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Learning the Concepts of Magnetic Effects of Current through Experiential Learning Approach as Envisaged in National Education Policy 2020

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Abstract: ***The National Education Policy 2020 (NEP2020) introduced a paradigm shift in Indian education by focusing on the worth of experiential learning. This approach goes beyond rote learning by bringing students at the centre of the learning process. Present study discusses how experiential leaning approach can be practiced for learning the concepts of magnetic effects of current. The study also attempts to facilitate teachers in equipping with requisite knowledge, understanding and skills necessary for applying experiential learning approach not only in the learning teaching process of science classrooms but beyond the four walls of the classrooms. To realise the importance of the four main stages viz. experiencing, reflecting, conceptualising, and experimenting of experiential learning, a few concepts of magnetic effects of current have been taken into consideration for facilitating the learning teaching process of science in classrooms. The study summarizes how an experience can be transformed into a trustworthy source of knowledge. Hence it is envisaged that one should go through all the four - stages of experiential learning for making learning the concepts of magnetic effects of current more meaningful.***

Keywords: NEP2020, Experiential Learning, Kolbe's Learning Cycle and Magnetic Effects of Current

1. Introduction

Education is fundamental for achieving full human potential, developing an equitable and just society, and promoting national development [1 - 9]. The National Education Policy 2020 (NEP2020) aims to address the evolving needs of students, foster holistic development, promote multidisciplinary learning and equip learners with 21stcentury skills [1]. The National curriculum framework for school education 2023 (NCF - SE 2023) aligned with NEP2020 provides the framework for curricular and pedagogical restructuring at each stage, considering students' diverse needs, abilities, and interests [2]. It emphasizes a learner centred approach, promoting active engagement, critical thinking, creativity, and the integration of knowledge across subjects [2]. NEP2020 emphasises on the holistic development of students, going beyond academic achievements to include life skills, social, ethical, and emotional capacities and dispositions, skills, attitudes, temper, values, resilience, critical thinking, creativity, problem - solving, experiential learning, hands - on experiences, practical skills, emotional intelligence and moving away from content - centric education and towards competency - based learning [1 - 9]. This policy introduced a paradigm shift in Indian education by focusing on the worth of experiential learning. Experiential learning goes beyond rote memorization and passive learning by bringing students at the centre of the learning process [1 - 10]. Experiential learning approach promotes students' holistic growth by addressing cognitive, emotional, social, and physical elements [11 - 21]. It fosters innovation, empathy, resilience, and adaptability. Students gain life skills that are necessary for their personal and professional development through experiential learning [1 - 21]. By preparing and presenting students with real - world problems, experiential learning cultivates critical thinking and problem - solving abilities. They acquire the skills necessary to analyse and come up with creative solutions to solve challenging situations in real life. The gap between theoretical knowledge and real - world application is filled through experiential learning. It gives learners the knowledge and assurance they need to apply what they learn in the actual classroom situations. This supports lifelong learning while preparing students for the rigours of the workplace. Experiential learning approach is participatory, which increases student motivation and engagement. Due to the active participation of the students, learning is more joyful and meaningful. Experiential learning approach equips students with the skills, competencies, and mindset required for success in the 21st century [10 - 21]. It also encourages learners to explore, experiment, and apply their knowledge in real - life contexts, fostering critical thinking, problem - solving skills, creativity and collaboration. Implementing experiential learning approaches and strategies across schools will create a dynamic and student - centred educational ecosystem that prepares learners to meet out the evolving challenges of education. Experiential learning approach not only brings conceptual clarity but also instills critical thinking among the students. It is to be noted that all the four components viz, experiencing, reflection, conceptualisation and apply/experimentation as referred in Kolb's cycle are necessary for experiential learning approach [10 - 21]. It engages the learners in processes that nurture their curiosity and creativity particularly in relation to the environment. Experiential Learning Theory (ELT) emphasizes the importance of experience and its role in the learning process [10]. Earlier research studies have revealed that ELT has played a key role in various studies that use the theory as a theoretical framework to examine its usefulness in the learning process. Lai et al. (2007) [14] used ELT as a framework to investigate the contribution of technology in experiential learning. They considered the possibility of using technology to provide and support experiential learning. Alkan also examined experiential learning's effects on student teachers' achievement and scientific process skills and concluded that experiential learning can positively impact learners' academic achievement and learning outcomes because it promotes going through a process of experiencing, reflecting, thinking, and acting upon their own experiences [13]. In addition, Arnold and Paulus (2010) [11] used ELT as a theoretical framework for their study and concluded that the ELT process also allowed learners to reflect and think about potential challenges they might face. McLeod (2017) [15] has shown that ELT could be used as the key to take the students through the whole process in sequence. Keeping aforesaid in view, present study has been conducted to investigate learning the concepts of magnetic effects of current at secondary stage through experiential learning approach. Efforts have also been made to create the experiential learning teaching environment as per stages of Kolb's experiential leaning cycle [10]. This can be done by experiencing, reflecting, conceptualising and experimenting using following steps to:

- discover what students already know about the concepts of magnetic effects of current.
- compare what they think about with what they are actually observing regarding the concepts of magnetic effects of current.
- connect their previous experiences with the conceptual framework of the concepts of magnetic effects of current.
- apply the concepts in new situations and relate their previous experiences to them.
- encourage students to explore, experiment, and apply their knowledge in real - life contexts, fostering critical thinking, problem - solving skills, creativity, and collaboration.
- ensure students learners involvement, encouragement and giving them opportunity to participate in learning the concepts of magnetic effects of current through group exercise, group work, quizzes, projects, concept mapping, experimentation and expression of thoughts during the learning teaching process.
- evaluate students' conceptual understanding about the concepts of magnetic effects of current and their ability to apply their learning outcomes in familiar and new situations.

2. Process

Attempts have to be made to conduct learning teaching for learning the concepts of magnetic effects of current by organizing all the four stages viz. concrete experience, reflective observation, abstract conceptualization and active experimentation of experiential learning [10]. Accordingly, a motivational and icebreaking activity session can be organized and students' problems need to be discussed. Students' involvement and participation in different activities related with the teaching learning process need to be ensured through exercise, group work, quizzes, creative projects, models, simulations, case studies, field works, debate, discussion, oral presentation of concepts of magnetic effects of current. They can be encouraged for participation in presentation of concepts of magnetic effect of current through concept mapping, experimentation. Freedom, opportunity for expression of their thoughts and interaction during the learning teaching process need to be ensured. Attention has to be focused on the following aspects:

- Asking open - ended questions and seeking students' responses, experiences and reflections.
- Encouraging studentsfor higher order thinking.
- Engaging students in dialogue with peers and facilitator (teacher) about the concepts of magnetic effect of current.
- Engaging students in experiments/activities that motivate them forreflections and discussions.
- Inquiring students about their understanding of the concepts of magnetic effect of current.
- Ensuring all the four stages of experiential learning while organizing different activities about the concepts of magnetic effect of current.
- Analysing and interpreting the data in order to draw the inferences about the concepts of magnetic effect of current. Accordingly planning and experimenting different activities.

3. Theoretical Consideration of Experiential Learning

Experiential learning is a pedagogical approach which involves students in hands - on activities, active engagements, reflections and experimentations [10 - 21]. It is an active and learners centered approach in which, learners construct their own knowledge of the world through experiencing things and reflecting on experiences. It also encourages learners to investigate and apply their knowledge in real - world situations. Experiential learning encourages critical thinking, creativity, problem - solving abilities and teamwork. Students get a better comprehension of concepts by actively engaging with them and relating them to real scenarios. It includes any pedagogical process which provides an opportunity for the learners to experience, reflect, conceptualise and apply/experiment the learnt concepts [10 - 21]. The key components of experiential learning approach are the active participation of the learner with the environment, reflecting on the experiences, analysing and applying inferences in new situations. Hence, if any one of these components is absent in the learning teaching process, activity will not be entitled to term as experiential learning [10]. For example, a teacher plans a field visit to a science park to provide students with a physical experience of different types of science models. Students need to be allowed to reflect about different aspects of science models as much as possible. Students, after coming back from the visit, they have opportunities to discuss and reflect upon their experiences of the visit. They can be asked to go for the other two phases of experiential learning i. e. conceptualise and apply/experiment. It may be noted that we often equate learning by doing with experiential learning. However, it is not so. One has to be vigilant about the fact that if the reflection component is missing then learning by doing cannot be considered as experiential learning [10 - 21].

4. Stages of Experiential Learning

Kolb (1984) defined learning as the process whereby knowledge is created through transformative experiences [10]. It is suggested that learning occurs in four - stage viz. concrete experience, reflective observation, abstract conceptualization, and active experimentation process,

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emphasising the importance of engaging in concrete experiences, reflecting on those experiences, conceptualizing the information, and applying it in new situation situations [10]. Figure 1 shows the process and sequence of experiential learning with its stages [10, 21]. In this process and sequence, each stage is interconnected and contributes to the overall learning process.

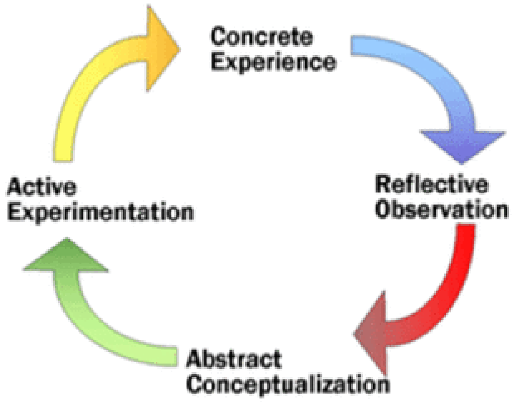

Figure 1: Stages of Kolb's experiential leaning cycle [10, 21].

After considering the above aspects of four stages i. e. experiencing, reflecting, conceptualisation and experimentation of **Kolb's** learning cycle [10], learning teaching process of the concepts of "magnetic effects of current" has to be conducted. The process of leaning teaching can be initiated in the following way:

5. Stages of Kolb's Experiential Leaning Cycle [10]

5.1 Experience

Teacher can facilitate students for planning an activity pertaining to the concepts of magnetic effects of current or any other concept of science where they can be actively engaged in a real experience. They can be motivated to participate in hands - on activities of concepts of magnetic effects of current. During this stage, learners gather information, feelings, and perceptions related to the experience. The teacher observes and records the students' behaviour, social skills, communication, etc. The students are also encouraged to note down their feelings, challenges faced, and information they gathered during the learning teaching process. All the students can be asked to cite few examples related with the concepts of magnetic effects of current or any other concept of science from daily life situations. Their responses need to be related to the concepts of magnetic effects of current. Afterwards discussion on magnetic effects of current need to be commenced in the light of four stages of Kolb's learning cycle. Students need to be motivated to share experience, reflect, predict, infer, analyse, interpret, draw conclusion, discuss, and design activities related to the concept of magnetic effects of current during learning teaching process. Students can be asked following questions:

- What is magnet?
- Do you know current - carrying wire can behave like a magnet?
- What does a compass needle do? How does it work?
- Does a compass needle get defected when an electric current passed through a metallic wire placed nearby?
- Do you think that electricity and magnetism are linked to each other?
- Have you ever realized about the existence of magnetic lines and field?
- Explain why use of mobile should be avoided near the electric poles/lines?
- Depict how a current - carrying wire behaves like a magnet?
- What happens if the direction of the current is changed?
- How **does** electric current increase the strength of a magnet?
- How do you identify the poles in different types of magnets?
- How will you search a needle if it falls down in a room?
- What is magnetic effect of current?
- How magnetic effect of current relates with electricity and magnetism?
- What are the applications of this effect?
- Suggests **a** few activities by which this effect can be demonstrated.
- Cite**a** few examples of domestic electric appliances in which magnetic effect of current are used.
- What are other effects of the current?

To explore and discuss the answers of above questions, teacher can facilitate students in organizing following activities:

Activity 1: Plan a learning experience to encourage the students to explore the environment to understand a concept 'a current - carrying wire behaves like a magnet'. Decide the assessment format for this activity. To demonstrate and understand this concept, a compass needle, a plug key, a resistor, a battery, a thick copper wire and connecting wires need to be used.

- Students can arrange a plug key, a resistor, a battery, a thick copper wire in series using connecting wires.
- They can place a small compass near to straight thick copper wire and notice the positions of its needle before & after passing the current to thick copper wire.
- They can observe the changes in the position of compass needle before and after passing the current to thick copper wire.
- It can be noticed by the students that the needle is defected when there is a current in the circuit.
- What does it mean? It means that the electric current through the thick copper wire has produced a magnetic effect.
- Students may be further facilitated to infer that electricity and magnetism are linked to each other. Students can be engaged further to experience about another concept 'magnetic field and field lines'as:
- Students can be asked to perform an activity to demonstrate that iron filings near the bar magnet align themselves along the field lines. They are familiar with the fact that a compass needle gets deflected when brought near a bar magnet. A compass needle is in fact, a small bar magnet. The ends of the compass needle point approximately towards north and south directions. The end pointing towards north is called North Pole. The other end points towards south is called South Pole.

It can be observed through various activities by the students that like poles repel while unlike poles of magnets attract each other. In order to conduct this activity a sheet of white paper, a drawing board, a bar magnet and iron filings can be utilised:

- Fix a sheet of white paper on a drawing board.
- Place a bar magnet in the centre of it.
- Sprinkle some iron filings uniformly around the bar magnet and observe it. You will find that the iron filings arrange themselves in a pattern.
- Why do the iron filings arrange in such a pattern?
- What does this pattern depict?

It may be argued that the bar magnet exerts its influence in the region surrounding it. Therefore, the iron filings experience a force. The force thus exerted makes iron filings to arrange in a pattern. The region surrounding a magnet is said to have magnetic field. The lines along which the iron filings align themselves represent magnetic field lines. Is there other way of obtaining magnetic field lines around a bar magnet? Yes, Students can themselves draw the field line of a bar magnet by performing following group activity using a small compass, a bar magnet, a sheet of white paper, a drawing board and a pencil:

- Take a small compass and a bar magnet.
- Place the bar magnet on a sheet of white paper fixed on a drawing board.
- Mark the boundary of the magnet.
- Place the compass near the north pole of the bar magnet.
- Mark the position of two ends of the needle.
- Now move the needle to a new position such that its south pole occupies the position previously occupied by its north pole.
- In this way proceed step by step till you reach the south pole of the magnet.
- Join the points marked on the paper by a smooth curve. This curve represents a field line.
- Repeat the above procedure and draw as many lines as learners can. These lines represent the magnetic field around the bar magnet. These are known as magnetic field lines.
- Observe the deflection in the compass needle while moving it along a field line. The deflection increases as the needle is moved towards the poles.

5.2 Reflection

Once students have gained experience, teacher can provide opportunities to reflect on their experiences and observe the outcomes and consequences of their actions about the concepts of magnetic effects of current. This involves carefully considering the thoughts, emotions, and reactions that arose during the experience. They share their observations and reflections with each other. The teacher can initiate, probe and prompt the students for reflections about the concepts of magnetic effects of current. At this stage the teacher records their observations and reflections wherein he/she consciously observes their communications skills along with their concepts about magnetic effects of current. The following questions may form some of the guiding questions for their reflections:

- Why did you like the activity? Orwhy did you not like the activity?
- How did the activity go?
- What did you do in the activity and why?
- What seems most important about the activity and what is learned?
- What were the challenging moments and what made them so?
- What were the most powerful learning situations and what made them so?
- What did you learn from this activity?
- How were you able to relate this activity with the concepts of magnetic effects of current?
- What did you enjoy the most?

To explore students' reflections about the concepts of magnetic effects of current, **Activity 2** pertaining to a concept 'Magnetic field due to a current - carrying conductor' can be deliberated as:

Students must have realized that an electric current through a metallic conductor produces a magnetic field around it. In order to find the direction of the field, following activity can be performed by the students using a long straight wire, a 6V battery, a compass, a plug key and connecting wires:

- Take a long straight copper wire, a battery and a plug key. Connect all of them in series as per instruction.
- Place the straight wire parallel and over a compass needle.
- Plug the key in the circuit and observe the direction of deflection of the north pole of the needle.
- Replace the battery connections. This would result in the change of the direction of current through the copper wire.
- Observe the change in the direction of the needle. Learners will see that now the needle moves in opposite direction.
- Students can be facilitated in concluding from the above activity that the direction of magnetic field produced by the electric current is also changed. They canalso be asked to share their reflections and have discussion on following questions in groups:
- How can the direction of the magnetic field be found?
- Does the direction of magnetic field lines get reversed if the direction of current through straight copper wire is reversed?

5.3 Conceptualisation

In this stage, students can actively analyse and make sense of their experiences by connecting them to existing knowledge and concepts about the magnetic effects of current. The teacher facilitates the students to understand the underlying principles and patterns that emerged from their observations and links them to the knowledge pertaining to the concepts of magnetic effects of current. The students acquire new knowledge based on their experience and teachers' interventions through activities. Hence the teacher checks the attainment of concepts through tests, essays, activities etc. They can ask the students to prepare a concept map of magnetic effects of current. Teacher can engage them to analyse the **Activity 3** related with the concept 'Force on a current - carrying conductor in a magnetic field'.

Now, it is known to students that an electric current flowing through a conductor produces a magnetic field. The field so produced exerts a force on a magnet placed in the vicinity of the conductor. Students can be associated in analysing that is it a possibility that the magnet may also exert an equal and opposite force on the current - carrying conductor? To explore this possibility, students can perform following activity using a small aluminum rod (say 5 cm), connecting wires, a stand, a horseshoe magnet, a plug key and a battery.

- Arrange above materials as shown in the following figure 2:

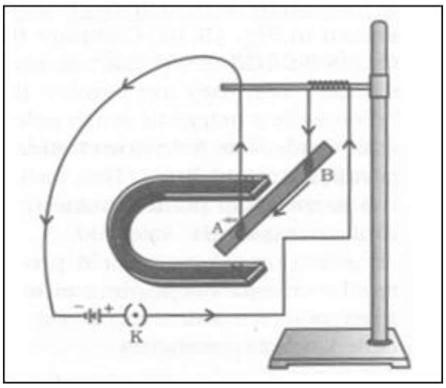

Figure 2: Force on a current - carrying conductor in a magnetic field [17].

Take a small aluminium rod (AB) and suspend it horizontally using a stand.

- Place a strong horse - shoe magnet in such a way that the rod lies between the two poles with the magnetic field directed upwards.
- Connect the aluminum rod in series with a battery and a plug key.
- Now pass a current through the aluminium rod from end B to end A. Teacher can ask the students about what do they observe? The rod is displaced towards the left.
- Ask the students to reverse the direction of current flowing through the rod and observe the direction of its displacement. It is now towards the right.
- Why does the rod get displaced?
- Does the direction of the force on the conductor depend upon the direction of current and direction of field?
- When the displacement of the rod is largest?
- List the devices that use current - carrying conductors and magnetic fields.

Teacher may discuss these questions in small groups of students and their responses need to be summarized and analysed by the students.

5.4 Experimentation

The teacher can provide opportunities to students to apply their newly acquired knowledge, experiences and conceptualisation and insights about the concepts of magnetic effects of current in practical and unfamiliar situations. Teacher can encourage students in this stage to examine their hypotheses, problems solving and adapt their understanding, conceptualisation and insights based on the outcomes of their real actions. The teacher needs to ensure both the process and students' learning assessment. Assessment of students' learning can be done through rubrics, observations and interviews. They can also be associated in creating models, solving problems and applying the concepts of magnetic effects of current in daily life situations as well as unfamiliar situations. Teacher can develop an assessment tool that can be used for assessing the process of creating and quality of the model developed by the students based on the concepts of magnetic effects of current. In previous concepts students have learned that when a current - carrying conductor is placed in a magnetic field such that the direction of current is perpendicular to the magnetic field, it experiences a force. This force causes the conductor to move. Let us consider a situation in which a conductor is moving inside a magnetic field. What will happen? To understand this, students can develop a model by performing activity **4** related to the concept of 'electromagnetic induction'**.** Activity can be performed using a galvanometer, a coil and a bar magnet as:

- Teacher can ask the students to connect a coil of wire having a large number of turns with a galvanometer.
- Students can observe a momentary deflection in the needle of the galvanometer, say to the right on moving magnet towards the coil. This indicates the presence of a current in the coil. The deflection becomes zero the moment the motion of the magnet stops.
- Now teacher can ask the students to withdraw the north pole of the magnet away from the coil. Now the galvanometer is deflected towards the left, showing that the current is now set up in the direction opposite to the first.
- Students can place the magnet stationary at a point near to the coil, keeping its north pole towards the other end of the coil. It can be observed that the galvanometer needle deflects towards the right when the coil is moved towards the north pole of the magnet. Similarly, the needle moves towards left when the coil is moved away.
- When the coil is kept stationary with respect to magnet, the deflection of the galvanometer drops to zero. What do they conclude from this activity?

Teacher can form small groups of students, discuss and chart information on topics as per the given Tables:

	Group I	**Group II**
S. No.	Sources of magnetism seen in school and outside the school surroundings	Devices that use current carrying conductors and magnetic fields
1		
2		
3		
4		
5		
	Group III	**Group IV**
S. No.	Technological applications of magnetism in daily life	Magnetic hazards and safety
1		
2		
3		
4		
5		

Teacher may conclude the discussion by asking the following questions with the students to assess their learning and by asking them to prepare a concept map on the concepts of magnetic effects of current:

- Why don't two magnetic lines of force intersect each other?
- Can you see magnetic effects of current and magnetism? Comment on it.
- Consider a circular loop of wire lying in the plane of the table. Let the current pass through the loop clockwise. Apply the right hand rule to find out the direction of the magnetic field inside or outside the loop.
- Would the magnetic field created around the wire be able to pick up a paper clip?
- Imagine that you are sitting in a chamber with your back to one wall. An electron beam moving horizontally from back wall towards the front wall is deflected by a strong magnetic field to your right side. What is the direction of magnetic field?
- Magnetism can be produced from electricity and electricity can be produced from magnetism. Discuss it in detail among your peers.
- State the principle of a motor and generator. What are the uses of these devices?
- Investigate how a bicycle generator that operates the light. Discuss it with your peer learners.
- Discuss both the generator and the motor are examples of electromagnetic induction. Give your critical remarks on it.

There are certain attributes of experiential learning for the teacher to keep in mind while designing an experiential learning - based lesson plan.

- The students can enter at any stage of the experiential learning cycle depending upon their experiences, readiness, interest, context, etc.
- The role of the teacher becomes very significant in bringing their experiences and reflections into the real practice so that they can learn from each other's experiences.
- Teachers should design experiences integrating, inclusivity, indigenous knowledge of India, etc.
- Assessment being an integral part of students' conceptual learning, the teacher can continuously assess the learning process and students' progress through various ways and forms of assessment during experiential learning cycle.

5.5 Methods for Involving Students in Experiential Learning

Experiential learning approach recognizes that students learn best when they actively engage with their environment and participate in meaningful activities. It is an educational approach that emphasises learning through direct, hands - on experiences and reflections [10]. They are able to connect theories and knowledge learned in the classroom to real - world situations much better by different methods viz. experiments, role - playing and simulations, story - telling and drama, problem solving, reflection and discussion, small group projects/assignments, practicum, student teaching and cooperative education experiences can be practiced for involving and engaging students in active experiential learning the concepts of science in general and effects of magnetic current in particular.

5.6 Assessment Procedure used in Experiential Learning

Assessment in experiential learning aims to evaluate not only what a student knows but also how he/she applies knowledge and skills in the real - world context. Some common assessment procedures viz, Observations, reflection journals, presentations and exhibitions, portfolios, peer and self - assessment, rubrics based assessment, feedback and discussions can be used in experiential learning for assessing the concepts of science in general and effects of magnetic current in particular.

5.7 Design for an Experiential Learning based Lesson

The teacher can use following design for developing an experiential learning based lesson and its execution:

- Select the class, unit, subject, and topic to be taught, accordingly identify the core concepts and sub - concepts to be learned.
- Identify the competencies and learning outcomes that are planned to be attained through the content selected.
- Follow all the four stages viz, experience, reflect, conceptualise, experiment/apply of the experiential learning cycle.
- Integrate assessment at every stage of the lesson in terms of inclusivity, Indian rootedness, multidisciplinary/interdisciplinary linkages, environment sensitivities, vocational capacities, skills and local context.
- Review the lesson before its execution.

6. Conclusion

It is concluded from the present study that experiential learning approach can create knowledge through transformative experiences focusing on active participation, reflection, and practical application of knowledge, hands - on activities for learning the concepts of magnetic effects of current in particular and science in general. It promotes critical thinking, problem - solving and collaboration skills by engaging students in real challenges. It also helps in nurturing practical life skills among students. It is noticed that experiential learning approach capitalizes on students' exploration, enabling them to connect genuinely with their learning environment and translate theoretical knowledge into practical skills, resulting in enriching their overall learning experience and holistic development. It is anticipated that by executing experiential learning strategies in learning teaching process, schools can create a dynamic and student - centred ecosystem that prepares students to meet out the evolving educational challenges of 21st century. Experiential learning benefits the students not only in making the concepts clear but also make them independent and strategic learners. It is worthwhile to mention over here that experiential learning helps in students' engagement, acquisition of practical skills, better retention and application, improved self - awareness, confidence and enhanced social and emotional competence make them to be productive, holistic, well - rounded citizens equipped with the necessary skills and competencies as desired in 21st century to realise the goal of education. It is suggested that the integration of experiential learning in the ecosystem of schools can augment curriculum and rejuvenate the learning experiences of the students. Teachers can also take this opportunity to leverage experiential learning for bridging the gap between theory and practice, enabling students to contextualize concepts in real - world scenarios.

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References

[1] www.education. gov. in/sites/upload_files/ Zmhrd / files/NEP_Final_English_0. pdf
[2] www.education. gov. in/sites/upload_ files/mhrd/files/NCF - School - Education - Pre - Draft. pdf
[3] www.education. gov. in/sites/upload_ files/mhrd/files/nipun_bharat_eng1. pdf
[4] ncert. nic. in/pdf/Mandate - NCF. pdf
[5] www.education. gov. in/sites/upload_ files/mhrd/files/upload_document/SARTHAQ_Part - 1_updated. pdf
[6] dsel. education. gov. in/sites/default/ files/SARTHAQ_Part_2. pdf
[7] www.eslkidstuff. com/lesson - plans/toys. html
[8] itpd. ncert. gov. in/course/view. php?id= 1692section n=12
[9] dsel. education. gov. in/sites/default/files/ update/toy_based_pedagogy. pdf
[10] Kolb, D. A. (1984). Experiential learning: Experience as the source of learning and development Prentice - Hall.
[11] Arnold N. and Paulus T., The Internet and Higher Education, 13 (4), 188–196 (2010).
[12] Cherry K., The David Kolb theory of how experience influences learning (2019) https: //www.verywellmind. com/experiential - learning - 2795154.
[13] Alkan F., Experiential learning: Its effects on achievement and scientific process skills. Journal of Turkish Science Education, 13 (2) (2016) http: //search. proquest. com/docview/1824858137/
[14] Lai, C - H, Yang, J - C, Chen, F - C, Ho, C - W, & Chan, T - W. Journal of Computer Assisted Learning, 23 (4), 326–337 (2007).) https: //doi. org/10.1111/j.1365 - 2729.2007.00237. x
[15] McLeod, S. A. Kolb – learning styles (2017) https: //www.simplypsychology. org/le
[16] Reijo Miettinen, International Journal of Lifelong Education, 19 (1) 54 - 72 (2000).
[17] Science Laboratory Manual, NCERT (https: //ncert. nic. in/science - laboratory - manual. php)
[18] Linn P. L., Howard A. and Miller E., The handbook for research in cooperative education and internships. Mahwah, NJ: Lawrence Erlbaum Associates (2004).
[19] Moore D. T., Forms and Issues in Experiential Learning&New Directions for Teaching and Learning (3 - 13) New York, Wiley (2010).
[20] Wurdinger, D. D., & Carlson, J. A. Teaching for experiential learning: Five approaches that work. Lanham, MD: Rowman & Littlefield Education (2010).
[21] Diyanat Ali, Experiential Learning Models, Methods, Principles, & Practices (2018), Outlifehttps: //www.outlife. in/experiential - learning. html

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