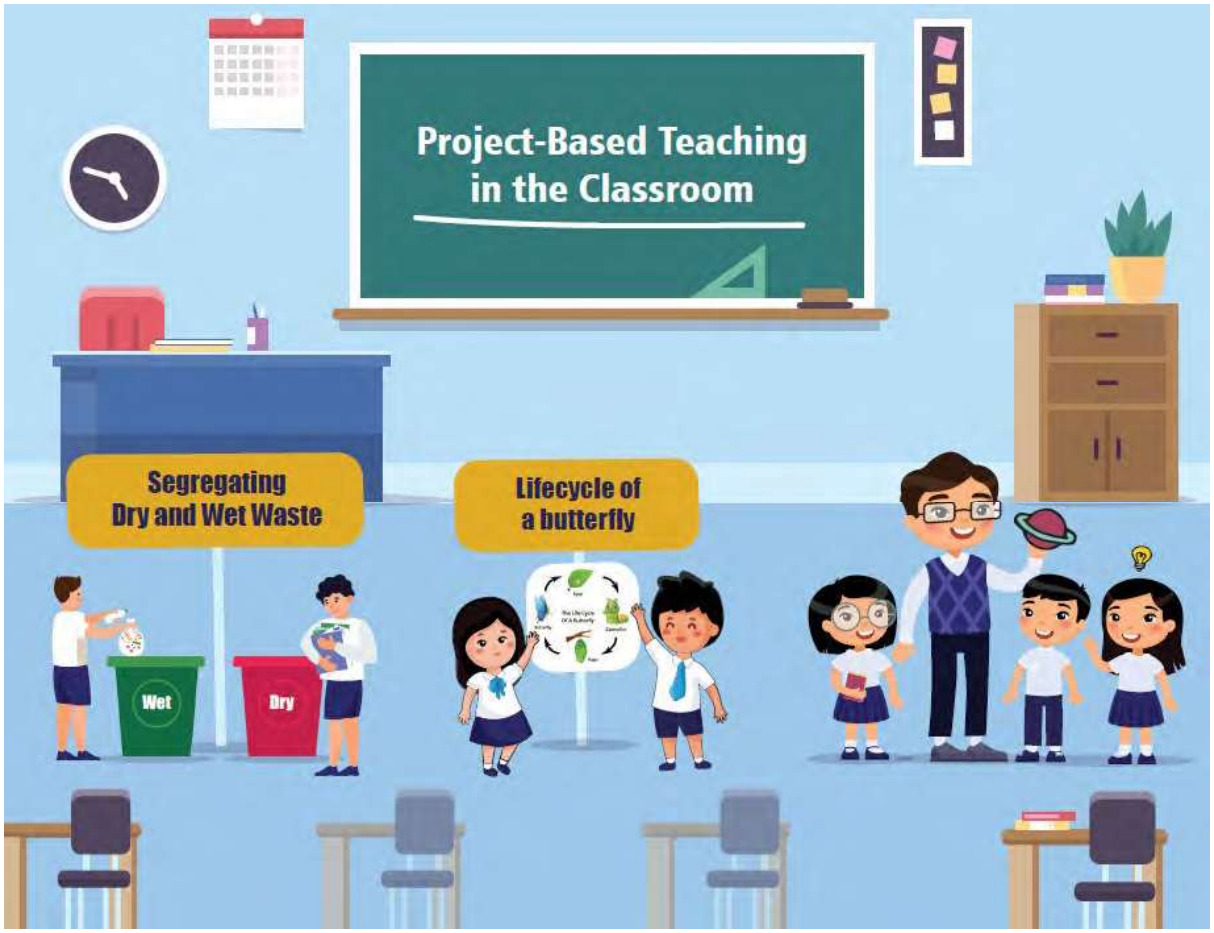
Let's teach and learn through project-work!

~ Champa Banerjee



One of the most widely accepted definitions of Project Based Teaching (PBT) involves helping and encouraging students to gain knowledge and skills by investigating and responding to a complex question, problem or challenge. The New Education Policy (NEP) 2020 stresses the need to emphasise on skill-based teaching and learning. Life skills such as communication, cooperation, teamwork and resilience have been accorded high priority. Learning such skills early on in life goes a long way in inculcating empathy.

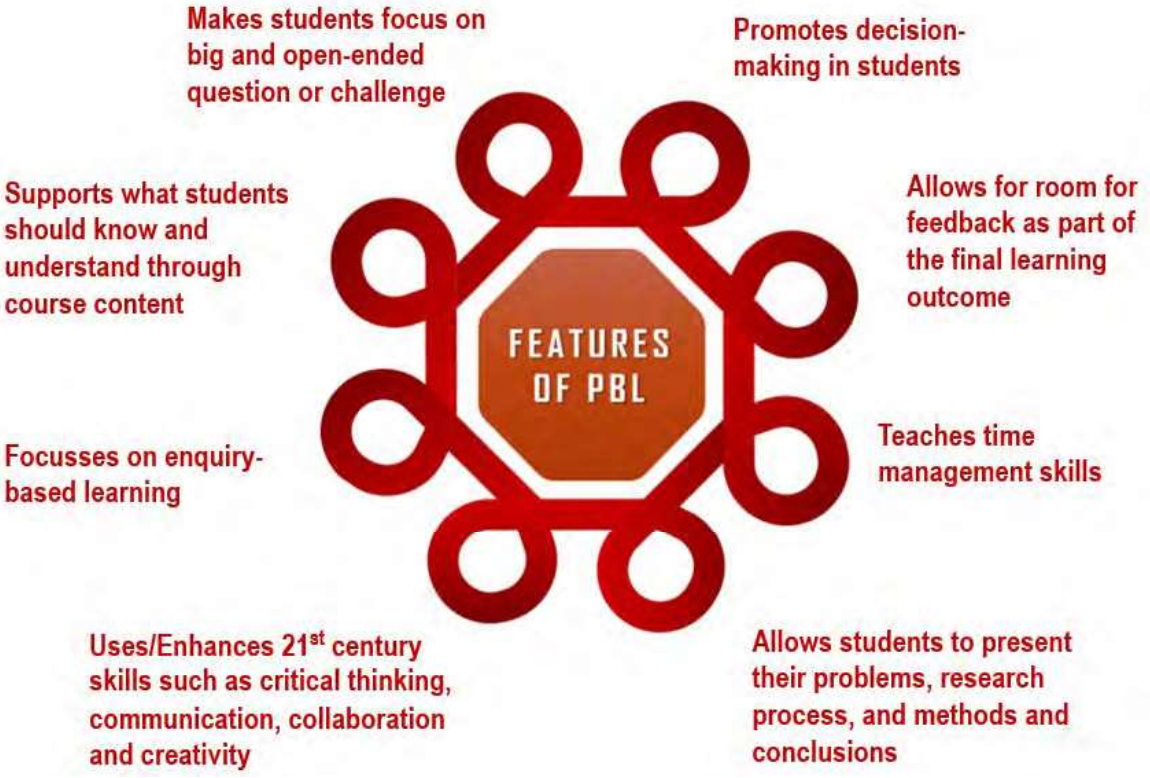
Project Based Learning (PBL) is enquiry based and therefore poses challenges which leads the learner to observe and find answers to questions. This is opposed to rote learning, which promotes students to simply learn answers given to them, hence cancelling out the natural curiosity in learners. PBL is also student centric rather than curriculum-based, textbook-based or teacher led. Instructions given by teachers might simply end up establishing facts or following an easy path to knowledge instead of posing questions. They usually don't cater to the learner's curiosity. Thus, if implemented appropriately PBL

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can prove to be a refreshing alternative which embraces the diverse capabilities of learners.

Why PBL?

PBL emphasises on long term, interdisciplinary and multitasking student activities. It allows students to organise and manage their work to a great extent, though at the primary level, parental guidance is required. Through PBL students deal with the real-world application of concepts which helps in long term retention of skills and knowledge. This is mainly due to experiential learning. Additionally, it helps in developing multiple intelligences.



Some defining characteristics of PBL

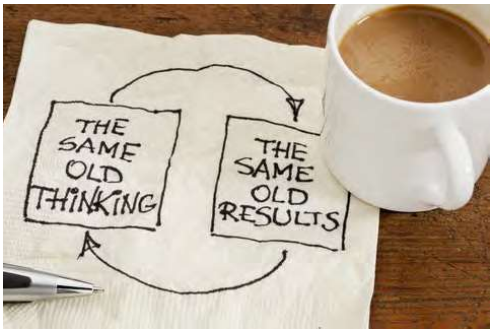
- The projects are designed keeping the learning objectives in mind. They aim at solving problems or finding answers to a question while undergoing different levels of challenges.
- Enhances 21st century skills such as critical thinking, problem-solving, collaboration, self-management,



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organizational skills, time management, etc.

- Engages the learners in a continuous process of asking questions, finding resource material, observing and applying the information gathered by them.
- Promotes decision-making in students like length of the project, whether to work individually or in a group, the level of creativity to be introduced, etc.
- Always open to improvement or change since the observations and conclusions are open-ended. The quality of work presented by the learners, challenges faced by them during the project and how they overcome them can be a learning experience.



- Feedback is a very important feature of this process since learners improve by both giving and receiving it. This is where engagement of the teacher at various levels of learning of the student becomes vital.



- Teacher functions as a guide and facilitator, working with the students to design the project, give it a meaningful structure, help in developing knowledge and social skills, and at the same evaluate students.
- An ideal project must aim at promoting problem-solving or investigating the cause behind a natural phenomenon. For example, importance of segregating waste with respect to its long-term effect on the environment. In other words, it should sensitize the learners towards betterment of the community and workplace.
- On the culmination of the project, the learners present their observation. The teacher involves the student in setting the criteria for assessing the project.

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How to initiate PBL?

Most Indian students are exposed to a learning process wherein they are expected to learn and reproduce pre-structured answers to given questions. It does not take much to realise that this does not help in developing their higher order thinking skills. When these learners aim to achieve for higher education, which involves research-based learning, they find it a handicap and therefore are unable to contribute successfully. Therefore, educators must try to initiate PBL at an early stage among their learners. Topics as simple as colours, food habits, animals, flowers, and so on can be given for making simple projects by students as young as four years old.



Some of the advantages of PBL

It is undoubtedly clear that PBL comes with a plethora of advantages that current education systems are finding difficult to ignore. It has scope for developing social responsibilities in learners since they need to learn to work as part of a community. Research shows that working in a group helps to create better work habits vis-à-vis coordination and an openness to learn from each other. PBL also helps to build self-esteem in learners as they get an opportunity to be part of a learning process that encourages them to choose and participate in decision-making exercises. This is particularly vital for learners who come from marginalized sections of the society. Learners also become more independent as teachers are no more the source of instruction. They are just there as facilitators. It brings with it the openness to accommodate individuals with different learning skills and abilities. PBL allows learners to expand their thinking and read beyond the textbooks. This may include referring to an encyclopaedia, current news and other books/weblinks on the given topic.

Some shortcomings of PBL and how to overcome them

Learning cannot have a one-size-fits-all process, and so even a forward-looking approach like PBL can have its shortcomings. However, these can be avoided by keeping some of these points in mind.

- Design projects keeping the learning outcomes in mind. If not, they remain unfocussed which may lead to learners losing interest in it.

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- As is the case with most group-projects, it is seen that not every member puts in the same amount of effort. To avoid this, explain to the learners right at the onset that they will be marked based on their participation and contribution in the project. Decide the marking/grading criteria in a way that rewards individual effort, even in a group project.
- In a complicated or lengthy project, learners may not get the desired result at each level of the challenge. Omit or change certain aspects of the project without disturbing the core elements to get the desired result. This will ensure sustained motivation, making leaners perform to their potential.

Shortcomings or not, project-based learning is the way forward for a well-rounded learning experience, which will pave the way for a better tomorrow. Embrace it and make it a part of the curriculum and foster the inbuilt capacity of learners and help them be better human beings. The role that a teacher/educator plays is not just to impart knowledge but also provide an inclusive space for individual intellectual growth.

Champa Banerjee is a teacher with a rich experience of more than forty years in the field of education. Through the course of her education, she has imbibed the best from her environment and throughout her teaching career this has manifested in her desire to instil a love for science amongst her students.

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Lesson Plan:

Project-Based Teaching in the Science Classroom

~ Champa Banerjee

With the emphasis on holistic learning and inclusivity in education, project-based learning is the best way forward. Here is an example of a project-based teaching method with detailed lesson plan.

Topic: Useful/Harmful insects

Objectives:

- Learners will identify, and name common insects found in the environment.
- They will be able to understand how these insects can be useful/harmful.
- They can be told how to protect the useful insects and help in their growth.



Test of previous knowledge:

- Learners are expected to know names of some of the insects found in the environment, like house fly, mosquito, ladybird, butterfly, moth, bee, wasp, etc.
- Show picture flashcards of these insects to students to revise identification.

Teaching-Learning aids: Distribute handouts of these pictures among the learners.

Introduction: Show photographs of a butterfly sitting on a full bloom flower, honey dripping from a bee hive, silk moth on a mulberry tree, silk cloth to the

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children to initiate interaction. Once the usefulness of these insects is established, a few more pictures can be shown like houseflies sitting on garbage, cockroaches eating leftover food and so on. Encourage learners to speak about insects that cause harm to us and are carriers of diseases like malaria, dengue, typhoid, etc.





Content: Assign a few projects to students to explore and find out about them. This will help reiterate the information exchanged during the interaction with learners in the introductory phase.

	PROJECT 1	PROJECT 2
NAME	**To create an ant station**	**To make a 3D model of a silk worm**
OBJECTIVE	To observe the lifestyle of ants and how they live in a community.	To make a 3D model of a silk worm
MATERIALS REQUIRED	- three transparent plastic bottles, 500ml/1l each - water - mud - borax powder (only handled by parents/ guardians) - some dead insects - sugar - small lump of wheat dough - small potato peal - small transparent plastic pipe (3 inches long and 1 cm diameter) - some adhesive	- old silk cloth -1 date palm seed - light adhesive for cloth

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STEPS	1. Make holes in all the bottles, such that the pipe fits in to join the two bottles like an interconnecting path. These holes have to be sealed from outside. Keep all the bottles horizontally and make some tiny holes on the top surface of the bottles. 2.One bottle is to be half filled with borax powder, the other with mud and the third one with water. The level of borax powder, water and mud should be below the level of the connecting pipe. 3.Put some dead protein matter (for example: dead cockroach, dead fly, dry bread, sugar crystals) Collect some ants from the garden and allow them to enter the bottle containing mud then close the mouth of the bottle. 4.Observe the activities of the ants for a period of a week and note down changes every day.	1. Separate strands of silk thread from the old silk cloth. 2. With the help of parents/guardians the students can identify the type of silk cloth they have used, for example: *muga*, *eri*, *tussar*, *gicha*, etc. 3. Wind the silk cloth around the seed. Add light adhesive wherever necessary. Repeat this process till you get a nice cocoon-like shape. 4. Mark the 3D model of the pupa by writing the kind of silk cloth used to make the model on a small piece of paper and attaching it with a durable thread/thin ribbon. 5. A 3D cardboard model of a mulberry tree can be prepared for representing the labelled pupas made by a class and these can be later fixed onto the cardboard tree.
QUESTIONS TO BE ASKED BY THE TEACHER ON COMPLETION OF THE PROJECT	1. Which activities show that ants are living beings? 2. Name any two things that the ant avoids. 3. Name 3 food items that the ant consumes. 4. Can ants swim in water or do they drown? 5. Did you find any dead ants? What happened to them?	1. What are the objects/things made of silk that are found in your house? 2. How do you think a silk thread is taken out of this pupa?

Follow up exercises: Simply introducing project-based learning in the classroom is not enough. Each session should have a follow-up exercise to maintain continuity of learning among students. Here are some examples of follow-up exercises.

- **Sunday activity**
  Duration: 40 minutes
  Instruct students to check open spaces near their houses to look out for containers which may have still clean water accumulated in them. Explain why they should upturn these containers and ensure that stagnated water is not kept anywhere in and around their houses.
- As a follow through to the previous activity, ask students to help their parents in household cleaning activities.
- Encourage learners to reduce disposing of biodegradable waste such as vegetable peels, used tea leaves, etc. on a daily basis. These can be thrown in a pit for making manure at home. This will be a first-hand experience of how we

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can all contribute in reducing garbage and in turn reduce the chances of house flies breeding on them.

Some more examples of project-based teaching and learning

- Introduce students to the practice of segregating waste into dry and wet in everyday life, be it in school or at home.
- Show them how to make organic manure from vegetable and fruit peels, used tea leaves, etc.
- Assign them the task to note down articles made of plastic used at their homes and suggest methods of replacing them with biodegradable material.
- Explain how to use pH paper to find the acidity or alkalinity of various food items like lemon juice, curd, milk, apple juice, tomato juice, water, liquid soaps or detergents, sanitizer, etc.

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Heuristic (adjective)



Pronunciation: /ˌhjʊ(ə)ˈrɪstɪk/

Meaning: Enabling someone to discover or learn something for themselves

Origin and additional information: The history of heuristics has its roots in ancient Greece. Its earliest use is as recent as early 19th century when the word was formed irregularly from Greek "heuriskein" (meaning "to find" or "to discover"). Nobel laureate, Herbert A Simon introduced the concept for the first time elaborating on the idea of "bounded rationality" through his research on problem solving, and it was further developed in the 1970s and 80s by psychologists, Amos Tversky and Daniel Kahneman.

Word section: Heuristic is a technique of approach to solve a problem or for self-discovery that employs a pragmatic method, not necessarily rational or perfect. In other words, it is a journey towards knowledge acquisition that evolves through a path of learning and re-learning. Some of the examples of such an approach is captured in expressions like "trial and error", "rule of thumb", "educated guess", etc. It uses previously acquired experiences to come towards a more concrete answer to a question. In psychology, these are simple yet efficient rules that help to understand how people make certain decisions or solve a problem. However, one of the down sides of this is stereotyping which people often end up using to form opinions or make judgements about something which they have no prior experience of, thereby leading to prejudice. This has been explained in psychology as "Cognitive Bias". It is easy to use mental shortcuts to come to a conclusion, but the shortcuts may be couched in a stereotype or prejudice.

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Usage:

1. *For any method or any explanatory theory to be useful (i.e., have heuristic value), it must be internally consistent and relevant.*
(Source: https://www.lexico.com/definition/heuristic)

2. *I also found this study loaded with useful heuristic encapsulations, and often entertaining in its wide-ranging choices for analysis, from early cinema to the present.*
(Source: https://www.lexico.com/definition/heuristic)

3. *The appeal of this model lies in its simplicity, logic and heuristic potential (ability to aid discovery).*
(Source: https://www.lexico.com/definition/heuristic)

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