A Study of Pattern Identification Ability of Mathematics Students using 'Self Guided Learning Method' and 'Teacher Guided Learning Method' exposed to the constructivist approach

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Abstract:

A Study of Pattern Identification Ability of Mathematics Students using 'Self Guided Learning Method' and 'Teacher Guided Learning Method' exposed to the constructivist approach.

Children are curious, inventive and constantly ask queries. In childhood they grow and change. This involves developing one's physical and mental capacities to the fullest. The child is a natural learner, and knowledge is the outcome of the child's own activity. Learning is acquiring new or modifying existing knowledge, behaviors, skills, values, or preferences and may involve synthesizing different types of information.

Objectives of the study

1. *To assess the Pattern Identification Ability of Mathematics students using Self Guided Learning Method exposed to the constructivist approach.*
2. *To assess the Pattern Identification Ability of Mathematics students using Teacher Guided Learning Method exposed to the constructivist approach.*
3. *To compare the Pattern Identification Ability of Mathematics students using Self Guided Learning Method exposed to the constructivist approach and students using Teacher Guided Learning Method exposed to the constructivist approach.*

Research Method*-Experimental Method was used*

Statistical Analysis Used: Anova and Tukey's Test

Analysis And Interpretation:

*On the basis of '**F**' test researcher observed that*

- *the gender will have no significant effect on student score.*
- *the treatment does have significant effect on student score.*
- *the interaction of gender and treatment will have no significant effect on student score.*

Tukey's HSD was found to be = 1.78

The teacher guided constructivist approach was most effective since the difference in the means was the highest when compared with control group.

Key Words : *Constructivism, Learning, Constructivist assessment of learning, Secondary School Stage, Mathematics, Mathematics Laboratory.*

I. INTRODUCTION

Children are curious, inventive and constantly ask queries. They actively engage with the world around them, exploring, responding, inventing and working things out, and making meaning. In childhood they grow and change. This involves developing one's physical and mental capacities to the fullest. The child is a natural learner, and knowledge is the outcome of the child's own activity. Learning is acquiring new or modifying existing knowledge, behaviors, skills, values, or preferences and may involve synthesizing different types of information.

Theories about human learning can be grouped into four broad "perspectives". These are

Behaviorist	-	focus on observable behavior
Cognitive	-	learning as purely a mental/ neurological process
Humanistic	-	emotions and affect play a role in learning
Social	-	humans learn best in group activities

Constructivism is associated with cognitive psychology. Constructivist learning is knowledge construction based on

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the assumption that the learner will actively create and restructure knowledge in highly individual ways, through experience learning. It recognizes the construction of new understanding as a combination of all prior learning, new information and readiness to learn.

Basic Principles underlying Constructivism are:

1) Learners construct new understanding using what they already know,
2) Learning is an active process in an interactive environment, student centered, and domestic.
3) The teacher facilitates a learning environment in which students are encouraged to be responsible and autonomous.

Constructivism emphasizes the importance of the knowledge beliefs and skill of individuals that brings the experience of learning. It recognizes the construction of new understanding as combinations of prior learning, new information and readiness to learn. Individual makes choices about what new idea to accept and how to fit them into these established views. Constructivism is a theory describing how learning happens, regardless of whether learners are using their experiences to understand a lecture or following the instructions for building a model airplane. In both cases, the theory of constructivism suggests that learners construct knowledge out of their experiences.

In India if any subject area of study evokes wide emotional comment, it is mathematics. Among children (who are compelled to pass mathematics examinations) there is often fear and anxiety. By Class III or IV, many children start seeing themselves as unable to cope with the demands made by mathematics. In high school the maximum numbers fail in mathematics. In class X the Indian state issues a certificate of education to a student. The largest numbers of Board Exam failures also happen in mathematics.

In 1937, when Gandhiji propounded the idea of basic education, the Zakir Husain committee was appointed to elaborate on this idea. It recommended: 'Knowledge of mathematics is an essential part of any curriculum. Every child is expected to work out the ordinary calculations required in or his personal and community concerns and activities.' The Secondary Education Commission appointed in 1952 also emphasized the need for mathematics as a compulsory subject in the schools. In line with the recommendations of the National Policy on Education, 1968, when the NCERT published its "Curriculum for the Ten Year School", it remarked that the 'advent of automation and cybernetics in this century marks the beginning of the new scientific industrial revolution and makes it all the more imperative to devote special attention to the study of mathematics'. It stressed on an 'investigatory approach' in the teaching of mathematics. The National Policy on Education 1986 went further: Mathematics should be visualized as the vehicle to train a child to think, reason, analyze and to articulate logically. Apart from being a specific subject, it should be treated as a concomitant to any subject involving analysis and reasoning. The National Curriculum Framework for School Education (NCFSE) 2000 document echoes such sentiments as well. Yet, despite this history of exhortations, mathematics education has remained pretty much the same, focused on narrow aims.

The shift in focus should be from mathematical content to mathematical learning environments, where a whole range of processes take precedence: formal problem solving, use of heuristics, estimation and approximation, optimization, use of patterns, visualization, representation, reasoning and proof, making connections, mathematical communication. Giving importance to these processes also helps in removing fear of mathematics from children's minds. A crucial implication of such a shift lies in offering a multiplicity of approaches, procedures, solutions. This is crucial for liberating school mathematics from the tyranny of the one right answer, found by applying the one algorithm taught. Such learning environments invite participation, engage children, and offer a sense of success.

Thus in this scenario the impact of Constructivist approach in Learning Mathematics in the Indian Education system becomes more than necessary than ever before and hence this research on the impact of **Constructivist approach** on **Self guided learning** and **Teacher guided Learning** is undertaken by the researcher.

Rationale:

Need For Research:

The need for research can be seen from the following

The National Curriculum Framework 2005, of India, in its *second chapter* *establishes the need to recognize the child as a natural learner, and knowledge as the outcome of the child's own activity. Our current concern in curriculum development and reform is to make it an inclusive and meaningful experience for children, along with the effort to move away from a textbook culture. This requires a fundamental change in how we think of learners and the process of learning. Hence the need to engage in detail with the underpinnings and implications of 'childcentred' education. 'Child-centred' pedagogy means giving primacy to children's experiences, their voices, and their active participation. This kind of pedagogy requires us to plan learning in keeping with children's psychological development and interests. The learning plans therefore must respond to physical, cultural and social preferences within the wide diversity of characteristics and needs. Our school pedagogic practices, learning tasks, and the texts we create for learners tend to focus on the socialization of children and on the 'receptive' features of children's learning.* ***Instead, we need to nurture and build on their active and creative capabilities—their inherent interest in making meaning, in relating to the world in 'real' ways through acting on it and creating, and in relating to other humans.*** *Learning is active and social in its character. Frequently, the notions of 'good student' that are promoted emphasize obedience to the teacher, moral character, and acceptance of the teacher's words as 'authoritative' knowledge.*

Children's voices and experiences do not find expression in the classroom. Often the only voice heard is that of the teacher. When children speak, they are usually only answering the teacher's questions or repeating the teacher's words. They rarely do things, nor do they have opportunities

to take initiative. The curriculum must enable children to find their voices, nurture their curiosity—to do things, to ask questions and to pursue investigations, sharing and integrating their experiences with school knowledge—rather than their ability to reproduce textual knowledge. Reorienting the curriculum to this end must be among our highest priorities, informing the preparation of teachers, the annual plans of schools, the design of textbooks, learning materials and teaching plans, and evaluation and examination patterns.

As per the NCF 2005, developing children's abilities for mathematisation is the main goal of mathematics education. The narrow aim of school mathematics is to develop 'useful' capabilities, particularly those relating to numeracy–numbers, number operations, measurements, decimals and percentages. The higher aim is to develop the child's resources to think and reason mathematically, to pursue assumptions to their logical conclusion and to handle abstraction. It includes a way of doing things, and the ability and the attitude to formulate and solve problems.

At the secondary stage, students begin to perceive the structure of Mathematics as a discipline. They become familiar with the characteristics of mathematical communication: carefully defined terms and concepts, the use of symbols to represent them, precisely stated propositions, and proofs justifying propositions. These aspects are developed particularly in the area of geometry. Students develop their facility with algebra, which is important not only in the application of mathematics, but also within mathematics in providing justifications and proofs. At this stage, students integrate the many concepts and skills that they have learnt into a problem-solving ability. Mathematical modeling, data analysis and interpretation taught at this stage can consolidate a high level of mathematical literacy. Individual and group exploration of connections and patterns, visualisation and generalisation, and making and proving conjectures are important at this stage, and can be encouraged through the use of appropriate tools that include concrete models as in ***Mathematics laboratories*** *and computers.*

Statement of the Problem

Study of Pattern Identification Ability of Mathematics Students using ***Self Guided Learning Method*** *and T****eacher Guided Learning Method*** *exposed to the constructivist approach.*

II. OBJECTIVES OF THE STUDY

1. To assess the Pattern Identification Ability of Mathematics Students using **Self Guided Learning Method** exposed to the constructivist approach.
2. To assess the Pattern Identification Ability of Mathematics Students using T**eacher Guided Learning Method** exposed to the constructivist approach.
3. To compare the Pattern Identification Ability of Mathematics Students using S**elf Guided Learning Method** exposed to the constructivist approach and students using **Teacher Guided Learning Method** exposed to the constructivist approach.

III. HYPOTHESES

1. The gender of the student has no effect on the Pattern Identification Ability of Mathematics Students using **Self Guided Learning Method** exposed to the constructivist approach **AND** Mathematics Students using **Teacher Guided Learning Method** exposed to the constructivist approach.
2. There is no significant difference in the achievement of Pattern Identification Ability of Mathematics Students using **Self Guided Learning Method** exposed to the constructivist approach **AND** Mathematics Students using **Teacher Guided Learning Method** exposed to the constructivist approach.

Conceptual Definitions of Terms in the Study

Constructivism

Constructivism is a theory of knowledge that argues that humans generate knowledge and meaning from an interaction between their experiences and their ideas.

Learning

Learning is acquiring new or modifying existing knowledge, behaviors, skills, values, or preferences and may involve synthesizing different types of information.

Constructivist assessment of learning

Assessment of student learning is of two types: formative and summative. Formative assessment occurs during learning and provides feedback to the student. It includes evaluations of ongoing portfolios, and demonstrations of work in progress. Summative assessment occurs through tests and essays at the end of a unit of study. Summative assessments provide little specific feedback. From a constructivist perspective, formative assessments are more valuable to the learner, but with the focus on marks obtained in exams, it is very difficult to harmonize formative and summative assessments.

Secondary School Stage

Students studying in std VI to std X in Schools imparting formal education as per the Central Board of Secondary Education

Mathematics

It is the study of quantity, space, structure, and change

Mathematics Laboratory: A room designed and equipped for conducting hands on activities in Mathematics.

Scope of Research:

1) Geographical - This research involves the students of CBSE schools in std. IX and studying mathematics. Mathematics is a compulsory subject for students studying in CBSE schools.
2) Social – The study involves all the students of secondary schools irrespective of their socio-economic status, caste, creed, race, language and colour.
3) Educational – The educational psychologists and teachers are concerned with 3 focal areas in education viz. The learner, the learning process, and the learning Situation. This study includes area of the 'Learning processes' in education.

IV. LIMITATIONS OF RESEARCH

1) This research is limited to the schools following CBSE curriculum prescribed by the NCERT.
2) This research is limited to the city of Nagpur.
3) This research is limited to Bhavan's B.P. Vidya Mandir, Srikrishna Nagar, Nagpur.
4) This research limited to the students studying in std. IX only.
5) This research limited to the Academic Achievement of students in Pattern Identification Ability .

V. BODY TEXT

RESEARCH METHODOLOGY

Research Method-Experimental Method was used

POPULATION AND SAMPLE:

i) Population- Students studying in STD IX in the secondary schools following CBSE curriculum constitute population of study.

ii) Sample and Sampling Technique –A minimum of 90 students were selected from the population (schools implementing the CBSE curriculum in and around Nagpur) using Multi Stage Sampling Technique.

Population Strata	Sample Size		Total	Sampling Technique to be used
	Boys	Girls		
Schools following CBSE curriculum	45	45	90	Multi Stage Random Sample

Research involves study of the

Constructivist Approach – self guided learning

Constructivist Approach – teacher guided learning

Hence the sample will be further divided as follows

Population Strata	Treatment			Total	Sampling Technique to be used
	Control Group	Experimental 1	Experimental 2	90	
Schools following CBSE curriculum		self guided learning	teacher guided learning		Multi Stage Random Sample
Boys	15	15	15	45	
Girls	15	15	15	45	

Action Plan

Sex	N	Distributing the students in 3 groups	Phase I Pre Test	Phase II Experiment	Phase III Post test
Boys	45	Data related to student's achievement in mathematics was collected. Based on this data students having equal achievement were divided in 3 groups	1) Students' Pattern Identification Ability was measured.	1)15 of these learnt the concept using normal technique. 2)15 were subjected to Self Guided Learning technique 3)15 were subjected to Teacher Guided Learning technique	1) Students' Pattern Identification Ability was measured.
Sex	**N**	**Distributing the students in 3 groups**	**Phase I Pre Test**	**Phase II Experiment**	**Phase III Post test**
Girls	45	Data related to student's achievement in mathematics was collected. Based on this data students having equal achievement were divided in 3 groups	1) Students' Pattern Identification Ability was measured.	1) 15 of these learnt the concept using normal technique. 2) 15 were subjected to Self Guided Learning technique 3) 15 were subjected to Teacher Guided Learning technique	1) Students' Pattern Identification Ability was measured.

VI. TOOLS OF RESEARCH:

Researcher developed relevant tests to assess the achievement of the learners in Mathematics.

Independent Variables:

1. self guided learning method
2. teacher guided learning method

Dependent Variable:

1. Test Scores

Precautions to be observed:

Following precautions were observed during course of experiment for ensuring effectiveness and high precision in experimental condition, which may have contributed to results.

- All the subjects were oriented to the tests and Self Guided Learning Technique and Teacher Guided Learning Technique as per their treatment in beginning of the treatment.
- Care was taken to ensure that no undue stress or control of any kind was imposed on the subjects at any time during the study and the experiment was conducted in relaxed natural setting.
- It was ensured that the material provided to the students for testing, treatment or during orientation was adequate to meet their demand.

Hypothesis : There is no significant difference in the achievement of Pattern Identification Ability of Mathematics Students using **Self Guided Learning Method** exposed to the constructivist approach **AND** Mathematics Students using **Teacher Guided Learning Method** exposed to the constructivist approach.

To test this Hypothesis following Null Hypotheses were formed

H01 : Gender will have no significant effect on student score.

H02: Treatment will have no significant effect on student score.

H03: the interaction of gender and treatment will have no significant effect on student score i.e. the effect of treatment on scores does not depend on gender.

VII. RESULT AND DISCUSSION

The summary of the data obtained on Pattern Identification Ability is presented in the table below:

Summary Pattern Identification Ability	Control group	Self guided Constructivist approach group	Teacher Guided Constructivist approach group	Total
BOYS				
Count	15.00	15.00	15.00	45.00
Sum	434.00	602.00	689.00	1725.00
Average	28.93	40.13	45.93	38.33
Variance	8.64	7.98	7.21	58.50
GIRLS				
Count	15.00	15.00	15.00	45.00
Sum	432.00	583.00	675.00	1690.00
Average	28.80	38.87	45.00	37.56
Variance	8.60	4.70	13.14	54.03
Total				
Count	30.00	30.00	30.00	
Sum	866.00	1185.00	1364.00	
Average	28.87	39.50	45.47	
Variance	8.33	6.53	10.05	

The ANOVA calculation for this data is shown in the table below :

Table No.2

ANOVA - PATTERN IDENTIFICATION ABILITY

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Gender	13.61	1.00	13.61	1.62	0.21	3.95
Treatment	4242.29	2.00	2121.14	253.19	0.00	3.11
Interaction	5.09	2.00	2.54	0.30	0.74	3.11
Within	703.73	84.00	8.38			
Total	4964.72	89.00				

VIII. ANALYSIS AND INTERPRETATION OF ANOVA FOR PATTERN IDENTIFICATION ABILITY:

1] From Table No. 2, researcher observed that : the calculated *F* test value for H01 is 1.62 and the *F crit* value for d.f. 1 is 3.95, i.e. here calculated *F* value < *F* critical.

On the basis of '*F*' test researcher observed that the probability associated with the calculated value of '*F*' is very large (0.21 > 0.05) , hence the above Hypothesis is accepted i.e. gender will have no significant effect on student score.

2] From Table No. 2, researcher observed that : the calculated *F* test value for H02 is 253.19 and the *F crit* value for d.f. 2 is 3.11, i.e. here calculated *F* value > *F* critical.

On the basis of 'F' test researcher observed that the probability associated with the calculated value of 'F' is negligible (0.00 < 0.05), hence the above Hypothesis is rejected and alternative Hypothesis is accepted i.e. treatment does have significant effect on student score.

3] From Table No. 2, researcher observed that: the calculated F test value for H03 is 0.30 and the F crit value for d.f. 2 is 3.11, i.e. here calculated F value < F critical. On the basis of 'F' test researcher observed that the probability associated with the calculated value of 'F' is very large (0.74 > 0.05) , hence the above Hypothesis is accepted i.e. interaction of gender and treatment will have no significant effect on student score.

Since the two way ANOVA showed a significant difference in test scores among the three groups based on treatments, a POST-HOC TUKEY'S HSD test was done.

IX. POST-HOC TUKEY'S HSD FOR PATTERN IDENTIFICATION ABILITY

Following table shows the means and variances for the three different groups:

Table No. 3

PATTERN IDENTIFICATION ABILITY	Control group	Self guided Constructivist approach	Teacher Guided Constructivist approach
Mean	28.87	39.50	45.47
Variance	21.15	13.10	12.93

From Table No 3, the researcher observed that the teacher guided constructivist approach was most effective since its mean was the highest. (45.47 > 28.87 and 45.47 > 39.50).

It was subjected to Tukey's HSD test to check whether the difference was statistically significant or not.

The calculations for Tukey's HSD are as follows: q (the studentised range statistic) = 3.374 ($\alpha = 0.05$, df = 84, k = 3)

Tukey's HSD was found to be = 1.78

Each difference between means was compared to the HSD. The difference is significant if it is at least as big as the HSD.

Table No. 4

GROUPS	Difference		Tukey's HSD	Significant
Control group vs. Self guided Constructivist approach group	10.63	>	1.78	Yes
Self guided Constructivist approach vs. Teacher guided Constructivist approach group	5.97	>	1.78	Yes
Control group vs. Teacher guided Constructivist approach group	16.6	>	1.78	Yes

From Table No 4 the researcher observed that the difference between all the pairs was statistically significant.

The magnitude of the effect was calculated using ω2

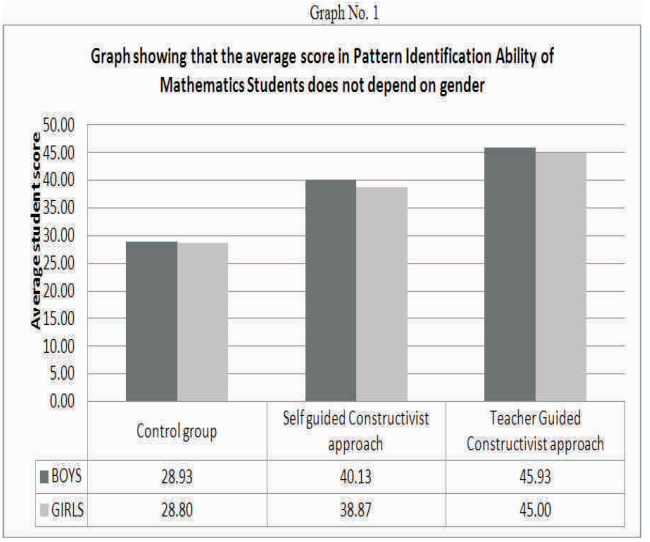
$$\omega^2 = \frac{SS_{between} - (k-1)\,MS_{within}}{SS_{total} + MS_{within}} = 0.67$$

This indicates that 67% of the variability in the pattern identification ability scores of Mathematics Students was due to the type of treatment they received.

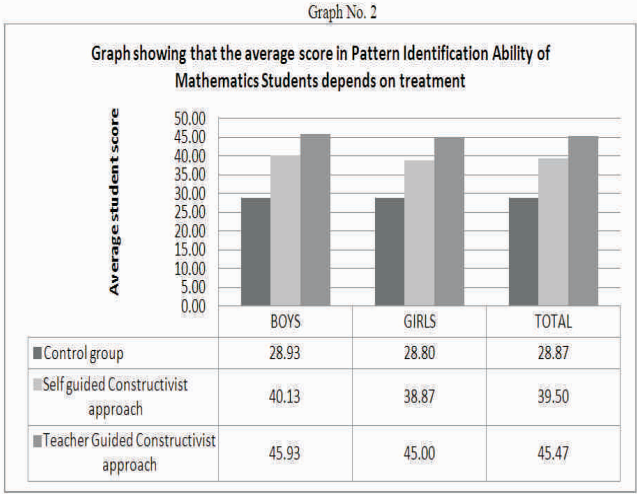
X. CONCLUSIONS

1. Gender will have no significant effect on student score.
2. Treatment does have significant effect on student score.
3. Interaction of gender and treatment will have no significant effect on student score.
4. The teacher guided constructivist approach was most effective since the difference in the means was the highest when compared with control group.
5. 67% of the variability in the pattern identification ability scores of the students was due to the type of treatment they received.
6. Following graphs depict the results observed above:

Graph No. 1



Graph No. 2



	BOYS	GIRLS	TOTAL
Control group	28.93	28.80	28.87
Self guided Constructivist approach	40.13	38.87	39.50
Teacher Guided Constructivist approach	45.93	45.00	45.47

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