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CREATIVITY IN SCIENCE AND TECHNOLOGY

Prof. Dundage G.B

Dept-Mechanical Engineering, Dhananjay Mahadik Group of Institutions,
Vikaswadi, Kagal (India)

ABSTRACT

In this paper ,what is necessary for creativity, what are the factors that motivate creativity, what qualities a creative person should have, the examples of creativity in our everyday life, the laws of creativity, the creativity thought process ,the guide lines for creativity etc are dealt with.

Keywords: Combination, Intelligence, Imagination, Inspiration, Illumination, Stimulation, Knowledge.

I. INTRODUCTION

We should not restrict our thoughts in a particular field only. For example being a civil engineer, Bharat Ratna award winner Mr. Vishweshvariya developed Automatic gates for dams. Actually it was a job of mechanical engineer. Thomas Edison, Bill Gates who were school drop outs but because of their creative ideas discovered new technology. A veterinarian doctor Mr. John Dunlop invented the Pneumatics tyre.Many times a person without having education in a particular field suggests a better solution than the people working in that field for a long time because that person views the problem from a different directions.

"What builds a nation is creative, inventive and vital activity" – Jawaharlal Nehru

Creativity has been given a great deal of attention during last few decades. Therefore some of the research has been centered on identifying forces within an individual related to creativity.

Many people fail to tackle their problems in a creative manner due to their restricted vision scopes and lack of tuning their mental faculties. Development of new ideas and techniques tend to promote less costs, increased productivity and profits. Creativity is the process of seeding and planting new ideas to solve problems from conventional to non-conventional kinds. Creativity is that, one should inculcate a firm belief that there are many available ways of tackling a problem. Although no universally agreed formal definition for creativity exists, the one word that can sum up a creative individual is 'non-conformist'. Creative thinking is often associated with the development of a new thought or idea or concept that has not been thought before. Another definition of creative thinking is that it is a product of the imagination where a new combination of thoughts and things are brought together. The key word here is " Combination". An excellent example of a new combination was the development of gunpowder. Mr. Bacon of Oxford University published a book on how to make gun powder. Potassium nitrate, Carbon and sulphur were known elements. What was not known was if combination of these elements when ignited an explosion results. Further by changing the proportions, the force of explosion could be controlled.

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Another example is of ice-cream and cone combination. A determined immigrant named Ernest Hamwi was trying his best to sell Persian waffles at the 1905 world's fair. He gave away free samples to every one but no one wanted to buy his waffles. But people were standing in line at the ice-cream booth which was two door away. The ice-cream was selling so fast that the ice-cream vendor ran out of dishes. In desperation he ran down to Ernest's Waffle stand begging for extra plates. Ernest did not have any plates. Suddenly Ernest had an idea of rolling one of his waffles up into a cone that would hold a scoop of ice-cream and that was the beginning of the world's ice-cream cone. Ice-cream and waffle combined to have a great taste. Similarly in the 20th century Karl Benz in Germany and Henry Ford in America combined the horse drawn carriage with I.C. engine to have the Automobile.

A creative solution is something like working with the children's blocks. The solutions to creative idea lie within us and the main thing is as to how these are picked up and arranged by our mental faculties and given a definite shape. Creative ability is to be nurtured from birth. This is in contrary to the old belief that only inborn skilled / talented persons with a very high intelligence are creative. Creativity and high intelligence do not necessarily correlate. Persons of high intelligence may be restricted to their thoughts and their creativity and judgments are curbed.

Unfortunately, road blocks come in the way of the development of a person's inborn creative talent. The influences of home and school often pull the child's creative drive by not allowing him to experiment . It also equally happens with a person when in job. The rules are often too rigid & inflexible. There should be an open environment to allow the individuals to develop creative capacity.

Lets look at some examples of creativity in our everyday life.

- **Small Children :** Parents wonder how their children can have so much of imagination at the tender age.
- **House wives :** As living costs increase, a house wife must provide a plan/new ways for stretching her budget for her family.
- **Scientists :** scientists produce new combination of chemicals, new properties of materials and new discoveries.
- **Writers :** Writers express new ideas and concepts to the reader.
- **Architects:** Architect uses his creativity for interior design with new combination of materials, colours etc. New design for new buildings, space allocations etc. and renovation of old buildings.
- **Engineers :** Engineers need variety of materials, ideas to arrive at their designs.

II. QUALITIES OF CREATIVE PEOPLE

The prime thesis behind creativity is that the individual must believe that it can be done. If he believes that something can be done, it will also activate his mind to find ways for a solution. If a person believes that it is impossible his mind will shut out though he has potential for valuable solutions. Following are some of the characteristics of creative people. (However they are not the only characteristics by which creative people are judged)

- **Motivation:** Motivation is often expressed in enthusiasm for the challenge of attacking a new and complex problem.

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- **Flexibility in Thinking :** A person should not think that, for a Civil Engineer it is difficult to make comments and suggestions on a mechanical design or the other way round. Many of the best recommendations came from people outside of their particular field of study. As an example the pneumatic tire was invented by a veterinarian (Animals doctor) Mr. John Dunlop
- **Sensitivity to the problem :** A person must have an awareness and feel for the problem areas.
- **Originality :** A creative person is able to come up with new and original (inventive, creative) ideas if he is unwilling to accept the statement "We have always done it this way only" a logical solution.
- **Drive :** Emotional drive is the motivating force that helps a person to overcome the roadblocks that we face when coming up with new and creative ideas.
- **Open to change :** The creator or innovator brings about the change. Resistance to change is often a firm thing in many person's minds. They are unwilling to take risk. On the otherhand if there is no risk there is no change, hence no progress.
- **Judgment :** If you have a great idea, just because a highly intelligent person or a highly positioned person says that it's not good, does not mean necessarily that he is right. Gather all the information you can, but in the final analysis use your own best judgment and not some one else's.

III. LAWS OF CREATIVE THINKING

Laws of creative thinking are associated with the following three basic elements of the ideas.

- Like ideas (Similarity)
- Adjoining ideas
- Opposite (Contrast) ideas
- **Like ideas :** Example of similarity of ideas can be found in the development of type writer which is designed similar to piano (Keyboard)
- **Adjoining ideas :** When we look up and see the cloudy sky, the adjoining thought we have is that it might rain. Louis Pasteur, in his development of the inoculation process is a good example of adjoining idea. Louis had been experimenting on the development of a cure to chicken cholera. In the middle of his experimentation he became ill and asked his land lady to take care of his chickens and cholera bacteria. She agreed to feed the chickens but refused to touch the cholera bacteria. Thus the germs became weak. Louis observed that by introducing weak germs into the chickens, it built an immunity within chickens and all chicken survived. Thus inoculation was born.
- **Opposite ideas :** A good example is the design of highways. To provide a smooth ride and save on fuel consumption, highway designs strive for straight roadway with minimum slopes. On dangerous curves the chances of losing control are due to skidding of wheels, as there is not enough friction between the road surface and the vehicle wheels. Therefore, on dangerous curves, highways are constructed with special aggregate material that is sometimes grooved to increase the friction of the surface to aid in stopping the wheels. The opposite idea of increasing the friction of smooth surface has helped to save from accidents.

IV. CREATIVE THOUGHT PROCES

The creative thought process is composed of three main categories i.e. three I's.

- Imagination
- Inspiration
- Illumination
- **Imagination :** Dr.Simon Newcomb a leading scientist at that time published this statement " The demonstration that there is no combination of force or machinery that can be put together by which men shall fly is as conclusive as anything could possibly be "

  About the same time that this statement was made, Two very intelligent bicycle mechanics (Wright brothers) were enthusiastically working on their mechanical bird with man made wings. Their imagination and persistence brought about the first successful powered flight in December 1903.

  In 1888 an Atlanta druggist by name Candler paid $ 2300 in cash for the exclusive rights to a carbonated fountain drink called Coca-Cola. It was available only in drug stores for 5 cents. Then Candler imagined that his company could make more money with less time and effort by introducing a unique method of bottling and Bottling became internationally famous.

  Albert Einstein once said that " Imagination is more important than knowledge" Again Imagination is directly proportional to Enthusiasm. Imagination does not seem to work if enthusiasm is not present. Imagination and enthusiasm go hand in hand. Imagination is at its peak when our enthusiasm is in full swing.
- **Inspiration :** Inspiration is a factor that is brought on by accidental stimuli. Knowledge & experience are often available but need some new elements that will trigger a new combination. We receive inspiration from the people that we come in contact with or by our exposure to new ideas that are parallel to our own or in contrast to our ideas or by some adjoining thought. For example , Subash chandra Bose was inspired by reading the books of Swami Vivekananda.
- **Illumination :** Illumination is what happens when the idea about a project you have been working on, simply arises from your subconscious mind to your conscious mind. Illumination is brought about by the addition of new information that enlightens us in alternate ways of performing the same function.
- **Examples :**

a) James watt's development of steam engine.

b) Archimedes developed the method to find density of materials during his bath in the tub.

c) Another method strikes to our mind while solving a mathematical problem.

d) We search a lost object without finding it but suddenly get reminded after one or two days and find it.

V. FACTORS STIMULATING /MOTIVATING CREATIVITY

For people who are creative thinkers, traditional thinking can be one of our worst enemies. It freezes our mind, it blocks our creative thoughts and prevents us from developing further. " Man is so constituted as to see what is wrong with a new thing and not what is right". To Verify this, submit a new idea to a committee. They will oppose 90% of rightness instead of 10% of wrongness.

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- **Search for beauty :-** This often probably works with the architects who look continuously for beauty in their structures.
- **Discontent with status quo :-** Any industry would soon fail if it thought that further improvements were impossible. Successful business live with the question of how they can improve their quality and performance.
- **War :** Many new innovations have come out of desperation of war. For example Development in Hiroshima and Nagasaki.
- **Ignorance of past :-** Our past experience will sometimes lead us away from a feasible solution. It is often necessary to look beyond our own expertise to find the solutions to a problem. Many times a person without having education in a particular field suggests a better solution than the people working in that field for a long time because that person views the problem from a different direction.
- **Necessity :-** It is said that the necessity is the mother of invention.
- **Greed :-** Criminals & business men often imagine / plan to find devious ways to make money.
- **Curiosity :-** A curious person is also an individual who is not satisfied with the obvious solutions.
- **Knowledge :-** More a person learns about a subject, the more he desires to further broaden the depth of knowledge in that subject. A knowledgeable person would be more interested in new development in his field, new designs, new materials etc.
- **Competition :-** To be successful a company must keep up with the latest advances in technology.

VI. CONCLUSIONS

To encourage creative thinking following guide lines are always useful.

- Overcome inertia toward change, toward unconventional.
- Remove all mental blocks and let imagination grow.
- Have crazy ideas. Encourage them .
- Remember, all truly great ideas seem absurd when first proposed.
- Be receptive to new ideas.
- Eliminate the word ‘impossible’ from your thinking

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