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2.0 **Introduction:**

It is today's students who must be prepared for the world in which their ability to function will not depend on their mastery of facts and principles now taught in school but rather on their ability to deal with new facts and principles that have not yet been imagined. So the primary aim of education is to raise the level of the academic achievement of individual in the school. Now it is a fact that the academic achievement and intelligence of the pupil are positively and highly correlated. One could think of creative thinking programme which has been widely used as a method to expand perspective knowledge of consciousness and unconsciousness in person in modern time.

This study concerns with the model of teaching, so the investigator has tried to brief the theoretical perspective views of divergent-lateral thinking, the
structure of intellect model, creative learning and enrichment models, and Williams' Model in this chapter.

2.1 **Divergent-Lateral Thinking**

In view of the challenge of twenty first century, the students will have to learn how to think rather than what to think. It is a first step to help the student to his mental thinking process and environment. In creating a climate where creativity can flourish, the teacher must assume responsibility skin to the former where work begins only after the nurture of the seed depends upon the conditions for growth. For creative thinking, the Divergent thinking and Lateral thinking should be developed by providing the proper situation.

2.1.1 **Divergent Thinking**

Divergent Thinking leads to a broadening of the definition and criteria of the problem so as to generate a wide variety of possible solutions, many of which are acceptable and some of which may be creatively superior. Divergent thinking is identified by fluency, flexibility, originality and elaboration in a process that is three wheeling and imaginative. Divergent thinking is free to develop its own data to raise its own questions and to take new directions.

The unique features of divergent problem is a
variety of responses produced. The product is not completely determined by the information, that is to say that divergent thinking does not come into play in total process of reading a unique conclusion, for it comes into play wherever there is trial and error thinking.

Fluent thinking is tested by asking the examinee to list words satisfying a specified letter required. This ability is now regarded as a facility in divergent production of symbolic unit. The parallel semantic ability has been known as identical fluency, the divergent production class is believed to be the unique featured, of a factor called spontaneous flexibility. In this, subject goes frequently from one class to another, when subject goes to think about one class to use, it is to be called identical fluency.

A unique ability improving relations is called associational fluency. One factor pertaining to the production of system is known as expressional fluency.

A factor that has been called originality is recognised as adoptive flexibility with semantic material where there must be a shifting of meaning. The examinee must produce the change in meaning and so come up with Novel, Unusual, Clever ideas. The number of clever responses given by an examinee is his score for originality.
Ability to produce a variety of implications is elaboration of given information.

They all, abovementioned, are the divergent thinking abilities and they are the base for creativity.

2.1.2 Lateral Thinking:

Lateral thinking is closely related to Creativity. Edward De Bono suggested in his book lateral thinking that at school the emphasis has traditionally always made on vertical thinking which is effective but incomplete.

Vertical thinking is traditional type of thinking. It is one moves towards by sequential steps, each of which must be justified. Correct solution would be impossible. One selects act only what is relevant.

Lateral thinking emphasis the effectiveness of vertical thinking. Vertical thinking develops the idea generated by lateral thinking. One could not dig a hole in a different places by digging the same hole deeper. Vertical thinking is used to dig a hole in a different place. Vertical thinking in itself is dangerous because it is useful to some extent.

Insight and humour both involves restructuring put with more emphasis on escape from restricting pattern. Lateral thinking involves restructuring escape and the provocative of new patterns. It is closely related to creativity but where creativity is too often only the description can only admire a result but one learn to use process.

Lateral thinking is concerned with the generation of new ideas. New ideas are stuff and innovative so they would progress in every field from science to art, from politics to personal happiness. It is also concerned with breaking out of prison of the old ideas. It leads to this change in attitude and approach to looking in a different way at things which have always been looked at in the same way. Liberation from old ideas and the stimulation of new ones are twin aspects of lateral thinking.

Lateral thinking like logical thinking is a way of using mind. There are specific techniques that can be used just as specific techniques in logical thinking. Goodwill and exhortation are not enough to develop skills in logical thinking. One's need is an actual setting in which to practice and some tangible techniques with which to practice.

From an understanding of techniques and from fluency in their use, lateral thinking develops an attitude of mind. Lateral thinking is not same magic new
system. Lateral thinking is a very basic part of thinking and that one can develop some skills in it.

2.2 **Teacher's Role in developing Creativity in Classroom**

Educationalists are interested in understanding different school environments. They are also interested in understanding the school conditions which affect creativity development positively. Researchers have shown that the school conditions, the child's needs and motivations, teacher's behaviour in the classrooms, teacher-pupil relationship, methods of teaching and materials of teaching are important factors to help developing creativity of the child. The degree of intellectual environment of school directly affects the level of growth of child's creativity.

The teacher's role in the classroom is very important which influences the children in many ways. As the teacher's classroom behaviour and approach to the topic of learning. Teacher's controlling strategies, open-mindedness, authoritarianism and other teaching characteristics affect the pupil. Teacher's level of creativity directly influences pupil's creativity, incentive and behaviour.
Behler\(^2\) has quoted twenty principles for developing creative thinking through school experience listed by Sparnes and Harding. They are worth to be noted.

1. Be on the Alert for new ideas and encourage the pupils to develop all their creative talents.

2. Make children more sensitive to environmental stimuli.

3. Encourage manipulation of objects and ideas.

4. Teach how to test systematically each idea, starting from as early as third grade. Show pupils how to define a problem and keep testing each idea. The heuristics described by Polya might be used as a guide.

5. Development of tolerance of new ideas.


7. Develop creative classroom atmosphere, a free, relaxed and unhurried one.

8. Teach the child to value his creative thinking. Encourage students to note down their ideas in concrete form whenever possible perhaps in a special notebook set aside for that purpose.

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9. Teach skills for avoiding peer sanctions. If a highly creative pupil rubs too many classmates the wrong way, help him to become more aware of feeling of others.

10. Give information about the creative process. You might do this by acquainting students with Wallach's four steps in problem-solving and by nothing some of heuristics.

11. Dispel the sense of awe of master-pieces. Indicate some of the methods and difficulties, experience brilliant and perfect insight of the first try.


13. Create 'Thorn in Flesh': Ask controversial questions and call attention to disturbing data.

14. Create necessities for creative thinking, confront your students with provocative problems. You might use the suggestions of Bruner and Biggs as guide.

15. Provide for active and quite periods. Remember the impact of habitual set and functional fixedness.

16. Make available resources for working out ideas.

17. Encourage the habits of working out the full
Type I enrichment called "General Exploratory Activities" gives students opportunities to 'sample' a variety of topics outside the regular curriculum. It may involve such activities as guest speaker, film strip or films or media presentations, or work with interest development centres in classroom.

Type II Enrichment called "Group Training Activities" which provide opportunities for learning process, inquiry and methodological skills involves teaching students 'process' skills including methods of problem-solving, thinking skills research or inquiry method of a general nature, and method of research that are specific to disciplines in which students are particularly interested.

Type III Enrichment called "Individual and small group investigation of real problem" call for students to become producers of knowledge. Thus, it places a strong emphasis on defining a real problem, formulating an original solution developing a product and sharing the results or products with appropriate guidance. It involves a problem for which the student has considerable motivation and emotional investment (task committees). Type III opportunities arise from the student's involvement and personal commitment to solving a particular problem in an effective and creative way.
2.4.3 Creative Learning Model:

Treffinger has presented a model of creative learning that involves three levels of sequential stages. It is illustrated in Fig. 5. The model emphasizes that creative learning involves with a cognitive and affective dimension. Students thinking and feeling process must be considered as teachers plan ways to enrich their learning in creative ways.

Level I is called 'Divergent Functions'. In this level, students learn to use the basic tools that will enable them to work successfully with complex reasoning and problem-solving task. It includes many enjoyable and popular activities such as brainstorming, attribute listing and scamper. They can be easily related to many content or subject matter topics at a variety of grade levels.

Level II is called "Complex thinking and feeling processes." At this level students learn and practice more complex methods and systems for creative thinking and problem-solving.

Level III of the model is called 'Involvement in Real Challenges'. At this level, students develop

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Cognitive
Independent Inquiry
Self-direction
Resource Management
Product Development
"The Practicing Professional"

Affective
Internalization of Values
Commitment to Productive Living Toward Self-actualization

Cognitive
Application
Analysis
Synthesis
Evaluation
Methodological and Research Skills
Transformations
Metaphor and Analogy

Affective
Awareness Development
Open to Complex Feelings, Conflict
Relaxation, Growth
Values Development
Psychological Safety in Creating
Fantasy, Imagery

Cognitive
Fluency
Flexibility
Originality
Elaboration
Cognition and Memory

Affective
Curiosity
Willingness to Respond
Openness to Experience
Risk Taking
Problem Sensitivity
Tolerance for Ambiguity
Self-confidence

FIGURE 5: CREATIVE LEARNING MODEL.
Williams has adopted eighteen strategies as mentioned below:

1. Paradoxes:
   There are self-contradictory statements or observations which the student has to explain.

2. Attributes:
   There are inherent properties, conventional symbols or identities and ascribing qualities involved in a given information.

3. Analogies:
   If there exist situations of likeness, similarities between things, the comparison of one thing to another is called Analogies.

4. Discrepancies:
   Gaps of limitations in knowledge, missing links in information are unknown. Here the student has to find such discrepancies.

5. Provocative questions:
   Provocative questions lead the student towards inquiry to bring forth meaning, incite knowledge exploration, summons to discovering new knowledge.

6. Examples of change:
   This strategy provides opportunities for making alternations, modifications and substitutions.

7. Examples of Habit:
   In the classroom, generally the thinking is
developed traditionally. There are less chances of building sensitivity against the rigidity in ideas and well tried ways. Such habit should be developed in a classroom.

8. Organized Random Search:

Here using a familiar structure one has to go at random to built another structure. Thus, the new approaches occur at random.

9. Skills of Search:

Search for ways something can be done in three ways.

(i) Historical Search

(ii) Descriptive search, and

(iii) Experimental search.

such situations develop the skill of search.

10. Tolerance for Ambiguity:

This strategy provides situations with puzzle, intrigue or challenge thinking. Here there are open-ended situations which do not force closure.

11. Intuitive Expression:

Intuitive expression arises the feeling about the things to all the senses. It is the skill of expressing emotion. To develop expressing emotion one should be sensitive to inward hunches or nudges.

12. Adjustment to development:
Developing many options or possibilities from the informations, one has to adjust to proper one. Here the students learn from their mistakes or failures.

13. Study Creative People and process:

Here the students have to analyse traits of eminently creative people. They study the process which lead to problem solving, invention, incubation and insight.

14. Evaluate Situations:

The student has to evaluate the situation by deciding the possibilities by their consequences and implications. They have to check or verify ideas and to guess against the facts.

15. Creative reading skill:

This strategy developed to mind-set for using information that is read. They learn the skill of generating ideas by reading.

16. Creative Listening Skill:

In this strategy the students learn the skill of generating ideas by listening. Here they have to listen for information allowing one thing to lead to another.

17. Creative Writing Skill:

In this strategy the student learns the skill of communicating ideas in writing. Here they have to learn the skill of generating ideas through writing.

18. Visualization:

This strategy emphasizes to express ideas in visual
forms. Here students have to illustrate thoughts and feelings. Moreover, one has to describe experience through illustrations.

**Dimension-3** Pupil Behaviour

Lists of four cognitive and four affective pupil behaviours as end of results or objectives to be derived from lesson ideas. These become ways pupils can produce by using content presented through certain strategies. Enabling pupils to be productive by thinking and feeling in these eight ways becomes the main emphasis in this type of teaching and learning. The eight behaviours are spelled out in detail as follows:

**Cognitive behaviour (Intellective)**:

1. **Fluent Thinking**:
   Here the student can think in the different ways. He can generate the ideas and gives a flow of thought. The fluent thinking depends upon the number of relevant responses given by the student.

2. **Flexible Thinking**:
   In this thinking student applies the various approaches to the situation. Thus, the variety of kinds of ideas are gathered. Flexible thinking measures the ability to shift categories of the responses given by the student.
3. Original Thinking:
Original thinking means to think in novel or unique ways. Keeping in view the given situation, the production of unusual responses or clever ideas are always away from the obvious responses or common responses. It depends upon the number of novel or unique responses.

4. Elaborative thinking:
Elaborative thinking means to add something to the situation. To stretch or expand upon the things and ideas which leads towards the elaborative thinking. It embroiders upon a simple idea or response to make it more elegant.

Affective Behaviours (Feelings):

The four feeling processes are curiosity, risk taking, complexity and imagination. They are also as important as thinking process. They are related to another important area of educational objectives which deals with attitudes, values, appreciations and motivations of the pupil who wants to do something with information and facts.

1. Risk Taking
In risk taking the student has courage to expose oneself to failure or criticism to make a guessing, to function under conditions of unstructured condition and to defend himself with his own ideas.
2. Complexity:
In this affective area, the student is challenged to seek many alternatives, to see gaps between how things are and how they could be and to bring order out of disorder situations.

3. Curiosity:
The students are always curious to think about the new situation. Here student is willing to be inquisitive and wonder, to be open to puzzling situations, to ponder the mystery of things and to follow a particular hunch just to see what will happen. Here the student is willing to toy with the ideas.

4. Imagination:
Imagination is a main factor to develop the creativity. Here the student has the power to visualize and build mental images, to dream about things that have never happened. Students can feel intuitively and reach beyond sensual or real boundaries.

The above model was tried and tested across all ability levels of pupils and was found to be good. F.E. Williams had developed two volumes of "Classroom ideas for encouraging thinking and feeling." The ideas are meant for three levels of students. They are primary, middle and upper grades. They were found to be effective with slow, average and fast learners. Williams' claim is that all pupils are creative to an extent and it is possible
2.6 Attitude towards Mathematics:

Attitude is a word used to refer to a general tendency of an individual to act in a certain way under certain conditions.

According to Allport (1935)¹⁰

"An attitude is a mental and neural state of readiness, organised through experience, exerting a directive or dynamic influence upon the individual's response to all subjects and situations with which it is related."

Teacher has to develop favourable attitude towards Mathematics because achievement depends upon attitude.

Teachers have an important role in forming the attitudes of pupils. They play a major role in pupil's achievement. They also possess the potential to transfer their own attitude towards mathematics to their pupils. Pupils have positive attitudes when they see mathematics as useful and interesting and when they have good teachers. Pupils develop poor attitude when they did badly or when they found mathematics as uninteresting. Good teachers can produce positive attitudes in their students.

Most instruments and items used for measuring attitude towards mathematics actually measure attitudes toward characteristics of mathematics. The characteristics concern to mathematics educators are problem solving, usefulness, importance, relevance, elegance, difficulty and interest.

Attitude towards teaching practices are mostly sought from teachers. When students respond with positive attitude towards teaching practices, the results are often interpreted in relation to course or teacher evaluation.

There are five categories for attitude assessment.

1. Self-reports.
2. Observation of behaviour in a natural setting.
3. Reaction to partially structured stimuli.
4. Performance on objective tasks.
5. Psychological reactions.

But the most widely used method is self-reporting.

Many studies were undertaken at improving mathematical achievement and attitude. While giving a treatment many variables are to be considered. Attitude towards the subject is one of the factor that effects in achievement so that investigator had taken attitude as a dependent variable while implementing the programme.
2.7 Relationship between the Cognitive and Affective Domains:

It is known that human behaviour can rarely be neatly compartmentalized in terms of cognition and affect. It is easier to divide educational objectives and intended behaviours into these two domains. However, even the division of objectives into these two groups is somewhat artificial in that no teacher or curriculum worker really intends one entirely without the other.

There is a great deal of research which demonstrates that "Cognition and affect can never be completely separated." (Roussell, David H)\(^\text{11}\) But even more interesting are the possibilities that one is in large part the effect of the other.

There have been many who take the view that interest will arise from increased information about some area of knowledge— that if one will forget all about the affective objectives, they will "naturally" arise from the development of the cognitive objectives. More recently a number of workers (e.g. Bruner, 1960)\(^\text{12}\) have felt that

\[\text{References} \]


it is the process of problem solving and discovery in learning that will bring about increased motivation for the subject and all the appropriate interests and attitudes. Their view is that it is not so much what is learned, but how it is learned, which will determine the affective objectives that will be attained at the same time as the cognitive objectives.

There are also some educators who believe that the primary problem is one of motivating students. If the students develop appropriate affective behaviours, then the learning of the subject matter (Cognitive objectives) will take place at a very rapid rate and at a high level of complexity.

The writers are persuaded that, although there may be varying relations between cognitive and affective objectives, the particular relations in any situation are determined by the learning experiences the students have had. Thus, one set of learning experiences may produce a high level of cognitive achievement at the same time that it produces an actual distaste for the subject. Another set of learning experiences may produce a high level of cognitive achievement as well as great interest and liking for the subject. Still a third set of learning experiences may produce relatively low levels of cognitive achievement but a high degree of interest and liking for the subject. There is a suspect that all three situations are not only
theoretically but actually possible. What is true in any given situation has rarely been investigated because one has not had the necessary instruments to study both cognitive and affective outcomes simultaneously. It is to be hoped that an increased emphasis on affective objectives, and the development of appropriate instruments and research designs will enable educational research workers to resolve some of these issues in both theoretical and more practical and specific educational situation.

2.8 **Summary**:

This chapter contains the theoretical perspective of models of teaching. Teacher's role in developing creativity in the classroom is described. It involves the description of Williams' model in detail. Relationship between cognitive and affective domain is explained in brief.

The review of related studies are taken in the next chapter.