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| ACTIVITY PLAN | | | | |
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| **Theme** | **Subtopic** | **Activity Title** |
| STEAM Integration in Environmental Education | Mathematics in Environmental Modeling and Analysis | Analyzing Environmental Impact Using Mathematical Models |

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| Introduction part (or activity overview) |
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| **Introduction part (or activity overview)** | This activity aims to teach students how to use mathematical models to analyze and predict the environmental impact of human activities. Students will gather data, apply mathematical concepts, and create models to understand and mitigate environmental damage. |
| **SETTING** | Location: Classroom and computer lab for research and analysis.  Educational Context: Collaborative group work (4-5 students per group). |

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| Materials Needed |
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| **Materials Needed** | Computers with internet access and relevant software (e.g., spreadsheets, mathematical modeling tools)  Access to online data sources for environmental statistics  Projector for presentations  Graph paper, calculators, and other mathematical tools |

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| **Learning Outcomes** | * Understand the role of mathematics in environmental impact analysis. * Develop skills in data collection, mathematical modeling, and impact assessment. * Enhance abilities in research, project development, and presentation. |  |
| **Activity Contents** | **Theoretical Part (Duration: 60 minutes)**: Begin with an introduction to the importance of mathematics in analyzing the environmental impact of human activities. Highlight various mathematical methods and tools used in impact assessment.   * **Introduction to Environmental Impact Assessment (EIA)**:   + Explain what Environmental Impact Assessment (EIA) is and why it is crucial for sustainable development. Discuss how EIAs help in understanding the potential environmental consequences of proposed projects before they are carried out.   + Break down the key components of an EIA, including screening, scoping, impact analysis, mitigation measures, public participation, and decision-making. * **Mathematical Methods in Environmental Analysis**:   + Discuss how statistical methods such as regression analysis, correlation analysis, and hypothesis testing are used to analyze environmental data and identify trends and patterns.   + Explain the principles of cost-benefit analysis and how it is used to weigh the environmental costs and benefits of a project. Provide examples of how mathematical calculations are used to determine the net benefits.   + Introduce computational models such as air quality models, water quality models, and climate models. Discuss the mathematical foundations of these models and their applications in predicting environmental impacts.   + Explain the use of differential equations in modeling dynamic environmental systems. Provide examples of how these equations are used to simulate the behavior of ecosystems over time. * **Case Studies**:   + **Case Study 1: Air Quality Modeling**: Present a case study on how mathematical models are used to predict air pollution levels in urban areas. Discuss the data inputs, modeling techniques, and the outcomes of the study.   + **Case Study 2: Water Quality Analysis**: Share a case study on the application of statistical methods to assess water quality in a river. Highlight the data collection process, analysis methods, and the environmental implications of the findings.   **Discussion Prompts**:   * How can mathematical models help in predicting the long-term impacts of human activities on the environment? * What are the limitations of using mathematical models in environmental impact assessments? * How can public participation be integrated into the process of environmental impact assessment?   **Task 1: Data Collection and Analysis (Duration: 45 minutes)** **Objective**: To collect and analyze data on the environmental impact of a specific human activity.   * **Step 1**: Form groups and assign each group a specific human activity to study (e.g., deforestation, industrial pollution, urbanization). * **Step 2**: Use online data sources to collect historical data on the environmental impact of the assigned activity. * **Step 3**: Input the data into a spreadsheet or mathematical software to analyze trends, patterns, and anomalies. * **Step 4**: Use statistical methods to interpret the data and draw conclusions.   **Task 2: Mathematical Modeling (Duration: 90 minutes)** **Objective**: To create a mathematical model that predicts the future environmental impact of the assigned human activity.   * **Step 1**: Based on the data analysis, develop a mathematical model using relevant methods (e.g., regression analysis, differential equations). * **Step 2**: Use the model to predict future impacts of the human activity under different scenarios (e.g., increased activity, implementation of mitigation measures). * **Step 3**: Validate the model by comparing its predictions with actual data and adjust as necessary. * **Step 4**: Prepare a presentation summarizing the data analysis, model development, predictions, and potential solutions based on the model.   **Task 3: Presentation and Feedback (Duration: 45 minutes)** **Objective**: To present the mathematical model and analysis to the class and receive feedback.   * **Step 1**: Each group presents their data analysis, mathematical model, and predictions to the class. * **Step 2**: Conduct a Q&A session where other students and the instructor can provide feedback and ask challenging questions. * **Step 3**: Groups reflect on the feedback received and discuss potential improvements. |  |
| **Assessments** | Accuracy and thoroughness in data collection and analysis.  Innovation and appropriateness of the mathematical model.  Quality and feasibility of the model predictions.  Clarity and persuasiveness of the presentation.  Team collaboration and dynamics. |  |
| **Key Competences** | Research and analytical skills  Mathematical proficiency in environmental applications  Strategic planning and project management  Effective communication and presentation skills  Teamwork and collaboration |  |
| **Connections with Eco STEAM** | Eco: Understanding and addressing the environmental impacts of human activities through mathematical analysis.  Science: Applying scientific principles to analyze and solve environmental problems.  Technology: Utilizing digital tools and software for data analysis and modeling.  Engineering: Designing and validating mathematical models to address environmental challenges.  Arts: Creating engaging presentations and visualizations to communicate findings.  Math: Using data analysis, statistical methods, and mathematical models to support environmental solutions. |  |
| **References** | www.environmentalmath.org |  |
| **Notes** | This activity can be extended into a longer-term project, where students continuously develop and refine their mathematical models based on ongoing research and feedback. |  |

**Evaluation Criteria Table for Analyzing Environmental Impact Using Mathematical Models Activity**

| **Evaluation Criteria** | **Points Available** | **Comments** |
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| **1. Accuracy and Thoroughness in Data Collection and Analysis** | 20 | Assess the precision and comprehensiveness of the data collected and analyzed. |
| **2. Innovation and Appropriateness of the Mathematical Model** | 20 | Evaluate the creativity and suitability of the mathematical model developed to address the environmental issue. |
| **3. Quality and Feasibility of Model Predictions** | 20 | Rate the reliability and practicality of the model's predictions and solutions. |
| **4. Clarity and Persuasiveness of Presentation** | 20 | Rate the clarity, persuasiveness, and professionalism of the presentation. |
| **5. Team Collaboration and Dynamics** | 20 | Assess the level of teamwork, including communication, cooperation, and mutual support among team members. |

**Total Points:** 100