Benefiting Science Students with Synectics: An SR Approach

Vol. IV, No. II (Spring 2019) | Page: 427 – 437 | DOI: 10.31703/grr.2019(IV-II).46

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Abstract Students’ understanding of science education in Pakistan is not up to the standard level. The main aim of the study is to see either comprehension level is raised through Synectics among high school students. A systematic review of related literature and Meta-analysis has been done. Literature leads to conclusion that there is a need to study the utility of Synectics model. Findings show that Synectics is more effective than routine methods in teaching. Synectics help in the development of creativity, training in creativity, and scholastic achievement. It is recommended that teachers and students must be familiar with Synectics and also implement this technique into teacher training institutes for quality education.

Key Words: Synectics, Meta-analysis, teacher training institutes, quality education.

Introduction

SR is used in several ways as the key tool in the emerging society of technology. Usage with the internet is growing rapidly in all kind of fields, agriculture, commerce, business, industry, medicine, companies, banks, communications and government for different official functions. This has become an essential instrument.

Science education in schools plays a vital role in student’s career development. It involves logical thinking and mathematical modelling and problem-solving skills. With the internet is a powerful device that enables students to learn new skills and current lessons with advanced version. helps students to explore creativity and problem solving but also help to understand technologies. Science deals with different theoretical aspects. It also deals with technical content, teaches a secondary school student to write programs using various programming languages such as FORTRAN, COBOL or BASIC.

Today existing science education in Pakistan faces a lot of problems. Yet the students learn very little about different concepts of science courses. There is no satisfactory science learning for difficult concepts and programming of different languages. In programming, students first spend a lot of time to learn the syntax and semantics of that language then they can represent algorithms. In this process, the level of frustration gets higher because students are unable to comprehend difficult concepts of a topic. Another reason is inexperienced teachers that they do not indulge in them with interesting examples and problems that are suitable for students’ level of knowledge and understanding. Students neither learn difficult concepts to analyze nor compare different solutions. Lack of subject knowledge, poor pedagogical skills are also another factor. Teachers use outdated teaching methodology which does not match with the ground realities (Rashid & Mukhtar, 2012). Analytical, logical and critical thinking cannot be nurtured in students without comprehension (Ali, 2011). Conceptual understanding also enhances students’ comprehension level. Learning concepts are very important for comprehension and cognitive development (Moreira, 2011).

Some general problems related to science education in Pakistan are lack of motivation, non-familiarity of teachers with ICTs, lack of training, illiterate family background and shortage of skilled persons (Taimur-ul-Hassan & Abdul Raheem, 2013). Teachers are unaware of students learning difficulties in science and not use

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Student centred computing pedagogy approach to make learning more comprehensive (Anders & Anna, 2009). Many students of science education at secondary level find difficulty in learning programming because of non-determinism and not understanding of algorithm (Jan Erik, 2011). Poor pedagogical methods, poor study methods and lack of problem-solving abilities are also major problems that affect students learning capabilities (Josephat O, Herbert, & Fredrick, 2012). Most of the students leave the science subject because of misunderstanding and bad experience (Maureen, Anne, & Tuba, 2008). Another major problem is the science curriculum that is not very effective at the secondary level in Pakistan so that students are unable to comprehend the knowledge given in the textbooks (Fariha, Mumtaz, & Mehwish, 2011).

How to Improve the Current State of Science Education

To improve the current state of science education in Pakistan, teachers must know the core difficulties of this subject. Teachers should be trained to advance pedagogical skills and techniques to build knowledge and make connections between prerequisites and what they need to know. Motivational level of student must increase to choose science as this is also a technical subject which is used now a day’s almost in every field of life. Teachers make student think logically and to solve problems through creative thinking.

With the rapid increase in the development of technology and technology and the big flow of information in our society desires innovative getting to know abilities to maintain pace with present-day technology. One of these techniques Synectics increase the power of students’ creativity in science comprehension is mapped by means of systematic literature review. So that this study is an effort for the development of science comprehension through the Synectics teaching model at secondary level in District Rawalpindi.

Synectics Model of Teaching:

Synectics is a technique of the Information Processing family of the teaching model. It was designed by William J. J. Gordon and his colleague in 1961. The model was used to develop creativity group in industrial organizations. Later on, it was adopted in education. Synectics model has two major characteristics that distinguish it from others. First, it attacks underlying concept of the problem rather than the problem itself. Second, it examines the problem in many ways to try to discover an analogy (Evans, 1996). The main element of Synectics is the use of analogies (Joyce, Weil, & Calhoun, 2014).

Synectics process follows two basic activities. These are:
1. Making the familiar strange/Creating Something New
2. Making the Strange Familiar

Objectives

The following are the objectives of the study.
1. To review the previous researches on Synectics systematically

Research Questions

• How well students can comprehend science through synectics in underdeveloped countries?
• How well students can comprehend science through synectics in developed countries?

Significance of the Study

The study will be of significant for:

Working Teachers

Synectics model of teaching provides an interesting systemic approach. So the use of this model will enhance the quality of instruction. This model will help teachers and students articulate new solutions to a problem.

Students

The use of this model will improve students’ learning of concepts on the subject of science. Also, this model
provides an interactive environment. This will enhance the academic performance of the students and will make them more confident.

Curriculum Planner and Training Institutions
The findings of the proposed study will be helpful for curriculum planners in the curriculum. They will be able to select appropriate instructional material and contents for a course. It will also helpful for the training institutions so that the same model will be implemented in teachers’ training.

Systematic Review
A brief synthesis of the findings of previous studies on Synectics model of teaching reveals that there are not many studies in this area, particularly in Pakistan, it is relatively limited and underused. General steps of previous tips may additionally lead researchers to a scientific evaluation: hassle formulation, assessment planning, and literature search, records collection and information evaluation, information synthesis and interpretation, effects presentation and evaluation replace.

Research Methodology

Research Method
The research is classed as a review of the literature. The literature review is a dependable research approach. Regarding its technique, its miles considered as qualitative, because it seeks to establish meaning and importance to the object of study.

Procedure of Experiment
The study examined that was conducted in 4 stages. The research problem becomes described in the first step and studies became completed within the google student database in the second step and the third step reading of text and classification of underdeveloped and developed countries was done. The fourth step of research was the analysis of all work of articles according to year, country and universities.

Analysis of Results
A total of 50 numbers of papers were obtained, which has a considerable amount of contributions to the relevant topic. The literature of developed and developing countries was reviewed systematically. The number of countries was maximum in which the synectics approach was applied and results were remained positive regarding educational activities and trainings as ahead.

| S | Year | Country | Authors | Findings |
|---|------|---------|---------|---------|
| 1 | 2004 | China   | His-Chi Hsiao, Ying-Hsin-Liang, Teng-Ying–Lin | It is the creative thinking teaching model. Through Synectics students' needs in terms of cognitions, skills, affections and creativity along with learning computer network can be met. |
| 2 | 2013 | India   | Hema V Nalini | It helps students and teachers to think creatively; and develops meta cognition and helps the concept get learnt. |
| 3 | 2015 | India   | Dr. Bapi mishra, rikichoudury | It helps in problem solving and also enhances creativity. |
| 4 | 2014 | India   | Girija, C | It helps in skill development and also in content knowledge. |
| S | Year | Country | Authors | Findings |
|---|------|---------|---------|----------|
| 5 | 2014 | India   | Kiranjit Kaur & Sesadeba Pany | Methods of teaching to enhance creativity as brainstorming, the synectics model of teaching and role playing. Creative teaching leads a child to give his best to society. |
| 6 | 2014 | India   | Dr. S. Chandrasekaran | Synectics technique enhances the interest and motivation levels in Biology. |
| 7 | 2013 | India   | Sumamol and Dhanya | Synectics model is more effective with respect to creativity for teaching Physics |
| 8 | 2012 | India   | Patil | Synectics model is more effective to increase the achievement of students |
| 9 | 2008 | India   | Paltasingh | Synectics model is better than traditional method for: (i) the development of creativity, (ii) gain in creativity, (iii) training in creativity, and (iv) scholastic achievement |
| 10 | 2015 | Indonesia | Tri-martini Nurharyani, St. Budi Walayo, Wardono | It helps in learning mathematical literacy in geometry and stats. |
| 11 | 2012 | Indonesia | Masda Tumangger, Tjut Ernidawati | Synectics teaching method can help students to be more dynamic in teaching and learning process |
| 12 | 2013 | Indonesia | Arye Dika Wijaya | Synectic model use to improve students’ writing skill. |
| 13 | 2012 | Iran     | Mandana Aiamy, Fariba Haghani | It helps in brainstorming. |
| 14 | 2015 | Iran     | Soheila Abed, Amir Hosein Mohammad Davoudi, Davoud Hoseinzadeh | It helps in critical thinking. |
| 15 | 2014 | Iran     | Hamidreza Fatemipour, Masoumeh Kordnacej | The students who were in the group where the Synectics technique was used outstanding |
| 16 | 2011 | Iran     | Tayebeh Tajari, Fateme Tajari | Teaching by Synectics method increases the creativity, fluency, flexibility and elaboration, but can increase individual differences. |
| 17 | 2014 | Iran     | Gholamhossein Afshari, Nasser Ghaemi | Synectics training enhances the academic achievement in the course of writing essay |
| 18 | 2014 | Iran     | Ali Yousefi | Synectics in science teaching and learning, student’s creative performance than more traditional methods increases. |
| 19 | 2012 | Iran     | Zavaraki e.z., Norouzi d., Safavi S.M.R. | Teaching by means of Synectics is more effective than teaching by traditional method suggesting using Synectics method any time appropriate. |
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| S | Year | Country | Authors | Findings |
|---|------|---------|---------|----------|
| 20 | 2011 | Iran    | Shabani | Synectics and metaphors enable students and teachers to find new ways of thinking towards a concept. |
| 21 | 2006 | Iran    | Taijri  | Students who learned using Synectics model outperformed than those who learned using lecture method. |
| 22 | 2001 | Iran    | Dastjerdi | Synectics model clarifies the concept. |
| 23 | 2017 | Pakistan | Aftab Ahmed Khan, Nasir Mehmood | Comprehension of abstract concept of geometry in mathematics can be improved by the Synectics. |
| 24 | 2016 | Tailand | Dr. Paitoon Kantunyaluk, Asst. Prof. Dr. Surapon Boonlue | The development of Synectics blended classroom to enhance creative thinking enhances the students to use information technology in the instructional activities integrating problem-based learning and collaborative learning to work interactively among learners. |
| 25 | 2012 | Tailand | Hsien-Hui Tanga, Ying-Ling Chena and John S. Gerob | Use of various design techniques affects the design manner. Brainstorming became more orientated towards useful thinking. Situation becomes more orientated toward the design of consumer-oriented merchandise. Synectics changed into extra orientated toward the considering product structures and their combination. |
| 26 | 2017 | Tailand | Sasipong Srisawat | Better for creativity. |

#### Articles of Developed Countries on Synectics

| S | Year | Country | Author | Findings |
|---|------|---------|--------|----------|
| 1 | 2001 | Australia | David Conley | The group that used Synectics techniques outperformed the other group in creativity. |
| 2 | 1994 | Cyprus | Georgiou | Use of Synectics model not only improves creative thinking but also interpersonal skills of the students. |
| 3 | 2010 | New England | Sadathoseini, Memaria | It enhances performance. Increases creativity. |
| 4 | 2009 | Germany | Duin, Hauge, and Thoben | Synectics fit very well for the development of concept. |
| 5 | 2011 | Greece | Pavlos Kallonis, Demetrios G. Sampson | Good for teachers development. |
| S | Year | Country | Authors | Findings |
|---|------|---------|---------|----------|
| 6 | 2006 | Italy   | Emilia Barone, Diana Olivieri | Findings have been favourable for media literacy, which highlights that how teens need to be educated for the crucial TV watching and to trendy mass media use. |
| 7 | 2017 | Poland  | Sebastian Koziołek | In computing education Synectics proved to be difficult in use but it help to attain a rich body of knowledge. |
| 8 | 2017 | Turkey  | Nalan Bayraktar Balkır, Ece Zehir Topkaya | Synectics had positive effect on writing fluency but not increase in lexical. |
| 9 | 2017 | Turkey  | Bahadir ERİŞTI, Mustafa POLAT | This increases vocabulary. |
| 10| 2008 | Turkey  | Mehmet Asmalı, Saniye Sanem Dilbaz Sayin | Students can retain vocabularies longer through Synectics. |
| 11| 2011 | Turkey  | Kaplan, Ercan | Students develops creativity through synectics applications rather than creating of original product. |
| 12| 2011 | USA     | Christina Sierra-Jones | It promotes scientific concept development. It also helps in questioning. |
| 13| 2001 | USA     | David Gonzalez | The study indicated that it is not possible to rank each of these methods against each other. |
| 14| 2016 | USA     | Jessica J. Monk, Adarsh K. Gupta, Lucia Weiss | Synectics technique may additionally improve the fine and variety of techniques used to achieve every day bodily pastime |
| 15| 1994 | USA     | Karen S. Meador | Synectics is such kind of strategy that is useful for both gifted and non-gifted kindergarten students. It develops individual level of thinking in students. |
| 16| 1986 | USA     | Jack Tapleshay | Synectics is good as teaching style of individual Instructor. |
| 17| 1973 | USA     | Leanna Gail Dent | Synectics treatment that increased the level of creative thinking exhibited in the written responses |
| 18| 1996 | USA     | Sylvia C Gendrop | There are different potential strength and one weakness, in the reflective reasoning of nurses and also Synectics developed creative abilities of nurses. |
| 19| 2009 | USA     | Walker | Synectics model of teaching promotes metaphorical and deep thinking. |
| 20| 2006 | USA     | Laura | Synectics enables students to solve a multitude of academic challenges |
| 21| 2003 | USA     | Nalon | Synectics model can be used in a variety of situations |
### Findings

| S | Year | Country | Authors | Findings |
|---|------|---------|---------|----------|
| 22 | 1997 | USA     | Dykstra, and Dykstra | Metaphor and analogies can be difficult for some students to understand, yet these are necessary for creative writing |
| 23 | 1996 | USA     | Evans   | Synectics model attacks the underlying concept of the problem rather than the problem itself and thus, enable students to develop concept. Synectics model examines the problem from many angles; this again gives better understanding of the concept. |

### Conclusion

This study performed literature review on effectiveness of synectics in different institutions of different developing and developed countries. Synectics approach was applied in both developing and developed countries and there is no significant difference between the effectiveness of synectics in both categories. It is concluded from the under developing countries that synectics model is very useful in different situation of educational activities and developed countries are also in favour of synectics to employs in education sector. It is suggested for future work that teacher must use synectics in any subject at any level of education that can enhance student’s ability to perform better and thinking abilities can be boosted up during educational activities.
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