PEDAGOGY OF BIOLOGICAL SICENCE PART – 2

(PONDICHERRY UNIVERSITY)

STUDY MATERIAL

UNIT -9

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Unit - 9

Exploring Learners

Syllabus *: Identification of Diverse learners in classroom-addressing the diversity of learners in the classroom.– Motivating learners to bring their previous knowledge into classroom – involving learners in teaching learning process – encouraging learners to raise and ask questions- and its techniques.*

Each learner is unique

Every learner is different from the other. You may ask yourself, "Why should I know individual differences among the learners when I have to teach the 'same content' to all of them in my class?" You can get the answer by recalling your own experiences. Recall some of the teaching-learning situations of your school days, where the teacher had taught the 'entire class' the 'same content' in the 'same way'.

What was the result? Did all the learners learn the 'same thing' at the 'same level'? Did they get the 'same marks or grades' when examined by the teacher? If not, then, why? Did you ever feel like sharing your experiences with the teacher and classmates during teaching-learning process? You will find learners in your class with a wide range of educational experiences that you should consider in planning teaching-learning experiences. Some have read a number of books; some have worked on many projects at the previous stages of learning, while some have travelled to various places.

Different learners interact with different people and they observe and interpret their environment differently. All these factors contribute to the difference in their experiences. They construct their knowledge differently by relating it to their previous experiences. Therefore taking into account the heterogeneity of the class as well as uniqueness of the learner and paying attention to the existing ideas of the learners brings enrichment in teaching-learning experiences. At the same time, this makes the learners feel valued and motivates them to get actively involved in the learning process.

Diversity in class

Inclusion is centrally a pedagogical issue, since it creates the most significant Barrier to learning and exclusion for many learners. These barriers to learning arise from various inter

locking parts of the curriculum and pedagogy, such as the content of learning programmes; the language and medium of teaching and learning; the management and organization of classrooms; learning style and pace; time frames for completion of curricula; the materials and equipments, that have been available for conduct of theoretical and practical sessions; and assessment tools and techniques.

Pedagogical principle that teacher should use a variety of approaches and strategies that promote meaningful learning, active participation of all learners, recognition of their knowledge and previous personal experiences, autonomy in their learning process and self control and collaboration among learners.

A number of assistive and adaptive devices such as Braille equipments, adapted science kits, hearing aids, communication aids, mobility aids, for transaction of curriculum contents as per the needs of the students. The pedagogical shift in science education should be based on giving respect and value to individual differences and providing opportunities for scientific exploration, manipulation, experimentation and discovery of scientific phenomena which ultimately enhance the personal development of every learner.

There are many kinds of learners in the classroom. They are :

- 1. Slow learners
- 2. Gifted children
- 3. Mentally, Visually and Hearing impaired learners
- 4. Multiple Disabilities
- 5. Orthopedic Impairment

1. Slow learners

A slow learner is a child of below average intelligence, whose thinking skills have developed significantly more slowly than the norm for his/her age. This child will go through the same basic developmental stages as other children, but will do so at a significantly slower rate. However, this development, while being slower, nevertheless is relatively even.

On the other hand, a child with specific learning disability is one of average or above average intelligence who has specific difficulties which can make learning very difficult. There may be

deficits in any of the basic central nervous system functions, which have to do with the acquisition and use of listening, speaking, reading, writing, reasoning or mathematical abilities i.e. attention, memory, language, auditory and visual perception, motor coordination and planning, spatial orientation, impulse control and sequencing. In short, if there is a discrepancy between the children's potential and actual achievement.

2. Gifted Children

"Children who give evidence of high performance capability in areas such as intellectual, creative, artistic, leadership capacity, or specific academic fields, and who require services or activities not ordinarily provided by the school in order to fully develop such capabilities."

3. Mentally, Visually and Hearing impaired learners

Mentellectual disability, also known as general learning disability and mental retardation, is a generalized neuro developmental disorder characterized by significantly impaired intellectual and adaptive functioning.

Identification of Intellectually Disabled Learners or Mentally Retarded

- Delays in reaching or failure to achieve milestones in motor skills development (sitting, crawling, walking)
- Slowness learning to talk or continued difficulties with speech and language skills after starting to talk
- Difficulty with self-help and self-care skills (e.g., getting dressed, washing, and feeding themselves)
- Poor planning or problem solving abilities
- Behavioral and social problems
- Failure to grow intellectually or continued infant-like behavior
- Problems keeping up in school
- Failure to adapt or adjust to new situations
- Difficulty understanding and following social rules

4. Multiple Disabilities

An underachiever is a person who fails to achieve his or her potential or does not do as well as expected. Of particular interest is academic underachievement. Studies of individuals who have not realized their apparent potential have identified learning disabilities, ADHD, and many other educational problems, and subsequently enabled methods of addressing these problems. Current theories among academic scholars prefer to address underperformance problems with remedial help.

5. Orthopedic Impairment

Hearing impairment refers to the inability or limited ability to hear. Some hearing impaired students have mild hearing loss and may be able to use hearing aids to amplify sounds, while others have no sound perception in one or both ears. A person who has no sound perception in both ears is deaf. People may be born deaf or may develop hearing loss from disease, aging, and exposure to noise, or trauma. Teachers may find it useful to know the origin or background of a student's hearing impairment.

Motivation Learners to bring previous knowledge into classroom

Learners' experiences and observations of real-life situations and their previous knowledge should be used in teaching-learning of science. They should be motivated to participate actively in the teaching-learning process for construction of their knowledge. Emphasis should be given on their involvement by facilitating them to experiment, form hypothesis, modify, discuss, infer, justify, defend, argue, analyse, solve, put question, relate, organise, use, apply, critically examine, explain, and interpretative.

Teacher should nurture a learning environment where learners can get motivated to share their previous experiences and knowledge without fear and take initiative to participate. You would find classroom with such an environment a very lively place in the pursuit of quality learning that helps learners to develop a sense of inquiry and scientific attitude. Providing situations of observations can arouse curiosity among learners and generate questions in their minds.

By the following ways, Teacher can motivate the learners in bringing their previous knowledge into classroom:

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Involving learners in teaching – Learning experiences

Involving learners in teaching-learning process provides a feeling of ownership in their learning. Traditionally, it has been the responsibility of the teacher to do all the planning for teaching learning but presently, it is considered as shared activity between the teacher and the learners about content, activities, approaches and assessment.

Keeping these in mind, teacher can interact with learners to decide what they would like to know about a particular theme. With their help teacher can identify the 'content' for the lesson.

Teacher need to know that learning takes place in a variety of ways through reading, asking, listening, writing, making and doing things, experimenting, discussing, thinking and reflecting, and expressing oneself through speech. They may perform these activities individually or with others. You can motivate the learners to share their existing knowledge and ideas by providing such opportunities to them.

Encourage learners to share their experiences, clear their doubts and share their existing ideas with the class. There is a lot of science in their experiences. Those experiences and ideas can be used as a stepping stone to learning scientific concepts.

When learners are encouraged to share and seek out knowledge from sources other than the textbook, in their own experiences, in the experiences of their peers, homes and surroundings, outside the school, in the laboratory and library, they realize that knowledge can be sought out, authenticated and constructed.

Recognising the evolving nature of cognitive development of the learners, they should be facilitated to construct new ideas over their native ideas. When teacher talk of native ideas we recognize that knowledge is always being constructed. Teacher need to view the learners as constructing knowledge all the time. This is true not only regarding science or any discipline, but equally regarding values, skills and attitudes.

Learners' mental representation of ideas are continually adopted, reformed and revisited in the process of construction of their knowledge. Teaching-learning of science helps them to develop their ideas in particular ways.

Active involvement of learners in intellectual stimulation with new and other's ideas, in social interactions with teachers and peers and their physical interaction with phenomena and materials can bring conceptual changes in them.

Teacher can add and supplement to the 'content' selected by them. The approach of transaction can also be negotiated with learners. Learners can suggest, discuss, share information and experiences, perform experiments, go for excursion or do other activities for learning and developing deeper understanding about the concept to be learned. You can use a variety of activities, strategies and approaches to involve the learners at various junctures of learning.

i) Appreciating dialogue among peers

You should appreciate dialogue among peers in the teaching-learning process. Dialogue involves one to one interactions in the classroom among the learners. Dialogue provides space to learners to reflect on their own ideas on scientific concept. It may lead to a discussion intended to produce an argumentation. Dialogue may be structured or unstructured.

Structured dialogue: It may be used by the teacher and the learners as a means of orienting the dialoguing discourse towards understanding the problems under consideration.

Unstructured dialogue: It may also be used as a form of discussion which may not have a desired end.

Dialogue is an important classroom tool which can be used to focus on a problem and has the potential to inculcate interest among learners and encourage them to open up for discussion and argumentation. It helps to reinforce learning by helping learners to construct collectively deeper understanding of concept and to know how the same learning experiences are perceived differently by different learners.

Encouraging dialogue among peers also develops bonding among them that provides a foundation to collaborative learning, negotiating ideas and other life skills. When students are engaged in conversation about their observation, hypothesis, ideas and thinking on a particular activity, experiment, project or scientific concepts, they get an opportunity to know one another's perspectives on the concerned issue make connections with their prior learning and get the key points.

They co-construct the meaning and learn how to express their opinions. However, guidance of the teacher is necessary to help them remain focused on the issue. In the process of dialogue the teacher empowers the learners through conversation and questions to build their own understanding and to learn to think analytically. Teacher can ask her own question in response of student's questions rather than simply providing readymade answers to them to keep the dialogue rolling on.

It can encourage learners to get an insight for interconnectivity of various concepts. Learners can examine and analyse the concepts from multiple points of view from the social interactions in the classroom. The teacher should facilitate the learner to listen to her classmates attentively without interruption and to use sensitivity to take her turn to express her ideas.

Obviously, knowledge is being constructed by learners through social interactions in the class and this knowledge is shared among the learners. It is important that teacher should remain vigilant, so that dialogue does not lead to wrong conclusion. She should intervene at critical juncture to guide the conversation, so that it leads to scientifically consistent explanations.

The process of dialogue can be followed by generating discussion in the class by emphasising on argumentation in science, highlighting the importance of learning from social interaction in the classroom and the role of learners in negotiating and mediating learning in physical science.

ii) Generating discussion

Discussion is an important process of learning and understanding our environment. It is a way of putting our point of view and supporting it through convincing information, arguments and evidences. Discussion is required to acquire scientific and technological knowledge and to understand the physical and social environment around us.

Therefore, teaching-learning of science should encourage the learners to generate discussions and question about the world around them. Many a times the term discussion is used for any type of oral interaction. For example, when a teacher says, *"let us discuss on the conservation of momentum"* and asks a few questions to the class about the content without providing the learners the space for raising and asking questions, performing activities, doing investigations, solving problems, interacting with peers and surroundings— it is not discussion and has little learning value.

Generating and conducting discussion for active participation of the learner require the following:

- Selecting suitable concept or topic which interests learners. Learners maybe involved in this.
- Creating situations like activity, experiment, project, video clip, learners' report, field trip, etc. It can provide a common platform to the learners for class discussion.
- Ensuring participation of all learners. When you plan discussion based on the activity or experiment, arrangement of materials and apparatus should be such that each learner may obtain, perform and return the materials herself with a minimum disturbance to the classmates.
- Encouraging the learners to put their questions as well as to response to other's questions or viewpoints with suitable reasoning and argument. Probing questions asked by the teacher seeking explanations and reasoning can foster critical and creative thinking in learners.
- Acknowledging and praising learners for their responses, adding and supporting their ideas, identifying knowledge gaps without criticising them can help them to sustain their interest and keep the discussion rolling on.

- ❖ Summarising, reviewing and evaluating the ideas with the help of learners at the end of the discussion.

iii) Argumentation in science

Argumentation is the process of doing argument. Argument is a form of discussion that needs to be planned through suitable learning experiences. It plays a vital role in science education. It helps building of explanations, models and theories in science and promotes learning.

Argumentation in science provides the learners an opportunity to generate, collect and use evidences to make sense of the concepts being studied. Learners critically evaluate each other's claim and evidences.

- It provides opportunity to the teachers to explore ideas of the learner in a social set up by engaging her in justifying, defending, collecting evidences, doing experiments and activities, critically evaluating evidences.
- It develops communication skills of learner. Learner learns to use scientific vocabulary and scientific concepts to support her arguments.
- It discourages learner to accept science as a mere collection of facts and accepting passively the provided explanation of natural world as right or wrong.
- It helps the teacher to know about thinking and learning process of the learner.

Generally, the most frequent type of questions that is used by teachers in science classroom demanding fixed responses, do not encourage students to share their ideas or enter into interactive discourse. It is observed that there is a direct relation between open-ended questions and increased involvement of learners in argumentation.

When learners are given opportunities to voice reasoning to their knowledge claims and throwing them to be evaluated by the peers and the teacher, they learn about constructing as well as evaluating arguments and making sense of their own knowledge.

Learners then view themselves as the constructor of knowledge and teacher as a facilitator of learning rather than a knowledge dispenser.

Encouraging learners to raise and ask questions and its techniques

Traditional schools in the classes, most of the time we will hear the voice of the teacher. Opportunities are seldom provided to students to raise and ask questions.

NCF-2005 recommends that teachers need to nurture an enabling learning environment in the class where children feel secure; there is absence of fear, and which is governed by relationship of equality and equity.

The classroom space should have a favourable climate where children can ask questions freely, engage in dialogue with the teacher as well as with their peers during an ongoing lesson.

Unless they can share their concept-related experiences, clarify their doubts and ask questions, they will not engage with learning.

Teacher encourages them to talk, they would find that the classroom is a more lively place and that teaching is not predictable and boring. It then becomes an adventure of interacting minds. Such an environment will facilitate the self-confidence and self-esteem of learners of all ages.

It will also goal on way in improving the quality of learning itself. Teacher may ask the students to apply the idea in a simple situation, and found, un expectedly, that they had formed some 'alternative conceptions'.

NCF–2005recommends,

- Science involves observation, investigation and inquiry.
- Asking questions is one of the most valuable skills a learner can have for learning science.
- Learning process should lead to a situation where the learner gets involved in cognitive conflict. Studies show that students find the class boring if only teacher asks questions and they are not allowed to express their ideas.
- In the class learners relate what they are learning in the school with the things outside the school. In this process many questions may come up to their mind.
- They should be explicitly encouraged to raise and ask questions.

Strategies to encourage learners to ask questions

- Welcome and value each and every question.

- No question should be stamped assembler silly question.
- Even if the question is simple or silly, it should not be tagged as such. learner should be guided to search the answer by asking some probing questions based on her previous experiences.
- Acknowledge their questions as very good; interesting; intelligent questions; good statement; your question shows, 'you are thinking;' 'you are creative;' 'you have read a lot;' or with similar feel.
- Only a few students should not be allowed to dominate the class.
- Provide equal opportunities of interaction to all. Students and teachers together may set a rule with respect to interaction.
- It may be each learner of the class has to raise at least one question during teaching-learning process of one chapter or unit.
- Familiarise them with the fact that asking a good question requires thinking and knowledge.
- The quality of their questions will be assessed in the class. This would motivate them to concentrate on learning and thinking.
- In spite of having a good social and emotional climate of classroom, you may find that a few students are hesitant in asking questions.
- When you set up a difficult problem and do not get any response from the class, you may provide hint or draw their attention to the difficult part of the problem to encourage them to think and raise questions.
- Teacher may speak in lighter tone, perhaps explained it very quickly;
- Instead of providing readymade answers to learners' question, the teacher should provide situation or experience so that they can get the answers themselves.
- You can pass on the question to different groups of learners. Let them enter into a dialogue with one another and then facilitate them to arrive at the answer.
- Teachers should not insist that all learners in her class must give identical answers to her questions.
- They should be encouraged to express themselves in their own words from their own experiences.

- Learners may ask questions not only during transaction o f a concept but also when involved in any teaching-learning experience.

Creating the habit of listening to learners

Asking and listening are closely tied together in teaching-learning process. Teacher can listen to students by asking questions or presenting an open-ended question or problem or conflicting situation or asking a battery of questions. Listening to students is one of the most powerful tools of teachers in order to know and understand students. While listening to learners, be focused on what the learners say, do not agree or disagree or be judgmental .Let the ideas first flow. You may respond non-verbally occasionally. Your body language should encourage the learners and convey that you are listening.

Creating opportunity of listening to learners

- ❖ Acknowledge the fact that each learner is unique with varied levels of interest and abilities.
- ❖ Learners come from a diverse social and educational background. Each of the learners may respond differently to the same learning situation.
- ❖ Each learner is capable of learning, but you need to be aware of her existing ideas to motivate her in learning.
- ❖ Take the time to observe and assess the ideas of all learners including those seemingly invisible students who seldom participate in teaching-learning process.
- ❖ Listen to their explanation of scientific concepts. You will be aware of the complex way of thinking that might give you an insight into choosing an appropriate approach to teaching-learning.

Activities that teacher can provide situations where learners can collect materials, learn and enjoy learning.

- Developing a science corner in the school.
- Opening science club in the school.
- Organising fieldtrips.
- Arranging for bulletin board or wall magazine.
- Maintaining as crap book.

- Taking up a project.
- Making static and working models.

For developing a science corner in the school, teacher can encourage learners to

Collect materials such as coloured stones, metallic wrappers, sheets and wires, spring balance, torch cells, small tumbler sand bottles, droppers, syringes without needles, small bulbs used in torches, thread, balloons, sieves, bead sand thread, sticks or sipper of cold drinks, ice-cream cup sand spoons, straws of different radii and many other things that can be used in making models, doing an experimenter Just to study.

- Learners may collect different samples of soil, water, rocks, fiber, fabric, toys and materials made using magnets, stamps with pictures of scientists, etc. An exhibition of the materials collected along with proper write-ups can be organised in the school to motivate them. Learners can also collect some materials when they go out for excursions, fieldtrips or visits to some places. They can use the collected materials in performing activities in science club. To develop the habit of reading, learners can be encouraged to identify and collect information regarding current issues and award winners in science from various sources such as news papers, magazines, and internet.
- A sense of wonder and curiosity can be generated when students see pictures given in newspaper sand magazines and read about them. This can enhance their learning.
- Students can express their own ideas and prepare write-ups for maintaining wall magazines and bulletin boards in the school.
- The wall magazines or bulletin boards can display theme-based information collected and displayed by learners.
- Learners may also search and collect learning materials for virtual experiments and activities from internet.
- Emphasis should be given on primary sources of data and use of manipulative materials in teaching–learning of science.
- Learning situations emerging from some events and their observations may also be used in teaching–learning of science.

- All activities can generate interest in the learners, motivate them for learning and give them a chance to move out from the school boundaries and collect relevant materials and information from their surroundings.
- Identify and discuss with your friend about the materials from there sources around your surroundings that can be used for performing activities, experiments and in other teaching-learning experiences.

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