

**ASSIGNMENT No. 1**

**Q.1 Explain different phases of teaching. Which activities can be arranged for evaluation of students at elementary classroom at the last phase of teaching?**

Teaching is a complex task. We need systematic planning to perform this task. Teaching has to be done in steps. The different steps constituting the process are called the **phases of teaching**. Each phase has some operations of teaching which create the situation for learning. Teaching process can be divided into three phases/stages.

1. Pre-active phase – refers to planning
2. Interactive phase – refers to the conduct and management
3. Post-active phase – refers to the follow-up and consolidation

Different phases involve different operations of teaching.

**The pre-active phase of teaching:-**

- It is the phase of planning for teaching.
- Good planning makes the task of teacher smooth, functional and successful.
- There one two major steps involved in this phase.
  1. Establishment of some kind of goals or objectives.
  2. Discovering ways and means to active these objectives.

**Operation of teaching at pre-active phase:-**

Before classroom teaching, a teacher has to perform many tasks. This phase includes all these activities which a teacher performs before entering the classroom. This stage involves the following activities.

**(1) The formulation or fixing up of goal:-**

- The teacher formulates in detail the instructional objectives in behavioral terms by using the taxonomy of educational objectives.
- Objectives one determined according to student's psychology and needs of the society and the school.
- Objectives are determined according to what changes teacher expects in students by achieving these objectives.

**(2) Selection of content or subject matter to be taught:-**

- After fixation of teaching objectives teacher decides about the content to be presented before learners.
- For content selection following points should be kept in mind.
  1. The demand of syllabus/curriculum.
  2. The entry behavior of the accepted learners.
  3. Level of the motivation of learners.
  4. Teacher's preference for assessment related to the content.

**(3) The arrangement of ideas and style of teaching:-**

After selecting the presentable content, the teacher arranges the elements of the content in a logical and psychological sequence. Sequencing should be able to assist in the transfer of learning.

**(4) Selecting Intuitional Methodology:-**

The teacher has to select appropriate strategies and tactics of teaching, keeping in view, of the content and objectives of teaching. This operation is very important in teacher-education programme.

**(5) Development of teaching strategies:-**

The teacher should decide beforehand about strategies and tricks, which he has to use during the course of his classroom teaching. He should decide about

- When and what device of teaching should be used.
- When the teaching aids will be used.
- When recapitulation or evaluation etc. will be done.

**(6) Deciding the duration, place, and management of classroom teaching.**

**(7) A decision about evaluation tools and techniques.**

So, this stage is about working out the details of the teaching or activities a teacher want to perform in the class. Here teacher hypothesizes about the possible outcome of his action.

**The interactive phase of teaching:-**

This phase refers to the execution of the plan made during the pre-active phase. This is actual classroom teaching. In this phase, the teacher gives students the learning experiences through some suitable modes.

In this phase, teachers give learners a pre-determined environment. The teacher interacts with students so that desired changes can be brought in the learner.

So learning is directed in pre-determined directions to achieve pre-determined goals. In this process, the teacher provides learners with verbal stimulation.

This stimulation can be of various kinds. Few examples are:-

- asking questions
- listening to student's response
- providing guidance
- making explanations etc.

**Operations of teaching at interactive phase:-**

This phase of teaching

- includes all those activities which a teacher uses after entering the classroom.
- includes actual teaching done in the classroom.

In this face to face encounter with learners. Here the teacher uses some of the techniques, aids, and material planned in the first phase. This helps the teacher in achieving the relevant objectives that were already set. Here the following operations are undertaken by the teacher.

**(1) Setting up the class:-**

It refers to the activity of perceiving the due size of the class, getting the feel of the mood of learners. here teacher should be aware of

- how many in the group are looking attentive
- how many are negligent and disinterested
- who are sharper ones
- who are troublemakers etc.

**(2) Knowing the learners:-**

Knowing the learners means to know about the previous knowledge of the new learners. It is done after preserving the class size. For this teacher can start by knowing the abilities, interests, attitudes and academic backgrounds of the new learners.

**(3) Starting teaching:-**

At this stage, the teacher starts teaching. This is done after diagnosing by questioning. Here, two types of activities are involved.

1. Initiation
2. Response

The initiation and response are known as 'verbal interaction'

The interactive phase of teaching is the classroom interaction between teacher and students. The interaction may be verbal or non-verbal. Interaction is the most important at this stage. This is the interchange between teacher and student by initiation or response operations.

In this phase, all the activities performed by a teacher when he enters the classroom are combined together. These activities are concerned with the presentation of content in the class.

**The post-active phase of teaching**

It is the evaluation phase of teaching. It arises when the teacher has left the class and tries to have a look back into what happened in the class. This phase is concerned with the following activities.

**(a) Evaluation Activities : –**

These activities are performed in various ways, e.g.,

- tests or quizzes
- by observing student's reactions to questions,
- instructional situations and comments etc.

**(b) Summing up teaching tasks:-**

To sum up, the teacher asks the questions from the learners, verbally or in written form. The behaviors of the students are also measured in order to evaluate their achievements.

In absence of all these evaluative activities, the entire learning process could be incomplete.

**Activities/operations at the post-active phase**

**(1) Determining the exact dimensions of behavior changes:-**

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Here the teacher compares the actual behavioral changes in students with their expected behavioral changes. If desired behavioral changes are observed in maximum students then it means that teaching strategies are very effective.

### (2) Selection of testing devices and techniques:-

For comparing desired and actual behavior changes, the teacher has to select appropriate, testing devices which are valid and reliable. For this criterion, tests are more preferred than the performance tests.

### (3) Changing strategies of testing:-

The student's testing result is also used for evaluating the effectiveness of instructions and teaching strategies. It should provide a base for improving the teaching and changing strategies of teaching.

### Importance of operations in different phases of teaching:-

1. It focuses on bringing desired behavior changes in the students.
2. It provides the scientific basis for developing effective instructions of the teaching.
3. The classroom teaching and interaction can be made effective with this background.
4. Teaching operations ultimately create the appropriate conditions of learning for achieving the desired goals.
5. Teaching can be organized effectively at different levels by employing appropriate teaching activity.

So we can say that the process of teaching starts even before the teacher enters the classroom. It continues even after classroom. It continues even after classroom interaction in the form of evaluation, feedback, and other activities. All three teaching phases are interrelated each one helps to modify the other in order to make teaching more meaningful and significant.

### Q.2 Discuss in detail different teaching styles. Which style of teaching do you think the most suitable to elementary students? Provide arguments to support your statement.

Every teacher has her or his own style of teaching. And as traditional teaching styles evolve with the advent of differentiated instruction, more and more teachers are adjusting their approach depending on their students' learning needs.

#### The Authority, or lecture style

The authority model is teacher-centered and frequently entails lengthy lecture sessions or one-way presentations. Students are expected to take notes or absorb information.

- **Pros:** This style is acceptable for certain higher-education disciplines and auditorium settings with large groups of students. The pure lecture style is most suitable for subjects like history, which necessitate memorization of key facts, dates, names, etc.
- **Cons:** It's a questionable model for teaching children because there is little or no interaction with the teacher. Plus it can get a little snooze-y. That's why it's a better approach for older, more mature students.

### The Demonstrator, or coach style

The demonstrator retains the formal authority role by showing students what they need to know. The demonstrator is a lot like the lecturer, but their lessons include multimedia presentations, activities, and demonstrations. (Think: Math. Science. Music.)

- **Pros:** This style gives teachers opportunities to incorporate a variety of formats including lectures and multimedia presentations.
- **Cons:** Although it's well-suited for teaching mathematics, music, physical education, or arts and crafts, it is difficult to accommodate students' individual needs in larger classrooms.

### The Facilitator, or activity style

Facilitators promote self-learning and help students develop critical thinking skills and retain knowledge that leads to self-actualization.

- **Pros:** This style trains students to ask questions and helps develop skills to find answers and solutions through exploration; it is ideal for teaching science and similar subjects.
- **Cons:** Challenges teacher to interact with students and prompt them toward discovery rather than lecturing facts and testing knowledge through memorization. So it's a bit harder to measure success in tangible terms.

### The Delegator, or group style

The delegator style is best suited for curricula that require lab activities, such as chemistry and biology, or subjects that warrant peer feedback, like debate and creative writing.

- **Pros:** Guided discovery and inquiry-based learning place the teacher in an observer role that inspires students by working in tandem toward common goals.
- **Cons:** Considered a modern style of teaching, it is sometimes criticized as eroding teacher authority. As a delegator, the teacher acts more as a consultant rather than the traditional authority figure.

### The Hybrid, or blended style

Hybrid, or blended style, follows an integrated approach to teaching that blends the teacher's personality and interests with students' needs and curriculum-appropriate methods.

- **Pros:** Inclusive! And it enables teachers to tailor their styles to student needs and appropriate subject matter.
- **Cons:** Hybrid style runs the risk of trying to be too many things to all students, prompting teachers to spread themselves too thin and dilute learning.

Because teachers have styles that reflect their distinct personalities and curriculum—from math and science to English and history—it's crucial that they remain focused on their teaching objectives and avoid trying to be all things to all students.

Although it is not the teacher's job to entertain students, it is vital to engage them in the learning process. Selecting a style that addresses the needs of diverse students at different learning levels begins with a personal

inventory—a self-evaluation—of the teacher’s strengths and weaknesses. As they develop their teaching styles and integrate them with effective classroom management skills, teachers will learn what works best for their personalities and curriculum.

Our guide encapsulates today’s different teaching styles and helps teachers identify the style that’s right for them and their students. Browse through the article or use these links to jump to your desired destination.

- What is a teaching style inventory, and how have teaching styles evolved?
- What teaching method is best for today’s students?
- How does classroom diversity influence teachers?

### Emergence of the teaching style inventory

How have teaching styles evolved? This is a question teachers are asked, and frequently ask themselves, as they embark on their careers, and occasionally pause along the way to reflect on job performance. To understand the differences in teaching styles, it’s helpful to know where the modern concept of classifying teaching methods originated.

The late Anthony F. Grasha, a noted professor of psychology at the University of Cincinnati, is credited with developing the classic five teaching styles. A follower of psychiatrist Carl Jung, Grasha began studying the dynamics of the relationship between teachers and learning in college classrooms. His groundbreaking book, Teaching with Style, was written both as a guide for teachers and as a tool to help colleagues, administrators and students systematically evaluate an instructor’s effectiveness in the classroom.

Grasha understood that schools must use a consistent, formal approach in evaluating a teacher’s classroom performance. He recognized that any system designed to help teachers improve their instructional skills requires a simple classification system. He developed a teaching style inventory that has since been adopted and modified by followers.

- **Expert:** Similar to a coach, experts share knowledge, demonstrate their expertise, advise students, and provide feedback to improve understanding and promote learning.
- **Formal authority:** Authoritative teachers incorporate the traditional lecture format and share many of the same characteristics as experts, but with less student interaction.
- **Personal model:** Incorporates blended teaching styles that match the best techniques with the appropriate learning scenarios and students in an adaptive format.
- **Facilitator:** Designs participatory learning activities and manages classroom projects while providing information and offering feedback to facilitate critical thinking.
- **Delegator:** Organizes group learning, observes students, provides consultation, and promotes interaction between groups and among individuals to achieve learning objectives.

Although he developed specific teaching styles, Grasha warned against boxing teachers into a single category. Instead, he advocated that teachers play multiple roles in the classroom. He believed most teachers possess some combination of all or most of the classic teaching styles.

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Whether you're a first-year teacher eager to put into practice all of the pedagogical techniques you learned in college, or a classroom veteran examining differentiated instruction and new learning methodologies, consider that not all students respond well to one particular style. Although teaching styles have been categorized into five groups, today's ideal teaching style is not an either/or proposition but more of a hybrid approach that blends the best of everything a teacher has to offer.

The traditional advice that teachers not overreach with a cluster of all-encompassing teaching styles might seem to conflict with today's emphasis on student-centered classrooms. Theoretically, the more teachers emphasize student-centric learning, the harder it is to develop a well-focused style based on their personal attributes, strengths, and goals.

In short, modern methods of teaching require different types of teachers—from the analyst/organizer to the negotiator/consultant. Here are some other factors to consider as teachers determine the best teaching method for their students.

**Empty vessel:** Critics of the “sage on the stage” lecture style point to the “empty vessel” theory, which assumes a student's mind is essentially empty and needs to be filled by the “expert” teacher. Critics of this traditional approach to teaching insist this teaching style is outmoded and needs to be updated for the diverse 21st-century classroom.

**Active vs. passive:** Proponents of the traditional lecture approach believe that an overemphasis on group-oriented participatory teaching styles, like facilitator and delegator, favor gifted and competitive students over passive children with varied learning abilities, thereby exacerbating the challenges of meeting the needs of all learners.

**Knowledge vs. information:** Knowledge implies a complete understanding, or full comprehension, of a particular subject. A blend of teaching styles that incorporate facilitator, delegator, demonstrator, and lecturer techniques helps the broadest range of students acquire in-depth knowledge and mastery of a given subject. This stands in contrast to passive learning, which typically entails memorizing facts, or information, with the short-term objective of scoring well on tests.

**Interactive classrooms:** Laptops and tablets, video conferencing, and podcasts in classrooms play a vital role in today's teaching styles. With technology in mind, it is imperative that teachers assess their students' knowledge while they are learning. The alternative is to wait for test results, only to discover knowledge gaps that should have been detected during the active learning phase.

**Constructivist teaching methods:** Contemporary teaching styles tend to be group-focused and inquiry-driven. Constructivist teaching methods embrace subsets of alternative teaching styles, including modeling, coaching, and test preparation through rubrics scaffolding. All of these are designed to promote student participation and necessitate a hybrid approach to teaching. One criticism of the constructivist approach is that it caters to extroverted, group-oriented students, who tend to dominate and benefit from these teaching methods more than introverts; however, this assumes introverts aren't learning by observing.

Student-centric learning does not have to come at the expense of an instructor's preferred teaching method. However, differentiated instruction demands that teachers finesse their style to accommodate the diverse needs of 21st-century classrooms.

**Q.3 Define the concept of demonstration method of teaching. Discuss the types and steps of demonstration method of teaching.**

The word demonstration means to give demos or to perform the particular activity or concept. In demonstration method, the teaching-learning process is carried in a systematic way. Demonstration often occurs when students have a hard time connecting theories to actual practice or when students are unable to understand applications of theories. In order to make a success of demonstration method, three things are necessary.

- (a) The object being displayed during demonstration should not be so small.
- (b) During the demonstration, the clear language should be used so that pupils may understand concept easily.
- (c) The pupils should be able to question teachers in order to remove their difficulties.

**Characteristic of demonstration method**

- (1) The demonstration should be done in a simple way.
- (2) In this strategy, attention is paid to all students.
- (3) Goals and objections of demonstration are very clear.
- (4) It is a well-planned strategy.
- (5) Time is given for rehearsal before the demonstration.

**Steps of Demonstration method**

There are six steps of demonstration process.

**(1) Planning and preparation**

proper planning is required for good demonstration. For this following points should be kept in mind.

- Through the preparation of subject matter.
- lesson planning
- collection of material related to the demonstration.
- rehearsal of demonstration.

In order to ensure the success of demonstration, the teacher should prepare lesson minutely and very seriously.

**(2) Introducing the lesson**

The teacher should motivate students and prepare them mentally for the demonstration.

The teacher should introduce the lesson to students keeping in mind the following things.

- individual differences
- Environment
- Experiences

The lesson can also be started with some simple and interesting experiments. Very common event or some internal story.



The experiment should be able to hold the attention of students.

**(3) Presentation of subject matter**

- In demonstration presentation of subject matter is very important.
- The principle of reflecting thinking should be kept in mind.
- The teacher should teach the student in such a way that their previous knowledge can be attached to their new knowledge.

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**(4) Demonstration**

- The performance in the demonstration table should be ideal for the student.
- The demonstration should be neat and clean.

**(5) Teaching Aids**

- The teacher can use various teaching aids like models, blackboard, graphs etc.during demonstration.

**(6) Evaluation**

- In this last step, evaluation of the whole demonstration should be done, so that it can be made more effective.

**Merits of demonstration method**

- (1) It helps a student in having a deeper understanding of the topic.
- (2) It helps students remain active in teaching -learning process.
- (3) It leads to permanent learning.
- (4) It accounts for the principles of reflective thinking.
- (5) It helps to create interest for topics among students.
- (6) It helps in arousing the spirit of discovery among students.
- (7) It imparts maximum learning to students.

**Demerits**

- (1) Students can not benefit with direct and personal experiences as teacher carry out the demonstration.
- (2) It can be costly as it requires costly materials.
- (3) It can be a time-consuming method.
- (4) It is not based on learning by doing.
- (5) This method does not provide training for the scientific method.
- (6) There is a lack of experienced teachers to carry out the demonstration.

It is the most suitable method for teaching the secondary classes. If a teacher feels that the demonstration is taking much time than he would have to take the help of students. Similarly, a small group of students can be invited to the demonstration table. Students can also demonstrate the experiment. This might help in removing objection regarding non-availability of learning by doing approach.

**Q.4 Questioning is teaching technique. What are the reasons of asking questions in classroom? What steps are used in questioning technique of teaching?**

The interaction between teacher and learners is the most important feature of the classroom. Whether helping learners to acquire basic skills or a better understanding to solve problems, or to engage in higher-order thinking such as evaluation, questions are crucial. Of course, questions may be asked by students as well as teachers: they are essential tools for both teaching and learning.

For teachers, questioning is a key skill that anyone can learn to use well. Similarly, ways of helping students develop their own ability to raise and formulate questions can also be learned. Raising questions and knowing the right question to ask is an important learning skill that students need to be taught.

Research into questioning has given some clear pointers as to what works. These can provide the basis of improving classroom practice. A very common problem identified by the research is that students are frequently not provided with enough 'wait time' to consider an answer; another is that teachers tend to ask too many of the same type of questions. (Adapted from Types Of Question, section Intro).

In 1940, Stephen Corey analyzed verbatim transcripts of classroom talk for one week across six different classes. His intent was to interrogate what the talk revealed about the learners' increase in understanding. He wrote, however, that "the study was not successful for the simple reason that during the five class days involved the pupils did not talk enough to give any evidence of mental development; the teachers talked two-thirds of the time" (p. 746). The research focus thus shifted to patterns of questioning.

Findings included:

- For every student query, teachers asked approximately 11 questions
- Students averaged less than one question each, while teachers averaged more than 200 questions each
- Teachers often answered their own questions
- Fewer teacher questions requires deep thinking by the learner

Much has changed since 1940 – except, it seems, these patterns. Classroom discourse continues to be dominated by the 'recitation script': teachers asking known-answer questions (Howe & Abedin, 2013) that limit opportunities for learners to experience cognitive challenge, thereby inhibiting effective learning (Alexander, 2008).

Effective questioning techniques are critical to learner engagement and are a key strategy for supporting students to engage thoughtfully and critically with more complex concepts and ideas

**The purposes of questioning**

Teachers ask questions for a number of reasons, the most common of which are

- to interest, engage and challenge students
- to check on prior knowledge and understanding

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- to stimulate recall, mobilizing existing knowledge and experience in order to create new understanding and meaning
- to focus students' thinking on key concepts and issues
- to help students to extend their thinking from the concrete and factual to the analytical and evaluative
- to lead students through a planned sequence which progressively establishes key understandings
- to promote reasoning, problem solving, evaluation and the formulation of hypotheses
- to promote students' thinking about the way they have learned

The kind of question asked will depend on the reason for asking it. Questions are often referred to as 'open' or 'closed'.

**Closed questions**, which have one clear answer, are useful to check understanding during explanations and in recap sessions. If you want to check recall, then you are likely to ask a fairly closed question, for example 'What is the grid reference for Great Malvern?' or 'What do we call this type of text?'

On the other hand, if you want to help students develop **higher-order thinking skills**, you will need to ask more **open questions** that allow students to give a variety of acceptable responses. During class discussions and debriefings, it is useful to ask open questions, for example 'Which of these four sources were most useful in helping with this inquiry?', 'Given all the conflicting arguments, where would you build the new superstore?', 'What do you think might affect the size of the current in this circuit?'

Questioning is sometimes used to bring a student's attention back to the task in hand, for example 'What do you think about that, Peter?' or 'Do you agree?' (Adapted from Types Of Question, section Why).

A striking insight provided by classroom research is that much talk between teachers and their students has the following pattern: a teacher's question, a student's response, and then an evaluative comment by the teacher. This is described as an Initiation-Response-Feedback exchange, or IRF. Here's an example

**I** – Teacher – What's the capital city of Argentina?

**R** – Pupil – Buenos Aires

**F** – Teacher – Yes, well done

This pattern was first pointed out in the 1970s by the British researchers Sinclair and Coulthard. Their original research was reported in: Sinclair, J. and Coulthard, M. (1975) Towards an Analysis of Discourse: the English used by Teachers and Pupils. London: Oxford University Press.

Sinclair and Coulthard's research has been the basis for extended debates about whether or not teachers should ask so many questions to which they already know the answer; and further debate about the range of uses and purposes of IRF in working classrooms. Despite all this, it seems that many teachers (even those who have qualified in recent decades) have not heard of it. Is this because their training did not include any examination of the structures of classroom talk – or because even if it did, the practical value of such an examination was not made clear?

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A teacher's professional development (and, indeed, the development of members of any profession) should involve the gaining of critical insights into professional practice – to learn to see behind the ordinary, the taken for granted, and to question the effectiveness of what is normally done. Recognizing the inherent structure of teacher-student talk is a valuable step in that direction. Student teachers need to see how they almost inevitably converge on other teachers' style and generate the conventional patterns of classroom talk.

By noting this, they can begin to consider what effects this has on student participation in class. There is nothing wrong with the use of IRFs by teachers, but question-and-answer routines can be used both productively and unproductively. (Adapted from The Importance of Speaking and Listening, section IRF).

Research evidence suggests that effective teachers use a greater number of open questions than less effective teachers. The mix of open and closed questions will, of course, depend on what is being taught and the objectives of the lesson. However, teachers who ask no open questions in a lesson may be providing insufficient cognitive challenges for students.

**Questioning is one of the most extensively researched areas of teaching and learning.** This is because of its central importance in the teaching and learning process. The research falls into three broad categories

- What is effective questioning?
- How do questions engage students and promote responses?
- How do questions develop students' cognitive abilities?

Questioning is effective when it allows students to engage with the learning process by actively composing responses. Research (Borich 1996; Muijs and Reynolds 2001; Morgan and Saxton 1994; Wragg and Brown 2001) suggests that lessons where questioning is effective are likely to have the following characteristics

Questions are planned and closely linked to the objectives of the lesson.

The learning of basic skills is enhanced by frequent questions following the exposition of new content that has been broken down into small steps. Each step should be followed by guided practice that provides opportunities for students to consolidate what they have learned and that allows teachers to check understanding.

- Closed questions are used to check factual understanding and recall.
- Open questions predominate.
- Sequences of questions are planned so that the cognitive level increases as the questions go on. This ensures that students are led to answer questions which demand increasingly higher-order thinking skills, but are supported on the way by questions which require less sophisticated thinking skills.
- Students have opportunities to ask their own questions and seek their own answers. They are encouraged to provide feedback to each other.
- The classroom climate is one where students feel secure enough to take risks, be tentative and make mistakes.

**The research emphasizes the importance of using open, higher-level questions to develop students' higher-order thinking skills.**

Clearly there needs to be a balance between open and closed questions, depending on the topic and objectives for the lesson. A closed question, such as 'What is the next number in the sequence?', can be extended by a follow-up question, such as 'How did you work that out?'

**Overall, the research shows that effective teachers use a greater number of higher-order questions and open questions than less effective teachers.**

However, the research also demonstrates that most of the questions asked by both effective and less effective teachers are lower order and closed. It is estimated that 70–80 percent of all learning-focused questions require a simple factual response, whereas only 20–30 percent lead students to explain, clarify, expand, generalize or infer. In other words, only a minority of questions demand that students use higher-order thinking skills.

**Q.5 Discuss in detail the role of investigation in teaching. Also discuss the 5Es instructional model.**

The widely established 5E teaching sequence – which includes the progressive stages Engage, Explore, Explain, Elaborate, and Evaluate – is helpful for informing the design of science programs, units, and lessons. The 5Es are an instructional model encompassing the phases Engage, Explore, Explain, Elaborate, and Evaluate, steps which educators have traditionally taught students to move through in phases.

First, instructors open a lesson with an activity or question meant to **engage** students, snag their interest, and offer the opportunity for them to share what they already know on the subject. This phase might include helping them make connections between their preexisting knowledge base and the new ideas that will come down the pipeline in the lesson or unit. Many educators use traditional KWL charts, in which students list what they already know and what they want to learn during this step. At the end of the lesson, students go back to this chart to list what they learned.

After engage comes **explore**, in which students carry out hands-on activities. Through their experiments or other interactions with the material, they deepen their understanding of the content.

Once they've explored, students attempt to **explain** what they have learned and experienced with help from the teacher – who only then explains concepts or terms encountered during exploration.

From there, students **elaborate** on their understanding, applying what they've learned to new situations to deepen their skills. In the final phase, students **evaluate**, reflecting on and providing evidence of their new understanding of the material.

At first glance, this seems like a good model for hands-on, student-centered instructional learning. However, this model misfires in one critical sense: it is used as a linear progression. Engagement comes first, exploring, explaining, and elaborating follow, and then evaluating wraps up the process.

The issue with this approach is that the 5Es are not actually a linear progression. Engaging is not separate from exploring. Exploring is not necessarily separate from explaining. Part of exploring requires elaborating. All of these elements require evaluating.

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Each step informs the others, even when they are more than once removed. To think of these phases in a linear sense, or to structure a lesson plan in this way, does not set students up to become scientists and engineers in the way required by the Next Generation Science Standards.

That doesn't mean we should throw the baby out with the bathwater. The 5Es are still an incredibly useful tool in teaching and learning.

### The 5E Model and NGSS

If it is to be of use with the Next Generation Science Standards, the 5E instructional model must move from a traditional model of instruction to a next generation model of instruction. Specifically, here is how it looks for each of the Es:

- “Engage” transitions from “I tell them or show them” to helping students reflect on what they already know and ask questions about what they don't yet understand, which propels them toward an initial feeling of dissatisfaction.
- “Explore” moves away from thoughts such as “I give them,” “I demonstrate,” or “They look at a model” and toward students themselves unpacking the problem, developing a model, and gathering data.
- “Explain” no longer means turning and talking, having a carousel discussion, or asking questions like “What did” and “What was.” Now, it means digging deeply into where the question has been answered or the problem solved, and using evidence to support claims.
- “Elaborate” is less about reading, watching or introducing new ideas, and more about forging the incredibly valuable concept-to-self, concept-to-concept and concept-to-world connections that help tie anchor and investigative phenomena together.
- “Evaluate” cannot simply mean vocabulary assessments or graded journals anymore; now it means reflecting critically on the investigative process, the hypothesis, and the anchor phenomena.

That's why we really see these Next Generation Science Standards as going beyond linear, two-dimensional models. This approach is not enough anymore; it is the formation of skills, and the ability to develop and use content, that is so vital to the classroom experience today.

The art of teaching is partly match-making. The "perfect match" is where students encounter phenomena first-hand that engages their curiosity at a gut level and makes them want to learn more. The key to making this work is that both the encounter and the reason to engage need to be owned by the student. Most traditional teachers rely on a show-and-tell model where a computer program, book, or demonstration/video shows students phenomena and then the teacher proceeds to tell them about it and why they should care. However, this is not how student's brains are structured to learn; in fact it fights their very biology. A student needs to believe something is important in order to begin processing it. This is why a next-generation model of inquiry instruction isn't about devices, eBooks, simulations, etc., but instead is about learning to think as a skill. This is why all of the Next Generation Science Standards (performance expectations) occur in the context of phenomena and have a science and engineering practices dimension.

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Once students believe something is important, they will have authentic questions about the phenomena, providing a platform for inquiry -- to answer students' own questions. But for students to want to ask their questions, they need to feel that their questions are respected and taken seriously by everyone [peers and teachers]. This is an issue of culture, both teaching and learning, that a teacher can influence. No one wants to look or feel stupid for asking a question, especially a teenager. Cracking jokes, allowing students to snicker at other students, or comments from adults like "we talked about that" or "you should already know that" are major barriers to building a culture of intellectual risk-taking. Remember: middle school and high school students will opt out of asking questions as a way of opting out of potential personal embarrassment.

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