Application of Engineering Concepts in Nursery Rhymes: An Innovative Approach

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Abstract

Children have been the most sought-after artist, sculptors, creators, innovators, poets, builders, and are likely to practice many professions and become one. As curious learners from their toddler life, they try to grab any object that is around and make some sense out of them. For instance, playing on a heap of sand they construct their dream homes, getting hold of their dad's stethoscope they try to feel the 'lub dub' beat on the chest of their parents; playing with the cooking vessels that they stealthily take it from their mother's kitchen and play the role of a cook and chef by heating water on a toy gas stove etc. These little incidents in their life, as little ones, have given a giant leap for mankind in the field of discovery and inventions. Many scientists like James Watt (watching the boiling kettle in his mother's cottage), Archimedes (incident in his bathing tub), Isaac Newton (falling apple) and many other such scientists have invented something or the other, through observations and experiences. These inventions are taught to children in their science classes according to their syllabus that are graded by the education department and syllabus makers. This article will make an attempt to cater interest among students to get into the picturesque and fascinating world of children's Nursery Rhymes to understand and learn many scientific and engineering concepts from it. Through the pictorial representations found in the nursery rhymes, many engineering concepts can be taught to children between the ages of six to fifteen. This can be seen as one of the innovative methods of revealing the great wonders of science through the Nursery Rhymes.

Keywords: Sing Song method, the Great Fall, Kindergarten and Montessori level, Harmonic Oscillation, Thermodynamics, Pulleys.

1. Introduction:

Children are born engineers. Their creative minds are always at work and they are constantly constructing and reconstructing, creating and recreating ideas, models, and concepts and are always attempting to transform them in real form. They are keen observers and keen learners. They learn to grasp things easily and are able to retain them for a long time. In such a case, the nursery rhymes are the best tool in introducing to them some simple, day to day engineering concepts and their applications in real life situations.

2. Nursery Rhymes As A Learning Tool

The nursery rhymes are a form of short poems taught to children at kindergarten level. These are always in the form of pictorial representations, designed in a way to attract the young minds' attention in order to convey a meaningful moral message. These rhymes are taught through the play way method, sing song method and through recorded CD's and other means. These various methodological ways make the teaching of nursery rhymes an interesting part of the kindergarten syllabus. As society is lacking moral and ethical values, these short sing song poems can be made effective to convey to them some moral values apart from just teaching them to speak English. Taking for instance the 'Jack and Jill' rhyme, it conveys caution and togetherness at work, 'Humpty Dumpty' could suggest the Great Fall of man after sinning and disobeying God and eating the forbidden fruit. This definitely helps in teaching the young minds in obeying all elders which will help them to get back respect from others; the 'London Bridge' highlights on some sort of sabotage on the government property and therefore it helps imparting the moral values of protecting and respecting public property and taking care of them as if they are our own. 'Ding Dong bell' is an apt example of domination of the strong over the weak where little Tommy thin cruelly throws 'poor pussy cat' into the well which advocates in the young minds to help and be compassionate to the weak and, animals as well and so

on. Apart from teaching language, pronunciations, values and ethics, these nursery rhymes can serve great purpose in teaching scientific and engineering concepts.

3. The Innovative Approach

Have we ever thought of implementing the teaching of science and engineering to them through these rhymes? An innovative approach can make these young ones aware of the various engineering concepts that will help them in building a strong foundation in the study of science and engineering. As nursery rhymes are taught at the Kindergarten and Montessori levels, the children learn them either through understanding them or through rote memory. Whatever be the case, they at least acquaint themselves to these little sing song poems. Their proud parents boast of their little ones' utterances (either intelligible or unintelligible) of the English words, which is the stepping stone for their future in the study of the English language. This helps them in building up their vocabulary, learning to make small sentences with the words they come across and gradually get into the world of English pronunciation. Pronunciation of English words in the rhymes can best train them to utter each sounds and help them to differentiate between sounds as well. A good trained English teacher can achieve his/ her goal through constant effort and dedication in making children presentable before a large group.

Having learnt these rhymes at the kindergarten level between the age three to six, a child can be made aware of more things apart from enhancing their vocabulary, correct pronunciation and constructing sentences etc. An innovative approach can be resorted to in making children aware of the engineering concepts from the age of seven to fifteen. This is the right time an English teacher can introduce them into the world of science and technology. As Engineering and technology department cannot sustain without the Humanities, so is the vice versa of it. The English teacher introduces the engineering concepts to them and the science teachers begin the basics and fundamental ideas of laws of science. Thus, both the departments lay the foundation stone into the entry of the world of wonders through science and technology.

4. Engineering Concepts in Nursery Rhymes

Through nursery rhymes, various engineering concepts can be taught to children. This is one of the best methods to take a wonderful stride and glimpse of the scientific world. Let us study some of the English rhymes and see how we can make use of them in the teaching and application of science and engineering concepts.

Rhyme 1: London Bridge

London Bridge is falling down

Falling down, falling down,

London bridge is falling down,

My Fair Lady.

Build it up with iron bars,

Iron bars, iron bars

Build it up with iron bars,

My fair Lady.

Fig. 1 (London Bridge)

1.1 Analysis:

The ‘London Bridge’ rhyme can be used to introduce the trade of Civil and Mechanical Engineering. The breaking or ‘falling’ of the London Bridge cannot be ignored. The ‘falling’ of any bridge is a matter of great concern which is the cause of the loss of life and property. Civil engineers need values and ethics in their profession. Good technical knowledge and basics of civil engineering on bridge construction goes a long way in cementing all loop holes for the construction of faulty bridges.

One needs to learn about cement, water, sand and various other compositions mixed in the erection of a bridge. Such compositions alone cannot erect a building or the bridge in our context. The advice given to us in the rhyme is: 'Build it up with iron bars' and the repetition of 'iron bars' four times is an implication to all civil engineering and mechanical experts to make use of iron bars to make the construction of any building strong and tough. Moreover, it can be assumed that the reference to 'My Fair Lady' in the rhyme is addressed to a female engineer and, that all engineers as a matter of fact need to exercise caution in the construction of bridges and the like.

1.2 Engineering concept learnt:

Children should be taught in a very simple way how to make a bridge strong and sustainable. Teachers should first of all make the students understand the various problems of constructing bridges, that is how much load a bridge can take in, how much of materials required for a bridge to resist the highest load, the designing process of constructing a bridge etc.(Source: https//www.teach.engineering.com. Accessed on 13 April 2021). Hence, the bridge constructing team needs to fully understand the problem before starting the construction.

Rhyme 2: I am a little Tea pot:

I am a little tea- pot

Short and stout;

This is my handle,

And this is my spout.

When the water's boiling,

Hear me shout,

Just lift me up

And pour me out.

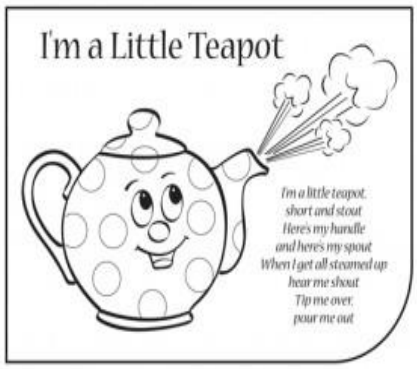


Fig. 2 (Steam from the tea pot)

2.1 Analysis:

This 'little teapot' concept can drive home the point about boiling water and its scientific analyses of it. Here the study on 'steam' can be associated with Mechanical Engineering and the wonderful invention that came up regarding it with James Watt. As a young child, James Watt used to sit by his mother in the fireplace in his mother's cottage when she used to boil water in a kettle. He used to watch it intently and looking at the steam rising from the boiling water, made him speculate over this observation. This led him to his lifelong fascination with steam and started working on it. In the year 1763, at the age of twenty eight, James Watt was working as a mathematical instrument maker at the University of Glasgow. During this time a model of Thomas Newcomen's steam engine was brought into his shop for repair. As James was always interested in the mechanical and scientific instruments and especially those that dealt with steam, this new machine by Newcomen fascinated him. He set up the model and watched it in operation. He noted how the alternate heating and cooling of its cylinder wasted power. He concluded, after weeks of experimenting, that in order to make the engine practical, the cylinder had to be kept as hot as the steam which entered it. Yet in order to condense steam some cooling had to take place. This was the challenge the inventor had to face. He came up with the idea of the separate condenser. If the steam was condensed in a separate vessel from the cylinder, it would be quite possible to keep the condensing vessel cool and the cylinder hot at the same time. The next morning Watt built a prototype and found that it worked. He added other improvements and built his now famous improved steam engine.

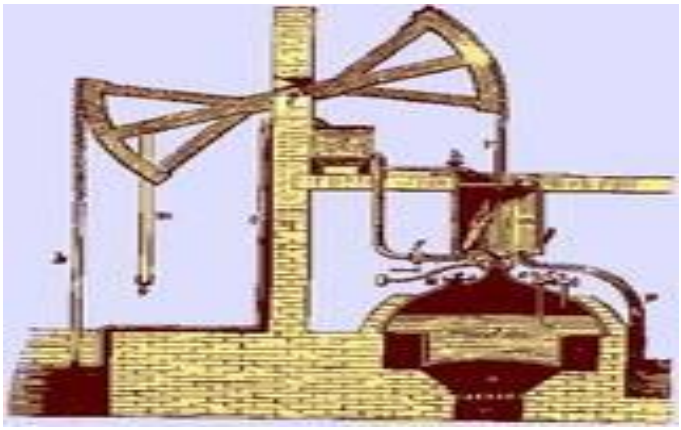


Fig 3

Illustration of Thomas Newcomen's Steam Engine (1712) (Source: Google.com)

2.3 Engineering concept learnt:

From this rhyme, a teacher can arouse the interest of many curious students about the wonders of boiling water and the results of it. Using boiling water, a teacher can teach the production of mechanical motion that dates back some 2000 years back. Steam engines since the late 1700s have become a major source of mechanical power and the first application of it was removing water from mines. James Watt in 1781 patented a steam engine that produced continuous rotative motions. From this simple illustration of the nursery rhyme, a teacher can then stress on what a steam engine is? It can be answered this way that “a steam engine is a heat engine that performs mechanical work using steam as its working fluid”

Rhyme 3: Hickory Dickory Dock:

Hickory dickory dock,

The mouse ran up the clock,

The clock struck one,

The mouse ran down,

Hickory dickory dock

Fig. 4 (The pendulum clock)

3.1 Analysis:

The ‘clock’ has always remained a vital part in learning to know the time of the day. This can help a child / student further in studying different types of clocks: a) analog and b) digital. This can even further enhance in the study of analog and digital signals for students interested in Electronics and Communication Engineering. The clock in Fig. 4 demonstrates an analog clock by which a science teacher can make his/her class interesting by comparing it to a digital clock and unravel the dynamics of science and engineering. Aside this, the pictorial representation as shown in Fig. 4 depicts a pendulum through which we can study harmonics of oscillation. It was Christian Huygens in the year 1656 invented the pendulum clock. Students can also learn the inventions and the inventors behind them.

3.2 Engineering concept learnt:

The ‘hickory dickory dock’ rhyme has the pendulum as its main focus of discussion. Children can be taught that a pendulum clock is a clock that uses a pendulum which has a swinging object as its weight and also as its time keeping element. The main advantage of this time keeping pendulum is its harmonic oscillator which keeps swinging back and forth in a precise time interval, dependant on its length that resists swinging at other length. This pendulum clock was the world’s best precise time keeper until the 1930s. So pendulum clocks

can be taught through this rhyme and help them understand that a pendulum clock must be stationary to operate; and any other motion or accelerations will affect the motion of the pendulum. However, these pendulum clocks are now kept mostly as a decorative piece or for its antique value.

Rhyme 4: Jack and Jill and Ding Dong Bell:

Jack and Jill

Went up the hill

To fetch a pail of water;

Jack fell down

And broke his crown,

And Jill came tumbling after.

Ding Dong bell

Pussy in the well

Who put her in?

Little Tommy thin

Who pulled her out?

Little Tommy stout

What a naughty boy was that!

To worry pussy cat.

Fig 5: (Ding Dong Bell)

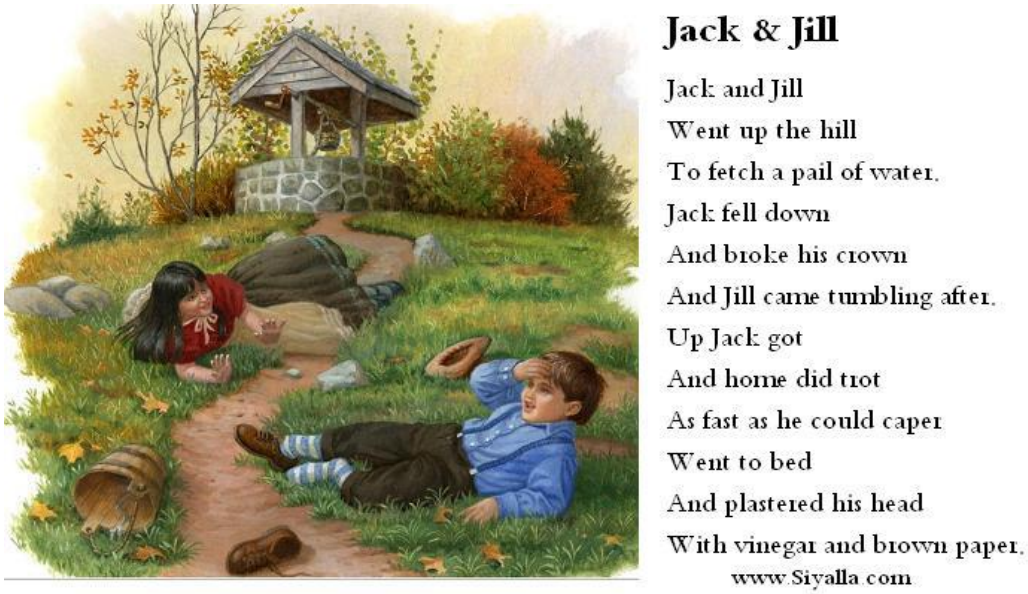
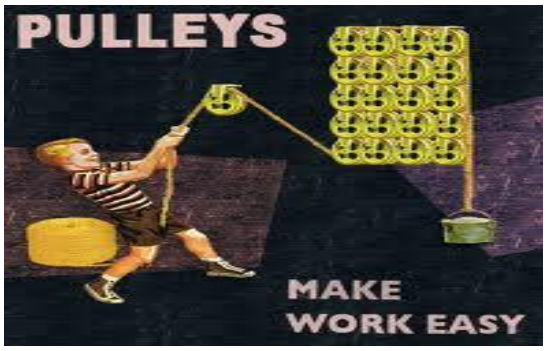


Fig. 6 (Jack and Jill)

4.1 Analysis:

Looking into both the pictorial diagrams of ‘Jack and Jill’ and ‘Ding dong bell’ we notice a well, a bucket and a rope. These nursery characters in both the rhymes use a bucket, one drawing up water and the other pulling up the ‘pussy cat’ from the well. Both activities involve exerting pressure and force. This act of pulling can be reiterated to the children in the teaching and uses of a pulley. The physics teacher can then try to relate this action of pulling water or the pussy cat by unfolding them the mysteries of science and teach them the operation of a pulley.

4.2 Engineering concept learnt:



The pulley is a simple machine used to lift buckets of water from the well or in this context 'poor pussy cat'. The pulley was created by Archimedes in 287 BC. The teacher can then give his/ her students lessons on pulleys by saying that this simple machine is found everywhere. It helps in lifting things, and can be used singly or with many pulleys working together in order, from one shaft to another. The application of pulleys are to hoist buckets out of the well, rock climbers use them to climb the mountains etc. The teacher can make the students cite several other applications of pulleys and other water-lifting devices and make his /her classes interesting with the help of these rhymes. He /She can also focus on the 'rope and bucket' technology. A small lesson can be given to them in this way: "Rope and bucket" is a device mainly used with hand dug wells. A rope is tied to a bucket which is lowered into the well. When the bucket hits the water, it dips and fills up the bucket which is then pulled with a rope. The rope may be held by hand (as it is seen in the picture how little Tommy Stout pulls little pussy cat out) which is operated through the device called a pulley.

Rhyme 5: Humpty Dumpty:

Humpty Dumpty sat on a wall,

Humpty Dumpty had a great fall;

All the King's horses and all the King's men

Couldn't put Humpty Dumpty

together again.

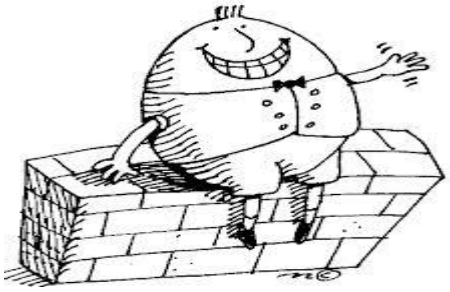


Fig. 7 (Humpty Dumpty sitting on a wall)

5.1 Analysis:

The line "Humpty Dumpty had a great fall" can make an excellent study of Laws of Physics, and also the second law of thermodynamics. Well if one can recall why Humpty Dumpty fell off the wall then this could be the answer:

Humpty Dumpty sat on a wall,

Humpty Dumpty had a great fall;

Because the wall had no cement at all

And the mixture of compositions was all wrong.

5.2 Engineering concept learnt:

This calls forth the expertise of civil engineers and mechanical engineers from whom the engineering concepts must be studied. This rhyme has been very popular in Great Britain and is used to demonstrate the Second Law of thermodynamics. The law describes a process known as entropy, a measure of the number of specific ways in which a system may be arranged, often taken to be a measure of "disorder". It is understood that the higher the entropy, the higher the disorder. After Humpty Dumpty's fall, and subsequent shattering, the inability to put him together again is representative of this principle, as it would be very highly unlikely,

though not impossible to return to his earlier state of lower entropy as the entropy of an isolated system never decreases.

5. Conclusion

Teaching is an art and an inborn quality which is possessed by a few and, innovative teaching is a God given gift which many lack. Teachers need immense patience to handle young budding engineers and help them bring out their latent talent to unravel His mysteries. This will help society with ample clues in demystifying them for a better living condition. Those who have the quality of innovative teaching can best utilize them in classrooms so that teaching-learning environment becomes interesting through creating and recreating and through the process of learning and unlearning and re-learning.

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