Because creativity is a word which has recently been taken over by science from religion, it is almost impossible to discover it in a dictionary or encyclopedia more than a decade old. It is a new concept, recently attributed to the personality of man and still fraught with some mystical connotations.

- Demos, Gowan & Torrance (1967)

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1.1 **Introduction**

Looking at the ancient educational system, it can be concluded that education in those days was mainly based on the power to memorize. As that education was related to one or the other type of scriptural studies, religious or spiritual matters were given prime importance and Mantras or Ruchā (रुचाः) had to be learnt by heart. Thus not for years or decades but for centuries together, in absence of development of any sort of mass-media for the expansion of education, the stress given on the power to memorise, encouraged the process of cramming. We must note here that although the educational system was not very clearly shaped and gave importance to the power of memory, after certain stages of education, thinking and meditating, debates and discussions had also their due place in it.

That is why various ancient treatises are available today, which contain in them long expositions, commentaries or glosses on the Mantras or verses. In these old treatises certain doctrines are established, and some others are refuted. Thus in order to understand and expound the
accepted doctrines in a popular way, the development of intellect, logic and creativity was really very much important.

Mention should be made of the fact that the original concept of creativity is clearly shown in the Vedic and post-Vedic literature. Not only that but we also have the 'Ruchās' of the 'Rigveda' which accept creativity as a mental faculty. Although different stages of the process of development of creativity are spiritually discussed in the post-Vedic literature, systematic teaching for the development of creativity is nowhere visible. Because of this, right up to the beginning of this century, creativity was considered to be a supernatural power of a God-given gift. Creativity was also not accepted as an independent mental ability either in the modern education system or in the modern science. Creativity was believed to be the monopoly of the chosen few only. As a result of this, various capacities of an individual such as understanding, memorising, thinking etc., were considered to be the different aspects of intellect, and through the comprehensive study of intellect the process of understanding the development of an individual was given great importance and considered vital.
1.2 **Intelligence**

That the school should insist that each pupil must achieve the maximum, which he is expected of is a motto often heard in educational circles. But behind that well-meaning phrase lurk the impelling problems. How does one know what a person's capacity is? Can it be defined or measured? Does a child have a general capacity to acquire knowledge or are there many different capacities, each specific to a given type of knowledge? These are all relevant questions. Psychologists have been using various labels such as capacity, potential, intelligence, aptitude, an ability to identify or construct that appear to be useful in helping to assess various kinds of behaviours.

Similarly intelligence has many pseudonames. Lyman says,¹ "mental maturity, scholastic aptitude, general ability, mental ability, college ability, primary mental abilities etc." The term intelligence is used widely in psychology and education. There is no commonly accepted definition of its specific meaning. Therefore it is better to classify and study the definitions arrived at by several psychologists.

According to Mehrens & Lehman, the definition of intelligence generally falls into one of the following patterns.

* ability to think abstractly,
* ability to learn,
* ability to integrate new experiences and adapt to new situations.

First group of definition (by Binnet, Terman, Garrett, Rexknight) emphasises upon the ability to carry abstract thinking. It means the effective use of concepts and symbols in dealing with situations.

The second group of definition (Buckingham, Thorndike, Woodworth, Dearborn) lays stress on ability to learn. The child with greater general ability possesses extensive ability to learn and to gain wide range of experiences.

The third group of definition (Burt, Pintner, Warren, Freeman) states that it is an ability to integrate the new experiences and adapt to new situations. It is the ability to recognize one's behaviour pattern so as to act more effectively and more appropriately in novel situations.

Is intelligence a single quality and ability, or is it a complex quality or ability? This question opens an avenue in developing theories of trait organisation. Halstead has characterised the theory of intelligence in terms of a number of factors and traits as below:

1. Unit Factor Theory (Binet, Terman & Stern)
2. Two Factor Theory (Spearman)
3. Group Factor Theory (Holzinger & Hermann)
4. Multi Factor Theory (Thurston & Guilford)

Guilford J.P. (1956) proposed a box-like model structure of intellect - SI model. Its one dimension is operation. Operation indicates the mental processes performed or activity involved. He further narrated five groups of operation abilities: cognition, memory, convergent thinking, divergent thinking and evaluation.

1.3 Intelligence and Creativity

Most of our education is concerned with promoting convergent thinking, the kind of thinking in which students

are encouraged to find the 'right answers' to the problems. Such a process assumes that there is only a single right answer and that it exists somewhere, usually in the textbook or in the course of study.

Divergent thinking, as the term implies, has to do with such thought processes or speculation, imagination and invention processes, which stem from the above assumption and implies that there may be several good ways to solve a problem.

In as much as most of the class instructions, fact oriented as they are, are concerned with convergent thinking. Students do not have to think divergently to get top grades. Divergent thinking is usually regarded by teachers as irrelat ed, time wasting or totally 'wrong' and is likely to go unrewarded. The routine admonition 'Don't guess' is indicative of the bias against divergent thinking. Most standardized objective tests, including tests of intelligence measure convergent thinking, which may be one of the reasons that they are correlated so highly with teachers' marks. Convergent type of thinkers refrain from guessing and are not inclined to answer a question, if they do not know the answer.

This state of affairs has led many people to become concerned with teaching methods and measures that penalise
creativity and that may even place creative students at a disadvantage. The fact is shown by a study conducted by Getzels & Jackson (1962) who compared teachers' reactions to highly creative and highly intelligent school students. Teachers reported that they personally preferred the high intelligent students to high creative group.

Possibility of resolving differences between those who favour 'creativity' and those who favour 'intelligence' lies in the fact that the difference between these two abilities may not be as great as Getzels & Jackson's research may imply. In fact the usual finding is that the relationship between measures of creativity and intelligence is modest, but is nevertheless statistically significant. Of particular importance is the tendency of persons with high I.Q.s to show a great range of creativity i.e. from high to low, whereas persons of low I.Q., generally show only low creativity scores. Thus high IQ does not guarantee high creativity, but appears to make it more feasible.

It also seems very likely that a good proportion of students, who score high on intelligence tests would also score high on tests of creativity. Yamamoto (1964) found that 24 out of 54 gifted students were high on both creativity

and intelligence. Such students are "twice talented" and do not present any special problem for the teachers, for they are flexible enough to solve problems by convergent or divergent thinking, whichever is more appropriate. The problem is more of the high I.Q. student, who has not developed skill in divergent thinking, and of the highly creative student, who might be ignored by compelling him to use convergent thinking. There is also a problem of encouraging many students to use more of their creative skills and do more divergent thinking. One solution to these problems of how to raise the level of creativity for all students is that of providing more opportunities in the classroom for divergent thinking.

1.4 Towards the Problem

Though a student with high creativity is sometimes a problem for school teachers and yet he may prove the most respected and intelligent citizen of the whole world. The teachers' predictions based on the I.Q. score or school results proved quite reverse in that a child appearing to have high intelligence in school career turned out to be a very ordinary citizen and inversely a very ordinary looking child proved to be a citizen possessing eminent personality later on. It proves that the norms which are accepted for the selection of individuals with high traits
and grades at school levels are found to be erroneous and wanting. Till the latter half of this century no one could explain or understand clearly why it so happened. All the educationists and psychologists were so far groping in the dark in the matter concerning evaluation of the students for the predictions of their personality and intelligence. Just at that time in 1950 the famous president of American Psychological Association Mr. J.P. Guilford drew attention of the whole world to the fact that utter disregard of an important mental ability known as creativity was responsible for such absurd results.

Creativity is an important mental trait, which includes (i) ability to solve the problem tactfully, (ii) courage, (iii) imagination, (iv) patience (v) free thinking (vi) to correlate the past experiences with reference to the problem and such other different factors. If creativity is a concept, which includes these things, then it is a type of mental ability aseem to intelligence but not a part of intelligence. This truth was realised by the psychologists and educationists after Guilford’s hint. Having gained new light, many researches and projects were started in this direction.

The progress that the world has achieved since 1950 and onwards in the field of science and technology is
extremely marvellous. Credit for these achievements should be attributed to the realisation of the importance of creativity that has dawned upon the developed countries. Seeing this phenomenal progress of developed countries, the developing country like India also places more emphasis on the concept and development of creativity. From this point of view any research on creativity is not only useful for the nation but also is a pious duty of a real educationist in the present circumstances.

During the last two decades, however, our nation has taken strides in space science. This progress is amply proved by the fact that several artificial satellites have been sent in the space for the purpose of education and telecommunication. When we think of researches carried out in the field of creativity in India, we are convinced that the scientific progress has direct relation with creativity. In the beginning of this decade the research worker read the review of the work done in this field in India, which gave inspiration to start such work in Gujarat so that it can be useful for our next generation. For this reason the following topic is undertaken.

1.5 Statement of the Problem

"An investigation into the impact of Divergent Thinking Programme in Mathematics on the creative levels of the children of Classes VII & VIII".
of the given problem. This is the development process of creativity. Moreover it is an innate ability latent in all the persons in different measures. Schools should encourage this ability by preparing proper atmosphere, because the creativity is a mental trait, which is partly a heredity factor and partly an environmental factor.

By the positive results of different projects in education all over the world, we are convinced of the necessity to overhaul our educational system completely for the better development of modern sciences and technology. Moreover the developed countries like America and Russia have accepted the importance of creativity and have introduced this type of approach in their present education. Being a developing country, India also must think over the necessary change in the educational system. Our nation has started to think and do something in this direction. U.P. and M.P. are leading states in education from creativity aspect today. It has been possible due to rich contribution of Dr. Baker Mehdi, Dr. B.J. Passi, Dr. Surendranath Tripati and others in this field. In Gujarat very little work in creativity has been done. So this research work, which has been carried out for Gujarati medium students of urban area, will prove its worth in course of time.
The creativity programme of this study can be used for the secondary students of Gujarati medium for one semester. For our convenience and good comparison maximum two problems should be given fortnightly. Thus one term will cover totally twelve problems. This large span of time will be more useful for the development of creativity in teenagers all over Gujarat. Any city of Gujarat can start this programme along with its traditional education. Academic institutions can discover and bring out real personalities lying dormant in their teenagers.

This study has been carried out on the students coming from the families of higher socio-economic condition. So it will be useful for upper middle class students to develop their creative thinking. This study is purely based on Mathematics and hence it will help the school children create interest in the school-subject like Mathematics, which is generally considered to be dry and uninteresting. This programme may help the students develop interest in other subjects like languages and drawing too. The whole programme has a very high impact on educational interest of the student, although he may have low calibre in his school subjects. Side by side this study will be useful to our growing kids of any sex to develop positive attitude towards education. As the study has been carried out on the
students, having chronologically transitional age, it will help channelise their aptitude in the proper direction.

1.8 Limitations of the Study

As usual this study has also its limitations, which we discuss as follows:

1. As the study has been carried out on the students of only one school of a city like Ahmedabad, it is too small a sample to generalise the norms regarding creativity for the whole state like Gujarat.

2. The sample is purely from the urban area, so it may not be equally useful for the rural students.

3. Students selected for the sample are coming from economically upper middle class families. Hence it is not possible to predict about the creativity development of the students coming from other socio-economic levels.

4. The selected sample school is one of the best schools in Gujarat. The students have generally very good I.Q. So it may not be applicable to the students having lower I.Q. than 100.

5. As only one educational institution is selected for the research work, conclusions drawn from the study may prove misleading.
6. The programme is useful only for the Gujarati speaking students, as the programme is prepared in Gujarati.

7. For administrative convenience, 4 sub-tests out of 6 sub-tests of Passi's test of creativity were selected in order to measure creativity.

1.9 Plan of the Report

The report of the study has been compiled in eight chapters. The purpose of the chapterization is explained below:

The first chapter gives comprehensive outline of the
study.

The second chapter explains due place of creativity
in the ancient era and in the modern science. Along with
the concept, the definitions and the components are
described. Finally the relation between the creativity and
education are shown with the hurdles and encouragements.

The third chapter deals with the popular research
work on creativity. In this chapter the layout of some
researches are described. The description is made into two
parts (a) Abroad and (b) in India.
The fourth chapter deals with the study undertaken from the following points of view: The planning, construction and the tryout of divergent thinking programme in Mathematics.

The fifth chapter gives the methodology of the statistical analysis. It covers the points like the information of statistical tools, available for the study and the appropriateness of the tool which is used for the analysis.

The sixth chapter shows the statistical analysis. The ANCOVA method is applied to study creativity Grade, Sex and component-wise.

The seventh chapter deals with the t-test for Grade difference and sex difference in creativity. Moreover, the ANCOVA for 2x3 factorial experiment is to be used to check the interaction effect of treatment and creative levels.

This is the last chapter. It concludes the research work undertaken and recommends for future guidance and further actions.