A study of effectiveness of content×strategy matching in teaching Geometry of the upper primary level students.

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Abstract:
In the present system of Geometry teaching, students are taught in Expositional method, which we call traditional for a long time. But we find that after learning geometry through this process Students often fails to solve new problems.

Conceptually through Expositional teaching by providing facts, principles, relations etc., the frame of the discipline can be made clear to the learners. But the purposes of the geometry teaching do not end there. The main objectives are to verifying the truth of proposed relations within the frame of application of relations to solve problems. Expositional teaching can hardly meet these requirements.

So, the investigator had tried to evolve such an effective method of geometry teaching, called Propositional teaching through which student's retention will be higher, transferability and deduction ability will be created. They will be able to think rationally in proper way to solve a new problem situation. The investigator thought that for the teaching learning of upper primary classes, there is likely to be the best match of content × strategy to make teaching most effective. The present paper showed that the students achieve more through content×strategy match than through content× strategy mismatch. The cause of failure seems to be in mismatch.

Keywords: *Content×Strategy Match, Content×Strategy mismatch, Propositional teaching, Expositional teaching.*

1. Introduction

Geometry is the science of space and space relations. It deals with the position, shape and size of bodies and the structural relations among parts but has nothing to do with their material or physical properties. So far geometry learning, students require rationality and ability for abstract thinking.

Geometry is essential for upper primary students as well as the higher courses because the major purpose of geometric instruction at this stage is to inculcate in the students an appreciation for logical demonstration to help them develop effective methods of clear impartial thinking, critical evaluation and intelligent generalisation; to train them in the discovery of truth and to introduce them to the solving of geometrical problems. Every student should acquire a comprehensive knowledge of geometric facts, concepts and processes; an intimate acquaintance with the nature of deductive reasoning; and some facility in the application of geometry for the better interpretation and appreciation of one's environment.

Geometry contains some definitions, postulates, assumptions etc.

Geometrical judgements are of two types:

1. Judgements of some relations of hypotheses, these are called proposition.
2. Constructions of limited space figures abiding some space relations.

The main objectives of geometry teaching are:

A. To enables the learners to acquire—

1. Knowledge of a mass of geometric facts.
2. Knowledge of geometric principles of equality, symmetry and similarity as implanted in the very nature of things.

B. To develop in the learners—

3. Rationality and ability of judgement based on different forms of reasoning.
4. Ability of verifying hypotheses related to spatial relations.
5. Ability to solve problems related to spatial relations.

Since the learning of proposition is not always based on concrete experiences, so the knowledge of space relation should be deep. For this reason, learning of proposition is less effective at knowledge level, it should be taken at the understanding level. The index of this level is the ability of problem solving.

There are so many methods of geometry teaching, but school teachers teach geometry through so called traditional method. Materially it is only the exposition of some content presented in the text and is a form of expositional teaching. Teachers expose all the facts and students learn it passively. As a result, most of the students of higher classes in secondary schools are not familiar with the geometrical relation and they are not able to apply their knowledge to solve a problem in new context. They can not work out extra proposition given as exercises. Through expositional teaching as is practised main purposes of geometry teaching are not fulfilled. Proper way of thinking, rationality, power of judgement is not evolving in the students.

It is normally found that most of the students of upper primary level as well as secondary level avoid the problems given in the question paper to solve. They only answer the part that can be reproduced from memory.

Students develop a fear for geometry and as a result, they try to avoid it at the first chance. As they do not learn the theorems at the level of deeper understanding, they can not remember geometrical facts and fail to recall data necessary to verify even the simplest proposition. As such they depend very much on rote memorization. From experiences of some school teachers, the investigator realised that these difficulties are due to the lack of clear concept in geometry. Proper methods of teaching may eliminate student's difficulties. The investigator realised not only proper method but for the teaching learning of each classes there is likely to be the best match of content × strategy to make teaching most effective.

2. Expository Teaching Strategy

Expository teaching is a learning situation within which the entire content of what is to be learned is presented to the learner in the final form. This is teacher centred learning usually occurring through massed verbal instruction, drill and competitive games. According to Carrol (1964), "Expository teaching is very successful in teaching concepts and principles. Expository teaching offers the students the best opportunity to obtain an organised view of the discipline he is studying because the teacher can organise the field much more effectively for learning than the novice student can."

Expository teaching is the situation in which the teacher gives both the principles and the problem solutions. The usual verbal instruction of the lecture hall exemplifies expository teaching. It is sometime called deductive teaching because the teacher often begins with a definition of the concepts or principles illustrate them, and unfolds their implication

3. Expository (Traditional) Teaching Model

3.1 Syntax

Situation creation by teacher through simple announcement.
|
Presentation of content logically with explanations, references and examples.
|
Presentation of deductive verification of principles and relations.
|
Evaluation.

3.2 Social System

The social system is highly structured; classroom environment is fully controlled by teacher. The successful acquision of learning units depends on learner's desires and on teacher's presentation and organisation of learning units. It is completely guided by the teacher. Goal fixed by the authority.

3.3 Principles of interaction

Teacher is seen as dominator. Teacher controls student's responses. Teacher will try to shape student's responses according to the objectives. He will select appropriate responses of the students and will help in promoting a critical approach to know.

Support System

The support sustem for Expository model should be extensive responsive to the need of the teacher for delivering the lesson appropriately. Well organised material is required for this model. Teacher will help the students in preparing materials. This model provides guidelines for building instructional materials.

Instructional and Nurturant Effects

1. Meaningful assimilation of information and ideas.
2. Concept's formation about the units.
3. Creation of interest about the subject.
4. Development of the habits of precise thinking.

Propositional Teaching Strategy

Propositional teaching is learning situation within which the entire content is evolved through the interaction of student thinking with previous knowledge. The teacher with his or her knowledge of the logical order of operations guides the learners through these interactions. He helps co-ordinate group thinking though interacting questions, identifying and recording evolved data, pointing to the ultimate and immediate goal or target.

The strategy helps,

1. To develop the skill of solving cognitive problems.
2. To develop the skill of verification of proposition.

The strategy is not teacher centred. Learning easily occurs through the logical development of the content. It is a teaching situation, in which the teacher gives only the problem situation as a goal, guidance to reach the goal and date needed. The students have sufficient scope to search for the goal and propose the alternative concepts or theorems from the problem situations and to verify those with the help of teacher's guidance.

Propositional Teaching Model Syntax

Evaluation of entry level preparation ---- Remediation of learning gaps ---- Orientation to the context ---- Enunciation of rule or principles(proposition) ---- Specification—describing the rule in specific

context ---- Planning for verification ---- Collection of data ---- Data organisation ---- Argumentation ---- Conclusion ---- Evaluation ---- Feedback and remediation.

Social system

Social system is democratic. The activities of the group emerge with a minimal amount of the external structures provided by the teacher students and teachers have equal status except role difference.

Principles of Instruction

Teacher helps students only in making correct hypothesis and students are directed to right verification. Interaction between students and teacher is very high through question answer. The teacher's role is one of the councillors, the facilitator and the reflector. Teacher must direct the group and guide the group to get the solution of the theorems.

Support System

Chart of previous knowledge necessary for the proof of the propositions.
Instructional and Nurturant Effects:

A. 1. Concept and skill development.
   2. Interaction process development.
   3. Knowledge about logical approach.
B. To develop the skills of
   1. Critical thinking & decision making.
   2. Self learning.
   3. Respect for dignity of all.

Content –Strategy Matching

If any special type of content can be taught by a special type teaching strategy more effectively and students can reach at the criteria of mastery learning, then it can be said that the strategy is match with that content. Learning materials are prepared for selected content; the components of strategies were kept in view.

The purpose of this study is to find out, whether students achieve more through content ×strategy match than through content ×strategy mismatch. Also, the purpose of the study is to evolve an effective method of Geometry teaching; called Propositional teaching.

Objectives

1. To find out the homogeneity of the students of control group and experimental group.
2. To find out the relation between the pre test scores and post test scores of the students.
3. To find out whether Content ×Strategy match in teaching geometry is superior to Content ×Strategy mismatch.

Content ×Strategy Match: Propositional content ×Propositional Strategy
Content ×Strategy Mismatch: Propositional Content ×Expositional Strategy

Null Hypotheses

H_{01}: There is no significant difference between the pre test scores of the control group and the pre test scores of the post test scores of the experimental group.
H_{02}: There is no significant difference between the pre test scores and post test scores of the students.
H_{03}: Post test scores of Contents ×Strategy Match group is not greater than Content ×Strategy Mismatch group.

Methodology

Population: All students of class VIII of West Bengal.

Sample: Students of two sections of class VIII of two schools Vivekananda vidyapith and Srinanda High School from Birbhum district and one school Shibkumar Horijon Vidyalay from Burdwan District. Number of students is 180.

Sampling technique

a. Two schools from Birbhum district and one school from Burdwan district were selected randomly from the schools those were ready to co-operate.

b. One of the two sections was allotted to the experimental strategy by randomization in each of three schools.

Variables

A. Independent Variables.

A_1. Content variables: fixed.

A_2. Content ×Strategy:

Variations: (i) Match, (ii) Mismatch.

B. Dependent Variables:

Student's Achievement.

C. Error variables and intervening variables:

C_1. Previous knowledge of the students

C_2. Learning ability of students.

C_3. Teacher's efficiency and personality influence.

Intervening variables:

C_4. Contamination (students)

C_5. Teacher's carryover.

Method of controlling variables

Variables	Sources	Controlling phase	Controlling Process
1. Student's Achievement (D.V.)	Evaluation	Test	Using same test.
2. Learning content(E.V.)	Content	Planning and Experimentation	Teaching same selected content.
3. Previous Knowledge(E.V.)	Students	Planning and Experimentation	Previous knowledge test and ANCOVA.
4. Learning ability of students.(E.V.)	Students	Analysis of Data	ANCOVA
5. Teacher's efficiency and personality. (E.V.)	Teacher	Planning and Experimentation	Teaching by the same teacher
6. Contamination. (I.V.)	Students	Experimentation	Content rotation
7. Teacher's carry over(I.V.)	Teacher	Experimentation	Same teacher with content rotation

Tools

A. Instructional tools:

A_1. Instructional schedule for the students.

A_2. Learning Materials:

i. Lesson plan for Expository teaching.

ii. Lesson plan for Propositional teaching.

iii. Data Chart.

B. Measuring Tools.

B_1. Entry level Behaviour test (used as pre-test).

B_2 Achievement test based on the unit selected for the study. (Used as post-test).

Construction of Tools

All the tools constructed by the Investigator were standardized by the Experts of different area.

A. Instructional tools

To use the Propositional and Expositional strategy, learning materials were constructed on four propositions of geometry based on four propositions of geometry based on angel side relationship. This was done through the following phases:

Phase -I:

The objectives of teaching were identified and expressed in cognitive behavioural terms.

Phase -II:

Learning elements were identified and arranged in a sequential order.

Phase III:

1. Geometric knowledge necessary to verify the proposed relations were identified. A progressive data chart was made with these materials and made ready for display.

2. The four selected propositions were made into two clusters on the basis of similarity of content. Two sets of lesson notes were prepared to teach through the two strategies. The lesson plans were evaluated against the objectives.

B. Measuring Tools

Entry Level Behaviour test:

The test items were constructed by the Investigator, from the selected elements for the entry level behaviour test and the test was standardized by the experts of different universities. The final test consists on 20 items and content validity is considered to be high by the judgement of the experts. Reliability of this test was measured from try out by Rational Equivalence Method and was found to be 0.76. So, the test can be considered as highly reliable.

Construction of Post test:

Schematic plan of Test construction

Item Assembling ---- Blue-Print ---- Item Selection (40 items0 ---- Presented to teachers and Experts (10 items were rejected) ---- Modification ---- Preliminary test (30 items) ---- try out ---- Rejection of items (10 items) ----Preparation of Final Test (20 items) ---- Try out and determination of reliability.

Difficulty index of the test items was from 0.25 to 0.75. Content validity is considered to be very high. Reliability of the test was found to be 0.87, which is very high. It was found by the help of Kudar Richardson's formula in Rational Equivalence Method.

Procedure: After construction of all the tools, the Investigator at first gave the instructional schedule to the students and then the entry level behavioural test was administered upon two sections of class VIII of each of the previously stated schools. Evaluating the response-sheet, the Investigator took a remedial class for those students, who were backward in particular area. It had been seemed the all the students came the same level of previous knowledge. Then Investigator took one section for Expositional teaching, strategy B and another section for Propositional teaching, strategy A by randomization. After a week of completion of the content an evaluative test which was constructed before was administered. Data were collected from evaluating all response- sheets.

Statistical analysis of various data, were done in order to find out mainly the effectiveness of content-strategy match in Geometry teaching. For statistical analysis, Investigator took 30 scores (10 student's scores from each school) from controlled group and 30 scores (10 student's scores from each school) from experimental group randomly.

In order to test $H_0$1, ANCOVA had been done between the mean pre test scores of controlled group and experimental group.

To test $H_0$2, the coefficient of correlation between pre test scores and post test scores was obtained through Product Moment method.

To test $H_0$3, ANCOVA had been done between pre test scores and post test scores of total students followed by t-test.

Analysis and Interpretation of data

First purpose of the study was to find out the homogeneity between the scores of controlled group and experimental group.

ANCOVA is used to determine homogeneity.

Table-1 showing F test results of the two groups from analysis of pre-test scores

	ss	df	v
Total	297.34	59	
Among	2.4	1	2.4
Within	294.94	58	5.08

F = 5.08/2.4= 2.12 < 4.00

F is not significant at 0.05 level. Therefore, it can be said on the basis of pre-test scores, two groups were homogeneous.

Second purpose of the study was to find out the relation between the pre-test scores and post-test scores.

Table-2 showing correlation between pre-test scores and post-test scores

sstx	297.34
Ssty	473.34
sstxy	133.67

r = 133.67/√(297.34×473.34) =0.36>0.325

r is significant at 0.01 level. Its degree of freedom is 58.

So, it is clear that pre-test scores and post-test scores are correlated significantly.

Third and main purpose of this study was to find out whether content× strategy match in geometry teaching is superior to content× strategy mismatch.

Table –3 showing Analysis of covariance of post- test scores on pre- test scores

	Ssy.x	df	v	σ
Total	413.25	58		
Among	198.44	1	198.44	
Within	214.44	57	3.76	1.92

F= 198.44/3.76= 52.77> 7.08.

F is significant at 0.01 level meaning thereby: the two groups differ according to their variance.

Table 4 showing 't'-test results of two groups from their adjusted mean scores

	MY.X(Adjusted)
Gr.A--	18
Gr. B--	15.33

SED = 0.49

t = 918-15.33)/0.49 = 6.79> 2.66.

For df 58, t is significant at 0.01 level, meaning thereby achievement of group A is significantly higher than that of group B.

Findings & Discussion:

The study was conducted to find out whether content×strategy matching could affect in learning of the students. Also, the study was conducted by the Investigator to reveal the effectiveness of two teaching strategy in teaching propositional content of geometry. One is Propositional and another is Expositional or Traditional. Keeping the entry level behaviour in view, the homogeneity of two groups, controlled and experimental, was verified by 'F'-test. It was found that 'F' is not significant at 0.05 level. So, two groups were taken to be homogeneous initially.

The findings of this study showed that there is a positive significant correlation between pre-test scores and post test scores of the students.

Finally, the study showed that content×strategy match is superior to content× strategy mismatch. ANCOVA was adopted for analysing the data and it reveals that F is significant at 0.01 levels. To verify the gain of the strategies't' test was adopted and the result indicates't' is significant at 0.01 level, so propositional strategy is superior to Expositional strategy.

It can be said that, in case of propositional content, students learn more through propositional teaching than through expositional teaching. This implies that matching of content × strategy is an effective and it is a mean of improving student learning through classroom teaching. Here is an indication that a content character and Teaching strategy match is more effective than a mismatch.

Although to understand the teaching learning effectiveness more clearly, many other matches are to be identified and their effectiveness verified, such studies indicate the need for change in the emphasis on curricular studies in Upper primary education and teacher education.

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