changes. This introductory activity serves two purposes:  Engagement and Thinking/Analyzing. Students will also be given a Knowledge Ratings handout, with 11 terms that are pertinent to the lesson. For each term, students will indicate whether they can define the term, have seen or heard the term, or have never seen or heard the term before. They will then be given a few minutes to look up the terms that they do not know in the text before beginning the main activity.

**Anticipation Guide for Evolution Activity: True/False Chart**

For each of the following statements, circle true or false. Do this once at the BEGINNING of the lesson, and again at the END to see if your answers have changed.

1. Living things choose to evolve           T                 F

2. Individuals evolve                                 T                 F

3. There is an end to evolution               T                 F

4. Genetic mutations are always bad    T                 F

5. Humans evolved from monkeys        T                 F

6. “Survival of the fittest” means that the biggest and strongest individuals always do best    T          F

7. Bacteria and animals have a common ancestor    T                 F

8. All humans today are ancestors of a single female from Africa, who lived over 200,000 years ago                T                 F

**Knowledge Ratings Activity – Evolution**

|  |  |  |  |
| --- | --- | --- | --- |
| **Term** | **Can Define** | **Have seen/heard** | **?** |
| evolution |  |  |  |
| DNA |  |  |  |
| mutation |  |  |  |
| genetic drift |  |  |  |
| population |  |  |  |
| natural selection |  |  |  |
| random |  |  |  |
| gene |  |  |  |
| allele frequencies |  |  |  |
| genetic diversity |  |  |  |

**Developmental Strategies: (45 minutes)**Teachers have prepared a game to explain the concept of evolution in a different way. Teachers will focus on the different learning abilities that students have bearing in mind the attempt to deliver the materials in a fun way. Creativity is necessary in order to trigger students’ curiosity and their passion to know more about the materials. Teachers will group students into groups of 2-4 students depending on class size. The game below is self-explanatory:

**Evolution: The Game of Games**

            All life on earth is playing a game of chance on a daily basis with the highest stakes possible, existence. Survival of the fittest, the ultimate game where everyone can lose and the only way to win is to not get chewed up by the forces of nature.

This is a card game representing natural selection affecting different populations. Each player has a population on an adjacent but distinct island. While all populations start out the same no one knows what the islands will look like in the end!

**Rules:**

1. 2-4 players
2. Each player gets 10 tokens of each of six colours. These 60 tokens represent your population and each colour represents a different genotype.
3. The deck of cards is shuffled and placed in the middle of the players.
4. Each card is an event occurring to the population. In each player’s turn, draw a card off the top and apply the effects of that card to their population, removing or adding members to your population accordingly. Dice are provided for card effects.
5. After every round, each player must roll the colour die, and then remove two individuals of that colour. This represents natural death in a population in any given year, that occurs randomly and as a result of old age, disease, etc.
6. If a player runs out of a particular colour ignore all card effects to that colour **except for Immigration**, since there are no individuals left to reproduce.
7. Use chart provided to record the number of each token type after each round of all players drawing a card.
8. Continue for 30 rounds or until teacher stops class.

**Differentiated Instructional Strategies:**Students who are having difficulties understanding the concepts could be given a different Knowledge Ratings chart, in which the terms are defined for them on the page and they are simply asked if this is a term they have heard before or not.  Students can also be partnered with another student while playing the game, sharing one of the populations and working together to record their data.

**Culminating Activity: (10 minutes)**At the end of the class, students will submit their data sheets so that the teacher can enter them into a large class spreadsheet, which will be used in subsequent lessons. Students will be asked to refer to their Anticipation Guides, and once again read through the true/false questions. Many of these questions are addressed in the game, but some are not. As a class, we will go through the questions and have a discussion using examples from the game where applicable. Students will be encouraged to research some of the questions not addressed by the game and bring their findings to the next class.

**ON-GOING ASSESSMENT/EVALUATION:**

Formative assessment will be conducted through observation of groups as they play the game. The teacher will circle the room and make stops at each group to ensure they understand the rules and objectives of the game. The teacher will also ask questions about how the game is linked to the unit concepts, for example “How have your populations changed since you first started playing? You all started with the same genotype frequencies – are they still the same?” Such questions will allow the teacher to gauge their understanding and clear up any misconceptions. The Anticipation Guides, Knowledge Ratings Charts, and game data sheets will be collected at the end of class so the teacher can further examine the students’ grasp of the material.

**NEXT STEPS:**

Future classes could consist of structured instruction of Darwinian evolution and how natural and sexual selection take part in it. Natural selection could be compared and contrasted with artificial selection as well. Additionally, students could be presented with fossil record evidence of evolution to show them the empirical data behind the idea rather than just relying on the idea itself.