



## CREATIVE THINKING – NEED OF THE HOUR

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**“Creativity is inventing, experimenting, growing, taking risks, breaking rules, making mistakes, and having fun”.-Mary Lou cook.**

Creativity is that aspect of intelligence, which is characterized by the even sprouting of ideas. Every human being has the creative potential. It varies from person to person in its type of expression and amount of expression.

Creativity involves not one but many abilities and productivity. It is a mental activity, with perception, thinking and imagination going hand in hand. Creativity is an essential part of ‘innovation’ and ‘invention’.

Therefore creativity is process of developing new, uncommon or unique ideas using imagination, restructuring and re-evaluating an already existing knowledge.

### **Who is a creative thinker?**

Creative thinkers may be intellectuals but are definitely talented in some special way. They desire to be creative, they believe there is a solution, they relentlessly pursue the solution for its own sake, they are highly motivated (intrinsically), are self-directed (no one need prompt them), are self starting (without external push), are diligent, are independent in their judgments, are self-assertive and do use their talents optimally, do hard work incessantly, consciously and sub consciously

### **Factors of creativity**

1. Keen observations: of both the minute and larger aspects of any thing, discovering the new and the strange in already familiar objects and events.
2. Creative perception: novelty and flexibility in perception viewing objects and events from new and varied angles.
3. Curiosity and sensitivity to problems : posing questions, enthusiasm to know, enquiring to probe in to depths of any thing unknown, guessing and wondering.
4. Capacity for divergent thinking : fluency, flexibility, originality and elaboration can be exhibited at various stages of creative process
5. Capacity to evaluate and judge : against criteria of relevance, originality, simplicity, elegance, aesthetic appeal, economic etc. as also capacity to generate these criteria themselves.
6. Personality traits : Sensitivity openness to experience, diverse interests, independence in thought, judgment and action, non-conformity, courage of



conviction, and risk taking, liking for complexity, tolerance for ambiguity, persistence desire for self-actualization, visionary, flexibility in thinking feeling and doing, spontaneity, perseverance

Besides these cognitive and personality factors certain social factors like freedom, extensive independence from the prevailing values, conventional practices and will to work also influence creative people.

According to Sternberg's theory of creativity, the ability to be creative is the amalgamation of several different kinds of intelligence and personality traits. Creativity is an amazingly complex subject. This conclusions were made by him by observing his colleagues and students, his personal experiences, reading biographies of scientists, mathematicians and composers of music and reading psychology books on creativity. But among these some were highly creative but others were not. What brought the difference in creative output?

But before one can be creative whether in science and engineering, one should have some technical knowledge of facts, laws, and methods (e.g., study of physics, chemistry, calculus, differential equations, statistics, computer programming, etc.). If we compare highly creative people with ordinary people, one can find the same kind of intelligence and knowledge in both groups. Therefore, the personality traits distinguish creative from noncreative people. The factors are creative people are highly diligent, have an inner *need* to express their creativity, new ideas take shape in their minds, they have a natural tendency to add some thing new to the already existing idea.

In Kursheed (2005), he summarized his positive experience in teaching engineering fundamentals through a hands-on/historical approach using historical case studies to put students in the inventors' or discoverers' frame of mind. History contains a wealth of ingenious experiments and unconventional ideas that are the results of creative thinking. By learning from both successful and unsuccessful historical examples, students can draw from these resources and learn how to be creative. A hands-on/historical approach in science and engineering subjects and getting students to work under an experienced mentor can help science and engineering students develop thinking skills. While a discipline-specific approach might have been effective in teaching science and engineering students thinking skills, the initiatives and means used would vary according to disciplines.

**Students need to see more homework problems that require creative solutions:**

- Instead of asking for one solution, require the A students to give *two* different methods of solving one problem. Encourage students to find creative solutions instead of prosaic solutions.
- Give problems that are unreasonably difficult to answer correctly, and have the students find a rough approximation.
- Give students problems without adequate information; let them go to the library



and find the information that they need.

- Give more problems that ask the student to design a circuit, interpret data, design a method of doing an experiment, ..
- Assign term papers that require reading from multiple sources, making a creative synthesis of the information, and finding contradictions or inconsistencies in authoritative, published works.
- Occasionally assign exercises that show an *incorrect* solution to a problem (e.g., computer program that contains at least one bug, electronic circuit that will not function properly) and have the students find the defect and suggest a correction.
- Assign laboratory experiments that allow students freedom to choose technique(s) and topics.
- Arrange or compose music, not merely playing music.

### **Creativity is not valued in the contemporary engineering education.**

Very often, creative work by the students is discouraged by faculty. They believe that engineering requires tedious attention to details and an absolute need for accuracy. Embracing ambiguity and exercising flexibility is equated with sub standards., expect the students to follow well-proven design techniques that are covered in the text books or lectures rather than challenge students to think through a new process or innovate a unique solution. Few barriers to creativity in engineering education are:

1. **Perceptual blocks** : Imposition of self restriction , Incomplete observation, Biased perception, Difficulty forming new association
2. **Intellectual blocks**: Success orientation , Avoiding risks, Making mistakes, Inhibition in questioning and guessing
3. **Emotional blocks** : Fear of failure, Criticism and ridicule , Ambiguity

As the engineering program teaches that there is a known correct answer which aims at accuracy so there is no room for the student to wonder, discover, and innovate as Engineering programs are highly competitive and sufficient grades are very important, and will determine whether a student can stay in the program or not. Although it may be a valuable experience to learn to work under pressure, such restrictions also inhibit students from taking risks.

### **Can we create more creative thinkers?**

It is possible to produce creative thinkers by providing an extrinsic atmosphere to nurture and promote the desire to be creative, the relentless pursuit of a solution for its own sake and the intrinsic motivation.

1. By bringing together a band of creative thinkers because 'creativity is contagious'.
2. There should be assurance of full management support no interference or restrictions in terms of research duration of budget, of working hours.
3. There should be system of rewards.



4. There should be appreciation of effort by meeting the expectations
5. There should not be interference or intervention in the research activity by 'administrative' leaders.
6. 'Innovation' efforts should not be look through 'expenses' spectacles; the genuineness of the effort is to be taken in to account.

### **Fostering Creativity in Engineering Students**

1. Identify factors and traits that delineate creativity, as appropriate to education based on established research in the fields of psychology, educational psychology, and in current creative work practices of innovative product designers.
2. Evaluate the self-perception of engineering as well as non engineering faculty of how they may or may not elicit creativity in their classrooms.
3. Evaluate engineering students as well as non engineering students on how they perceive factors contributing to creativity in their educational environment.
4. Identify the specific factors \_if any\_ that impede creativity in engineering education and determine whether they are more or less prevalent in engineering education than in other disciplines.
5. Use these factors that impede creativity to suggest recommendations to modify the engineering classroom experience to include creativity development

### **How to Guide creative students?**

1. Brain storming is an effective technique where students can produce more ideas leading to more productive ideas.
2. Relaxation, leisure avoidance of criticism and control.
3. Assigning more individual tasks under competent supervision.
4. Criticism of the teacher should be constructive.
5. Encouraging manipulation of ideas and objects.
6. Self-expression in spontaneous and planned activity.
7. self-initiated learning, acquisition of knowledge, creative thinking, questions posed by the students, unusual ideas should be encouraged and appreciated.

Hence it is possible to identify people who has an inclination towards creativity and therefore it is a duty provide an environment and hope for the best

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