Creative approaches in teaching science

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Science teaching

- Didactic approach of teaching is not conducive for conceptual learning
- There is a need to use creative approaches in teaching so that students can be better engaged with the content taught
- In this workshop, a few approaches are shared – demonstrations, infusing of interesting contexts, and enrichment activities

What is a demonstration?

- It is the showcasing of a scientific phenomena with the use of resources such as materials and apparatus
- Suitable presentation techniques are woven in when illustrating the concept

Why use demonstrations?

- Helps to promote conceptual understanding
- Allows the interspersing of questions to promote thinking
- Fosters fun element in the lesson
- Makes lesson more interesting
- Good attention-grabbing technique
- Makes science come alive
- Pleasurable interlude in the learning process
- Questioning can be incorporated

Presentation techniques when doing demonstrations

- Need to keep in mind students' cognitive level
- Check that visibility issues are taken care of
- Safety is of paramount concern
- Rehearsal of demonstrations very important
- Infuse humor in the demonstration
- Desirable to frame questions which can test understanding of concepts
- A strategic approach to use would be **P**redict, **O**bserve and **E**xplain (or POE for short)

It is demonstrations time!

- A few demonstrations, which illustrate various science concepts, will now be shown
- It is essential to observe carefully how the demonstrations are done

Chemistry demonstrations

- http://www.youtube.com/watch?v=zbmLMm2Mpa8 (Jumping sodium)
- http://www.youtube.com/watch?v=mwhvO3zmOW8 (Combustion of lycopodium powder)

- http://www.youtube.com/watch?v=QSZ-3wScePM (Reactivity of Group I elements)
- https://www.youtube.com/watch?v=cvRcUeWjBu0 (Gallium spoon melting)

Biology demonstrations

- https://www.youtube.com/watch?v=8e-xNbk2bxw (Osmosis)

- https://www.youtube.com/watch?v=MHwEqjlwA2U (Change of flower color)

Use of interesting contexts to spice up lessons

- Infusing everyday contexts as well as hypothetical scenarios into teaching can help to spice up science lessons
- There’s so much of interesting contexts on many topics in the sciences that can be drawn upon for this purpose
- Let us look at a few examples

Examples

- In a field or track used for long distance running, runner always runs in an anticlockwise direction? Why?
- The proportion of oxygen in the atmosphere is about 21 %. What happens if it is higher, say about 42 %? ?
- The proportion of carbon dioxide in the atmosphere is about 0.04%. What happens if it is higher, say about 4% ?

More examples of interesting contexts in science

An object is thrown vertically upwards with a non-zero velocity. If gravity is turned off at the instant the object reaches its maximum height, what happens to the motion of the object?

The velocity of the object at the maximum height just before gravity was turned off is zero. Beyond this time, there are no forces acting on the object. According to Newton's First Law, the object should stay at rest in this position forever

More examples of interesting contexts in science

An object is thrown upwards at an angle with a certain velocity. If gravity is turned off at the instant the object reaches its maximum height, what happens to the motion of the object?

The vertical component of the velocity of the object in the absence of gravity at the maximum height is zero. But it still has a non-zero horizontal component at the maximum height for this velocity. This will make the object go in a straight line parallel to the x-axis

More examples of interesting contexts in science

Are heavier objects easier to pick up and move around on the Moon than on the Earth since gravity is less on the Moon than on the Earth?

Picking up an object is easier on the Moon than on the Earth since a force slightly larger than the weight of the object needs to be applied in the vertical direction Since the acceleration due to gravity on the Moon is about 1/6th that on the Earth, this force would be much less.

Moving the object around means applying a force in the horizontal direction in order to accelerate it to some velocity and then bringing it to rest in the new location. This acceleration is resisted by the mass of the object, which has not changed on taking it to the Moon. Thus, moving the object around horizontally requires about the same force as that needed on the surface of the Earth. In fact, the absence of an atmosphere on the Moon would slightly aid the forward motion

More examples of interesting contexts in science

Since the acceleration due to gravity is lower on the Moon's surface than on the Earth's surface, is it easier to accelerate when running on the Moon?

The acceleration of an object in the horizontal direction is resisted by the mass of the object. Since the mass of the person is unchanged on the moon, it can be expected that it is just as hard to accelerate on the Moon as on the Earth.

In practice, it is likely that the person can accelerate only more slowly, even though there is no atmosphere on the Moon to contribute to atmospheric friction to the motion. Since the weight of the person is reduced on the Moon, the normal force of the ground on the feet is also reduced. This, in turn, causes the frictional force between the feet and the ground to be smaller. With less friction with the ground, the person may not be able to accelerate horizontally as rapidly as on the Earth's surface in spite of the reduced gravity. There is also the possibility of the feet slipping on the ground as the person applies large horizontal forces on the ground in an attempt to accelerate rapidly.

More examples of interesting contexts in science

A car manufacturer recommends that a particular model be pumped with air of 32 psi for driving on roads. If the car needs to travel from Point A to Point B on the expressway, a distance of about 500 km, what air pressure should the motorist pump the tyres with?

It would be better to pump air of pressure slightly lower than 32 psi as the air in the tyres will heat up during driving, thus increasing the pressure in the tyres

More examples of interesting contexts in science

Hot black coffee as well as milk at room temperature are placed on a table. Suppose you need to go out urgently for about 5 minutes before you can drink the coffee, and that you wish to drink it as hot as possible, what would be a useful strategy – mixing the black coffee and milk first before going out or coming back after 5 minutes and then mixing the black coffee and milk?

The higher the temperature, the faster is the rate of cooling – Newton's Law of Cooling. Therefore, mixing the black coffee and milk first would keep the coffee relatively hotter than if these were mixed later

Use of enrichment activities

- Importance of enrichment activities in learning of science cannot be under-estimated.
- They provide a useful context to extend learning beyond the textbook.
- Common enrichment activities include making of gadgets such as straw flute, Cartesian diver, etc
- There are a few enrichment activities which can be done in the classroom – for example, word symbol puzzles.

Use of Word Symbol Puzzles in the teaching of Science

- It is an innovative tool to promote interest in science
- It uses words, letters, numbers, and symbols juxtaposed in a certain manner or format to convey ideas
- It provides an enrichment component to the school science curricula
- It is a filler activity that can be used in any lesson as a teaser or to fill up spare moments

General Examples of Word Symbol Puzzles

- YY4U — Too wise for you
- YEAR SALE — Year end sale
- BLOOD — Blood is thicker than water
- CUT — Cut above the rest
  THE REST

Word Symbol puzzles in Physics

- CIR CUIT
- 4, 4, 4, 4, 4, 4, 4
- CONDUCTOR

  2
- CIRCUIT // CIRCUIT

Word Symbol puzzles in Physics (cont'd)

- + ✓
- INSULATION
  INSULATION
- //x
- C 5/6 /1024
- PLER DOP
- WAVE

Word Symbol puzzles in Chemistry

AGENT

AGENT

AGENT

AGENT

B.Sc., M.Sc., Ph.D., D.Sc.

0

Word Symbol puzzles in Chemistry

- QL
- 007

  007

Word Symbol puzzles in Chemistry (cont'd)

- Molecule- 007-Molecule
- (x, y) 007
- PRO1000KG
- Table, Table, Table, Table, …..
- HIJKLMNO
- 2

Word Symbol puzzles in Biology

- VIT_MIN
- FOOD-FOOD-FOOD-FOOD
- PERMEABLE
  2
- P+H+O+T+O

Word Symbol puzzles in Biology (cont'd)

- HELIX
  HELIX

- SISOMSO
- ET
  ET

- SCOPE

Summarizing comments

- Interest in science is declining in many countries
- There's a need for science to be taught in interesting ways so as to engage students and get them excited about wanting to pursue careers in science
- A few approaches have been suggested in this workshop

Thank you

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