**INTRODUCTION TO THE NATURE OF SCIENCE**

**WHAT IS SCIENCE?**

The word science is derived from the Latin word “SCIENTIA” which means knowledge. Therefore, science can be defined as a system of acquiring knowledge which involves observation and experimentation to describe and explain natural phenomena.

Science could also be referred as the systematic study of nature which includes the living and nonliving things around us.

Science is a process by which we try to understand how the natural and physical world works and how they come to be the way they appear to be.

Science actually attempts to disprove ideas (hypotheses) or confirm them and it is limited strictly to solving problems about the physical and natural world. Explanations based on supernatural forces, values or ethics can never be disproved and thus, they do not fall under the scope of science.

Science can be divided into three main branches namely, Natural Sciences, Social Sciences and Applied Sciences.

***Natural Sciences*** deal with the study of the physical word and they include Physics, Chemistry, Biology, Geology etc.

***Social Sciences*** deal with the scientific study of human society and social relationships. They include Economics, Politics, Sociology, Psychology etc.

***Applied Sciences*** deal with the application of existing scientific knowledge to practical applications like technology or invention. They include Engineering, Microbiology, Medicine, Childhood education etc.

NB: A person who works in and has expert knowledge of a particular field of science is called a scientist.

The nature of science seeks a recognition of the values contained in the development of theories and statements (Laws and Principles). In general, the nature of science refers to the key principles and ideas which provide a description of science as a way of knowing as well as the characteristics of scientific knowledge.

Many of these ideas are lost in everyday aspect of a science classroom resulting in students learning biased notions about how science is conducted.

The study of nature (science) must follow certain rules which make the scientific process as objective as possible. To be ***objective*** in science means the results obtained from an experiment or investigation are not influenced by feelings, interests and prejudices. That is to say they are unbiased.

On the other hand, to be ***subjective*** in science means the results obtained from experiments or investigations are influenced by feelings, interests and prejudices. That is to say they are biased.

**MAIN IDEAS REGARDING THE NATURE OF SCIENCE**

The main ideas regarding the nature of science include the following;

1. ***Scientific Knowledge is Tentative:*** Although scientific knowledge is supported by data from repeated trials, it is not considered the final word because scientists continually test and challenge previous assumptions and findings. After all, science is human endeavor and as it is known, human perspective is limited and fallible. Thus, the idea of fundamental uncertainty is vital to scientific study. Therefore, quality control in investigations and experiments as well as a systematic way of carrying them out increase the reliability of their results and conclusions.
2. ***Nature of Facts/hypothesis/theories:*** Some key words in science are often misinterpreted.
3. ***Facts***: Students often think of a piece of scientific knowledge as “facts”. Scientific knowledge should not be referred to as facts as this tends to perpetuate the idea that scientific knowledge is inalterable. It should be noted that scientific facts are observable phenomena in a particular situation. E.g. Dinosaurs were ‘cold blooded’ is not a scientific fact because this phenomenon can’t be observed. However, the statement “the caterpillar is 2.6 cm in length “is an example of a scientific because the phenomenon was observed in a particular situation.
4. ***Hypothesis***: Most of the time students define a hypothesis as an educated guess. Although a hypothesis is partly a “guess” in the sense that it is an idea, this inevitable definition is not adequate. Thus, a hypothesis is a statement based on previous observations, which can be tested scientifically. It is important to note that the idea that a hypothesis must be testable eludes students.
5. ***Theories***: Scientific theories are broadly based concepts that make sense of a large body of observations and experimentations. Because theories successfully tie together such large amount of information, they are among the most important ideas in science.
6. ***Scientific Method***: This refers to “a step-by-step” process that apparently must be followed in order to conduct scientific studies. Scientists usually do not follow the method sequentially, they often bounce around; in some cases, forming a new hypothesis during experimentation. Studies in which no experiment is performed are also valid scientific studies but do not follow the scientific method. Thus, a general or universal scientific method does not exist. Scientists approach and solve problems systematically with imagination and creativity reflecting on prior knowledge and also with perseverance.
7. ***Observations and Inferences***: It is vital for students to understand the difference between observation and inference as well as learn to make good observations and inferences. They should also understand the role that observations and inferences play in the development of scientific knowledge.
8. ***Observation***: When we describe an environment or object based on our five senses, it is called an observation.

E.g. “Upon magnification, the lady’s painted eggs appear bluish and barrel shaped.”

Observations are direct enough that most would make the same observation in the same situation.

1. ***Inferences***: When we bring our past experience into making a judgement based on an observation, it is called an inference.

E.g. “The caterpillar appears as if it is about to its chrysalis (pupa of a butterfly)”

is an inference because you are interpreting observations according to knowledge gained from past experience.

NB: Inferences are important in science in making explanations but one must be careful not to confuse observations with inferences when conducting studies.

1. ***Human Error***: Although steps are usually taken in order not to make errors in observations or experimentations, scientists are still human and make mistakes. It is important to challenge students to view their mistakes or unexpected results as potentially helpful. Scientific studies are often riddled with problems that must be addressed. Sometimes scientists do not find the answer they expect but if they do not allow their expectations to shadow their judgement, they may be able to approach the problem in a more appropriate manner

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**PURPOSE OF SCIENCE**

All sciences seek to explain, predict and control the occurrence of natural phenomena (events, behavior or conduct). Patterns of phenomena can be explain by general theories.

E.g. – Why do earthquakes occur?

- Why does cancer occur?

- Why do countries democratize?

- Why do welfare policies change?

However, specific phenomena might be explained by idiosyncratic (peculiar) explanations.

E.g. – Why did I get cancer?

- Why did Spain democratize in 1976?

Nonetheless, scientists prefer general explanations to idiosyncratic explanations.

Thus, the general theories that are developed in order to explain why or how natural phenomena occur, are also used to predict future events as well as prevent the harmful outcomes or create good ones.

NB: Theories provide explanations to causes and explanations relate specific events to general class of events.

E.G. – Today’s thunderstorm is related to thunderstorms in general.

- The civil war in Colombia is related to civil wars in general.

**CHARACTERISTICS OF SCIENTIFIC KNOWLEDGE**

Scientific knowledge could be regarded as any piece of knowledge that is developed through the processes of science (investigation, experimentation or observation)

There are six characteristics of scientific knowledge, namely:

Consistency, observability, natural, predictability, testability and tentativeness.

This could be easily remembered from the acronym CONPTT.

1. **CONSISTENCY**: The results of repeated observations and/or experiments concerning a naturally occurring phenomenon are reasonably the same when performed and repeated by competent investigators.

E.g. – Green plants will grow towards a light source.

- Walking under a ladder will cause bad luck.

Using the idea of ‘’consistency’’, how can one determine which of the statements above is scientific?

1. **OSERVABILITY**: The event under study, or evidence of the occurrence of the event could be observed and explained. The observations are limited to the basic human senses or by extensions of the senses by equipment such as electron microscope or Geiger counters etc. If the phenomenon can’t be reproduced through controlled conditions, natural evidence of the event’s occurrence must be available for investigation.

E.g. – Some plants are carnivores.

- Extra-terrestrial beings have visited Earth.

Using the idea of ‘’observability’’, how can we determine which of the statements is scientific?

1. **NATURAL**: A natural mechanism must be used to explain why or how the naturally occurring event happens. Scientists must not use supernatural explanations as to why or how naturally occurring evens happen because reference to the supernatural is outside the realm (scope or domain) of science.

E.g. – Green plants convert sunlight into energy.

- With a rod, Moses parted the sea so that his people could cross to the other side.

Using the idea of ‘’natural’’, how can we determine which of the statements above is scientific?

1. **PREDICTABILITY**: The natural mechanism of the naturally occurring event could be used to make specific predictions. Each prediction can be tested to determine if the prediction is true or false.

E.g. – Without sunlight or comparable artificial light, green plants will die.

- If you are a ‘’Scorpio’’, your horoscope is ‘’You will be saying ‘I feel rich!’ Lunar position highlights back pay, refunds, correction of accounting error.

Using the idea of ‘’predictability’’, how can you determine which of the statements above is scientific?

1. **TESTABILITY:** The natural cause of the naturally occurring event must be testable through the processes of science, controlled experimentation being only one of these. Reference to supernatural events or causes are not relevant tests.

E.g. – The Bermuda Triangle causes ships and planes to sink and disappear.

- Life comes from life and cannot come from non-life.

Using the idea of ‘’testability’’, how can you determine which of the statements above is scientific?

1. **TENTATIVENESS:** Scientific theories are subject to revision and correction, even to the point of the theory being proven wrong. Scientific theories have been modified and will continue to be modified to consistently explain observations of naturally occurring events.

E.g. – The number of human chromosomes was once ‘’known’’ to be 48, but is now considered to be 46.

- Living things were once grouped into 2 major groups, then 3, then 4, and now 5, because the criteria used for classifying living things have changed.

- We know that the world began about 6000 years ago, and nothing will change that.

- At one time, it was thought the heart pumped blood out of a large container as an ‘’open system’’, but now it is known that blood ‘’circulates’’ in closed system.

Using the idea of ‘’tentativeness’’, how can you determine which of the statements above is scientific?

**SCIENCE PROCESS SKILLS**

Science Process Skills could be defined as a set of related abilities that scientists use to study nature. They are suited to all the science disciplines, and are indicative of the behavior of scientists. Science process are classified into basic or integrated.

**Basic Science Process Skills**: These include:

1. **Questioning:** Wondering about something you have been thinking about or something you have noticed or observed. It raises doubts and allows an idea to be tested.

E.g. – Why do birds have different shaped beaks?

- Will all materials be attracted by magnets?

2. **Classifying/Sorting**: This refers to grouping information, objects or events together according to their observable properties. Objects are grouped together based on the characteristics they have in common.

3**. Observing**: This involves the use of the basic senses (seeing, feeling, hearing, smelling and tasting) to collect information.

4**. Reporting/Communicating**: This involves the use of written and spoken words, graphs, tables, diagrams and presentations to explain or share ideas and information.

5. **Recording:** This is the process of documenting what one is doing, observing and finding out. Recording can be done using many different methods such as:

- A written report or graphs

- Pictures or drawing

- Result tables etc.

E.g.

|  |  |
| --- | --- |
| Day | Height of plant/cm |
| 0 | 0 |
| 2 | 0 |
| 4 | 2 |
| 6 | 4 |
| 8 | 7 |

Result tables can be represented in the following ways:

- Bar charts and Histogram (Bloch-Graphs)

Bar graphs are used to show discrete information- where each variable is separate, such as colours.

- Line graphs

These are used to show continuous data; that is to see something changing gradually.

- Pictographs

These are similar to bar charts but use symbols and pictures to show the amount of things.

- Pie charts/graphs

Pie graphs are used to represent data in percentage form. They are shaped like a circle and the size of each ‘’pie slice’’ is determined by the percentage it represents.

6. **Predicting**: This involves forecasting what will happen by considering your prior knowledge and experience about a thing or an event.

E.g. I think that clothes will dry faster when it is warmer because on sunny days, clothes take less time to dry.

7**. Inferring**: This involves providing a fitting reasoning or explanation for what one observes.

8. **Measuring:** This is the process of finding out the magnitude of quantities such as mass, weight/force, length, capacity/volume and time using the standard or non-standard methods.

**Standard units of measurements**

-Length is measured in centimeters (cm), meters (m) and kilometers (km)

-Mass is measured in grams (g) and kilograms (kg)

-Capacity is measured in milliliters (ml) and Liters (l)

Time is measured in seconds (s), minutes and hours

**SI Units and Instruments used to measure basic units**

|  |  |  |
| --- | --- | --- |
| Quantity | SI unit | Instrument |
| Mass | Kg | Beam balance |
| Weight/Force | N | Spring balance |
| Length | m | Tape line/Ruler |
| Capacity | V | Graduated cylinder |
| Time | s | Watch/Clock |
| Temperature | oC/K | Thermometer |

**Non-Standard Measurement**

E.g. – How many cups of water will fill the bucket?

- You can use your hand span to measure the length of your desk.

- Shadows and sand times can be used to measure time. Etc.

9. **Concluding**: This involves making generalized statement about something based on observed pattern or proven evidence.

10. **Hypothesis:** This a special prediction that can forecast how the independent variable will affect the dependent variable.

**Integrated Process Skills**

These are a combination of the basic skills used in a single science activity and they include:

1. **Investigating**: This is the process of systematically searching for an answer to a question or solution to a problem, usually through an experiment.

E.g. investigating the best material for an umbrella.

2. **Experimenting**: This is the process of testing an idea to see if you can find evidence to support it.

E.g. If you wonder whether all flat objects floats on water, you can test a number of flat objects to see if you can prove your idea.

3. **Exploring**: This the process of satisfying curiosity about an object or event. It involves the use of various senses to study things, situations and events (to raise questions and find answers about them).

4. **Surveying:** This involves collecting statistical data about scientific events or processes for various purposes in daily life.

5. **Controlling Variables**: Being able to identify variables that can affect an experimental outcome, keeping most constant while manipulating only the independent variable.

E.g. Realizing through experiment that the amount of light and water need to be controlled when testing to see how the addition of organic matter affects the growth of beans.

6**. Defining Operationally**: That is satisfying the expected outcome of an experiment.

E.g. satisfying that beans growth will be measured in centimeters per week.

7. **Formulating Hypothesis**: That is stating the expected outcome of an experiment.

E.g. the greater the amount of organic matter added to the soil, the greater the bean growth.

10. **Interpreting Data**: Organizing data and drawing conclusion from it.

E.g. Recording data from the experiment on bean growth in a data table and forming a conclusion which relates trends in the data to variables.

11. **Formulating Models**: Creating a model or physical model of a process or event.

E.g. The model of how the process of evaporation and condensation inter-relate in the water cycle.

**CONSTRUCTIVISM THEORY OF LEARNING**

The constructivism theory of learning states that children learn better when they construct their own knowledge.

It is basically a theory based on observation and scientific study about how people learn.

It says that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences.

When we encounter something new, we have to reconcile it with our previous ideas and experience, maybe by changing the way be behave or maybe by discarding the new information as irrelevant. In any case, we are active creators of our own knowledge and to do this, we must ask questions, explore and assess what we know.

In the classroom, the constructivists’ view of learning can point towards a number of different teaching methods. In the most general sense, it usually means encouraging students to use active techniques (experiments, real-world problem solving) to create more knowledge and then to reflect on and talk about what they are doing and how their understanding is changing. The teacher makes sure s/he understands the students’ pre-existing conceptions and guide the activity to address them and then build on them.

Constructivist teachers encourage students to constantly assess how the activity is helping them gain understanding by questioning themselves and their strategies.

Students in the constructivist classroom ideally become ‘’expert leaners’’. This gives them ever-broadening tools to keep learning. With a well-planned classroom environment, the students learn HOW TO LEARN.

Contrary to the criticism by some conservative/traditional educators, constructivism does not dismiss the active role of the teacher or the value of expert knowledge. It modifies that role so that teachers help students to construct knowledge rather than to reproduce a series of facts.

The constructivist teacher provides tools such as problem-solving and inquiry-based learning activities with which students formulate and test their ideas, draw conclusions and references and convey their knowledge in a collaborative learning environment.

Constructivism transforms the students from passive recipient of information to active participants in the learning process. Always being guided by the teacher for them to construct their own knowledge actively rather than just mechanically ingesting knowledge from the teacher or textbooks.

In a constructivist classroom, learning is more on thinking and understanding and not just merely on rote memorization. Students in a constructivist classroom are curious and ask questions, they enjoy learning in having a part in the exchange of ideas. It only not promote learning but also promote social and communication skills.

A constructivist classroom is learner-centered, students are active learners and not just recipients of information, and the teacher facilitates and guides students to learning.

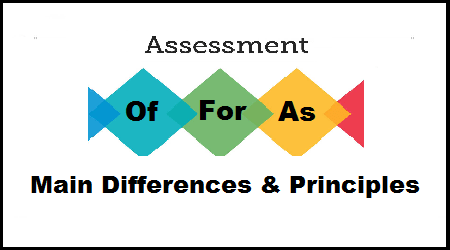
On the other hand, a traditional classroom is more on direct instruction and teacher-centered. Students are passive learners and it is the teacher that directs and controls most of the learning activities.

**WHY SCIENCE SHOULD BE TAUGHT IN SCHOOLS**

1. To allow children to gain knowledge and understanding of the world in which they live.
2. To help children better understand and develop positive attitude towards themselves and their environment.
3. For children to acquire skills that will allow them to do science and discover things about nature.
4. For children to develop positive attitude towards the study of science.
5. Because science is everywhere in all parts of our lives.

**ASSESSMENT MODELS**

Assessment Of, For & As Learning – The Main Differences & Principles



Assessment Of, For & As Learning – What are the Main Differences?

**1. Assessment Of Learning**

**I**t involves looking at assessment information **at the end of the teaching and learning process**to rank students’ achievement levels against a standard. It is summative in nature and typically involves standardized tests.

Assessment OF learning scores are often used to move students from one grade to a higher one or from one learning level to another based on their results of specified achievement tests – e.g., state tests.

The effectiveness of assessment of learning for grading or ranking depends on the validity and reliability of tests.

Assessment of learning is also known as a summative assessment.

**Summative Assessment**

* Made at the end of a unit of study to determine the level of understanding the student has achieved.
* Includes a mark or grade against an expected standard.
* Used to plan future learning goals and pathways for students
* Provides evidence of achievement to the wider community, including parents, educators, the students themselves and outside groups.

**Main Principles of Assessment Of Learning**

* Accompanied by a number or letter grade.
* Compares one student’s achievement with standards.
* Results can be communicated to the student and parents.
* Occurs at the end of the learning unit.

**2. Assessment For Learning**

**Assessment FOR learning** embeds assessment processes **throughout the teaching and learning process.**It includes both quantitative and qualitative data.

During assessment for learning teachers know where their students are in terms of their learning and check their progress.

Students are guided on what they are expected to learn and what quality work looks like. As the unit progresses, the teacher and student work together to assess the student’s knowledge, what she or he needs to learn to improve and extend this knowledge, and how the student can best get to that point (formative assessment). Assessment for learning occurs at all stages of the learning process.

The ultimate purpose of assessment for learning is to create self-regulated learners who can leave school able and confident to continue learning throughout their lives.

Assessment for learning is also known as formative assessment.

**Formative Assessment**

* Made to determine students’ knowledge and skills as they progress through a unit of study.
* Used to guide learning.
* Occurs during the course of a unit of study.

**Main Principles of Assessment For Learning**

* Includes initial or diagnostic assessment and formative assessment.
* Based on a variety of information sources (e.g., portfolios, works in progress, teacher observation, conversation).
* Provides descriptive verbal or written feedback that primarily emphasizes student strengths, identifies challenges and points to the next steps to take.
* Keep students on track.
* No grades or scores are given – record-keeping is primarily descriptive.
* Occurs throughout the learning process, from the outset of the course of study to the time of summative assessment.
* Involves students in their own learning.
* Encourages self-assessment and peer assessment as part of the regular classroom routines.
* Reflects a view of learning that helps students learn better, rather than just achieve a better mark.
* Involves formal and informal assessment activities as part of learning and informs the planning of future learning.
* Represents a detailed analysis of a student’s work.

**Assessment For Learning Strategies**

Research has identified a number of classroom strategies that are particularly effective in promoting Assessment For Learning such as:

**1. The Strategic Use of Questioning**

Questioning is used to find out what students know, understand and are able to do.

**2. Effective Teacher Feedback**

Effective teacher feedback tells the students what they have achieved and where they need to improve. Importantly, the feedback provides specific suggestions about how that improvement might be achieved.

**3. Peer Feedback**

Peer feedback occurs when a student tells another student what they have achieved and where improvement is necessary. Again, the feedback provides specific suggestions to help achieve improvement.

**4. Student Self-Assessment**

Student self-assessment encourages students to take responsibility for their own learning. It incorporates self-monitoring, self-assessment and self-evaluation.

**5. The Formative Use of Summative Assessment**

Summative assessment is a necessary aspect of education. Formative use can be made of summative assessment, both before and after the assessment event.

**Benefits of Assessment For Learning**

**For teachers**

Assessment for learning helps teachers gather information to:

* Plan and modify teaching and learning programs for individual students, groups of students, and the class as a whole.
* Pinpoint students’ strengths so that both teachers and students can build on them.
* Identify students’ learning needs in a clear and constructive way so they can be addressed.
* Involve parents in their children’s learning.

**For students**

Assessment for learning provides students with information and guidance so they can plan and manage the next steps in their learning.

It uses the information to lead from what has been learned to what needs to be learned next.

**3. Assessment As Learning**

It occurs when students are their own assessors, when they monitor their own learning, ask questions and use a range of strategies to decide what they know and can do, and how to use assessment for new learning.

**Principles of Assessment As Learning**

* Encourages students to take responsibility for their own learning.
* Requires students to ask questions about their learning.
* Involves teachers and students in creating learning goals to encourage growth and development.
* Provides ways for students to use formal and informal feedback to help them understand the next steps in learning.
* Encourages peer assessment, self-assessment and reflection.
* Begins as soon as students become aware of the goals of instruction and the criteria for performance.
* Involves goal-setting, monitoring progress, and reflecting on results.
* Occurs throughout the learning process.

**Final Word**

Assessment is a powerful process. As a result, it can either optimize or inhibit learning, depending on how it’s applied.

What matters most is not so much the form of the assessment, but how the teacher uses the information available to improve teaching and learning. To achieve this goal assessment should be authentic.

**Authentic Assessment**

* Based on content or media in which the students actually have a genuine interest.
* Engages students in real-life activities.
* Asks students to synthesize information and use critical-thinking skills.
* Measures not just what students remember but how they think.
* Helps students understand where they are academically.
* Helps teachers know how to best teach their students.

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[**Effective science teaching in primary school should take place in supportive learning environments**](https://www.bing.com/ck/a?!&&p=36aaa741595acb4aJmltdHM9MTcwMDc4NDAwMCZpZ3VpZD0wNDExNTliNi0zZjg5LTZlMjYtM2U2ZS00YTFlM2U0YTZmOWYmaW5zaWQ9NTcyMw&ptn=3&ver=2&hsh=3&fclid=041159b6-3f89-6e26-3e6e-4a1e3e4a6f9f&psq=How+should+science+be+taugt+in+primary+schools&u=a1aHR0cHM6Ly93d3cucHJpbS1lZC5jby51ay9ibG9nL3Bvc3QvdGVhY2hpbmctc2NpZW5jZS1pbi1wcmltYXJ5LXNjaG9vbHMv&ntb=1)[**1**](https://www.bing.com/ck/a?!&&p=e80b5d499307262cJmltdHM9MTcwMDc4NDAwMCZpZ3VpZD0wNDExNTliNi0zZjg5LTZlMjYtM2U2ZS00YTFlM2U0YTZmOWYmaW5zaWQ9NTcyNA&ptn=3&ver=2&hsh=3&fclid=041159b6-3f89-6e26-3e6e-4a1e3e4a6f9f&psq=How+should+science+be+taugt+in+primary+schools&u=a1aHR0cHM6Ly93d3cucHJpbS1lZC5jby51ay9ibG9nL3Bvc3QvdGVhY2hpbmctc2NpZW5jZS1pbi1wcmltYXJ5LXNjaG9vbHMv&ntb=1). Here are some tips for teaching science in primary school:

* [Teach science across the curriculum to help pupils make connections and transfer knowledge and understanding](https://www.bing.com/ck/a?!&&p=451c5e624b85a52bJmltdHM9MTcwMDc4NDAwMCZpZ3VpZD0wNDExNTliNi0zZjg5LTZlMjYtM2U2ZS00YTFlM2U0YTZmOWYmaW5zaWQ9NTcyNQ&ptn=3&ver=2&hsh=3&fclid=041159b6-3f89-6e26-3e6e-4a1e3e4a6f9f&psq=How+should+science+be+taugt+in+primary+schools&u=a1aHR0cHM6Ly93d3cucHJpbS1lZC5jby51ay9ibG9nL3Bvc3QvdGVhY2hpbmctc2NpZW5jZS1pbi1wcmltYXJ5LXNjaG9vbHMv&ntb=1)[**1**](https://www.bing.com/ck/a?!&&p=6077cf8bba52c7f0JmltdHM9MTcwMDc4NDAwMCZpZ3VpZD0wNDExNTliNi0zZjg5LTZlMjYtM2U2ZS00YTFlM2U0YTZmOWYmaW5zaWQ9NTcyNg&ptn=3&ver=2&hsh=3&fclid=041159b6-3f89-6e26-3e6e-4a1e3e4a6f9f&psq=How+should+science+be+taugt+in+primary+schools&u=a1aHR0cHM6Ly93d3cucHJpbS1lZC5jby51ay9ibG9nL3Bvc3QvdGVhY2hpbmctc2NpZW5jZS1pbi1wcmltYXJ5LXNjaG9vbHMv&ntb=1).
* [Capture students' interests and curiosity to get them engaged](https://www.bing.com/ck/a?!&&p=4f6da622c1d8c0f5JmltdHM9MTcwMDc4NDAwMCZpZ3VpZD0wNDExNTliNi0zZjg5LTZlMjYtM2U2ZS00YTFlM2U0YTZmOWYmaW5zaWQ9NTcyNw&ptn=3&ver=2&hsh=3&fclid=041159b6-3f89-6e26-3e6e-4a1e3e4a6f9f&psq=How+should+science+be+taugt+in+primary+schools&u=a1aHR0cHM6Ly9lZHVzcG90LmNvLnVrL2FydGljbGUvcHJpbWFyeS1zY2hvb2wtc2NpZW5jZS8&ntb=1)[**2**](https://www.bing.com/ck/a?!&&p=01bd0919a50202a2JmltdHM9MTcwMDc4NDAwMCZpZ3VpZD0wNDExNTliNi0zZjg5LTZlMjYtM2U2ZS00YTFlM2U0YTZmOWYmaW5zaWQ9NTcyOA&ptn=3&ver=2&hsh=3&fclid=041159b6-3f89-6e26-3e6e-4a1e3e4a6f9f&psq=How+should+science+be+taugt+in+primary+schools&u=a1aHR0cHM6Ly9lZHVzcG90LmNvLnVrL2FydGljbGUvcHJpbWFyeS1zY2hvb2wtc2NpZW5jZS8&ntb=1).
* [Involve students in mental pursuits or physical adventures to explore their ideas](https://www.bing.com/ck/a?!&&p=4cdf46473ab464cfJmltdHM9MTcwMDc4NDAwMCZpZ3VpZD0wNDExNTliNi0zZjg5LTZlMjYtM2U2ZS00YTFlM2U0YTZmOWYmaW5zaWQ9NTcyOQ&ptn=3&ver=2&hsh=3&fclid=041159b6-3f89-6e26-3e6e-4a1e3e4a6f9f&psq=How+should+science+be+taugt+in+primary+schools&u=a1aHR0cHM6Ly9lZHVzcG90LmNvLnVrL2FydGljbGUvcHJpbWFyeS1zY2hvb2wtc2NpZW5jZS8&ntb=1)[**2**](https://www.bing.com/ck/a?!&&p=e064db1829683fedJmltdHM9MTcwMDc4NDAwMCZpZ3VpZD0wNDExNTliNi0zZjg5LTZlMjYtM2U2ZS00YTFlM2U0YTZmOWYmaW5zaWQ9NTczMA&ptn=3&ver=2&hsh=3&fclid=041159b6-3f89-6e26-3e6e-4a1e3e4a6f9f&psq=How+should+science+be+taugt+in+primary+schools&u=a1aHR0cHM6Ly9lZHVzcG90LmNvLnVrL2FydGljbGUvcHJpbWFyeS1zY2hvb2wtc2NpZW5jZS8&ntb=1).
* [Introduce technical-scientific explanations in an imaginative way](https://www.bing.com/ck/a?!&&p=331f2ee8768c038dJmltdHM9MTcwMDc4NDAwMCZpZ3VpZD0wNDExNTliNi0zZjg5LTZlMjYtM2U2ZS00YTFlM2U0YTZmOWYmaW5zaWQ9NTczMQ&ptn=3&ver=2&hsh=3&fclid=041159b6-3f89-6e26-3e6e-4a1e3e4a6f9f&psq=How+should+science+be+taugt+in+primary+schools&u=a1aHR0cHM6Ly9lZHVzcG90LmNvLnVrL2FydGljbGUvcHJpbWFyeS1zY2hvb2wtc2NpZW5jZS8&ntb=1)[**2**](https://www.bing.com/ck/a?!&&p=2be07fb238f2b625JmltdHM9MTcwMDc4NDAwMCZpZ3VpZD0wNDExNTliNi0zZjg5LTZlMjYtM2U2ZS00YTFlM2U0YTZmOWYmaW5zaWQ9NTczMg&ptn=3&ver=2&hsh=3&fclid=041159b6-3f89-6e26-3e6e-4a1e3e4a6f9f&psq=How+should+science+be+taugt+in+primary+schools&u=a1aHR0cHM6Ly9lZHVzcG90LmNvLnVrL2FydGljbGUvcHJpbWFyeS1zY2hvb2wtc2NpZW5jZS8&ntb=1).
* [Take on new challenges and apply the skills and knowledge to new problems so students can test how much they understand](https://www.bing.com/ck/a?!&&p=4207cfd909b95480JmltdHM9MTcwMDc4NDAwMCZpZ3VpZD0wNDExNTliNi0zZjg5LTZlMjYtM2U2ZS00YTFlM2U0YTZmOWYmaW5zaWQ9NTczMw&ptn=3&ver=2&hsh=3&fclid=041159b6-3f89-6e26-3e6e-4a1e3e4a6f9f&psq=How+should+science+be+taugt+in+primary+schools&u=a1aHR0cHM6Ly9lZHVzcG90LmNvLnVrL2FydGljbGUvcHJpbWFyeS1zY2hvb2wtc2NpZW5jZS8&ntb=1)[**2**](https://www.bing.com/ck/a?!&&p=faa21f76b3ef8d12JmltdHM9MTcwMDc4NDAwMCZpZ3VpZD0wNDExNTliNi0zZjg5LTZlMjYtM2U2ZS00YTFlM2U0YTZmOWYmaW5zaWQ9NTczNA&ptn=3&ver=2&hsh=3&fclid=041159b6-3f89-6e26-3e6e-4a1e3e4a6f9f&psq=How+should+science+be+taugt+in+primary+schools&u=a1aHR0cHM6Ly9lZHVzcG90LmNvLnVrL2FydGljbGUvcHJpbWFyeS1zY2hvb2wtc2NpZW5jZS8&ntb=1).

Teaching science to primary school children involves planning and preparation to create an effective, hands-on curriculum. By engaging the kids in interactive projects, you give them the opportunity to explore basic science concepts and relate them to the world. A balance of activities makes the teaching approach more effective for students with different learning styles. Here are some steps to follow when teaching science in primary schools:

1. **Outline the topics** you’ll teach the primary school students. Refer to the curriculum guidelines or the primary science textbook if you’re using one. List the main topic and the subtopics under each one. Refer to this outline as you plan the specific activities for each topic.
2. **Create a time line** for the teaching topics. Determine how much time you need for each chapter. Refer to the school year calendar to pencil in approximate dates for each part of the curriculum.
3. **Write the goals** or expected outcomes for each chapter. This will include what the primary students should understand about the concept and what they will do to demonstrate an understanding. It might include completing a particular science task, taking a written test or verbally explaining the concept. Keep these goals in mind as you plan the activities.
4. **Plan an introductory activity** for each chapter or concept. A demonstration such as a science experiment or video clip is a good way to pique the interest of the primary students. Conducting a quick prior knowledge assessment such as a KWL chart is another good way to introduce a new chapter.
5. **Choose at least one hands-on activity** for the kids for each subtopic. This might include a science experiment, building a 3-D model or creating a science-related art project. The specific subtopic will help plan the specific activity that works well. Create a list of materials needed so you are prepared for the activity when you reach that point in the curriculum.
6. **Select children’s books** to complement the primary science curriculum. Choose both fiction and nonfiction children’s books for variety.
7. **Fill in the science lessons** with a mixture of textbook work, paper-and-pencil activities and science games. You can easily customize classic kids’ games to fit the science topics you’re studying. Games such as Memory, “Jeopardy!” and Bingo work well. This gives the kids an alternative way to practice the science concepts.
8. **Use science journals** with the primary students to help them record their observations. There are many uses for science journals. They can draw pictures of science observations, write predictions about science events or answer daily science questions as a warm-up activity.

[Effective science teaching should take place in supportive learning environments that are engaging with visual displays, that create a desire for pupils to find out something, where pupils have a sense of belonging, and where talk is encouraged to help pupils clarify their scientific understanding](https://www.prim-ed.co.uk/blog/post/teaching-science-in-primary-schools/)[1](https://www.prim-ed.co.uk/blog/post/teaching-science-in-primary-schools/). [Science in elementary school covers basic concepts of life sciences, physical sciences, and Earth and space sciences that develop across the grades](https://undsci.berkeley.edu/for-educators/prepare-and-plan/teaching-tips/)[1](https://undsci.berkeley.edu/for-educators/prepare-and-plan/teaching-tips/).

If you want more detailed strategies, you can refer to this [article](https://www.edweek.org/teaching-learning/opinion-four-good-science-teaching-strategies-how-to-use-them/2021/07) which provides four good science teaching strategies and how to use them. The article suggests that **student talk** is the most effective instructional strategy for teaching science. Getting learners to talk through concepts, practices, and understandings had the greatest impact on their science learning. Fostering and nurturing opportunities for learners to talk about the different types of chemical reactions and the role of a catalyst in those reactions allowed high school chemistry students to make their thinking visible and get immediate feedback from their peers. [In high school physics, critical conversations allowed learners to deeply think about the physical principles involved in a problem, the different approaches to solving that problem, and then making meaning of the solution within the context of scientific phenomena](https://undsci.berkeley.edu/for-educators/prepare-and-plan/teaching-tips/)[2](https://www.edweek.org/teaching-learning/opinion-four-good-science-teaching-strategies-how-to-use-them/2021/07).

Learn more:

[[](https://www.bing.com/ck/a?!&&p=663acb8b9748126dJmltdHM9MTcwMDc4NDAwMCZpZ3VpZD0wNDExNTliNi0zZjg5LTZlMjYtM2U2ZS00YTFlM2U0YTZmOWYmaW5zaWQ9NTAyNw&ptn=3&ver=2&hsh=3&fclid=041159b6-3f89-6e26-3e6e-4a1e3e4a6f9f&u=a1aHR0cHM6Ly93d3cuM3BsZWFybmluZy5jb20vYmxvZy80LWNoYWxsZW5nZXMtdGVhY2hpbmctc2NpZW5jZS1wcmltYXJ5LXNjaG9vbC8&ntb=1)](https://www.bing.com/ck/a?!&&p=663acb8b9748126dJmltdHM9MTcwMDc4NDAwMCZpZ3VpZD0wNDExNTliNi0zZjg5LTZlMjYtM2U2ZS00YTFlM2U0YTZmOWYmaW5zaWQ9NTAyNw&ptn=3&ver=2&hsh=3&fclid=041159b6-3f89-6e26-3e6e-4a1e3e4a6f9f&u=a1aHR0cHM6Ly93d3cuM3BsZWFybmluZy5jb20vYmxvZy80LWNoYWxsZW5nZXMtdGVhY2hpbmctc2NpZW5jZS1wcmltYXJ5LXNjaG9vbC8&ntb=1" \t "_blank)

**To involve students in science teaching, you can try the following tips:**  
  
1. Teach science across the curriculum to help pupils make connections and transfer knowledge and understanding.  
2. Capture students' interests and curiosity to get them engaged.  
3. Involve students in mental pursuits or physical adventures to explore their ideas.  
4. Introduce technical-scientific explanations in an imaginative way.  
5. Take on new challenges and apply the skills and knowledge to new problems so students can test how much they understand.  
6. In the United States, students begin studying science in lower elementary school in an observational way. Science in elementary school covers basic concepts of life sciences, physical sciences, and Earth and space sciences that develop across the grades .  
  
If you want more detailed strategies, you can refer to this [article](https://www.edweek.org/teaching-learning/opinion-four-good-science-teaching-strategies-how-to-use-them/2021/07) which provides four good science teaching strategies and how to use them. The article suggests that student talk is the most effective instructional strategy for teaching science. Getting learners to talk through concepts, practices, and understandings had the greatest impact on their science learning. Fostering and nurturing opportunities for learners to talk about the different types of chemical reactions and the role of a catalyst in those reactions allowed high school chemistry students to make their thinking visible and get immediate feedback from their peers. In high school physics, critical conversations allowed learners to deeply think about the physical principles involved in a problem, the different approaches to solving that problem, and then making meaning of the solution within the context of scientific phenomena . Message has links.