Course: Teaching Strategies in Science Education (696)
Semester: Spring, 2022

ASSIGNMENT No. 1

Q.1 Explain the concept of nature of science. Describe advantages and disadvantages of knowledge of nature of science by giving examples.

Science- is the system of systematic knowledge based on facts and human experiences.

The science of the Latin word scientia meaning, the ”knowledge". Over the course of human history, people have developed many interconnected and validated ideas about the physical, biological, psychological, and social worlds. Those ideas have enabled successive generations to achieve an increasingly comprehensive and reliable understanding of the human species and its environment. The means used to develop these ideas are particular ways of observing, thinking, experimenting, and validating. These ways represent a fundamental aspect of the nature of science and reflect how science tends to differ from other modes of knowing.

It is the union of science, mathematics, and technology that forms the scientific endeavor and that makes it so successful. Although each of these human enterprises has a character and history of its own, each is dependent on and reinforces the others. Accordingly, the first three chapters of recommendations draw portraits of science, mathematics, and technology that emphasize their roles in the scientific endeavor and reveal some of the similarities and connections among them.

The advantages of Science and Technology are:

1. It will make our life easier.
2. It helps us organize our daily activities.
3. This helps our work can be done faster.
4. It helps us to communicate more easily with others.
5. This helps us to better know and understand other cultures and societie

By discovering science, scientists are able to create something that can immeasurably improve the quality of life; for example, computers, telephones, televisions, planes and the list go on. With the discovery of these inventions, people can achieve their aspirations much more easily. As we know, science has helped our country a lot. It can turn a small, poor country into a progressive country. Science is the only hope of man against diseases. Without the inventions of science and the ceaseless efforts of scientists, many diseases and diseases such as the malaria , the cancer etc. were considered incurable diseases and diseases in the past would be defeated. The technology is so popular and economically profitable that benefits are published regularly. These include his ability to improve education and communication. Technology is the practical science. With the use of technology, you can make your daily work easier. To know the use and technology, you need to read on every department of life like, business, education, health, and communication etc. For example in case of education; know that Teachers use multimedia for teaching instead of chalkboard and graphics, saving time in the classroom. In business, a computer has information about all his clients. Science has brought many unique benefits to humanity. The vast progress made in the field of medicine has made it possible to extend our life expectancy and reduce the infant mortality rate. The discovery of mechanization, better seeds, better irrigation

techniques and pest control has helped to increase farm productivity levels. In transportation, railways, modern liners, jets and motor vehicles have made our lives more comfortable and have offered great opportunities for modern commercial development and industrialization. The invention of the computer helped the process of calculation in the laboratories.

The disadvantages of science and technology are :

1. it can be easily handled by irresponsible people.
2. We will be too dependent on that. When technology fails, we are helpless (in one way or another)
3. Sometimes it affects our health and our lifestyles (we will be complacent and lazy.) Chemicals are dangerous.
4. It destroys our simple and healthy life (the traditional lifestyle I miss).
5. Invasion of our private life.

If on the one hand, science and technology have brought us a lot of wonders, on the other hand, there are also disadvantages of science and technology. First, he has increased anxiety in our lives. Second, when technology falls into the wrong hands, it can have a negative impact on society, such as the rising rate of cyber criminality , hacking, theft of personal information and pornography websites. Third, technology has also increased alternatives and opportunities for terrorists. In addition, technology has removed our physical efforts and we are getting more luxurious and comfort living. Economies lagging behind in the integration of new technologies are seen as poor economies and their progress in the world is hampered. Science has been responsible for pollution and given us the nuclear bomb that threatens our very existence. But in this also the fault lies not in science, but rather in the intention of man to abuse the discoveries of science. Science is not intrinsically good or bad. It is a way to acquire knowledge in a systematic way. The disadvantage of new mobile phones is too many can communicate with us all at the same time. He can create scams and spam in many ways. Young people have also been very addicted to gadgets that they can spend too much time with him. A disadvantage of production is the energy it uses. It consumes a lot of energy to run the machines. And so, we need more fuel, and that will leave a lot of waste and pollution to our environment. This is the most destructive price for the technology of our time. We cannot avoid the inconveniences that come with the benefits of technology.

Q.2 Highlight the significance of affective domain of educational objectives in teaching of science. Suggest strategies to achieve the objectives of affective domain during science teaching.

Affective refers to those actions that result from and are influenced by emotions. Consequently, the affective domain relates to emotions, attitudes, appreciations, and values. It is highly personal to learning, demonstrated by behaviors indicating attitudes of interest, attention, concern, and responsibility.

According to the National Guidelines for Educating EMS (Emergency Medical Service) Instructors, the following words describe the affective domain: defend, appreciate, value, model, tolerate, respect.

In the mathematics classroom, the affective domain is concerned with students' perception of mathematics, their feelings toward solving problems, and their attitudes about school and education in general. Personal

development, self-management, and the ability to focus are key areas. Apart from cognitive outcomes, teachers stress attitude as the most common affective outcome.

THE TAXONOMY OF THE AFFECTIVE DOMAIN

Most psychologists describe five "levels of understanding" within the affective domain. These five levels define the path from passively observing a stimulus, such as watching a movie or reading a textbook ("receiving"), to becoming self-reliant and making choices on the basis of well formed beliefs ("characterization").

- Receiving
- Responding
- Valuing
- Organization
- Characterization.

The major work in describing the affective domain was written by David R. Krathwohl in the 1950s. In his book, Taxonomy of Educational Objectives, Handbook II: Affective Domain (1956), he described the five levels mentioned above. These five levels are restated below with definitions, based on Krathwohl's book, as well as classroom examples.

In the mathematics classroom, and indeed in all classrooms, instructors are role models. Sometimes, we lose sight of this inherent fact, yet we must remember that our actions model the behavior that students will emulate. When focusing on content, we model the procedures and strategies that we would like students to employ when they solve problems on their own. In the same way, we must model the attitudes and behaviors that we would like students to exhibit when interacting with others and making personal decisions.

Model the behaviors and values that you would like your students to emulate, such as:

- Honesty
- Punctuality
- Fairness
- Competence
- Sensitivity
- Preparedness
- Dependability
- Helpfulness
- Self-reliance.

Remember that students constantly observe and scrutinize your actions, and immediately correct behaviors that do not model appropriate values. Consider affective objectives when assessing student work. Establish classroom procedures that support affective objectives; that is, through classroom rules, encourage students to

be honest, punctual, fair, and so forth, and provide opportunities for them to develop as independent thinkers and self-reliant problem solvers.

Effective teachers promote inquisitiveness and perseverance, and they do not make statements such as “This is an easy problem.” Successful teachers establish good relationships with students by acting more friendly than formal, and they share personal anecdotes about their own problem-solving that reveal their strengths and weaknesses. Effective teachers hold students accountable for performance and base assessment on strategies and communication of conjectures, not simply on finding the correct answer.

Due to the technical nature Of the radiologic technology profession, educational programs tend to emphasize teaching in the cognitive and psychomotor domains, with learning in the affective domain being largely informal or inadvertent. However; professional values must be instilled by teaching methodologies that focus on the affective domain. This article discusses the importance of teaching in the affective domain and provides methods for including it in the professional curriculum.

More than 3 decades have passed since Benjamin Bloom published his Taxonomy of Educational Objectives, which outlined the learning domains: cognitive, psychomotor and affective. More recently, with the ascendancy of cognitive psychology, we have come to view humans as problem solvers whose thinking operates much like a computer. In such a view, learning in the affective domain often is seen as a "regrettable flaw" in an otherwise perfect cognitive machine.

The notion that learning in the cognitive and psychomotor domains is segregated from learning in the affective domain is erroneous. Learning is an internal process of responding to one's environment. Researchers recognized some years ago that every cognitive behavior has an affective counterpart and a "cognitive approach is as much concerned with affection as it is with cognition." Cognition stimulates active thinking, whereas affection is the psychological process that reorganizes learned structures as a result of the interaction. The literature that addresses this meshing of the 2 domains suggests that affect and cognition are inextricably intertwined in the learning process and form the basis for critical thinking and action learning.

The purpose of teaching and learning in the affective domain is to assist students in internalizing desirable professional and humanistic characteristics. Research demonstrates that students in health care educational programs develop an attitude of affective neutrality that can be attributed to their socialization during their educational programs. Interestingly, members of other service-oriented professions do not develop such neutral relationships with their clients. Neglecting the affective domain results in undesirable behavior patterns that negatively influence the quality of care patients receive and the degree to which radiologic technologists actively participate in their profession.

Defining the Affective Domain

Bloom seemed to place the definition of affective opposite cognitive by associating the cognitive domain with thinking skills and the affective domain with emotions and feelings. One definition of the affective domain is the internal part of a student that reflects the student's behaviors, conditions, principles and standards, more

commonly known as his or her attitude, creativity, self-development and motivation. When instructors purposefully target the affective domain, students' value systems are being challenged and, one hopes, modified. The complex affective domain and the behaviors that result from it originate within a particular culture and are the result of community values, ethnicity, and the influences of parenting; therefore, the pursuit of common affective behaviors is elusive. One must recognize that learning in the affective domain is a long-term undertaking that must be nurtured throughout an educational program's socialization process. Affective domain learning is classified on a continuum that begins with...

Q.3 Elaborate the use of cooperative learning model in teaching of science at secondary level.

Cooperative learning is a classroom instruction presentation model that involves students working together to meet their **learning goals** in learning teams or groups. In the 1940s, education reformers like John Dewey began to analyze the benefits of students working together in the classroom. At that time, cooperative learning was considered cutting edge compared to the preferred format of individual student learning. In the one room schoolhouse of the 1800s and early 1900s, students of all ages worked on their own learning goals.

True cooperative learning involves more than just having students sit together in groups. When done well, cooperative learning involves planning with clear directions, student work roles, and outcomes and measures for learning goals. Teachers who use this method see the value in cooperation, teamwork, and collaboration as a major part of their classrooms. Students who learn how to collaborate through cooperative learning can become adults who work together more effectively in the work place.

In the classroom, a cooperative learning lesson involves students working in small groups to accomplish a learning task. The task is assigned by the teacher with clear directions. Students then work on the task together with defined roles (i.e. reporter, spokesperson, researcher, recorder). Teachers who are effective at evaluating the group together as one understand that each person in the group has a “shared” responsibility.

When the cooperative learning group completes the learning task, the teacher evaluates the results. That evaluation needs to include some type of format to determine if the student(s) accomplished their learning goals (i.e. rubric). If each student sitting in the group isn’t held responsible for helping complete their portion of the learning task, then it isn’t truly “cooperative learning”.

There are many benefits for classroom instruction when cooperative learning strategies are done correctly. There are several briefly discussed here including: promotion of social interaction, buildup of student self-confidence, improvement in collaborative skills of students, as well as the improvement in student decision-making skills. Cooperative learning-run classrooms can also assist teachers in working with students who have wider skill gaps.

Teachers with students who work in cooperative learning groups typically allow for more social interaction and can enhance students’ collaborative skills. Cooperative learning groups force students to interact socially and practice collaboration. Teacher lessons that include positive, active student collaboration are planned out with clear directions and expectations for students.

Cooperative learning lessons that are planned out efficiently can allow for growth in student decision-making. Students who work in groups and collaborate (talk, plan etc.) are more likely to build on their decision-making skills. Many modern workplaces call for employees who are capable of making decisions while working with "teams" vs. working in isolation. Group lessons that allow for students to collaborate and talk about the task can prompt students to share thoughts and thus build on decision-making skills. A quad, or student group of four, can allow for four different students, with four different thoughts, to build on decision-making skills while improving their socialization. Young people need the socialization, and cooperative learning lessons greatly enhance this.

Teachers who use cooperative learning groups also have some flexibility to pull small groups and work with individual students or small ability groups during the lesson time. This can arguably be a great advantage for a teacher with a classroom of 30 students. There may be a need to work more closely with the 4 or 5 students who have the highest learning gaps. Allowing students to independently work in small groups gives teachers the opportunity to work with those individuals on targeted gaps. Use of cooperative groups can allow for **differentiation of instruction**, depending on how the teacher decides to establish them.

There are so many best practice strategies to consider when using the cooperative learning approach in the classroom. Several strategies for teachers to use that involve cooperative or group learning include pair-share, small groups (quads), and mixed skill groupings.

One common strategy that teachers use is called pair-share. This can be easily adapted into most classrooms by asking students to collaborate with an "elbow" partner or person close by. Students can discuss a question or topic, and then share with the whole class. Teachers often refer to this strategy as "think-pair-share".

Teachers who plan cooperative lessons often use **small groups** or quads (groups of 4). Students are assigned roles within the group so that they can divide and conquer the learning task at hand. For example, the reporter is responsible for sharing out the new learnings of the task. Often quads are divided into mixed skill groups. This can help students who struggle to have higher-level students mixed with lower-level students so that peer learning and coaching is incorporated. All of the mentioned techniques require planning and coordination on the part of the teacher.

When used in combination with individual learning assignments, cooperative learning can enhance classroom instruction and make learning more social and fun for students.

Q.4 How the objectives of science subjects are different than social science subjects? Is the criterion for writing objectives of science teaching different? Justify your answer with examples.

Social studies and social science can be easy to confuse. Though Social they are sounds like two similar concepts, and deal with some of the same subject matter. They are two different fields of study. However, there are some key differences which distinguish the two terms so that they cannot be used interchangeably. In this article, we are going to look at the difference between social science and social studies.

Social studies can be introduced as the study of both social sciences and humanities. According to U.S American National Council for the Social Studies, "Social studies, is the integrated study of the social sciences and humanities to promote civic competence." However, social studies is most often used as a name of the course taught at schools. Social Science is a subject area that studies the society and the relationships among individuals within a society. Social Science is categorized into many branches such as Geography (study of the earth and its features, inhabitants, and phenomena), Anthropology (study of humans), History (study of past), Economics (study of productin, distribution and consumption of goods and services), political science(study of theory and practice of politics and the description and analysis of political systems and political behavior.) etc.

1. The main difference between social science and social studies is in their intended purposes. The social sciences are branches of study that analyze society and the social interactions of people within a society. Subjects that fall under the umbrella of social sciences are: anthropology, history, economics, geography, and many others that explore societal relations.

Social studies is the systematic study of an integrated body of content drawn from the social sciences and the humanities. It enables students to develop their knowledge and understandings of the diverse and dynamic nature of society and of how interactions occur among cultures, societies, and environments.

2. Social science is more streams oriented. It's the science of the society; the in depth knowledge and systematic study of each branch of social transaction. It is empirical and based on various scientific methods of deduction to arrive at a conclusion based on facts.

Social studies is the integrated study of the social sciences and humanities to promote effective citizenry. Social studies are subjects most frequently taught to school students to help them understand how to be effective citizens of society.

3. Social Science, as the name implies, deals with the science of society utilizing the gathering of data and analysis of that data. Whereas Social Studies normally deals with the observation of Society. Here students develop and apply skills as they investigate society, explore issues, make decisions, and work cooperatively with others.

4. Social sciences are taught under higher studies curriculum whereas, social studies are subjects most frequently taught to school based students to help them understand how to be effective citizens of society.

5. The core difference between social science and social studies exist in their purpose; in social science, you study the society and social life of human groups while in social studies, you study both social science and humanities in order to promote effective citizenry.

6. Social Studies is the study of all phases of societies whereas Social Science is the inference of those studies with the intention of solving problems within a society, which may lead to the ultimate development of the society as a whole.

7. Social science is the field of sciences concerned with the studies of the social life of human groups and individuals. Social studies is a term used to describe the broad study of various fields which involves past and current human behavior and interactions

8. Another difference is that Social science is divided into many branches while social studies is divided into two main categories of humanities and social sciences.

9. Social science dates back to the 18th century while social studies is a relatively new term.

Q.5 Discuss the role of different types of questions in implementation of instructional plan for science 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.

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
- 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. 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.