

UNIT 5

PROCESS OF INQUIRY

OUTLINE

- What is inquiry method?
- Types of inquiry
- Steps of inquiry
- The role of inquiry in science teaching
- Guidelines for using inquiry method
- Advantages and disadvantages of using inquiry method

OVERVIEW

- Scientific investigations are full of inquiry learning.
- Individuals engage in inquiry learning during their search for knowledge. Inquiry is the motivation behind scientific investigations.
- This unit is on the process of inquiry.
- It will take you through the meaning of inquiry, types of inquiry, steps of inquiry, the role of inquiry learning in science teaching, guidelines for using inquiry method, and the advantages and disadvantages of using inquiry method.

WHAT IS INQUIRY METHOD?

- Science should be taught as a process that will initiate thinking among learners. Students learn science best by doing it.
- The teacher should create opportunities for students to take part in meaningful learning experiences. Students should be empowered to conduct investigations and find out answers to problems by themselves as young scientists.
- This process of problem solving and engaging in investigations is the inquiry method.
- Inquiry comes from a Latin word that means to search for something so inquiry method or inquiry in the classroom is the act of searching or looking for knowledge.
- It involves activities or learning experiences students go through that help them to develop knowledge as scientists.

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- The process of inquiring begins with gathering information through the human senses.
- Students formulate questions, explore problems, observe, and apply new information in the quest for knowledge during inquiry.
- Therefore, inquiry method is an approach to teaching that involves the process of exploring the natural world that leads to asking questions and making discoveries in the search of new knowledge and understandings.
- Students usually engage in five activities during inquiry.
- These are questioning; investigating; using evidence to describe, explain, and predict; connecting evidence to knowledge; and sharing findings (National Science Education Standards, 1995)

Characteristics of Inquiry

- Students work together to learn content and reasoning skills in investigations
- Inquiry learning is organized around relevant, authentic problems or questions
- Students are cognitively and affectively engaged in meaning making, developing explanations, and communicating their ideas.
- Inquiry learning is self-directed learning.
- Students ask questions, look for the answers and evaluate the answers.

- Students question the truth and accuracy of the information obtained

Role of the Teacher in Inquiry

- The teacher is the primary mentor, advisor, and planner.
- The teacher guides students during the learning process
- The teacher provides topics consistent with students' entry cognitive and affective characteristics so the students will easily understand and become interested in the topic.
- The teacher should also plan the objectives of the lesson and look for resources that can guide students toward realizing the objectives.
- The teacher tells students where and how a resource is available for reference so that they can do their own search/research.

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- The teacher should create a conducive environment in the classroom that will promote verbal interaction, make students feel accepted and will not deter them from expressing their views and ideas
- The teacher should encourage students to ask questions, interrogate answers, and consider diverse perspectives about subject matter.
- The teacher should encourage students to use multiple approaches and solutions to solve problems,
- The teacher should provide opportunities for students to engage in critical discussions and evaluate the subject matter content

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- The teacher should use thought provoking questions to facilitate discussion, clarify, and extend students' thinking and understandings
- The teacher should encourage students to think and to communicate clearly and precisely.
- The teacher plays a facilitation role

Role of Learners in Inquiry

- Students should be able to recognize that science is more than memorizing and knowing facts
- Students should have the opportunity to develop new knowledge and understandings that build on their prior knowledge, experiences and scientific ideas.
- Students should collaborate with each other during investigations and take control of their learning.
- Students pose their own questions with either complete freedom or with several options provided by the teacher.

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- Students design procedures for investigation by themselves with either complete freedom or with several options provided by the teacher
- Students make their predictions and provide the reason for the predictions in investigations.
- Students interpret data or phenomena during investigations with either complete freedom or with guidance from the teacher
- Students are involved in recording observations of phenomena during independent practical activities with either complete freedom or with guidance from the teacher
- Students independently organize data or observations into tables, graphs, or charts with either complete freedom or with guidance from the teacher.

Principles of Inquiry

- Learners are at the centre of the entire process, while teachers, resources and technology are adequately organized to support them.
- All learning activities revolve around information-processing skills.
- Teachers facilitate the learning process, but they also seek to learn more about their students and the process of inquiry.
- The process of inquiry emphasises conceptual understanding and the development of information-processing skills.

Self-Assessment Questions

- What is inquiry method?
- Describe four characteristics of inquiry
- Explain four roles of the teacher during inquiry
- Explain four roles of the student during inquiry
- Describe the four principles of inquiry

Types of Inquiry

- There are basically four types of inquiry.
- These are confirmation inquiry, structured inquiry, guided inquiry and open/true inquiry (Banchi & Bell, 2008).
- Confirmation inquiry is the process of verifying concepts by following laid down procedures.
- Structured inquiry is following a procedure to find an answer.
- Guided inquiry is finding answers under the guidance of a teacher.
- Open inquiry is when students pose their own questions and then find the answers by themselves without any guide.

Confirmatory Inquiry

- Confirmation inquiry is the type of inquiry-based instruction which is basically led by the teacher to the greatest extent.
- In this type of inquiry, learners are given a question, its answer and the method of reaching this answer. The goal is to confirm the answer.
- This helps learners to learn how the specific method works and reinforce already established ideas.
- The goal is to build investigation and critical-thinking skills.

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- For example, if a teacher teaches a topic, he/she can then develop questions and the procedures that will guide students through activities where the results are already known.
- This method is useful to confirm or verify laws and theories, to deepen the understanding of concepts taught and to introduce students into learning to follow procedures, collect and record data correctly and to confirm their understandings.
- It also helps teachers to develop the observational, experimental, and analytical skills of students.

Structured Inquiry

- Structured inquiry is the type of inquiry-based instruction which is led by the teacher to the some extent.
- The learners are given the question and the method of reaching the answer.
- The goal is enable students to provide an explanation that is already supported by the evidence gathered during and through the investigative process.
- For example, the teacher can give students an open question and an investigation method and ask them to use the method to reach an evidence-backed conclusion.
- The students are required to provide explanations of their findings through evaluating and analyzing the data collected.

Guided Inquiry

- Guided inquiry is the type of inquiry-based instruction which is guided by the teacher.
- The learners are only given a question and the teacher actively guides them to reach the answer.
- The main goal is to enable the students to design the method of investigation and then use it to reach the results.
- For example, the teacher can put the students in groups and ask them to design investigation methods to reach a conclusion and communicate their results and findings.
- The students are supported by the teacher less than in confirmatory inquiry and structured inquiry so the level of the student independence increases.

Open/True Inquiry

- Open/True inquiry is the type of inquiry-based instruction which is not led by the teacher but based on the independent activity of the student.
- The goal is to enable students to make their own discoveries and claim ownership of new knowledge.
- This is cognitively demanding and promotes problem solving skills, creative skills and critical thinking among students.

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- In open inquiry, the learners must formulate their own questions, design investigative methods, and then carry out the inquiry itself and communicate their results and findings at the end of the process.
- In this type of inquiry, there are no wrong results, and students have to evaluate the strengths and weaknesses of the results they collect themselves and decide their value.
- Open inquiry is the highest level of inquiry. Banchi and Bell (2008) explain that teachers should begin their inquiry instruction at the lower levels of inquiry and work their way to open inquiry in order to effectively develop students' inquiry skills.

Self-Assessment Questions

- Describe the four types of inquiry.
- Differentiate between structured inquiry and guided inquiry

Scientific Method

- The scientific method is a way of acquiring knowledge about the environment.
- It provides logical procedures for arriving at knowledge. It also provides knowledge that can be verified.
- It is the process by which science is carried out. It involves careful observation of events and phenomena.
- The scientific method is a process for experimentation that is used to explore observations and answer questions.
- It is a method of research in which a problem is identified, a hypothesis stated, then relevant data are gathered and the hypothesis is empirically tested.
- It is a method in which a problem is first identified, hypothesis stated, experiment designed, observations and relevant data collected, and then used to test the hypothesis. It is used to solve problems in our environment

Some Key Underpinnings of the Scientific Method

- The hypothesis must be testable and falsifiable. This simply means that the hypothesis must be either true or false.
- Research must involve deductive reasoning and inductive reasoning.
- Deductive reasoning is the process of using true premises to reach a logical true conclusion.
- In deductive reasoning, the learner is presented with a general principle and what the learner does is to apply a number of tests and reasoning to discover whether it is true or not.

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- However, inductive reasoning takes the opposite approach.
- Learners will have to reason during observations and move from specific observations to broader generalizations and theories.
- The learner reasons to examine related matter to see whether any general conclusions can be drawn.
- The learner uses the mental faculty to reason and put pieces of information needed to establish general principles.
 - An experiment should include a dependent variable and an independent variable (which does change)
 - An experiment should include an experimental group and a control group

The Steps of the Scientific Method

- Identification of problem
- Collection of information about the problem
- Hypothesis formulation
- Experimentation
- Analyzing, evaluating and interpreting the data
- Reproducibility of Experiment
- Replication of methods and results

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- **Step 1: Identification of Problem:** The first step of scientific method of scientific method is the identification of problem. The problem is usually identified through careful observation of an aspect of phenomenon of the natural environment and the formulation of questions pertaining to that aspect or phenomenon.
- **Step 2: Collection of Information about the Problem:** The identification of problem is followed by the collection of information about the problem. The scientist will have to ask questions about the observations and gather information about the phenomenon.

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- **Step 3: Hypothesis Formulation:** The next step is the formulation of hypothesis based on the observations. Designing the hypothesis involves formulating analytical questions. The hypothesis could be the cause of the phenomena, its effect, or its relation to any other phenomena.
- **Step 4: Experimentation:** After the hypothesis is stated, it needs to be tested scientifically. The testing of the hypothesis is done through experimentation. The aim of the experiment is to determine whether the hypothesis is true or false. During the experiment there is collection and recording of data.

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- **Step 5: Analyzing, Evaluating and Interpreting the Data** : The collection and recording of data is followed by the analysis of the data. At this stage the scientists uses procedures to analyze the data, interpret the findings and draws conclusions and generalizations. The scientist makes deductions and evaluates the hypothesis based on the findings. If the results support the hypothesis, the hypothesis is accepted. However, if the results do not support the hypothesis, the hypothesis is rejected or modified if necessary. Results that support a hypothesis do not mean that the hypothesis is totally correct, but they do mean that the hypothesis is likely to be correct. A hypothesis cannot be proved or disproved by doing one experiment. It needs to be done repeatedly until there are no discrepancies in the data and the results. There must be consistency in the data and results. When a hypothesis has been supported by really convincing evidence it is accepted as a theory. This evidence must be obtainable in many different laboratories and by many independent researcher

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- **Step 6: Reproducibility of Experiment:** This step is the reproducibility of the experiment. After evaluating the results and drawing conclusions and making generalizations the scientist will have to make sure that there are no discrepancies between the observations and the generalizations. The scientist will have to reproduce the experiment to ensure that the analyses of the results are consistent with the findings and generalizations. Reproducibility is obtaining consistent results using the same data. If the hypothesis is true then the scientist will have to do additional test using the same data to confirm it or revise it to be more specific. The reproducibility stage may be a cyclical process since the results of the first experiment serves as feedback to improve the next one.

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- **Step 7: Replication of Methods and Results:** Replicability means obtaining consistent results across studies aimed at answering the same scientific question using new data. The replication of results and methods is key to building confidence in methods, results and generalizations. A replication study involves repeating a study using the same methods but with different subjects and experimenters. Replication of a study is repeating a study's procedure and observing if the prior findings repeat in similar conditions. A study is replicated when the results of original study are as closely related to the newly collected data. Replication is one of the key ways scientists build confidence in the scientific merit of results. When the result from one study is found to be consistent by another study, it is more likely to represent a reliable claim to new knowledge.

Self-Assessment Questions

- What is the scientific method?
- Explain any two key underpinnings of scientific method.
- Describe the steps of scientific method.

Role of Inquiry in Science Teaching

- Most of our schools **focus on teaching a set of basic skills that do not serve the needs of modern society**. Traditionally, schools stressed the accumulation of information, and did not emphasize skill development or nurturing inquiry-based habits of mind. Our modern society is faster paced, globally networked, technologically oriented, and requires workers who can problem solve and think critically. Today, much learning, if not most, occurs after formal schooling. Our schools must change their approach to education to produce students who can thrive in the modern world. The traditional focus of education is no longer appropriate.

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- The world has changed: local apprenticeships are rare, and young people must **master new ways of acting and thinking**. Our society is becoming increasingly larger and more complexly diverse. Young people must develop an understanding for the complexities of modern life and be able to grapple with new ethical and practical issues. We must educate our young so they can participate as responsible members in contemporary society. They also need to be given the chance to grow and develop fulfilling personal identities in settings that are relatively free of risk.

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- **Inquiry learning can turn information into useful knowledge.** It stresses skill development and nurtures the development of good habits of mind. Information, lacking a useful context, often has limited applications beyond passing a test. Learning plans and teaching materials need to include a relevant context for new information to lead to broader understandings. It is often hard for students to understand the connections between activities within a particular subject. This confusion is heightened when students struggle to understand the connections between different subjects within traditional schools.

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- **When students engage in inquiry, they utilize skills from across multiple disciplines** (e.g., science, math, social science, language arts, and creative thinking) by collaborating with others, collecting and interpreting data, organizing and developing representations of their data, and sharing their findings with others.
- Inquiry-based teaching methods **provide flexibility to the teachers and students** by facilitating student contribution of their strengths, so students of different developmental levels and learning styles learn together.

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- Inquiry-based methods align with the hands-on, experiential education format agricultural education provides. Inquiry-based learning requires **students to actively use their hands and minds**, and as a result, students are able to assemble ideas to create their own knowledge and understanding.
- **It helps students to better understand the topics:** In-depth analysis of a particular topic is entrenched in this style of learning. Students can understand the basics of the topics and also learn them at an extensive level. This way, the credibility of knowledge increases manifold. Also, the students can retain the knowledge for a significant number of times as they fully understand it.

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- Too many students describe school as boring. This is a common refrain and a challenge to educators. Learning can be boring. It's a fact. But it doesn't have to be. The power of inquiry learning is that **it harnesses natural curiosity**. And that is never boring. People of all ages can cultivate curiosity to learn. By letting students engage in and take more control over what and how they learn, interest increases. Suddenly school isn't so boring. The time flies by as students explore, research, and answer their own questions.

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- How teaching inquiry can improve school performance is also a **huge advantage for students who are not the type who loves to read long texts on books.** Because of the hands-on development of investigations, it would be interesting for a student who does not have the attention span to sit and read books for hours. Those long unbearable hours of trying to understand each lesson in a textbook could be the reason why a student is categorized as a low-achiever. Schools that have been using inquiry teaching have reported that this method of teaching has created wonderful results out of low-achiever students.

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- This method of teaching could also be **an advantage for the educational system issues pertaining to the racism and the gender inequities**. Studies showed that educators who was trained to do inquiry teaching was more successful in maximizing the students potential when it comes to learning the subjects at hand. Teaching inquiry is the key to the problems about not giving fair equal education that the American system could not offer to all of the races or in both genders.

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- It seems particularly important that **inquiry-oriented teaching may be especially valuable for many underserved and underrepresented populations**. In one study, language-minority students were found to acquire scientific ways of thinking, talking, and writing through inquiry-oriented teaching (Rosebery et al., 1990). Inquiry-oriented science teaching was shown to promote development of classification skills and oral communication skills among bilingual third graders (Rodriguez & Bethel, 1983). Active explorations in science have been advocated for teaching deaf students (Chira, 1990). Finally, experiential instructional approaches using ordinary life experiences are considered to be more compatible with native American viewpoints than are text-based approaches (Taylor, 1988).

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- Good science education **requires both learning scientific concepts and developing scientific thinking skills.** Inquiry is an approach to learning that involves a process of exploring the natural or material world, and that leads to asking questions, making discoveries, and testing those discoveries in the search for new understanding. Inquiry, as it relates to science education, should mirror as closely as possible the enterprise of doing real science.

Self-Assessment Questions

- Describe at least five roles of inquiry in science teaching.

Guidelines for using Inquiry Method

- Planning Behavioral Objective
- Designing Teaching Materials
- Designing Questioning Strategies
- Designing Teaching and Learning Strategies
- Evaluation

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- Using Authentic Examples to illustrate the concept.
- Adopting a Thematic Approach to integrate various disciplines.
- Initiating the lesson with an engaging demonstration.
- Using interactive teaching materials (I-Board).
- Hands-on Activities.

Planning Behavioral Objective

- In the process of planning the inquiry method, teachers should focus on students' abilities.
- In this case, the teacher should be aware of the students' background and their ability to carry out the activities in the inquiry method.
- This is important because each student will go through specific processes in the inquiry process, and teachers also need to know about the abilities of the students in their different classes.

Designing Teaching Materials

- Teachers should also provide students with appropriate titles.
- At the same time, teachers should also ensure that the resources for a title are adequate and provide the resources needed to implement them.
- For example, teachers can provide appropriate reference materials to enable students to gather information.
- Reference materials may include reference books, textbooks, newspaper and magazine clippings, documents, maps, electronic media, and others.

Designing Questioning Strategies

- In the inquiry method, the questioning strategy is more important than the answer.
- In this case, the teacher should plan the questions that can guide the students towards the learning objectives they want to achieve.
- The questions submitted must be able to develop critical and creative thinking among students.
- Questions that are more complex and challenge students' thinking. There are three levels of questions:
 - for information (Recall Questions),
 - questions that require interpretation, and
 - High-Level questions in which students are required to develop tentative answers.

Designing Teaching and Learning Strategies

- Before implementing the inquiry method, teachers must be clear about what their students need to achieve and learn.
- Next, teachers should plan student activities according to specific steps.
- Teachers also need to instruct students to understand what they need to do.
- In this case, teachers can also decide whether the inquiry is to be conducted individually or in groups.

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- If it's group work, teachers should take into account specific factors such as group size, group members of the same or different gender, problems to solve, and so on.
- In this regard, teachers need to be more democratic in the formation of groups.
- Also, teachers should consider the techniques and methods that will be used in teaching and learning.
- For example, teachers can use the discussion method within the group they have formed.

Evaluation

- Teachers should also know how to evaluate the inquiry process.
- Evaluation can be done through questions that students ask, how they perform in learning activities, and how they handle information.
- Evaluation can also be done using media or audio-visual tools for viewing, listening, and analyzing.

Using Authentic Examples to illustrate the concept

- Using authentic examples can be highly effective in facilitating the learner's association of any given concept to his daily life.
- This is often integrated in a thematic setting to facilitate development of important facets of understanding such as application, perspective and empathy (see section on Promoting Understanding).

Adopting a Thematic Approach to integrate various disciplines

- Using themes allows the educator to integrate various disciplines in a seamless and highly engaging fashion, thus allowing the learner to appreciate the interconnectiveness of different disciplines in any given topic.
- An extension of this approach involves the dramatization of concepts and scenarios to involve the students at the beginning of the lesson, facilitating 'buy-in' for what they are about to learn.

Initiating the lesson with an engaging demonstration.

- One of the advantages that surround the teaching of science is involves the ability of the learner to be engaged by observing an interesting phenomenon that exists in nature.
- Abstract concepts such as the various properties of air can be readily demonstrated to the students in the laboratory without using highly sophisticated instruments.
- Once the learner views the phenomenon with wonderment and awe, helping him understand the underlying concepts can be done with ease.

Using interactive teaching materials (I-Board)

- Our experience with students aged 6 to 17 have revealed that when information is presented to them in a highly interactive fashion through the computer or the use of the I-Board (an interactive whiteboard), they become highly engaged in the process of learning, making the process highly enjoyable for both the educator and learner.

Hands-on Activities.

- Science lessons involve a great amount of experimentation to “discover the truth” of different naturally occurring phenomena.
- These activities, when structured as important means to help the learner achieve a certain objective and coupled with a skillfully-designed set of questions, can be highly effective in promoting interest and more importantly, understanding in the topic to be discussed.
- **Resist the urge to answer all student questions.** Remember that this is student-focused learning and exploration.
- **Limit the time spent introducing a concept or lesson.** A lecture can quickly become boring and unengaging. Provide only what students need to get started in their own exploration.

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- **Be prepared to be flexible.** Classes and students are different and require more or less guidance. Some strategies for a lesson may seem perfect when you start but fail partway through. Be willing to adapt and adjust to keep the inquiry going and engagement strong.
- **Let your own curiosity unfold, too.** Model lifelong learning and engagement by asking your own questions and exploring them with students. They'll appreciate it.
- **Make time for reflection at the end of every inquiry lesson.** This may be a discussion as a class or a period of quiet journaling. Reflection should include the concepts learned, but also the learning process. Ask leading questions like "How did exploration deepen your understanding?" or "Was it frustrating to not get immediate answers?"

Self-Assessment Questions

- Describe at least five the guidelines for using inquiry method.

Advantages of using Inquiry Method

- Inquiry-based learning **provides opportunities for students to develop skills** they will need all their lives.
- The inquiry method **instills curiosity among individuals about something.**
- Inquiry-based learning **helps students learn how to cope with problems that are ill-defined and can help students deal with changes and challenges to their understandings.** Students need inquiry skills to shape their search for solutions now and in the future" (Branch, 2003, p.6)

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- Inquiry-based science is a powerful way to learn science, regardless of a **student's language background**. When students ask questions, write observations, make predictions, share their thinking, and reason and debate with each other, they are using language to make authentic and meaningful connections to the scientific phenomena they are investigating. Thus, increasing learner's communication and sophisticated uses of language that take place during investigations engagement that can support language development in science.
- Instead of just presenting the facts, use questions, problems, and scenarios to **help students learn through their own agency and investigation**. A dependent learner relies on the teacher to bear most of the cognitive load in the classroom through direct instruction and other passive sit-and-get approaches. An independent learner is an active participant in their learning. They have the grit to take the initiative and are curious, critical thinkers who can transfer their learning to new and novel situations with a minimum of scaffolding.

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- Memorizing facts and information is not the most important skill in today's world. Facts change, and information is readily available -- what's needed is an **understanding of how to get and make sense of the mass of data**. Educators must understand that schools need to go beyond data and information accumulation and move toward the generation of useful and applicable knowledge . . . a process supported by inquiry learning. In the past, our country's success depended on our supply of natural resources. Today, it depends upon a workforce that "works smarter."

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- Through the process of inquiry, **individuals construct much of their understanding of the natural and human-designed worlds.** Inquiry implies a "need or want to know" premise. Inquiry is not so much seeking the right answer -- because often there is none -- but rather seeking appropriate resolutions to questions and issues. For educators, inquiry implies emphasis on the development of inquiry skills and the nurturing of inquiring attitudes or habits of mind that will enable individuals to continue the quest for knowledge throughout life

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- Inquiry-based learning can be **used to reinforce relevant content and improve understanding of core concepts**. This is due to curiosity's effect on the brain. When a concept sparks curiosity, there is increased activity in the hippocampus -- the region of the brain responsible for memory creation.
- Running a brief inquiry activity to start class can **help students absorb information throughout the day, according to the same study**. Specifically, it states that curiosity prepares the brain for learning -- allowing students to become more proficient at understanding and remembering skills and concepts. An easy way to inspire curiosity is by launching an inquiry activity as a surprise.
- Another benefit that inquiry-based learning **offers is the development of habits of mind that can last a lifetime and guide learning and creative thinking**.

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- **Promotes a Deeper Understanding of Content.** By delving into a concept through inquiry, students should see it as more than a simple rule, idea or formula. Many of them will understand how the idea was developed, Why the rule or formula works and When they can properly apply the rule, idea or formula. This is because the process of asking open questions, solving them through original strategies, empowers students to take ownership of their learning.
- **Helps Make Learning Rewarding.** Inquiry can help students see the intrinsic rewards of learning. That is many kids learn in an attempt to earn “the rewards of parental or teacher approval or the avoidance of failure.” As a result, they may not appreciate the inherent benefits of learning. That is inquiry-based learning instills a different mindset. It shows students how fulfilling the act of discovery is, and that theorizing a new strategy or original conclusion is a reward. Because of this, they grow to enjoy the learning process itself -- not parent or teacher approval.

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- **Builds Initiative and Self-Direction.** That is Students can improve certain transferable skills through inquiry-based learning, many of which relate to initiative and self-direction. This is evident when examining the steps of the inquiry process. Students learn how to ask questions, investigate, discuss, collaborate, cooperate and reach their own conclusions.
- **Works in Almost Any Classroom.** That is Inquiry-based learning can also benefit teachers, as you can repurpose activities for almost any classroom. Even regardless of grade and individual skill levels. This is because you can adapt the pace and content to suit the needs of students, appeal to students who struggle to grasp content through traditional lessons, deliver exercises that greatly differ, using distinct content and investigation methods, use an inquiry exercise as either a “minds-on” activity, review, full lesson or standalone project, and reinforce and expand upon any relevant concept, as long as students have shown curiosity towards it.

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- **Offers Differentiated Instruction.** That is Running an inquiry-based learning activity will give you a chance to use differentiated instruction strategies, appealing to the diverse learning styles of your students. Students can work by themselves, or as part of a small or large group. Inquiry itself typically involves methods such as discussion and guided research. You can also provide content in form of text, audio, video and virtual or physical manipulatives such as building blocks.
- In an instructional setting, inquiry-based learning **can give instructors the opportunity to allow students to fully explore problems and scenarios**, so that they can learn from not only the results, but also the process itself. They are encouraged to ask questions, explore their environments, and obtain evidence that support claims and results, and design a convincing argument regarding the way they reached to the end result.

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- Inquiry-based learning combines students' **curiosities with a scientific method to promote critical thinking skills**. Rather than just being "instructed to," students can actively ask questions, explore various subjects, and create their own solutions. This empowers them, increases engagement, and allows them to take responsibility for their learning. The result is a deeper understanding of concepts.
- Inquiry-Based Learning is an **Opportunity for Authentic Assessment**. Assessment is all about determining what students know. But traditional tests provide limited insight into student learning. There are many more ways to find out what students know, inquiry lessons included. As teachers observe students working on their projects, they are able to assess where students are in their learning and can find more ways to put that learning into context. This provides another way to include more students in academic achievement. A student may perform poorly on tests.

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- **Students Achieve and Demonstrate Mastery.** When students explore and discover rather than only listening to lectures, they develop greater mastery of concepts and skills. Using math as an example again, a teacher can show students an algorithm for solving an algebra equation. However, real mastery occurs when students are asked to develop their own algorithms.
- **Inquiry-Based Learning Promotes Teamwork.** Team-based learning and projects are perfect for inquiry. An inquiry lesson could be done individually, but many are centered on small groups within the larger classroom. Collaboration and discussion help students learn from each other. Teamwork also provides students with the opportunity to teach each other. This in itself is a powerful learning tool.

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- **Improved Knowledge Retention.** Studies have shown that many of the elements of inquiry-based lessons promote greater retention of what students learn. Mastering and learning new things in the classroom is essential, but students must be able to recall that information later. When they go deep into a topic or subject, collaborate with others, and work through questions instead of being given answers, retention improves.
- **It improvise the learning experience.** Since this process gravitates towards practicality, students can retain the concepts learned in this method for a significant period. Students, instead of memorizing the concepts, understand them and can also clarify their doubts. This enhances the learning experience of the student.

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- **It develops analytical thinking skills.** Since the students get to decide what they have to learn, students develop better analytical skills. They explore the roots of every concept, and their comprehensive skills get improvised. Students become more aware and also develop better cognitive skills in this process.
- **It promotes curiosity and the will to learn.** Inquiry-based learning fosters curiosity among the students as they start to inquire what they are being taught. They develop more doubts and can enhance the clarity of the concepts they learn. They feel encouraged to share their opinions and explore everything to their best potential.

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- **It promotes active student participation in class.** As the learning procedure becomes more fun, students actively participate in it. Students start to love the process of learning and hence practice it eagerly. The interaction between the students and teachers also gets enhanced, and the communication skills of the students improvise. Altogether, inquiry-based learning uplifts the classroom ambience.
- Teaching inquiry is a **great way to teach students who are culturally challenged or those who are in need of special attention.** In other words, students who do not possess the ability to learn and understand a lesson right away are said to have maximized their potential through inquiry teaching. Through the hands-on teaching, students are more likely to relate themselves through their own experiences, which is why it is more effective for them than the traditional way of teaching.

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- Within a conceptual framework, inquiry learning and active learner involvement can **lead to important outcomes in the classroom. Students** who actively make observations, collect, analyze, and synthesize information, and draw conclusions are developing useful problem-solving skills. These skills can be applied to future "need to know" situations that students will encounter both at school and at work.
- One benefit of true inquiry is a **genuine feeling of student ownership as students are given meaningful tasks that are engaging and challenging.** Additionally, student accountability increases when students are part of a cooperative group and have others depending on them. A sense of ownership and accountability aren't the only benefits to inquiry-based learning. Students' natural curiosity is peaked in true inquiry as they explore a concept and ask their own questions to further understand what they are learning.

Disadvantages of using Inquiry Method

- Several students who are shy and timid may face problems due to the lack of confidence. This can be overcome by providing extended support and individual attention to the students by the teacher.
- If the teacher is covertly minded towards this concept, its effectiveness can be hampered. Hence, the teacher needs to accept it to practice it whole-heartedly.
- Improper setting can also deteriorate its effectiveness. A proper system should be developed where every student is provided with the opportunity to put forward their opinions. A mismanaged situation can prove to be no-beneficial.

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- Lack of a base can **make the whole process non-productive**. Hence a teacher needs to be well versed and encourage the students to steer in the right direction. Sometimes confusion may get created among the students.
- There are several common misconceptions regarding inquiry-based science, the first being that inquiry science is **simply instruction that teaches students to follow the scientific method**.
- Some educators believe that there is only one true method of inquiry, which would be described as the level four: Open Inquiry. While open inquiry may be the most authentic form of inquiry, there are many skills and a level of conceptual understanding that the students must have developed before they can be successful at this high level of inquiry.

Cont'd

- Not every student is going to learn the same amount from an inquiry lesson; students must be invested in the topic of study to authentically reach the set learning goals. Teachers must be prepared to ask students questions to probe their thinking processes in order to assess accurately. Inquiry-science requires a lot of time, effort, and expertise; however, the benefits outweigh the cost when true authentic learning can take place.
- It should be cautioned that inquiry-based learning takes a lot of planning before implementation. It is not something that can be put into place in the classroom quickly. Measurements must be put in place for how students' knowledge and performance will be measured and how standards will be incorporated.

Cont'd

- While some see inquiry-based teaching as increasingly mainstream, it can be perceived as in conflict with standardized testing common in standards-based assessment systems which emphasise the measurement of student knowledge, and meeting of pre-defined criteria.
- **Time and resource consuming.** As contextual inquiry is performed with one participant at a time, it is fairly time consuming. Again, the participants are more in control of the flow so they decide how long or short the session would be.

Self-Assessment Questions

- Describe four advantages of using inquiry method.
- Describe four disadvantages of using inquiry method.



THANK YOU