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TRAINING STUDENTS TO DEVELOP CREATIVE AND INNOVATIVE TALENTS

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Abstract

Creativity is the ability of a person that enables him/her to think of, dream up or visualize unusual solution to a problem. It plays an important part in the development of a nation. Generally, a creative process involves five significant steps: first insight, preparation, incubation, illumination and verification. Innovation, on the other hand, is the process of reducing creative ideas to practice, making some systems, components or equipment. The success of a creative process depends to a great extent on the individual, and the environment that exists around him / her. The generation of ideas is considered one of the most important elements, where brainstorming plays an important role, which is subjected to stringent evaluation process before being implemented. An encouragement and support from educators towards creative signs of students would help in the development of creativity. An awareness of creative and innovative process and an involvement in the solution of a creative problem may help students to develop creative and innovative talents. To promote creativity and innovation, areas e.g. projects, laboratory experiments, design of systems and components, where opportunities exist for the development of creativity, should be identified to play an active role in it.

Keywords: Creativity and innovation; exposure to the process; creative environment; creative curriculum; encourage idea generation; creative problem solving.

1 INTRODUCTION

In a rapid technological change of the world, creativity and innovation play an important role in the development of a nation. It enables the achievement of much needed rewards for scientific and technological investments made by nations for economic growth to improve living standard of common people.

Creativity can be defined as the ability of a person to produce something new – new, at least, for that person [1-3]. It is an ability, which enables a person to think, dream-up, visualize new/unusual solution to problems encountered. Innovation is the process of reducing a creative idea to practice, making a system, components or equipment [1,2]. It can be treated as a controlled process of attempts to improve a known process or product to achieve a desired goal.

Education plays an important role in the identification and development of creativity. It enables to motivate students and inculcate in them the usefulness of performing creatively [4,5]. It is

important to have elements of creative activities in the educational programme and the educators need to emphasize the importance of these activities. Students can play an active role and act creatively only when the process of creativity and innovation is made known to them [5]. Educators play an important role to inspire and motivate students to act creatively.

Everyone is born with a natural ability for creative thinking and a favourable environment must exist for the successful development of these attributes. This paper deals with the creative and innovative process, how educators can inspire students to perform creatively, and the educational programme / environment that must be included to maximize the utilization of creative and innovative talents of students.

2 CREATIVE AND INNOVATIVE PROCESS

Creativity is a process and an efficient utilization of the process can be achieved through a thorough knowledge of the process. A creative process can be broadly divided into the following steps [1,6]:

- i) First insight – the seeds of creation are sown in this phase. An idea occurs to a person for the first time, where a problem exists that requires a solution.
- ii) Preparation – divergent thinking, which explores several possibilities, would be of great value rather than convergent thinking, which concentrates mainly on a single path of reasoning.
- iii) Incubation – the process of preparation is followed by a period of incubation, where conscious concentration ends and instead subconscious data processing takes place. The next stage of creative process cannot occur until the subconscious mind has performed its task.
- iv) Illumination – once the thought processes of subconscious mind are successful, everything falls into place when a sudden, new insight, discovery of the previously unrelated ideas conceived as a solution to the problem, occurs in the mind. The creative process reaches its climax at the moment of illumination.
- v) Verification – in this final stage of creative process, results are carefully controlled against objectives. Intellect and judgments are brought into play and the raw materials of creative achievements are refined at this stage. Independent opinion of others may also be sought and it may be necessary to review / revise the idea or even come up with new ideas.

3 CREATIVITY AND EDUCATION

The influence of education on the development of creativity has been investigated to a great extent by many researchers [4,7]. Teaching for the development of creativity strengthens the rational ability of students – the imaginative ability to interrelate knowledge [8]. The development of creativity through education is still not very clear. Some teachers with exciting ideas have probably contributed to creativity of students without being able to say what they did and why they did. Poor teaching, on the other hand, may put brakes on the development of creativity. The change of attitude of teachers towards creative signs in students would help in the development of creativity. Studies show that creative students are irritating at times and they very often do not conform to the usual standard.

A teacher cannot teach, a student has to learn. Learning is a learner active exercise. A teacher must be able to create an interest among students in the subject and inspire them to pursue learning. It is necessary to identify areas of instruction where opportunities exist for the cultivation of creative habits e.g. projects / design, case studies, industrial attachment, and final year projects. Students should be encouraged to solve the problem in a number of different ways and highlight the merits and shortcomings of each method. Creative problem solving can be introduced in the existing curriculum where students can solve open-ended type of problem, which requires improvement [9]. Students may be asked to find as much information as possible either from a visit to the site or from literatures. Once the relevant information have been found, they would think about probable solutions. All these ideas can be put together, discussed, fully evaluated before implementation is carried out. For engineering students, laboratories should be the centre of these activities, where students should be allowed to play with their ideas and appropriate recognition should be given.

4 CREATIVE ENVIRONMENT

If the environment comprising the teaching staff, the students and the culture is not conducive to creative thinking, merely providing good facilities and well planned curriculum are not adequate for the healthy development of creativity and innovation. It is felt that more activities / opportunities that encourages creativity among students should be included in the teaching-learning programme. This enables the students to apply theories and techniques that they learn to solve a problem. Students in undergraduate programme may be provided with undergraduate research opportunity programme (UROP) [10]. Some of the attributes of creative environment observed by researchers [10-12] are as follows: a) incentives, b) deadline, c) visual thinking, d) receptive to new ideas, e) spirit of playfulness, f) one problem at a time, and g) personal touches. There must exists a compelling reason for generating new ideas – money, status, a new and better career and even emotional satisfaction. A sense of urgency –deadline – must be imposed. At some point, it may be necessary to block out verbal thoughts and concentrate on forming a mental picture of the problem. Judgment should be applied when all the ideas have been developed. Allow the mind to wonder, toys with ideas and consider creativity as fun although the results may be serious. This approach enables a significant increase in idea generation.

5 PROBLEM CENTRED APPROACH TO LEARNING

Most of us are concerned about better teaching but very few of us worry about effective learning – although emphasis should be on learning. Effective learning measures how well the practitioner has absorbed and apply the body of know ledge demanded by the profession.

For teaching, there are two main processes in practice: subject-centred and student-centred. In subject-centred teaching, basic teaching is delivered by lectures, supported by tutorials and supplemented by laboratory classes. In student-centred teaching, the framework teaching is given by tutorials and students are asked to attend lectures considered suitable for his/her abilities and interest. The student-centred teaching enables to evoke from the student the greatest intellectual effort of which he/she is capable and to stretch his/her abilities to the utmost. The

level and pace of teaching is geared to the different degrees of ability of the students and the speed at which their minds move. Like subject-centred teaching, these students are also required to perform experiments and projects.

Most of the universities practice traditional subject-centred approach, where lectures are used to transfer information, concepts and to create interest in the subject; tutorials to develop understanding and to promote dialogues; and projects, both design and research, academic exercises, special task and problems for which solution has to be found and implemented [11].

Every student is different from another and they learn themselves at their own pace, stimulated perhaps by others. Tutorials are held in small groups, 15-25 students, to overcome some of the difficulties encountered in lecture situations. Each student learns at his / her own pace, sometimes stimulated by competition or by fear of failure. In subject-centred teaching, individual variation in learning can be taken into account only when the student-tutor ratio is small. The student centred teaching method is considered expensive and involves repetition of materials [11].

As described by Tay et al. [10], undergraduate research opportunities programme , where students are allowed to work on their chosen projects and use their own ideas to find solutions, shows potential for the development of creativity and innovation.

6 ENGINEERING DESIGN TO PROMOTE CREATIVITY AND INNOVATION

‘Engineering design is a systematic, intelligent process in which designers generate, evaluate and specify concepts for devices, systems or processes whose form and function achieve clients’ objectives and clients’ need while satisfying a special set of constraints.’ – Dym et al. [12].

As part of creativity and innovation, designers will go through a convergent thinking and divergent thinking process. Convergent thinking leads to a specific or a special set of answers for a given question. Answer to convergent thinking leads to a response that can be verified. Questions involving deep reasoning fall under convergent thinking process. For divergent thinking process, for any given question, there exist multiple alternatives known answers, regardless of being true or false, as well as multiple unknown possible answers. This type of questions are considered characteristic of divergent thinking, where questions attempt to diverge from the facts to the possibilities that can be created from them. In this case, the questioner is not necessarily concerned with the realities / truthfulness or verifiability of potential answer. The distinction between the two thought processes is that convergent thinking operates in the knowledge domain and the divergent thinking operates in the concept domain. Concepts need not have truth value, whereas knowledge does.

7 CONCLUTIONS

- A creative process involves five distinct steps: first insight, preparation, incubation, illumination and verification.
- A creative person shows greater openness to his experience and an ability to toy with ideas.

- An awareness of creative process can promote creativity among students. By solving creative problems, deliberate development of creativity can be achieved.
- To promote creativity of individual student, education has a strong role to play. Creative students very often fail to conform normal standards. A change in attitude of lecturers towards creative signs of students would lead to a better development of creativity.
- To develop creativity, students should be encouraged / trained in divergent thinking and provide opportunities to cultivate these habits.
- Students should be encouraged to solve a problem in different ways – a design problem offers such opportunities.

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