Effect of Duval's Semiotic Approach on Higher Order Thinking Skill in relation to Brain Dominance

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ABSTRACT *The currentresearch investigation, for which apretest was conducted and subsequently a post test was given to judge the efficiency of Duval's Semiotic approach on Higher Order Thinking Skill in relation to four parts of Brain Dominance (Left, Right, Integrated and Mixed) is an experimental Work.A sample of 268 mathematics students of class X waschosen by the researcher. 132respondents were included in the experimental group and 136 students were in thecontrol group. Apretest of Higher Order Thinking Skill was given to both the groups, investigator had given a 40 days treatment based on Duval's semiotic Approach to the experimental group, which were then administered a post test of HOTS. The results show that Duval's Semiotic Approach was an effective intervention strategy to develop the HOTS of the mathematics students.*

Keywords: *Duval's Semiotic Approach, Semiotic Register, Higher Order Thinking Skill and Brain Dominance,*

1. Introduction

Mathematical discussion is full ofsigns, formula and figure and Raymond Duval has developed a mechanism to depict the potentials and difficulty of functioningwith several representations of such, conceptual, numerical entities. A symbolic depiction or indication consists of a mattersignifier instead of something: the signified. The material stuff that is changed in order to create representations is denoted medium.

Numerical objects are sometimes representations of a very technological nature. Raymond Duval (2006) stresses that a mathematical object always has more than one semiotic depiction linkedto it. Duval points to both the facts as a basic problem with imparting instruction in mathematics; it is very easy to see the mathematical object as being one of its representations.

Most of the original potential in mathematics begins from change of semiotic representations (e.g. calculations). Duval explains two qualitatively dissimilar types of changes of semiotic representations: Treatments and Conversions.

1.1. Duval Semiotic Approach

We know what semiotic representations are in general terms; still the schemais not completely drawn. We still can analyze several angles about semioticrepresentations and specially their importance in mathematical activity.Nowwe will introduce thethree cognitive activities which play a main role in the activity of representation andat the same time are the fundamental cognitive activities of semiosis, these activitiesare:

Formation - of representations in a particular **semiotic register** either to express mental representations or to recall a 'real' object.

Treatments are changes inside a semiotic classification (or mode), such asrewording a sentence or separating*x* in an equation.

Conversionsare changesin the system while keeping the similartheoreticalposition, such as moving from an arithmetical to a geometric illustration of a line in the plane.

Duval (1995, p.21) says a semiotic system of representation is called a **register of semiotic representation** when it satisfies the three cognitive activities which areinherent to all representations.

1.2. Higher Order Thinking Skill

Higher order thinking includes decisive, rational, insightful, metcognitive, and original thinking. They are stimulated when a person comes acrossunknown problems, doubts, queries, or dilemmas .Explanations, decisions, performances, and products are the outcomes of the successful implementation of this skill and they are applicable within the framework of available knowledge and understanding.Higher order thinking skills have their basis in lower order skills such as discriminations, simple function and investigation, and intellectual methods and are related to previous knowledge of subject matter content.

Suitable teaching methods and learning environments assist their development along with the student determination, self-monitoring, and unbiased, flexible attitudes.

Resnick (1987) higher order thinking can be conceptualized as a non-algorithmic, intricatestyle of opinion that often gives many solutions. Such thinking involves doubt, application of numerous criteria, manifestation, and self-regulation.

1.3. Brain Dominance

Brain dominance is the utilization of the altered sides of the brain for gaining knowledge and listening patterns Itis the continuous of use of one side of the brain more than the other side. Brain dominance indicates the preferred way of learning, comprehending and conveying something (Herrmann, 1995). The brain is used to explain the thinking styles of the brain. A function may rely more on one hemisphere than the other (e.g., language, motor control), the notion that one hemisphere is governing and the other is non-dominant is quite simple for telling most tasks (Gabbard, 1997). Brain Dominance is also called Brain-Based Learning or Hemispheric Dominance or Cerebral Dominance.

2. Review of Related literature

Mcmahon (2009) studied the association between learners working in a technology-rich surroundings and their improvement of higher order thinking abilities. The findings show that there are statistically important correlations between learning in a technology-rich surroundings andimprovement of learners' critical thinking skills.

Santos and Curi (2011) performed a study to show how the theory Raymound Duval on the registers of semiotic representation can configure as teaching tool in the teaching of physics, taking into account the need for articulation and mobilization of math concepts for solving tasks in physics. They concluded that the memorization of formulas is not enough for solving tasks in physics and the difficulties of students can be focused on transit through different registers of representation on the same job, which is associated with cognitive appeal required for conversions.

Venkataraman and Jebakumari (2015) explored the influence of brain dominance in activating multiple intelligence of the higher secondary students in selected schools of Chennai district. A descriptive survey study in which data was collected from 1000 students of both boys and girls with the help of the standardized SOLAT tool and validated multiple intelligence tool. The study reveals that students with integrated brain dominance were found to have greater language intelligence, reasoning intelligence, creative intelligence, social intelligence, naturalist intelligence, value oriented intelligence and artistic intelligence. Students with left brain dominance were found to have greater sports intelligence. Students with integrated brain dominance and right brain dominance were found to have greater visual intelligence. Computer intelligence was greater for students with right and left brain dominance. Students with mixed brain dominance were found to have greater emotional Intelligence and value oriented intelligence

Khan and Singh (2016) investigated the relationship between the style of learning and thinking and academic performance of the students and other sub-questions. SOLAT developed byVenkataraman (1994) was administered on 200 students of 12th standard and the major finding was that there exists no noteworthyassociationbetweenintellectualsupremacy and scholastic performance of learners.

3. Objectives

The present study was conductedbyobservance in vision the subsequent objectives:

1. To study the effect of brain dominance on higher order thinking skills.
2. To study effect of two instructional strategies (DSA vs. CGL) on higher order thinking skills.
3. To study the interactive effect of brain dominance and two instructional strategies (DSA vs. CGL) on higher order thinking skills.

4. Hypotheses

H1: No significant difference exists in the Higher Order Thinking Skill scores of students at the four levels of Brain Dominance (Left, Right, Integrated and Mixed).

H2: There is no significant difference in the Higher Order Thinking Skill scores of students learning through two instructional strategies (DSA vs. CGL).

H3: There is no significant interaction outcome of Brain Dominance and two instructional strategies on Higher Order Thinking Skill.

5. Tools

Subsequent research tools were used in present study.

1. Duval's Semiotic Approach (developed by the investigator himself)

2. Higher Order Thinking Skill (developed by the investigator himself)
3. Brain Dominance (Venkataraman, 2014)

6. Sample

The data for the present investigation was collected from268 higher and secondary school students comprising of 157boys and 111 girls from 4 schools belonging to private type of management .The study is undertakenin the schools ofAmritsar district of Punjab.

7. Results

In this segment by using various statistical techniques the hypotheses of the research investigation was verified as given below:

Table 1. Summary of ANCOVA to test the effect of Brain Dominance on HOTS

Sources of variation	Sum of Squares (SS)	df	Mean Sum of Squares (MSS)	F-ratio	Level of Significance
Main Effect: (B) Brain Dominance (LBD/IBD/RBD/MBD)	8.756	3	2.919	.341	N.S.

Hypothesis H1:

Brain Dominance

It may be observed from the table 1 that F-ratio, testing the main effect ofBrain Dominance on Higher Order Thinking skill was not found to be significant even at the 0.05 level of confidence, leadingto supporting the hypothesis *H1 No significant difference exists in Higher Order Thinking Skill of students with four levels of Brain Dominance (Left, Right, Integrated and Mixed).*It may be concluded that HOTS mean scores were not significantly different for different groups of students with brain dominance (Left, Right, Integrated and Mixed).

Table 2. Summary of ANCOVA to test the effect of Instructional Strategies (DSA vs. CGL) on HOTS

Sources of variation	Sum of Squares (SS)	df	Mean Sum of Squares (MSS)	F-ratio	Level of Significance
Main Effect: (A) Instructional strategies DSA and CGL	566.636	1	566.636	66.106	.01 level

Hypothesis H2:

Instructional Strategies (DCM and CGL)

It may be observed from the table 2 that F-ratio, testing the main effect for two instructional strategies viz. DSA andCGL was observed to be significant at the 0.01 level of confidence, indicating that bothgroups differ significantly on their means as measured by the HOTS. Hence, the hypothesis H2 stating that N*o significant difference exists inHigher Order Thinking Skill of students studyingthrough instructional strategies (DSA vs. CGL)*was rejected at specified level. It may be inferred that the HOTS mean scores were significantly different fordifferent groups of students learning through the two instructional strategies. Thesedifferences have been further investigated with the help of t-test. The Means, SD andt-ratios for the differences between HOTS adjusted mean ofdifferent combination group- DSA and CGL were computed and have been reportedin Table 3.

Table 3: Adjusted Mean and t-ratio for difference on Post -Test scores of HOTS for DSA and CGL

Group	N	Adjusted Mean	SD	t-value	Level of significance
DSA	132	23.11	12.98	3.52	0.01 level
CGL	136	18.29	9.15		

The table 3 reveals that the t-ratio for the variation in Post Test HOTS scores of DSA and CGL (t= 3.52) was found to besignificant at the 0.01 level of confidence, suggesting that the Post TestHOTS means score of students learning through two instructionalstrategies differed beyond the contribution of chance factor. An examination of theircorresponding means suggested that DSA yielded higher HOTS mean (M=23.11) than CGL (M=18.29).

Mean gain scores of main effect corresponding to instructional strategies (DSA and CGL) on Higher Order Thinking Skill are depicted through bar diagram figure1.

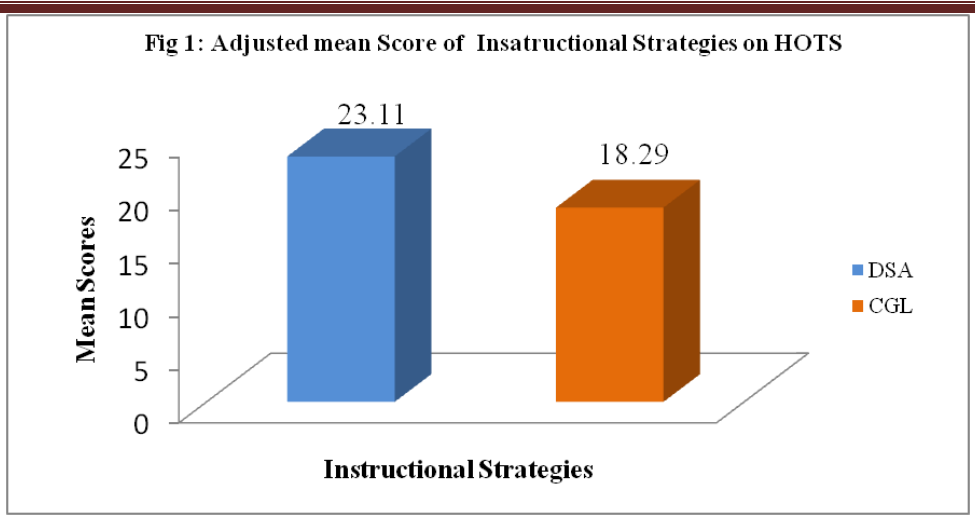

Figure 1 show that means scores of group taught through Duval's Semiotic Approach is more than group taught through conventional learning on Higher Order Thinking Skill.

Table 4.Summary of ANCOVA to test the effect of interaction effect of Brain Dominance and instructional strategies on Higher Order Thinking Skill.

Sources of variation	Sum of Squares (SS)	df	Mean Sum of Squares (MSS)	F-ratio	Level of Significance
Interaction (A X B) Instructional Strategies × Brain Dominance	20.231	3	6.744	.787	N.S.

Hypothesis H3:
Interaction Effect: Instructional Strategies × Brain Dominance

The table 4showsthat F-ratio, testing the interaction effect ofInstructional strategies and Brain Dominance Higher Order Thinking skill was not found to be significant even at the 0.05 level of confidence, leadingto supporting the hypothesis *H4There is no significantinteraction effect of Brain Dominance and two instructional strategies (DSA vs. CGL) on Higher Order Thinking Skill.*It leads to concluded that interaction effect of Brain Dominance and instructional strategies on Higher Order Thinking Skill is not significant.

8. Conclusion

From the above study it was conclude that

- The mean score of Left, Right, Integrated and Mixed Brain Dominance groups were not significantly different on HOTS.
- The HOTS mean scores were significantly different for groups of students learning through the two instructional strategies (DSA and CGL).
- Students studying through DSA achieved higher means (23.11) than those who were studying in a CGL situation (18.29) on Higher Order Thinking Skill.
- The interaction effect of instructional strategies (DSA/CGL) and levels of Brain Dominance (Left, Right, Integrated and mixed) yielded not significantly different Higher Order Thinking Skill means score.

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