Luma StarT

Best educational practices

CURRICULAR PROJECTS USING THE STEAM PROJECT-BASED LEARNING

ALHuda Secondary School

Gaza / Palestine

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2020/2021

Table of contents

STEAM Project-Based Learning

STEAM PBL concept

STEAM project-based Learning is,

-Learning that integrates principles of engineering design into the curriculum, which improves real-world application and helps prepare students for post-secondary school, 21st century skills, and job opportunities.
-It can be defined as an educational approach based on social constructivism theory, including problem solving, open-ended questions, manual practices, and the creation of interactive group activities.

The importance of STEAM project-based learning

STEAM PBL

- Changing the method of teaching science and mathematics in school so that the student can, through it, plunge into scientific knowledge
- STEAM project-based learning makes the school a more active and effective place for the student, providing him with a real reality of learning.
- Learning improves and learning stays for a long time

Builds skills for success in university, career and life, and provides job opportunities for post-secondary education

Connecting the student and school to the local community and the real world

- The student tries to implement the project and self-assess himself and draw conclusions. It is not necessary for him to succeed, rather failure prompts him to try again until he succeeds.

Characteristics of a STEAM course for secondary school

Any lesson applied using the Steam method has the following general characteristics:

1. Integration of STEAM-oriented disciplines and their employment.
2. Good planning of tasks and activities and the distribution of teacher and learner roles.
3. Cooperation between teachers in different disciplines, teachers of scientific investigations of mathematics, chemistry, physics, biology and technology, and teachers of human sciences (English, Arabic, Islamic education, history and geography) with science, technology, mathematics and engineering designs.
4. Diversity in outcomes, active learning strategies, teacher and student skills for the 21st century.
5. Performance evaluation, observation cards, self-evaluation and learning outcomes.

A teacher and student guide for teaching a STEAM PBL

A STEAM guide for curricular project-based learning was created that may include a problem-solving and investigation method for methodological projects in the textbook of various scientific investigations, or humanities studies, in it, the scientific practices of the next generation science standard(NGSS) are integrated into four planning models that aid the teacher, the student, and the assessment process**,** form (A) planning for the teacher in a schedule that contains STEM-based learning objectives based on projects, schedule and activities, explaining the role of the teacher and the student and the methods and methods used and the evaluation, Then I prepared a form (B) for the student to define and plan the theoretical aspect designed in tables, to determine the methods of collecting information, materials and tools needed, financing methods, and the integrative approach to STEAM in the project, then form (c) for the steps of implementing the project or practical experience and a form (D) The evaluation included a realistic and self-evaluation with appreciation and verbalization, and after applying it in practice during my 2020 initiative, some modifications were made to it to be used in a practical way.

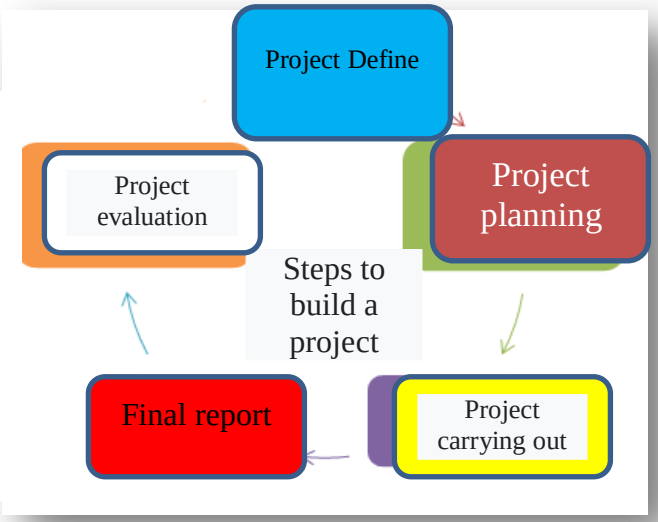
The agenda of curricular projects using the STEAM PBL included the following projects, which were implemented in February 2020:

- Scientific culture for the 12th grade of the first semester **(detergent production project).**
- Scientific Culture for Grade 11, First Semester **(Unit Two Projects, Contemporary Environmental Problems, pg. 45-pg. 67 & Herbs from the Palestinian environment**)
- Chemistry of Grade 11, Sciences of the first semester **(Unit Two, Chemical Calculations - Scientific Projects, pg. 53)**
- English for Grade 11 Second Semester (Recipe)

We found that applying the STEAM curve in high school gives better results and achieves the desired goals of the Steam curve well and creatively. I did not address the analysis of goals and the identification of needs because the teacher had prepared them in advance at the beginning of the study of each unit. Rather, it relied on the methodological projects in the last pages of the units of study of the textbook.

In January 2021, a detergent production project, research and investigation of a surface cleaning and disinfectant production project, with the integration of aspects of the STEAM PBL

Steps to build a STEAM project



First: Defining the project in the curriculum:

1-Defining the topic and topic in the textbook for the Palestinian curriculum.
2. Selecting and defining the project.
3. An explanatory explanation to the students about the concept of the project and how to implement it, through presenting samples of previous projects or a PowerPoint presentation or a video on the concept of the project

Second: planning the project

1. Developing a detailed plan for the implementation of the project, specifying the objectives, procedures, scientific practices, the role of the teacher, and the roles of students.
2. Linking activities, skills and experiences with science, mathematics, engineering design and the use of technology, and emphasizing the complementarity and interdependence between fields and knowledge unit.
3. Divide the students into groups, and each group has a leader. The name of the project is chosen in the research, the tasks and roles are distributed, and the teamwork is done.
4. Distribute roles to each student and determine the time period for delivery.
5. Determine the methods of obtaining the necessary information, materials and tools.
6. Determine the sources of financing.

Third: Implementation of the project

1. The teacher is a guide, mentor, and follower of students' active learning.
2. The student has to discover, investigate, research and solve problems.
3. Application of the project from the theoretical side to a tangible scientific reality under the supervision of the teacher.
4. Producing new knowledge in the light of knowledge integration.
5. Writing the practical activity report and the implementation steps.
6. Flexibility to accept opinions and discuss them with scientific evidence.

Fourth: the final report

Documenting and making a final project report that includes the following:
1) The name of the project
2) The time period to deliver the project
3) The project's importance and purpose
4) Integration of STEAM aspects into the project
5) Project procedures and implementation steps
6) Project results
7) Realistic Self-Assessment Cards
8) The most important recommendations and proposals for improving the project.

Fifth: Evaluating the project

. Determine who will participate in the evaluation process, and they are:

1) The student himself
2) Colleagues of the student
3) Teacher to the student
4) Parents

1. 1. Evaluating the learning by defining the standards for educating the next generation, including the following scientific practices:

i. Ask and formulate questions and define the problem.
ii. Clear planning and accurate goal setting.
iii. Executing, conducting experiments, verifying answers to questions, and recording results
iv. Form development and use
v. Systematically analyze, interpret and present data and build interpretations.
vi. Use mathematics and computational thinking
vii. Engage in scientific controversy with evidence
viii. Evaluation and information transfer

2. Evaluating project learning based on criteria:

Standard for learners' acquisition of knowledge

The criterion of learners' acquisition of a skill

- Standard for learners' acquisition of trends
- A criterion for learners' acquisition of multiple intelligences

3. Using a self-evaluation card during implementation and a realistic scorecard for the final report of appreciation and verbally appraising performance based on several specific criteria.

An example of implementing a detergent production project using STEAM learning and the expected performance in the learning process according to the next generation NGSS standards linked to three dimensions:

Key ideas, science and engineering practices, and overarching concepts

Main ideas in the field (The basic knowledge that the student learned previously and which will lead to his learning later)	Scientific and engineering practices (Includes scientific practices)	Cross-disciplinary concepts (Linking ideas and concepts between them)
The concept of saponification How does soap work? - A practical experiment activity for soap making Financial study Proficiency in using Microsoft software in the computer -	Ask questions and set a goal - Planning and preparing chemicals and calculating the required quantity Implementation and production of soap in practice Product evaluation Financial and economic feasibility study Displaying and promoting the product	Science: saponification for soap making and the method between chemistry and physics. Mathematics in the method of calculating cost and net profits. Engineering in the steps of manufacturing the product. - Arts in preparing and presenting the folded product. Technology in the use of computers, Microsoft programs and video design.

Form (A) for Educator Project Planning using STEAM PBL

Date :	Class:
Topic :	Unit :
Prerequisite:	the lesson :

evaluation	Means and methods	Activities and procedures Student's role	Teacher role	Time	Aims
self - Evaluation caed Real - evaluatin Based - on perform - ance - Evaluating the project and product with the terms of the performance evaluation verbally (very appropriate - appropriate - good - not appropriate) **Self evaluation** **Real evaluation**	**Project Based STEAM**	The student's role during group work Each student chooses a group and determines the type of project and its role in the project	- The teacher displays the types of projects in the textbook Guides students to the concept of the project, its implementation steps, and evaluation methods	Implementation period during every week	**Choose the project and its type**
	Student Project Planning form	It poses well-phrased questions and explains why he chose this project and what is its purpose? - Generates other questions	Directs to ask questions: What is the importance of the project? What is the economic feasibility of its production?		**Explain the importance of the project**
		The student connects the main ideas with comprehensive concepts and scientific and engineering practices. Uses the scientific knowledge you have gained in science, mathematics, technology and engineering designs Defines integration between disciplines -	Explains to students the STEAM approach Students are encouraged to link knowledge and disciplines: What knowledge and concepts in science and mathematics are needed to implement the project? What do we need from scientific and engineering practices, technological applications, and computational thinking skills to implement the project? -		**Specify the sides of STEAM**
		forming groups and allotting leader to each -	Directs students to form groups.		**Put detailed**

		one. Distributes roles and tasks to the group and checks the answers to the project question. Identifies tools, materials and information sources needed Identifies funding sources	Guides them to active learning, problem-solving, and inquiry style Supervises the distribution of tasks Determines the length of time for delivery		**plan for the project**
	Experiment activity sample and its procedure **Displaying The students Work**	Accurately implement the project steps and procedures and apply the Steam approach Uses information in constructing interpretations and follows the scientific method. Discuss with his colleagues his findings. He defends his opinion with scientific evidence. -	- Follow-up of students and overcoming obstacles during implementation Observing scientific practices Guidance and counseling -		**Carry out the project an**
		Writes the final report He provides the information he has found to his colleagues and his mentor Evaluates results in light of available evidence and facts. - He adjusts his knowledge in the light of new evidence -	guide students to the matters included in the final report: Project name and significance Integration of Steam aspects, procedures, economic feasibility, results, recommendations and proposals		**Write the final report about the project**
	Evaluation cards	Self-evaluation during project implementation	Project evaluation based on performance Provide feedback		**Project evaluation**

Form (B) planning a project for the student according to the STEAM approach

The title of lesson :	Subject:
Project Title :	Class :
Name of the Leading Student:	Duration :
Teacher :	delivery date :

Project question: What is the purpose of this project?

What are the methods of collecting information?	
What materials and tools are needed?	
What are the sources of financing the project?	

Project-based integration of Steam aspects	Complementary oriented **STEAM**
	science- S
	Technology- T
	Engineering design - E
	Arts –A
	Maths -M

Defining roles and responsibilities:

Scientific roles and practices	**Names of participants students**	
Ask questions, identify main ideas, and determine the knowledge and skills required to integrate aspects of STEAM		**1**
Good planning, information gathering and preparation of materials and tools		**2**
Implementing project steps according to the scientific method		**3**
Analyze and interpret data, and produce a video or PowerPoint		**4**
Self-evaluation and involvement in scientific debate		**5**
Prepare a final project report and use the evidence		**6**

- **Evaluating the project based on criteria set by the teacher**
- **Notes**: This model can be applied to any project in any topic with appropriate adjustments made for each project .This activity is distributed at the beginning of the project work.

Form (C) Procedures for experimenting activities and implementation steps

Subject /
Teacher /
Group number/

Day/
Date /
Class /

	Title of the project / experiment
	The goal of the project / experiment
	Safety and security precautions

Necessary tools	Necessary items

Steps and implementation procedures:

1 ....
2. ....
3. .....
4……...

Notes:----------

Note: This activity is distributed upon the implementation of the experiment or business activity

Form (D) Self-Assessment

Tick X around the appropriate rating

The student himself					Items / evaluator
Weak	**Moderate**	**Good**	**Very good**	**Excellent**	**NGSS**
					Ask and formulate questions
					Create a detailed implementation plan
					Teamwork
					Analyze data and build interpretations
					Project implementation and acquisition of knowledge and skills
					Project results
					STEAM-oriented integration

The students peers					Items / evaluator
Weak	**Moderate**	**Good**	**Very good**	**Excellent**	
					Discusses with his colleague when choosing a project title
					Collaborate and team up on execution
					Steam-oriented integration between fields and disciplines
					Implementation of the project and commitment to the specified time period
					He accepts and respects the opinion of his colleagues
					He defends his opinion using scientific evidence

Guardian					Items / evaluator
Weak	**Moderate**	**Good**	**Very good**	**Excellent**	
					Suitable project selection linked to practical life
					Collecting information and data accurately and scientifically
					Project implementation and acquisition of skills and knowledge
					It provides an opportunity for the student to understand the real world
					The project develops the students' intelligence

Realistic evaluation of the student's project

Project Title **Group Number**

Evaluation of the final report with evaluation according to scientific practices

1 Not achieving the goal	2 Partially accomplishes the goal	3 It achieves the goal well	4 It achieves the goal with distinction	Items	NGSS Next Generation Science Education Standards Items
				The project title is clear and relevant to the topic	**Ask questions and identify the problem**
				The student asks questions and identifies a problem	
				The project is presented in an integrative manner for the STEAM approach	**Form development and use**
				The student develops a clear and complete plan	
				The student follows the scientific method and checks the answers to the questions	**Planning, implementation and investigation**
				The student displays the data in an orderly fashion	Data analysis and interpretation
				The student uses information and observations to construct interpretations	
				The student defends his opinion with scientific evidence	Engage in controversy and evidence
				The student discusses with his colleagues his findings	
				Comprehensiveness of the report to the objectives and outcomes of the project	Building explanations and design solutions
				The implementation of the project contributed to the development of students' knowledge	Obtaining evaluation and transfer of information
				The student evaluates the project in achieving the goal and purpose	

48 Excellent / 36 Good / 24 Acceptable / 12 Needs to be revised and re-report

Verbal performance evaluation

evaluations				Criteria items	Criteria
not suitable	good	suitable	very suitable		
				Familiarity with professional ideas and scientific practices	Learners gain knowledge
				Follow safety and security measures	
				Answer any questions about the project	
				Collecting information and data	
				Integration of Steam curve aspects into the project	
				Carry out procedures and steps accurately	Learners acquire the skill
				Build a model or design	
				Computer use and its applications	
				The skill of communication, communication and teamwork for students	Learners gain directions
				The project was delivered on time	
				Spatial intelligence in building a mental image of the project	Multiple Intelligences
				Linguistic intelligence in discussing and presenting the project	
				Social intelligence in team work	
				Intelligent self-confidence in self-abilities	

Scientific culture for grade 12

A project planning model according to the STEAM PBL

Teacher planning a detergent production project using STEAM PBL Scientific Culture Curriculum for Grade12 studied detergents 2021

evaluation	Means And procedures	Activities and experiences		Time	Aims
		The role of the student during group work.	The role of the teacher		
- **Evaluation card** - **Realistic performance based** - **card** - **-A form consisting of several items to evaluate the report with evaluation (Excellent, Very Good, Acceptable, or Needs Amendment).** **- Project and product evaluation with points**	Learn project -based STEAM	Students are divided into groups in a detergent production project -The student thinks about what kind of detergent he will make on the project -Each group chooses the type of product: dishwashing liquid detergent, hands, floors, laundry, solid soap, etc.	-The teacher presents a project to produce a cleaner from the textbook. Explain to students the concept of the project and the steps of its procedure Follow up and oversee the division of groups and assign a leader to each group	Duration: 3 weeks **from 9/1 To 31/1**	**He chooses and determines the type of project**
	Project planning form For the student	-The student asks the project question. Students explain why this project was chosen and what is its purpose? What is its economic importance?	Asks a question: What is the importance of the project? What is the economic feasibility of its production?		**Explains the importance of the project**
		- Students connect key ideas with the whole concepts and scientific and engineering practices- - Uses scientific knowledge in determining the required materials and how the product will produce its shape, packaging, basic information about its use, mathematics in	- Explains to students the STEAM approach - Explain the STEAM approach to connect knowledge - disciplines - What do we need from knowledge and concepts in science and mathematics to		**Defines integration of aspects of STEAM**

Verbally evaluation performance (very appropriate - adequate - good - inappropriate)		calculating expenses, profit, and engineering design in tracking manufacturing steps, product production and technology in preparing a video or PowerPoint for the project	implement the project? - What do we need from scientific, engineering and technological applications to implement the project ؟		
		-Forming groups, and a leader is identified for each group, who defines a clear plan for the project -The distribution of roles and tasks in the group Identifies tools, materials needed, sources of information and financing	Directs students to form groups Guides them in the method of problem-solving and investigation Supervises the distribution of tasks, collection of information and materials, and preparation of tools -Specifies the time period for delivery		Establishes a detailed project plan

evaluation	Means And procedures	Activities and experiences		Time	Aims
Self-evaluation card Realistic Evaluation card	Sample activity experiment and implementation steps Show students' work	-Implement the project steps accurately - apply STEM approach and integration between disciplines - Follow up the steps of manufacturing the product - Knowing each student's turn - Colleagues discuss together the manufacturing steps, materials used, and the role of each - Commitment to the deadline for implementation and delivery of the project	- -Follow-up of students and overcoming obstacles during implementation - Observing scientific practices - Guidance and counseling	The Second week	The project is being implemented
		- You write a report that includes the name of the project, its importance, procedures, economic feasibility and results - Other materials are suggested to improve the product - Rate the product that was manufactured - Modifies its knowledge after practical application of the product	- Directing students to the matters included in the final report	The Third week	Writes a final report on the project
	Evaluation cards	- Self-evaluation during project implementation	- Project Evaluation Performance evaluation and final report Provide feedback		Project Evaluation
		Show the product to mates in other groups and for parents and the local community	Set up an exhibition to display the group's **products.** Encouraging the best group		Product Show

➢ ▯ Statement during implementation

--In the first week: The students were divided into groups, and each group began to think about what kind of detergents would be made and started feeling the problem, determining the purpose of the project, then collecting data and information and seeking help from the local community, parents and the Internet**.**

-In the second week, the implementation and manufacture of soap was carried out inside the school laboratory after preparing the materials and tools and the students followed up on the steps of manufacturing and production. .

-In the third week, the evaluation was done and the products were presented to the school - students and teachers, and samples were taken for parents to evaluate them, and the students put forward suggestions and recommendations for improving the products
-Display products in a permanent exhibition .

Form (B) Planning a project for the student according to the STEAM approach to produce a detergent

- Project question: Is it possible to produce dishwashing liquid soap with good specifications? Can it be used as a source of income?

What is the purpose of this project?

Producing dishwashing liquid soap with good specifications that contributes to cleaning and daily use and is a source of income

Local community - parents	What are the methods of collecting information?
SLES - LABS - NaOH- NaOCL - salt - litmus paper - perfumed - color material	What materials and tools are needed?
School / Parents	What are the sources of financing the project?

Project-based integration of Steam aspects	Complementary oriented STEAM
Knowing the scientific name of materials, how they are used and their impact on the environment	science- S
Use Microsoft Word and PowerPoint applications to promote the product	Technology- T
Steps to produce and manufacture the product and add materials	Engineering design - E
Draw or design a product definition	Arts –A
A financial study of the project that calculates expenses, revenues and net profit	Maths -M

- **Defining roles and responsibilities**

Scientific roles and practices	The names of the students participating in the project	
Asking questions and generating other questions about the dishwashing liquid soap industry, identifying environmental risks, and integrating the Steam approach	Faryal Dabbish with the group students	1
Good planning and gathering of information to prepare materials and tools	Faryal Dabbish ,Yasmine Lababid& Fatema Awad	2
Implementing project steps according to the scientific method and following up on results	Farah Zoghbar , Malak Abo Naje & group students	3
Preparing a product introduction poster and preparing PowerPoint	Faryal Dabbish	4
evaluation	roup students, Parents and teacher.	5
Do a financial study	Farah Zoghbar	6

Notes: This activity is distributed at the beginning of the project work.

Form (C) Procedures for experimenting activity and steps for implementation

Title of the experience	Detergent production project
The goal of the experiment	Produce 20 liters of dishwashing liquid soap
Materials needed	2 Kilo SLES - 1 kilo LABSA - NaOCL
Necessary tools	Caustic soda - salt - fragrant - colorant
Safety and security precautions	Litmus paper - plastic container - wooden stick

Steps and implementation procedures:

1-We put 20 liters of water in a plastic container, then put 2 kg of SLES(Sodium Lauerth Sulafate)& 1 kg LABSA(Linear alkyl benzene sulfonic acid) in the bowl and stir it well slowly and quietly using a wooden stick

2-Then we leave the mixture for 24 hours, that is, for the next day, with stirring every 3-4 hours at least three times, to ensure that the SLES andLABSA are completely dissolved so that they cannot be seen and the liquid becomes clear.

3- We gradually add caustic soda to the mixture, and measure the pH using blue litmus paper when we reach the neutral stage,

4- add a little table salt, stirring well until it has a good consistency.

5-The next day we add freshener and colorant.

6-Formalin preservative is added 1 drop per liter

Surface cleaner and sanitizer preparation

In another bowl, put 10 liters of pure water and add 10 ml of 5% sodium hypochlorite to prepare a surface sterile liquid, then add 20 ml to 60 ml of the previous detergent before adding the salt then Formalin preservative is added 1 drop per liter

It is placed in spray packages

Note: This activity is distributed when the experiment or work activity is executed

Financial study report for the project

First: Calculating expenses for all purchases:

Operating expenses = how many raw materials x their price = 32 (the price of a kilo ETA is 7 - shekels - a kilo of LABS is 9 shekels + 9 miscellaneous)

Second: Calculating revenue = number of units x price = 20 liters x 3 = 60 shekels

Third: Profit account = revenue - expenditures = 60 - 32 = 28 shekels

Group number: 1)) 12 / literary Sample (D) Realistic teacher evaluation for the student

Project title: Production of a clear detergent liquid

Report Evaluation

1 Not achieving the goal	2 Partially accomplishes the goal	3 It achieves the goal well	4 It achieves the goal with distinction	Items	NGSS Next Generation Science Education Standards Items
			X	The project title is clear and relevant to the topic	Ask questions and identify the problem
		X		The student asks questions and identifies a problem	
		X		The project is presented in an integrative manner for the STEAM approach	Form development and use
		X		The student develops a clear and complete plan	
		X		The student follows the scientific method and checks the answers to the questions	Planning, implementation and investigation
		X		The student displays the data in an orderly fashion	Data analysis and interpretation
		X		The student uses information and observations to construct interpretations	
		X		The student defends his opinion with scientific evidence	Engage in controversy and evidence
		X		The student discusses with his colleagues his findings	
		X		Comprehensiveness of the report to the objectives and outcomes of the project	Building explanations and design solutions
			X	The implementation of the project contributed to the development of students' knowledge	Obtaining evaluation and transfer of information
			X	The student evaluates the project in achieving the goal and purpose	
Final evaluation for the project :Good					Total

•48Excellent / 36 Good / 24 Acceptable / 12 Needs to be revised and re-reported

Verbal performance evaluation

evaluations				Criteria items	Criteria	NO.
not suitable	good	suitable	very suitable			
			X	Familiarity with professional ideas, basic concepts, and scientific practices	Learners gain knowledge	1
		X		Follow safety and security measures		
		X		Answer any questions about the project		
		X		Collecting information and data		
		X		Integration of Steam curve aspects into the project		
			X	Carry out procedures and steps accurately	Learners acquire the skill	2
		X		Build a model or design		
		X		Computer use and its applications		
			X	The skill of communication, communication and teamwork for students	Learners gain directions	3
		X		A project is delivered on time		
		X		Spatial intelligence in building a mental image of the project	Multiple Intelligences	4
		X		Linguistic intelligence in discussing and presenting the project		
			X	Social intelligence in team work		
		X		Intelligent self-confidence in self-abilities		

Final Report of a project to produce a liquid detergent using the STEM PBL

Project title: Project for producing liquid detergent(Dishwasher detergent cleaner ,Hand cleanser & Surface disinfectant.

The goal of the project: Practically applying the steps of producing a dishwashing liquid - detergent to produce a dishwashing liquid

Duration: three weeks

Sources of information: the local community network of information on the Internet -

Funding sources: school - parents

Integration of STEM aspects	Necessary materials and required quantity		Tools
Science in identifying the names of the scientific materials included in the cleaning liquid and their degree of danger to the environment - Technology in using computers to prepare PowerPoint - Engineering in mastering manufacturing steps and packing stages - Mathematics in calculating cost, revenue and net profit	2 kg	ETA-SLES(Sodium Laureth Sulfate)	Plastic bowl
	1 kg	Dressing material (LABSA): Linear alkyl benzene sulfonic	Balance
	20 liters	Water	Wooden spoon
	10 ml	Essential oil	Included glass cup
	1gm	Colorful substance	Blue litmus paper
	50 g dissolved in water	SODUIM hydroxide	
	Kilo	Sodium chloride salt-	
	200 ml of 5%	Sodium hypochlorite	
	20 points	Formalin or sodium benzoate	

Practical steps:

As llustrated in form C

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Recommendations: Use of Tylose to produce a detergent with higher cleaning efficiency, smoothness and viscosity

Note: The self-evaluation and financial study of the project are attached

Scientific culture for grade 11

A project planning model for the student according to the STEAM PBL
Entitled Pollution Resistance In Your Area

Project question

What type of pollutants and their sources will you choose? **solid waste**

What is the purpose and importance of this project**? Reducing solid waste around the school**

What are the methods of collecting information?	Camera photography
What materials and tools are needed?	Mobile video maker program ,pens and posters
What are the sources of financing the project?	Self

Project-based integration of Steam aspects	Complementary oriented STEAM
Writing a scientific report on the concept of solid waste, its sources, methods of recycling, and proposals to reduce it	science- S
using a photography camera to create a video montage for presentation to the local community and to publish it on social media	Technology- T
View the report on a wall panel	Engineering design - E
	Arts –A
	Maths -M

Defining roles and responsibilities

Scientific roles and practices	The names of the students participating in the project	
Ask questions and identify the types and sources of pollution in the area	Marwa Abu Nahl & Student group	1
Good planning to solve the problem and determine the effects resulting from these pollutants and measures to reduce them		
Identify aspects of integration and project implementation		2
Analyzing and interpreting data, preparing brochures, banners and school radio		3
Self-evaluation, engaging in scientific debate, and a PowerPoint or video of the project		4
Writing a final report and presenting the project to colleagues		5

Final report of the pollution control project in your area

Project Title: Solid Waste
Objective of the project: Pollution resistance of household solid waste in the vicinity of Al-Huda Secondary School
Duration: three weeks
Sources of information: Textbook - The local community - Information network -internet
Funding sources: school - parents

Project-based integration of Steam aspects	Materials and tools used
S - Science in scientific knowledge of solid waste damage forming a positive trend towards preserving the environment	- - A mobile camera for photography
T - The technology of using a photography camera to create a video montage for presentation to the local community and to publish it on social media	- Computer
E - Engineering design in preparing and designing an interesting project presentation	-
A - Arts use of drawing	world Wide Web
M - Mathematics in calculating pollution damages from solid waste according to the Statistics Center data	

Steps: -

Writing a report that displays ⦿

The concept of solid waste

- Filming a video about the problem of household solid waste surrounding the school
- Show pictures and video design of solid waste about Al Huda Secondary School for Girls
- To express an opinion and determine the damages resulting from the existence of such waste Propose solutions and come up with recommendations
- Post the video on the school page
- Observation and conclusion: the interaction of parents and guardians towards the problem of pollution with solid waste and the formation of a trend towards preserving the environment

Note: The self-evaluation is attached to the PowerPoint presentation and the video of the project, along with a display of the project steps

There are three groups of students for the pollution project in your area, one of them chose solid waste pollution, the second noise pollution, and the third contamination of the groundwater reservoir in the Sheikh Radwan area, Gaza.

Project Videos

https://youtu.be/ROEJwqBqGlo?list=PLwzjps7YEnKX9WAc_IDQHPQtcoahHGqyI

https://youtu.be/7V5-_1gS-y8?list=PLwzjps7YEnKX9WAc_IDQHPQtcoahHGqyI

A project planning form for the student to reuse the consumed products Scientific Culture Study 11

The question of the project: What kind of pollutants can be reused ?

The importance of the project : Recycle plastic and cardboard products.

What are the methods of collecting information?	The Internet and the local community
What materials and tools are needed?	Boxes of consumables- colored paper- a pair of scissors- sticky glue
What are the sources of financing the project?	The school and the community

Project-based integration of Steam aspects	Complementary oriented STEAM
Product classification and scientific ideas for reuse	S- science
Design a video	T- Technology
Various engineering designs	E - Engineering design
Drawing and coloring to decorate	A –Arts
Take measurements	M -Maths

Defining roles and responsibilities

The roles and duties	The names of the students participating in the project	
Asking the project question, identifying the consumed products to be recycled and identifying aspects of integration	Inas Khadra	1
Well-planned grouping of consumable products to be recycled	, Basma and Saja	2
Executing the project in clear steps, using art or drawing, and making engineering designs	Abeer Al-Hindawi - Malak Abunadi	3
Writing a report, PowerPoint or video for the project	Inas Khadra	4
Determine the environmental and economic feasibility of recycling and product presentation	Sarah Al Ghoul	5

Project evaluation is subjective and realistic

Final Report of the Consumer Products Reuse Project

Project Title: From a Box Create the Impossible -
Objective of the project: to implement practical steps to reuse cans - -
Duration: three weeks -
Sources of information Textbook network of information on the Internet - -
- Funding sources: school - parents

Project-based integration of Steam aspects	Materials and tools used
S - Science in the scientific knowledge of the consumable materials and waste recycling methods and the formation of a positive trend towards preserving the environment	Boxes of consumables
T - Technology of using software in video montage to promote the idea and use of scientific practices for recycling	colored paper
E - Engineering design in preparing different designs for reusing consumable cans for different purposes	a pair of scissors
A - Arts use drawing to decorate	sticky glue
M - Mathematics in a financial study to calculate the cost of expenses, revenues, and net profit if the product is shown to the public	

Steps ➢

- Ask questions about the most consumable and most recyclable products
- Choose consumable products such as boxes and bring a box
- The box is cut to the appropriate size
- After that, the box is wrapped from the outside with colored paper
- And it is also wrapped inside with colored paper
- After that, bring shapes for decoration or drawing
- Calculate the cost
- Presentation of the product for use and a suggestion for its development
- Observation and conclusion: obtaining a new form that can be used for different purposes

Note: The self-evaluation, financial study of the project and PowerPoint presentation are attached
(https://youtu.be/EPDvhsKTYFQ?list=PLwzjps7YEnKX9WAc_IDQHPQtcoahHGqyI)

There are several groups of students for the Consumer Products Reuse project

Form (A) Ateacher Planning using STEM PBL in chemistry

Evaluation	means	Activities and experiences		Time	Aims
Project title: Measuring chlorine concentration in tap water			Grade: Eleven /scientific stream		
The main requirement			Topic: Chemistry, Chapter One		
Duration: 3 weeks			Lesson: Chemical Calculations		
- Self evaluation card - Realistic performance based evaluation card - A form consisting of several items to evaluate the report with appreciation (Excellent, Very Good, Acceptable, or Needs Amendment).- - The product with the terms of the performance appraisal verbally		**Student's role**	**Teacher's role**	**First week**	**He chooses and determines the type of project**
	Learn project-based Steam STEM	Students are divided into groups in a project Each group chooses a leader -Each group determines the type of project and chooses one of the projects, p. 53	-The teacher presents the project from the textbook Explain to students the concept of the project and the steps of its procedure Follow up and oversee the division of groups and assign a leader to each group		
		-Students explain Why was this project chosen and what is its purpose? What is its economic importance?	He asks a question Why is the project important?		**Explains the importance of the project**
		- The student thinks about what is the appropriate experiment to measure the proportion of chlorine in the water - The student connects the main ideas with comprehensive concepts and scientific and engineering practices - The science of chemistry is used in the design of the experiment, the determination of the	- Demonstrates a STEM / STEAM approach to students - Asks questions: - What do we need from knowledge and concepts in science and mathematics to implement the project? - What do we need from scientific, engineering and technological applications to implement the		**Defines integration of aspects of STEM**

(very appropriate - appropriate - good - not appropriate)		required materials and the method of chemical calculations - And mathematics in calculating the proportion of chlorine in the water and technology in preparing a video of the work steps and PowerPoint of the project	project?		
	Student planning form	Forming groups and allotting leaders -Identifies necessary tools, materials and information sources Determine funding sources	Instructs students and oversees assignment assignments, information gathering, experiment design, and preparation of materials and tools - -Specifies the time period for delivery		To develop a detailed project plan

Evaluation	means	Activities and experiences		Time	Aims
		Student's role	Teacher's role		
	Project based Steam curve STEAM Sample business experience activity	**The project steps are implemented accurately** **-Using the Mohr method or** the chemical calculations method from the silver chloride precipitate Knowing each student's turn -turn commitment to the deadline for implementation and delivery of the project -Filming a video of the work steps Record the results and come up with	- Follow-up of students and smooth out pre-implementation - Supervising chemical accounts - Guidance and counseling		**To carry out the project**

		recommendations and proposals Preparing PowerPoint for the project			
	Final report Power point PowerPoint And video	You write a report that includes the name of the project, its importance, procedures, results, significance of that and the most important difficulties - Other methods of chlorine measurement are suggested	**Directing students to the matters included in the final report**		**Writes a final report on the project**
	evaluation cards	Self-evaluation during project implementation by the student himself, colleagues and parents	Project evaluation realistic evaluation Provide feedback -		**Project evaluation**

سؤال بعد دراستك هذه الوحدة، ما اثر الحسابات الكيميائية على جوانب الحياة المختلفة؟

المشاريع العلمية:

Question:

After your study of this unit ,what is the effect of chemical calculations on the different sides of life?

The scientific projects:

After studying this unit , you can carry out one of the following projects:

- Designing experiment to measure calcium in water.
- Designing experiment to measure the effective substance in many types of acid anti acid which exist in the local markets
- Designing experiment to measure the concentration of chlorine in water sample ,and making comparison of the results with the Palestinian qualities.
-

A project planning model for the student according to the STEAM approach, chemistry course for the 11th grade

Sample project planning for the student to design an experiment to measure chlorine concentration in a drinking water sample

What is the purpose of this project

Measuring the percentage of chlorine in tap water and drinking water for Al Huda Secondary School for Girls in Sheikh Radwan area

Textbook - the internet	What are the methods of collecting information?
0.0141 Silver Nitrate Solution - Potassium Chromate - Erlenmeyer flask, pulverizer and glass beaker	What materials and tools are needed?
School / Parents	What are the sources of financing the project?

Project-based integration of Steam aspects	Complementary oriented STEAM /STEM
Chemical formulas of compounds - Chemical calculations in weighted equations - Titration method	S - science
Using Microsoft PowerPoint applications and video photography and montage	T - technology
Steps to apply the experiment and design an alternative experiment in case the materials are not available	E - Engineering design
Draw experiment steps	A - Arts / Humanities
Chemical calculations and calculation of chlorine concentration in water	M - Mathematics

Defining roles and responsibilities •

Scientific roles and practices	Students' names	
Define the problem, gather information, and prepare materials and tools	Rabiaa Al-Gharabawi and a group of 11 scientific students	1
Planning and investigation to put experience into practice		2
Chemical calculations and measurement of chlorine concentration in a drinking water sample		3
Build explanations after gathering evidence and results		4
Writing a report and the steps of the experiment		5
PowerPoint presentation and a video of the project to students and the Internet		6
Evaluating the results and presenting the project to the students and teachers		

Notes:

This activity is distributed at the beginning of the project work while the actual evaluation takes place after the completion of the project

Final determination of measuring chlorine concentration in tap water Mohr method

- Project title: Project for measuring chlorine content in tap water and drinking water
  The goal of the project: To apply practical steps to calculate the percentage of chlorine in tap water and drinking water
- Duration: three weeks
- -Sources of information Textbook network of information on the Internet
  Funding sources: school – parent
- **Materials and tools required**

Integration of STEAM aspects	Necessary materials and required quantity		Tools
In science design an experiment and determine materials to measure chlorine concentration -Using computer technology and preparing PowerPoint -In mathematics, chemical calculations -Engineering experiment steps in order	Placed in a burette	A solution of silver nitrate is 0.0141	Glass cup capacity of 400 ml Distilled water
	One millimeter	Potassium chromate 5% concentration	Burette (25 ml)
	٢٠ millimeters	Water sample to be tested	Conical flask

Steps:

Calibration method
A 0.0141 standard silver nitrate solution is used in a burette
- Put 20 ml of the water sample in the beaker and 1 ml of the potassium chromate reagent
Silver nitrate is added until the color changes and we reach the end of the titration
In this test a precipitate was formed in the presence of chloride ions in the form of a white sediment of silver chloride AgCl.
The end point of the titration is known as the presence of Ag silver ions in the presence of potassium chromate, which precipitates Ag silver ions as a red precipitate of silver chromate.
$AgNO_3 + NaCl$ ----------> $AgCl + NaNO_3$
$AgNO_3 + K_2CrO_4$ ----------> $Ag_2CrO_4 + KNO_3$
- AgCl is a white precipitate, Ag_2CrO_4 is a precipitate of two red colors, with some indicating a cream color, which indicates the end of the calibration.

Calculations:

Take a burette reading and substitute in the following formula:
Cl ppm = (m1-m2) * 35.45 * 1000 * N / ml sample concentration
-Chlorine concentration in ppm = amount of silver nitrate used x molecular weight of chlorine x 1000 x titration of silver nitrate / sample weight in mm
-In the event that the result is less than 200ppm, then this water is suitable for drinking and irrigation.
-In the event that the result is between 200ppm to 500ppm, then the water quality is poor, it is used to irrigate plants with moderate salt tolerance. In the event that the result is between 500ppm to 1000ppm, it is used to irrigate plants that tolerate high salinity. In the event that the result is greater than 1000ppm, it is used to irrigate plants Very salt tolerant

Final report of a project to measure chlorine concentration in tap water for the Sheikh Radwan area in Gaza

- -Project title: Al-Huda Secondary School for Measuring Chlorine in Tap and Drinking Water
- The goal of the project: To apply practical steps to calculate the percentage of chlorine in tap water and drinking water
- Duration: three weeks
- -Sources of information: the textbook - the information network on the Internet
- Funding sources: school - parents

Integration of STEAM aspects	Necessary materials and required quantity		Tools
- In science design an experiment and determine materials to measure chlorine concentration Using computer - technology and preparing PowerPoint In mathematics, chemical - calculations	1.96g in 100 ml	Silver nitrate at a concentration of 0.1 mol / L	Glass cup capacity of 400 ml
	3 100cm	Water sample to be tested	Distilled water
			Glass funnel
			Paper nomination

Steps:

- -We prepare silver nitrate at a concentration of 0.1 mol / liter by dissolving 1.69 g of silver nitrate in 100 cm3 water
- We put 100 cm3 of the water to be tested in the glass beaker
- -Add silver nitrate gradually to it with stirring until the sediment formation stops
- We weigh the filter paper on the sensitive scale, then use it to filter the sediment
- We filter the solution and let it dry for several days, then measure the weight of the filter paper and calculate the mass of the precipitate
- Observation and conclusion: The silver chloride precipitate was AgNO3 + Cl ----------> AgCl + NaNO3
- -Weight of the precipitate in tap water = 0.9 g
- The weight of the deposit in drinking water = 0.1 g

- ## Calculate the percentage of chlorine ion in water

- **Silver nitrate concentration = number of moles / volume (liter) = k / km m × h liter = 1.6 / 170 x 0.1 = 0.94 mol / liter**
- **-n the number of moles of silver chloride (precipitated in tap water) = k / km m = 0,9 / 35.5 + 108 = 0,0063 mol**
- **-The concentration of chlorine ion in silver chloride (precipitated in tap water) = n / h liter = 0,0063 / 0,1 = 0.063 mol / l**
- **-Ppm = chlorine ion concentration (in tap water) x molar mass of chlorine x 1000 = 2236,5ppm**
- **-Ppm = chlorine ion concentration (in drinking water) x molar mass of chlorine x 1000 = 247.4ppm**

-According to the Palestinian Public Health Laboratories: The result is higher than 1000 ppm used to irrigate plants that are highly tolerant to salinity / Results: The water in the tap is not suitable even for irrigation of plants, while in drinking water it is not suitable for drinking

Final report of the Antacid Drug Measurement Project

- **Project title: Measurement of Calcium Carbonate in Antacid Drugs Project**
- **Objective of the project: To apply practical steps to calculate and compare calcium carbonate in antacid drugs**

- Duration: three weeks

-Sources of information: the local community - the textbook - the information network on the Internet

Funding sources: school - parents

Integration of STEAM aspects	Necessary materials and required quantity		Tools
In science designing a practical experiment and identifying the substances, their scientific names, and how to interact to measure calcium concentration in antacid drugs Using computer technology and - preparing PowerPoint In mathematics, chemical calculations - Engineering experiment steps in order -	Antacid medicine piece	Acidity medication contains calcium carbonate	Glass beaker glass beaker Glass funnel
	Ml 50	**HCL acid**	Sensitive balance filter paper

➢ Steps:

.Weigh the pill. And put the pill in the glass cup. And we add HCL acid -

.We weigh the filter paper. Then the resulting solution is filtered with a filter paper and let the filtrate dry -

We weigh the precipitate, and from the mass of the precipitate, we calculate the number of moles, and then - with the formula, we calculate the mass of calcium carbonate in a pill

Observation and conclusion: CO2 sublimation. Calcium chloride precipitate was formed -

CaCO3 + 2HCl ----------> CaCl2 +H2CO3

- **Calculate the mass of calcium carbonate in an antacid pill**

-mass of the filter paper = 0.9 g.

-the mass of salt precipitated with filter paper = 1.8 g.

-mass of precipitate = mass of salt precipitated with filter paper - mass of filter paper.

Salt mass = 1.8 - 0.9 = 0.9 g.

Calcium chloride moles (precipitate) = mass ÷ molar mass. = 0.9 ÷ 111 = 0.008 mol

-From the equation 1 mole of calcium carbonate 1 mole of calcium chloride (precipitate)

-The mass of calcium carbonate in the medicine, K = n × km, = 0.008 x 100 = 0.8 g = 800 mg is identical to the mass of calcium carbonate written on the pill.

A final report for the project of measuring calcium concentration in tap and drinking water at Al Huda School

Project title: Calcium Measurement Project in Tap Water in Sheikh Radwan Region
The goal of the project: To apply practical steps to calculate the percentage of calcium in tap water and drinking water
Duration: three weeks
Sources of information: the local community - the textbook - the information network on the Internet -
Funding sources: school – parents

Integration of STEAM aspects	Necessary materials and required quantity		Tools
In science designing a practical experiment, identifying materials, their scientific names, and how to interact to measure calcium concentration in water Using computer technology - and preparing PowerPoint In mathematics, chemical - calculations Engineering experiment steps in - order	١ مل	Arsenazo's reagent solution lll	5ml test tubes
	25 µl	Concentration titrator standard	Pipette a volume of 1 l and 100 ml
		Water sample to be tested	Conical flask

Steps:

Bring 4 test tubes and put 1 ml of the reagent solution in each tube and write them down -
We use 25 µl of the standard 10mg / dl concentration titrant into the second tube -
We use 25 l of the drinking water sample to be tested into the third tube -
We use 25 l of the tap water sample to be tested to the fourth tube -
Then mix the ingredients and leave it for 5 minutes at room temperature -
We set the wavelength 650 on the Spectrophotometer, then zero in through the first tube, then read the - samples on the device, which depends on the color degree when the calcium interacts with the detector solution and record the values

Observation and conclusion: We notice the darker color in the eye that contains the largest amount of calcium, which is the tap water sample
Calculations: Calcium concentration = Absorption value in sample / Absorption value in titrated solution x 10
Results: Calcium concentration in tap water = 22.49 mg / dl = 224.9 mg / l
 Calcium concentration in drinking water = 1.44 mg / dl = 14.4 mg / l
According to the Palestinian Public Health Laboratories, the calcium ratio is from 100-200 mg /l

https://youtu.be/FfWyX3Vtye8- Video link showing the steps

Final report of a project to measure calcium concentration in water

Project title: Calcium Measurement Project in tap and drinking water
The goal of the project: To apply practical steps to calculate the percentage of calcium in tap water and drinking water
Duration: three weeks
-Sources of information: the local community - the textbook - the information network on the Internet
Funding sources: school – parents

Integration of STEAM aspects	Necessary materials and required quantity		Tools
In science designing a practical experiment, identifying materials, their scientific names, and how to interact to measure calcium concentration in water Using computer - technology and preparing PowerPoint In mathematics, - chemical calculations Engineering experiment steps - in order		EDTA	burette
	2ml	NaOH solution is sodium hydroxide	Conical flask ml 250
	5ml	Water sample to be tested	Pipette
	20ml	Distilled water	
		Pyroxane reagent 50 mg concentration	

Steps:

into an Erlenmeyer flask -
Add 5 ml of water to be tested -
Add 20 ml of distilled water -
Add 2 ml of NaOH until the medium becomes basic -
Add pyroxane reagent concentration of 50 mg to make the middle color reddish-pink - -
Adding EDTA to burette -
EDTA is added to the conical flask gradually with stirring until the color becomes purple -
Record the volume of EDTA consumed per burette -

Calculations
Calcium concentration = Ca + 2
PPm = EDTA size x 292.24 x N EDTA x 1000 / sample size mm

English Language for Grade 11

A project planning model according to the STEAM PBL

- Project question:
  - What is the purpose and importance of this project?

    How to prepare a balanced diet with nutrients?

What are the methods of collecting information?
What materials and tools are needed?
What are the sources of financing the project?

Project-based integration of Steam aspects	Complementary oriented **STEAM**
Determine the components of the meal and determine the nutrients of carbohydrates, fats, vitamins and mineral salts	S – science
Using Video show for video editing	T - technology
Preparing the meal in neat steps	E - Engineering design
Incorporate the English language during the preparation steps	A - Arts / Humanities
Calculate the amounts and the number of calories per meal	M - Mathematics

- **Defining roles and responsibilities**

Roles and scientific practices	Students' names	
Define the problem and ask questions	Aya Barakat and 11 scientific students	1
Good planning and collection of materials and tools needed to make the recipe		2
Prepare the meal and count the number of calories and balanced nutrients used		3
Preparing PowerPoint and video montage for the project		4
View the final report		5
Presenting the project to students and the public		6

Use realistic self-evaluation

➢ Displaying sites for various students ’projects

- **YouTube for a project to produce a detergent for the Scientific Culture Study for Grade 12 Humanities**
- https://youtu.be/rfUTTaZNlMU

- https://youtu.be/ikCtNqHDHfk
- https://youtu.be/lwduMCOVmsE
- https://youtu.be/LI0iJ4ztf_w
- **YouTube for projects for the topic of scientific culture for grade 11 / Literary stream**
- **https://youtu.be/UsjHCfFTuEQ**
- **https://youtu.be/7V5-_1gS-y8**
- **https://youtu.be/EPDvhsKTYFQ**
- **https://youtu.be/8iWs0E3N_kE**
- **https://youtu.be/NOQ0ovF76EE**
- **https://youtu.be/ROEJwqBqGlo**
- **https://youtu.be/3wQxBhmp-dk**
- **YouTube for chemistry research projects for grade 11 science**
- **https://youtu.be/cKjHvqqaV1Y**
- **https://youtu.be/SE8j3Sh4h7A**

➢ Google Site

https://sites.google.com/view/stem