

Scientific Thinking Through Stories: An effective way of science communication

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Abstract— School education plays a major role in nation building as well as development. A child requires theoretical as well as practical knowledge about the particular subject. It is highly applicable to science related subjects. As science involves observation, analysis and experimenting along with study. Teaching beyond books is necessary to achieve this.

One of the best methods is to show experiments to children. Another method is to narrate the stories of particular interest and explain the scientific facts to them. This is an important method for primary school children. This method is also applicable to inculcate scientific thinking in children.

Keywords: science, education, experiments, stories, school children.

I. INTRODUCTION

"tell me a fact, I'll learn it

Tell me the truth. I'll believe it

Tell me a story, It'll be in my heart forever"

This is an interesting American proverb which shows an importance of stories in education.

Basically, stories are considered the best way to teach kids. And imparting whatever are the values required for children since pre-primary ages as imaginative narratives will easily enter into the minds of children.

What is science?

Science is the systematic study of nature and natural phenomena with different hypotheses and experimental techniques, observations and analysis.

Since the time immemorial, the human mind has tried to understand nature and natural phenomena by observing surroundings.

And there are many people who contributed to science as well. But due to superstitious beliefs in the communities, science faced many difficulties to flourish.

But many thinkers, who made a victorious attempt to think beyond the box, contributed to science and performed many experiments, pioneered many fields in the 20th century.

When human mind came out of the box and realized the importance of science because science says every natural phenomena is not because of supernatural powers but it is an interaction between atoms, molecules, particles as well as living organisms for example if we see sunlight, green leaves, rainbow, everything is a result of some natural interactions.

What is scientific thinking?

A student, studies science from his primary school but the problem in system is people never think about the way of explaining those natural phenomena, and system generally focussed on getting good grades in subject, finally systems condition the minds of people to look at science as a subject for good marks and high positions in society. But the main essence of science is still missing in many aspects, and society believes many things which are unscientific.

It is very important to impart scientific thinking and rationality from childhood through different pathways.

Scientific thinking is a way of understanding nature, thinking about contents in science as well as set of reasoning processes such as deduction, induction, hypothesis testing, experimental design, causal reasoning, concept formation and so on.

It will improve reasoning, the logical explanations behind any natural processes and rationality in the human mind which helps society to take a leap towards advancement of the nation as a whole. And scientific thinking definitely eliminates social evils because science imparts the thought in the mind that the entire human race originated from common ancestor in Africa, the inequalities will be eliminated from the minds of people if the education system concentrates on training students in scientific thinking, as teachers have more responsibility in this regard.

A teacher who teaches science subjects should be called as science communicators as they have a crucial role in science education as well as scientists.

Teachers will teach different theories of nature, different laws which are discovered by scientists, different experiments performed to prove those theories. But what is the way of explaining those theories? Is a real matter .. How a student is imbibing them . Is he or she understanding it just for marks and grades, then the problem starts. Because he or she thinks the objective of science is to get a good percentage in school or college, then settle in a job. But the real motive of science is rationality and objective thinking completely missed in the classroom.

There comes the ways of science communication into picture where a teacher can take different ways to communicate scientific thinking along with science. For example the schools and colleges will have laboratories where they will see many experiments to learn and understand scientific phenomena. But when the focus is shifted towards below 10 year old children, the way which can be taken is "stories" as children are very good in imagination they will show connectivity towards stories.

So the motive of science can be reached to kids if the way of explaining is shifted to impart scientific thinking.

What is a story?

Many of the kids interested in stories are a combination of events which are related to imaginative creation of objects as well as people, which depicts particular values or reasons that can be used to teach in classrooms. Basically for kids.

Or, any life incident from biographies of great inspiring personalities used to teach moral values as well as other values to inspire children and can be used to impart scientific values as well.

For example, the crow and pebbles story, tortoise and Hare story and so on, which have beautiful moral values.

Why storytelling is important?

Stories are universal by which passions, fears, feelings, joys, and hardships can be shared and can create commonalities between people, stories can help in understanding different things very easily because the meaning and purpose of narration can be conveyed very easily with interesting events and enacting

as well. (colourful pictures and handmade articles also can be used for narration) to attract children.

Why is it important to use stories to teach science?

Neuroscientists, based on different experiments on the human brain, said that our brains will respond totally differently when we listen to a story than to recitation of facts or laws. Especially when it is compared to a child's brain, the brain will respond very quickly and the main motto of narrating a story will be fulfilled. Because the dopamine will be released when the story is taught.

So, it is very important to teach science in stories, to make them understand the importance of scientific thinking as well as imagination.

Albert Einstein, a great theoretical physicist who always pointed out that imagination is more important than knowledge. To provoke imagination capacity in children, stories are the best tool according to some psychologists and Neuroscientists.

And to connect with children very easily to make them understand the scientific facts very easily. The stories related to the animal world, the physical world are very useful. In a period given to teacher, she or he can use sometime for these narration with the help of pictures, then they will get connected very easily to it.(especially used for primary school children)

Teachers can use two ways to blend science and storytelling

1. Explain a story and then narrate the scientific elements and importance in it
2. Tell the scientific theory and law, then make them find a story to illustrate it.

Because, if a science teacher narrates a story in the class, children will understand science concepts with interest, slowly it will open the doors to wonderful imagination. And opens the door to new creative ideas.

Stories from different parts of literature :

There is a lot of literature available in the form of stories, that can be used to narrate science, for example, panchatantra stories which can have wonderful morals but most of them belong to zoological world, there can be an opportunity to make them understand animal community and their struggles as well.

And many biographies of scientists and other great people, which can imbibe scientific thinking that how they thought, how they questioned and how they observed their surroundings, their struggles to conduct experiments and so on.

Example stories and their analysis:

II. STORY NO.1

There are many inspiring personalities and their lives inspire people and lives. One among such great people is Swami Vivekananda.

Though he was a monk throughout his life, his scientific insights are less known to the world. During his childhood days, he was brave, intelligent and inquirer, and tried to test each and everything.

This is the story from his childhood days. When he was around 10-12 years old, the story was titled find the truth yourself.

The main characters involved, narendranath dutta (swami Vivekananda's childhood name), his friend, and an old man near to the tree.

This story belongs to the children's stories category and it explains that everybody should not believe anything blindly but find out the truth by yourself.

II.I. BRIEF NARRATION

When Swami Vivekananda was a boy and studying in a school, he was very brave, intelligent and inquiring. He used to ask many questions about different things.

He tried to test everything and then believe. He did not believe anything blindly. When he was a boy, he along with his friend, used to go to play in a ground where there was a huge champak tree. They were playing very happily by jumping on the tree. Days passed. After some days, when they were enjoying themselves, an old man saw this, who was living near that tree. He did not like it. So, he went to the boys and told,

"O! Boys,, don't play on the tree, there was a ferocious brahmarakshasa was there on the tree, it will swallow you, if you play.

Another boy who was with Swami Vivekananda was terrified, the old man thought the children would not come again.. He laughed and went. Swami Vivekananda also pretended that he was afraid. But again he came and played under the tree.

His friend, who saw this, asked him, hey.. Naren?!! Why are you playing again? The old man said there was a rakshasa living here, it would kill you..

Then he said.. O! Friend, that old man told a lie to us if it was true, the devil would have killed me now itself.

Do not believe anything blindly. Find out the truth by yourself.

II.II. ANALYSIS

1. This story is taken from swami Vivekananda's biography and it successfully narrates the importance of questioning
2. People usually believe whatever is told to them by elders without questioning the true reason behind anything
3. Swami Vivekananda as a student, who tried to find out the truth by himself in each and every time as he questioned his parents, teachers as well as scholars many times
4. But his friend, who did not have questioning mind set and rationality he just believes whatever is told by the old man and ran away.
5. Old man tried to impact their way of thinking by frightening them that if you do this, you will be killed by the ghost. This

problem is still continuing in our society. Many pseudoscientists are trying to influence people with many superstitious beliefs and they condition the minds of people to be in the comfort zone, and they create fear if anyone tries to come out of it and question. This is the main cause of the spread of unscientific beliefs in communities.

6. Since childhood, the teachers should teach children about this scientific temper by using such amazing examples.

7. But swami Vivekananda did not believe in old man's words, he came again to the tree and he himself tested, and concluded that there was no ghost, it's just a false statement made by old man

8. Later, he told his friend that this is a false statement made by that old man, do not worry, When his friend was still in fear and anxiety.

He proved, even to his friend what is the truth and what is false there

Every science student must have the mentality of questioning pseudoscience and a rational mind set to understand science as well as life. Because many times, blind beliefs are followed by communities from many years together.

9. Finally, he made him understand the truth by making him realize the fact by showing proof that he was not killed yet so the ghost was not there, it was a lie told by an old man to terrify them. Whenever pseudoscientific or unscientific beliefs spread in the community. The truth should be shown to them by different scientific research, experiments as well as in the form of stories up-to school level.

II.III. CONCLUSION

human mind's unimaginable capacity is to think beyond the box and rationality, observation and cause

In the course of evolution, human mind obtained the quality of researching surroundings, creative innovations

But still, the problem of irrationality, illiteracy and superstition is the biggest enemy of mankind.

But there is a ray of hope in the classroom that if effective ways get implemented to improve scientific temper through effective ways (student oriented ways) such as poems, stories and games, the conditioning of mind is shifted and through children, the entire family will understand the importance of scientific thinking.

Another example from the biography of Albert Einstein who was a great theoretical physicist, in his childhood, he used to ask so many questions to his uncle. He himself told me that I used to ask many questions whenever I observe something new, my uncle used to answer all questions up-to his extent. And Einstein who did not show his intelligence in exams but he got scoldings from his teachers because of his questions.

With the practicality of this incident, every teacher must encourage his or her students to ask questions and find out the truth by themselves through observation and experiment.

III. STORY:2

This is a story which has been narrated to children for many years, and a famous Indian story which shows the struggles of the animal community to get basic needs, as well as morals. This story is titled as "thirsty crow"

This is a very small and simple story in which only one crow is involved which was thirsty.

III.I. BRIEF NARRATION

Once upon a time, there was a crow which was travelling in the sky for so long. After some hours, it became thirsty. It was searching for water. But I could not find anything. After so much trouble it found a small pot but inside the pot, very little water. Crow could not drink the water because it was there in the bottom part of the pot. It struggled a lot to reach water but failed. After some time, it got an idea and went to the nearby field and saw some pebbles there. Then it lifted all those pebbles with its mouth one by one slowly and threw them in a pot. Slowly the water came up. Finally it drank water and fly away.

III.II. ANALYSIS

1. Crow, is a bird belonging to phylum chordata and class aves and order of passeriformes. Birds are evolved from reptiles with avian lifestyle with advanced modifications in brain

2. Basically, the way of animal's life and behavior is so amazing, that how they will get food, water, shelter and mates, which shows many facts through this small story

3. When the crow was flying, suddenly it got thirsty, so it tried to find water. Children can easily understand animals also have to eat and drink water to live like human beings and they will get connected to nature through story.

4. After it got some water with very less quantity, it suffered a lot to reach up-to water level but in vain. So that child can easily understand how important water is, and environment is. If the ecology is being neglected, one day mankind will be there in the place of crow

5. Animals also struggle with competitors and abiotic factors around them to get food and water

The Children will understand the struggle for existence in the natural world.

6. After so much struggle, the crow lifted some pebbles with its mouth one by one which shows the brain evolved from lower to higher forms of life as it could think to get whatever it wants. And human beings are more advanced and highest in evolution.

7. When it threw pebbles in the pot, the water came up where it shows the fact that heavier objects go down and lighter objects will come up. The matter occupied by the stones replaces the water as it is insoluble in water so that water comes up. Children will easily understand the differences between materials and objects.(when the teaching is done in this way)

8. A child will easily get attracted to nature and try to observe birds, animals their behavior and environment and try to explore more about them

9. Animals have intelligence to find out whatever it needs, this can be understood by a child, if the stories are used in this way.

10. A child starts observing different colors in nature, and understanding what is the importance of animals too. and tries to consider them as co-species in nature. This will give love and care towards nature and insights to stop environmental pollution from very childhood

III.III. CONCLUSION

The stories which are related to nature, animals and birds will surely influence children to understand the concepts of nature and environment. Children will understand how important the resources are, and how important other species also. And they will understand the behavior of different species and natural phenomena such as different materials their physical properties and others. Through effective narration of stories in scientific way will create an enthusiasm in children to observe nature, and experiment with nature to create many ideas.

"A story makes history"

Sometimes, there will be a need of adapting innovative and effective methods to fulfill education when science education is a matter, there will be an importance of stories because science will have facts, laws and truths along with experiments. There is an interesting way of explaining them by taking considerable stories from Any part of the literature and impart the scientific value behind the story. Because stories are the best way to communicate with children where the learning will be happy and joyful along with the message

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