

Learning Modes of Scientific Practices

Scientific Practices	Students' Overt Learning Behaviour			
	<u>P</u> assive (Individual)	<u>A</u> ctive (Individual)	<u>C</u> onstructive (Individual)	<u>I</u> nteractive (Group)
Asking scientific questions	Students listen to the teacher posing scientific questions	Students select scientific questions from provided materials .	Students ask genuine scientific questions	Students discuss with peers to create genuine scientific questions
Creating scientific models	Students read textbooks to understand some scientific models	Students follow given instructions to build models step-by-step	Students find patterns from scientific data and construct models accordingly.	Students collaboratively build scientific models in groups to explain phenomena.
Planning and conducting investigations	Students read provided procedures for scientific experiments or investigations.	Students follow fixed steps to conduct experiments or investigations.	Students design investigations or write experimental steps	Students collaboratively design investigations or write experimental steps in groups .
Computational thinking	Students listen to the teacher explaining how to calculate, represent and quantify data.	Students follow fixed steps to calculate, represent and quantify data.	Students use alternative methods to calculate, represent and quantify data.	Students discuss with peers and suggest alternative methods to calculate, represent and quantify data.
Analyzing data	Students listen to the teacher explaining data patterns and results	Students analyse data step-by-step	Students search for additional data to further analyse	Students collaborate in groups to search for additional data and further analyse
Constructing scientific explanations	Students read textbooks or listen to teachers explaining scientific concepts	Students explain phenomena based on given assignments after listening to teachers	Students apply learned concepts and data to create explanations in unfamiliar situations	Students discuss with peers and apply learned concepts and data to create explanations in unfamiliar situations
Conducting evidence-based scientific arguments	Students read textbooks to learn about scientific arguments and evidence related to certain issues	Students write scientific arguments based on provided data within a fixed framework (Claim-Evidence-Reasoning)	Students analyse data, summarise evidence and write scientific arguments	Students analyse data, summarize evidence , write different scientific arguments, and engage in scientific debates in groups
Communicating and evaluating science	Students listen to the teacher presenting scientific conclusions	Students express scientific ideas following fixed steps and formats	Students creatively express scientific ideas such as reflection articles and science posters.	Students discuss with peers to creatively express scientific ideas , such as reflection articles and science posters