

LEARNING & CREATIVITY PLAN (L&C PLAN): NETWORK ANALYSIS

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1. Overview

Title	Network Analysis
Driving Question or Topic	How to use Graph Theory in order to represent and analyze networking.
Ages, Grades, ...	Ages: 12-18 7 th -12 th grades
Duration, Timeline, Activities	3-4 DIDACTIC HOURS 4 activities
Curriculum Alignment	Discrete Math, Algebra Matrix Operations, Computer applications
Contributors, Partners	
Abstract - Synopsis	Students will learn how to use Graph theory concepts with spanning trees, weighted graphs, shortest paths in order to analyze networks. In real life it means to minimize the expenses of a company by selecting the shortest path and improve efficiency.
References, Acknowledgements	Edexcel AS and A level Further Mathematics- Decision Mathematics 1 - D1 Matrices Pearson IGCSE

2. STEAME Framework*

Teachers' Cooperation	1 st Teacher: Mathematics 2 nd Teacher: Computers
STEAME in Life (SiL) Organization	A real meeting with the person responsible to carry out the routes of their local post office or local central bus station.
Action Plan Formulation	Stage i: The Mathematics teacher introduces the concept of Graph theory with some useful links for the students to create a better understanding on the topic. Stage ii: The teacher will assign various problems that affect a network analyses such as routes for bus/train transportation. Stage iii: Action plan formulation. Refers to the creation.....

*under development the final elements of the framework

3. Objectives and Methodologies

Learning Goals and Objectives	By the end of the L&C Plans, students should be able to know and complete the following: <ul style="list-style-type: none"> • Important factors that affect the networking • Data collection and organizing data. • Representation of the data using graphs • Representation of the data using matrices
Learning Outcomes and expected Results	Upon completion of the project, learners will produce a better understanding of the complexity of networking and fosters their curiosity about new methods

<p>Prior Knowledge and Prerequisites</p>	<p>could be introduced, Their communicative skills will be enhanced, as they will be obliged to make decision as partners. No background information is needed.</p>
<p>Motivation, Methodology, Strategies, Scaffolds</p>	<p>The main methodologies and techniques of the course are based on inquiry-based learning. In this way, students are encouraged to explore the material, prioritize data, ask questions and share ideas. Inquiry-based learning uses different approaches to learning, including small-group discussion and guided learning. Students are involved in designing and conducting their own scientific research after having some queries and case studies. Specifically, students learn by making their own representation, instead of memorizing facts and material. This allows them to build knowledge through exploration, experience and discussion. In addition, students get the chance to explore various factors and learn from their own first-hand experience. Students have the opportunity to investigate a problem and find possible solutions, make comments and questions to test ideas, think creatively and use their intuition. As they explore this Learning Plan, students build critical thinking and communication skills. The cognitive skills that students develop can be used to improve comprehension in every subject, as well as in day-to-day life. Last but not least, team working and brainstorming can get the student on the path to success.</p>

4. Preparation and Means

<p>Preparation, Space Setting, Troubleshooting Tips</p>	<p>The theoretical framework will be taught in the classroom. However, the students will process the various factors of their decision. It is important that the students discuss the many factors involved in this problem, rather than just focusing on a single dimension. Is there a cost savings with eliminating on route of the direction? What are the needs of the customers and the company? What about new customers who may be deciding their directions? How do you decide which routes to eliminate and what alternatives can you offer?</p>
<p>Resources, Tools, Material, Attachments, Equipment</p>	<p>Examples, YouTube links, power point presentation created by the teacher. The tools needed will be access to computers in order to represent their data with the help of the Computer teacher. Mainly for Excel or TI-83 or Geometer's Sketchpad.</p> <p>Resources: Graph theory:</p> <ol style="list-style-type: none"> 1. https://www.youtube.com/watch?v=C7YrMRdLkqo&list=PLHXZ9OQGMqxersk8fUxiUMSIx0DBqsKZS&index=76 2. https://www.youtube.com/watch?v=gCORNpD2P1Y&list=PLHXZ9OQGMqxersk8fUxiUMSIx0DBqsKZS&index=77 3. https://www.youtube.com/watch?v=WTNBNSUhSTY&list=PLHXZ9OQGMqxersk8fUxiUMSIx0DBqsKZS&index=78 4. https://www.youtube.com/watch?v=dSK5jTEe-AM&list=PLHXZ9OQGMqxersk8fUxiUMSIx0DBqsKZS&index=79 <p>Matirces:</p>

1. <https://www.youtube.com/watch?v=PPOILLhsT6s>

5. Implementation

Instructional Activities, Procedures, Reflections

The plan can be completed in six learning hours, the first two hours will be the understanding of graph theory-spanning trees-degree of a vertex-Eulerian path and Eulerian circuit (power point is included). The two second hours will be two activities related to the understanding how graphs can be useful to represent real life problems given various factors (included on the power point). The last two hours is for students to present their ideas for their task with the help of the ID teacher either on Geometer's Sketchpad or excel.

The teacher can use the attached power point, YouTube links attached or the book of the Decision Mathematics 1 chapter 2 to explain the concept of the Graph Theory and shortest route on chapter 3.

The second part will be to provide some examples of transportation companies where they need to cover some routes by using the shortest path but also including the needs and perspective of their clients.

Last part will be the students to be given their own task where they need to split into groups and represent their own ideas with the help of the second teacher. Each group will develop a recommendation for their work and present this proposal to the class. The presentation may contain, but is not limited to, charts, matrices, adjacency matrices of various path lengths, minimum spanning trees, weighted graphs, and other documentation. Each presentation should be 7 to 10 minutes in length.

Assessment - Evaluation

Exercises are attached, or by using exercises from D1 book. Evaluation will be done by the students presentation at the end of the lesson.

Presentation - Reporting - Sharing

The sharing processes will be done during the students presentation.

Extensions - Other Information

STEAME Prototype/Guide for Learning & Creativity Approach
Action Plan Formulation

Major steps in the STEAME learning approach:

STAGE I: Preparation by one or more teachers

1. Formulating initial thoughts on the thematic sectors/areas to be covered
2. Engaging the world of the wider environment / work / business / parents / society / environment/ ethics
3. Target Age Group of Students - Associating with the Official Curriculum - Setting Goals and Objectives
4. Organization of the tasks of the parties involved - Designation of Coordinator - Workplaces etc.

STAGE II: Action Plan Formulation (Steps 1-18)

Preparation (by teachers)

1. Relation to the Real World – Reflection
2. Incentive – Motivation
3. Formulation of a problem (possibly in stages or phases) resulting from the above

Development (by students) – Guidance & Evaluation (in 9-11, by teachers)

4. Background Creation - Search / Gather Information
5. Simplify the issue - Configure the problem with a limited number of requirements
6. Case Making - Designing - identifying materials for building / development / creation
7. Construction - Workflow - Implementation of projects
8. Observation-Experimentation - Initial Conclusions
9. Documentation - Searching Thematic Areas (STEAME fields) related to the subject under study – Explanation based on Existing Theories and / or Empirical Results
10. Gathering of results / information based on points 7, 8, 9
11. First group presentation by students

Configuration & Results (by students) – Guidance & Evaluation (by teachers)

12. Configure mathematics or other STEAME models to describe / represent / illustrate the results
13. Studying the results in 9 and drawing conclusions, using 12
14. Applications in Everyday Life - Suggestions for Developing 9 (Entrepreneurship - SIL Days)

Review (by teachers)

15. Review the problem and review it under more demanding conditions

Project Completion (by students) – Guidance & Evaluation (by teachers)

16. Repeat steps 5 through 11 with additional or new requirements as formulated in 15
17. Investigation - Case Studies - Expansion - New Theories - Testing New Conclusions
18. Presentation of Conclusions - Communication Tactics.

STAGE III: STEAME Actions and Cooperation in Creative Projects for school students

Title of STEAME Project : _____

Brief Description/Outline of Organizational Arrangements / Responsibilities for Action

STAGE	Activities/Steps Teacher 1(T1) Cooperation with T2 and student guidance	Activities /Steps By Students Age Group: ____	Activities /Steps Teacher 2 (T2) Cooperation with T1 and student guidance
A	Preparation of steps 1,2,3		Cooperation in step 3
B	Guidance in step 9	4,5,6,7,8,9,10	Support guidance in step 9
C	Creative Evaluation	11	Creative Evaluation
D	Guidance	12	Guidance
E	Guidance	13 (9+12)	Guidance
F	Organization (SIL) STEAME in Life	14 Meeting with Business representatives	Organization (SIL) STEAME in Life
G	Preparation of step 15		Cooperation in step 15
H	Guidance	16 (repetition 5-11)	Support Guidance
I	Guidance	17	Support Guidance
K	Creative Evaluation	18	Creative Evaluation