IF CREATIVITY CAN BE TAUGHT, HOW SHOULD WE TEACH IT?

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CREATIVITY IS VITALLY IMPORTANT TO US

In preparing this paper, I made the assumption that we all agree: ***creativity is vitally important to us for our survival in our future.*** It is vital because the post-industrial era of this century is a contest of intelligence and its application to science and technology. Now at the turn of the new century, if we have the brain and the ***bronze***, which I believe we have in abundance, science and technology can now be purchased and transferred, and it is what good use we make of them that will ensure our continuous prosperity. This means that in the coming century, it is going to be a competition in creativity and its application to science and technology that will change our economic and social lives. And, this calls for creativity in our younger generations and we have the responsibility to educate them in such a way that they think creatively where appropriate.

In so saying, I have made another assumption, that is, ***creativity can be taught*** and I am not sure everyone agrees with me, because people differ in their views here, depending on who they are and what they mean by creativity. But, what is more important is what research says.

CREATIVITY BROKEN DOWN

In creativity research, as in other fields of scientific research, operationalisation of the conçept and development of its measurement are crucial to its advancement. The generally accepted operationalisation of creativity (Slabbert, 1994) includes some of the following features of creative product and process:

1. ***Originality****: the ability to make a mental leap, to break from the obvious, the everyday, or the conventional.*
2. ***Fluency****: The ability to generate many ideas to solve the same problem.*
3. ***Abstracting****: The ability to identify the best, most important or most effective from a number of possibilities.*
4. ***Elaboration****: The ability to fan out the original idea into specifics and into detail.*
5. ***Openness****: The ability to resist premature closure; it calls for divergent thinking and implies many solutions to a single problem.*

CREATIVITY CAN BE TAUGHT, SAYS RESEARCH

On the basis of these operations, measuring instruments were developed and research projects almost invariably used them to evaluate effectiveness of training programmes. As a matter of fact, educators and psychologists have over the past three or four decades developed programmes to promote creative ability (Westberg, 1996). How effective, then, are these programmes? Slightly more than a decade ago, Torrance (1984) analyzed the effectiveness of 142 experiments designed to develop creativity and concluded:

> *Rarely have any of the methods tested failed to produce measurable, statistically significant creative growth...the greatest growth occurs when creative problem solving is taught.*

Similarly, in a meta-analysis of 106 published studies investigating the effectiveness of creativity training programmes involving 177 independent samples of subjects, Cohn's (1984) analysis of the effect sizes shows that performance on creativity tests can be enhanced through the training programmes, although the benefit did not transfer to dissimilar tasks.

While the earlier studies focused more on school children, the ferment in creativity has led to a proliferation of creativity training programmes in American colleges and universities. As a follow-up on the First National Conference on Creativity in American Colleges and Universities, Montogomery and her associates (Montogomery, Bull, & Baloche, 1992; Baloche, Montogomery, Bull, Salyer, 1992) analyzed 67 course syllabi of such courses taught in 61 colleges and universities, from freshmen to doctoral level and for students in education, psychology, business, engineering, the arts and others. While an overall evaluation is awaited, the large number of programmes and the resources put into running them are indication of the conviction that creativity can be taught.

IF SO, HOW ARE WE TO TEACH IT?

If we are convinced that creativity can be taught, the next natural question is, How to teach it? Perhaps, we shall take a look at a typical example. Clapham & Schuster (1992) reported a successful attempt to train engineering students to think more creatively.

In this study, 27 students were given an one-hour training involving the following steps:

1. *Students were asked to list as many improvements they could think of for a given object and then counted the number of responses.*
2. *The leader led a discussion on creativity and showed that they were creative and could increase their creative power significantly.*
3. *Several idea-generating techniques were discussed including brainstorming, incubation, forced relationship.*
4. *Post-test similar to the pre-test. The scores were compared on the spot.*

Another group of 29 students took part in a training in interview skills, serving as the control group. Before the training, both groups completed the *Owen Creativity Test* and the *Structure of Intellect Learning Abilities Test: Evaluation, Leadership, and Creative Thinking (SOI)*. One week after the training, the students took the same two tests. Comparison on the *increased scores* shows the following results:

Group	Owen Test	SOI Test
Experimental	14.89	14.07
Control	6.63	7.03

Clapham & Schuster admitted that the results might have been partly due to the fact that the students, being volunteers, were highly motivated. They also pointed to the possibility of a much increased scores if the training were to last for a longer period. As the creative responses might have been brought about by the mood created in the training session, the researchers further pointed to the importance of appropriate environment for creativity.

WHAT AND HOW SHOULD WE TEACH?

This study may look simplistic as creativity training entails many more other aspects. For a more comprehensive listing of what can be considered in developing creativity training programmes, we have to refer to the study of Montgomery et al. (1992). From the 67 syllabi, they identified the following five dimensions of creativity inherent in the training programmes:

1. Social climate: *social influence, mentor relationships, family cultural heritage, creative climates and group interaction.*
2. Personality: *skepticism, independence, internal locus of control, self confidence, reflectiveness, and internal sensation seeking.*
3. General models: *approaches encouraging the students to critically analyze and generate their own thinking about creativity: motivational factors, psychological and psychoanalytical theories, measurement of creativity.*
4. Processes: *synectics, problem finding, problem solving, sociodrama, idea finding or idea combining, and critical thinking strategies.*
5. Product: *fluency, flexibility, design development, design strategies, patent and trademark development, and model building.*

While one or more of the above five dimensions of creativity could be considered at the programme development level, specific suggestions are needed at the classroom level. In the study by Baloche et al. (1992), 147 respondents who taught creativity in colleges and universities considered 17 products and experiences needed to improve student creativity. Those *deemed considerably and greatly important* by at least two-thirds of the respondents are as follows:

1. *Teach or demonstrate creative problem solving.*
2. *Keep a notebook of creative ideas.*
3. *Make a creative product (art, literature, invention, design, etc.).*
4. *Participate in one or more creative exercises (e.g. future problem solving).*

Several classroom techniques have been found effective in promoting creativity (Ford & Harris, 1992), and *brainstorming* is so popular. Perhaps, SCAMPER deserves more attention as a set of thinking strategies for encouraging divergent thinking. SCAMPER is an acronym for *substitute, combine, adapt, modify, put to other uses, elaborate, and reverse.* In SCAMPER, the teacher guides the students through thinking in different directions and thus suggests different frames of mind in the creative effort. (For chemistry-related questions under each of these thinking strategies, see Appendix.)

A recent example of how SCAMPER was used to teach young students to think creatively is provided by Westberg (1966). In this project, fourth through eighth grade students (N=417) were put through a creativity training programme of eight lessons:

1. Introduction to the Process of Inventing: *Students learned the definition of inventions, heard stories of inventions, and saw some examples of student inventions.*
2. Inventing Practice and Inventors' Notebooks: *Students learned to make entries in an inventors' log, and to adapt junk materials into new devices.*
3. Find a Need or Want: *Students learned problem finding and compiled a "bug list".*
4. Think of Solutions: *Students learned and applied SCAMPER to generate potential solutions.*
5. Evaluate Solutions: *Students selected criteria to judge their solutions.*
6. Make a Good Model or Prototype: *Students experimented with designs and obtained technical assistance to build models.*
7. Name the Inventions: *Students learned the techniques for naming and marketing their inventions.*
8. Share the Inventions: *Students completed their inventions and learned about outlets for inventions.*

A comparable group of students (N=290) were also given the first lesson, but not the remaining ones. Both groups developed inventions and provided three-page descriptions and a photograph of their inventions, which were assessed for originality, technical goodness, and aesthetic appeal. Westberg (1996) concluded that

The information from the [teachers'] logs indicated that students in the experimental group exhibited excitement and enthusiasm toward inventing early in the process...The students who received instruction in the inventing process developed a significantly greater number of inventions than students who received only one introductory lesson on invention. The quality of their inventions...was not significantly higher when compared to the control group. (pp. 261-262)

HOW CAN WE MAKE A START?

A journey of thousand miles begins with the first small step. Instead of waiting for someone to map the terrain and build the roads, we can start in our own small way by trying individually, but preferably in groups, to introduce into our classrooms an environment which is psychologically secure to explore and share ideas, and test out some of the techniques that researches have been found to be effective. This may call for some re-orientation of the school administrators, the teachers, and the students, or even the parents. It may also entail a bit more time and effort on our part as teachers. But, it will also make teaching more exciting and rewarding and in the long run benefit the nation as a whole.

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Appendix

SCAMPER	Questions *	Examples**
Substitute	What could you substitute? What might you do instead? What could you do as well or better?	$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$ What would happen if you use magnesium instead of zinc?
Combine	What could you combine? What might work well together? What could be added together?	How would the rate of reaction be affected if the size of particles and temperature are decreased at the same time?
Adapt	What could be adjusted to suit a purpose or condition? How could make it fit?	How else could you measure the rate of reaction besides the syringe method?
Modify	What would happen if you change form or quality? Could you make it larger, greater, stronger? Could you make it smaller, lighter, slower?	How would the rate of reaction be affected if bigger pieces of zinc are used?
Put to other uses	How could you use it for a different purpose? What are some new ways to apply it?	How would you apply the "effect of particle size on the rate of reaction" to cooking of sweet potato?
Eliminate	What could you subtract or take away? What could you do without?	What would happen if a few drops of $CuSO_4$ (aq) were not added?
Reverse	What would you have if you reversed it, or turned it around? Could you change the parts, order, layout, or sequence?	What would happen if zinc is added to the acid instead of the acid to zinc?

* Source: Ford & Harris (1992)   ** Source: Thirugnanam(1999)

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