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A COMPARATIVE STUDY OF THE FACTORS PREDICTING THE RECALL OF GEOMETRIC TERMS AMONG STUDENTS WITH AND WITHOUT HEARING IMPAIRMENT

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Abstract:-Mathematics education requires a strong foundation. The strong foundation in students is laid through compulsory Mathematics learning in schools. The curricula are organized in a graded fashion so that students in lower classes need to master the basic skills in order to move to the next skill. Once they move to the next skill, they need to recall and apply what they have learnt before, because of the internal correlation within the subject. Hence, recalling abilities of students play a significant role in learning Mathematics. Researches done in this area have identified familiarity, concreteness, imagery and signability as the major factors influencing the recalling abilities of students (Lang and Pagliaro, 2007). The present study aimed to compare the ratings of familiarity, concreteness, imagery and signability of Geometric terms in recalling among students with and without hearing impairment. A total of 90 students with and without hearing impairment from special and mainstream schools participated in the study. The scores obtained on developed rating scales were treated statistically using Pearson correlation. The ratings on signability of geometric terms among students with hearing impairment was found better than that of their hearing peers. On the other hand, ratings on imagery of geometric terms among students without hearing impairment was found better than that of their hearing impaired peers.

Keywords: Recall, Familiarity, Concreteness, Imagery, Signability, Geometric Terms, Students with Hearing Impairment, Students without Hearing Impairment .

INTRODUCTION

Memory plays a major role in the learning of students. Recalling memory generally refers to the retrieval of information or events from the past. Recalling is considered as one of the three core process of memory. The information which is stored in the long term memory is being recalled in situations when there is need to solve problems. Like any other subjects, Mathematics learning demands the recall of information. According to Lang (2007), constructivist perspective in learning Mathematics and problem solving emphasises the importance of recalling information from both long term and short term memory. It is often observed that the recalling ability varies across students. Research studies of Lang and Pagliaro (2007) have documented the major factors affecting the recall of mathematical terms among students. The factors include (i) familiarity, (ii) concreteness, (iii) imagery, and (iv) signability.

Familiarity plays a major role in learning and recalling of the knowledge gained. The familiarity of a word or sentence is generally dependent upon the frequency of its occurrence and reinforcement received by the individual. Mayberry (2002) mentioned that, familiar words, whether signed or spoken, are more often recalled by deaf participants than unfamiliar words.
According to Lang and Pagliaro (2007), concreteness is defined as the real or actual thing that can be felt with the hands and seen with the eyes. The concreteness of the knowledge gained has an influence on the recall of the same, 'higher the concreteness, better the learning.' This is because students have the opportunity to see and feel as a part of learning. Majority of the teaching–learning strategies followed in the classrooms are developed based on the principle of concreteness.
Imagery is the ability to perceive mental pictures, not through the retina of the human eye but through the mind's eye (Lang & Pagliaro, 2007).Imagery serves as a mental blackboard and aids students in the recall of what they have learnt. Mental imagery strategies have been found to assist students in making connections between the abstract symbols of letters/words and concrete concepts within the reading process.

Students with and without hearing impairment encode information in a number of ways. Some uses speech based codes and some, sign based codes. Signability is the usage of sign based codes by the individuals to gain and retrieve knowledge and skills. According to Marschark et al. (2002), those who are signers often use sign language-based coding. The signability of the mathematical terms plays a major role in recalling the terms for students. Students who are signers often use more sign language-based coding than speech-based coding in memory tasks.

Research studies conducted in India revealed that recalling abilities of students with hearing impairment lag behind their hearing peers in Mathematics. However, in the light of current educational practices of inclusive education in the country is very important to identify which of the above mentioned factors influence the recalling abilities of students with and without hearing impairment. A study of this kind will enable the inclusive school teachers to identify the students characteristics for Mathematics learning and can plan appropriate strategies for better Mathematics learning. Hence, the present study was initiated.

OBJECTIVES OF THE STUDY

The study mainly aimed to compare the ratings of familiarity, concreteness, imagery and signability of Geometric terms in recalling among students with and without hearing impairment.

Explanation of Key Terms

(i)Recall: means the ability of the students in remembering the Geometric terms presented by the researcher.
(ii)Familiarity: means how well the individuals knew the meaning of the term,
(iii)Concreteness: means a real or actual thing that can be grasped with the hands or seen with the eyes and opposed to a definition of abstractness defined as an idea or concept in the mind -not a thing that can be touched,
(iv)Imagery: means the formation of mental pictures in the human mind,
(v)Signability: means how easy it would be for the students to use an appropriate sign for each of the selected Geometric terms,
(vi)Geometric Terms: Means vocabulary selected from the Mathematics text books of standard VI, VII & VIII based on the unit 'Geometry',
(vii)Students with Hearing Impairment: means children with hearing loss of 60 decibels or more in better ear in the conversational range of frequencies and studying in special schools, and
(viii) Students without Hearing Impairment: means children having normal range of hearing and studying in mainstream schools.

Hypotheses

i.There exists no significant difference in the ratings of familiarity of geometric terms among students with and without hearing impairment,
ii.There exists no significant difference in the ratings of concreteness of geometric terms among students with and without hearing impairment,
iii.There exists no significant difference in the ratings of imagery of geometric terms among students with and without hearing impairment,
iv.There exists no significant difference in the ratings of signability of geometric terms among students with and without hearing impairment.

Method

Research Design: Survey research design was followed

Sample

The sample selected for the present study included 45 students with hearing impairment from special schools, and 45 students without hearing impairment from mainstream schools on a random basis using lottery method. All of them were pursuing secondary education at the time of study.

Tools

Rating Scales

Four rating scales were used for the present study. The researcher prepared a word list (Table 1) from 6th, 7th and 8th standard Geometry portions. Content validity was drawn from the subject and field experts.

Table 1: Word list

Unit	Subunit	Items		
Geometry	**Shape**	Square	Rectangle	Sides
	Measurement	Length	Breadth	Area
	Lines	Point	Parallel line	Perpendicular
	Angle	Bisector	Interior angle	Right angle
	Triangle	Equilateral Triangle	Isosceles Triangle	Scalene Triangle
	Circle	Circle	Centre	Diameter

In order to obtain the students' ratings on the selected vocabulary in terms of the four identified factors, scales for rating were developed. In order to mark the responses, a four point scale was selected for inclusion in all the four rating scales. A four point scale (4= very familiar, 3= familiar, 2= some what familiar, 1= no idea) was selected for marking which best represents the degree to which they rate each term with its familiarity. A four point scale (4=very concrete , 3= concrete , 2=less concrete,1= not concrete) was selected for marking which best represents the degree to which they rate each term with its concreteness. Another 4 point rating scale (4=strongly agree, 3=agree, 2=disagree, 1=strongly disagree) was prepared for imagery . Finally, a 4 point rating scale (4=very easy to sign, 3= easy to sign, 2= difficult to sign, 1=very difficult to sign) was also developed to rate each term with its degree of signability.

All the developed rating scales were given to two experienced Master trainers for their suggestions. A pilot study was carried out on four students with and without hearing impairment and necessary changes were incorporated and modified in all rating scales.

Treatment and procedure for data collection

The researchers contacted the special and mainstream (regular) schools for permission and finalization of schedule for data collection. The participants were requested to understand and follow the instructions given by the researcher prior to participation. At the outset, familiarity rating scale was given to the selected participants personally. They were requested to follow the instructions and rate each word given in the scale based on the descriptive scale given .On completion, the dully filled rating scale from the selected participants were collected. The same procedure was followed for data collection based on the other three rating scales. The responses on the test and the four rating scales were evaluated. The qualitative data was converted to quantitative data for the convenience of analysis.

Result

Table 2 shows the details regarding the analysis carried out.

Table -2:'t' test analysis

Parameter	Group	Mean	SD	df	't'- cal	't'- tab	Level of significance	Result
Familiarity of Mathematics terms	A n=45	65.69	6.287	88	0.221	1.99	0.05	Not significant
	B n=45	66.58	6.437					
Concreteness of Mathematics terms	A n=45	48.97	11.692	88	0.684	1.99	0.05	Not significant
	B n=45	50.60	10.886					
Imagery of Mathematics terms	A n=45	64.09	5.984	88	2.199	1.99	.05	Significant
	B	66.75	5.486					
Signability of Mathematics terms	A n=45	62.09	6.395	88	2.327	1.99	.05	Significant
	B n=45	58.22	9.142					

From the analysis, following results were obtained:

i.There exists no significant difference in the rating of familiarity of geometric terms among students with and without hearing impairment'. The ratings of students with hearing impairment based on the familiarity of the geometric terms selected was similar to that of students without hearing impairment

ii.There exists no significant difference in the ratings of concreteness of geometric terms among students with and without hearing impairment'. The ratings of students with hearing impairment based on the concreteness of the geometric terms selected was similar to that of students without hearing impairment

iii.There exists a significant difference in the ratings of imagery of geometric terms among students with and without hearing impairment'. The ratings on imagery of the geometric terms among students without hearing impairment was found better than that of the students with hearing impairment

iv.There exists significant difference in the ratings of signability of geometric terms among students with and without hearing impairment'. The students with hearing impairment rated the signability of geometric terms better than the students without hearing impairment.

DISCUSSION

Familiarity of geometric terms and recalling ability

For the present study, familiarity was operationally defined as how well the students knew the meaning of the terms. The geometric terms selected for the present study were picked up from their mathematics text books. The teachers have taught all the selected geometric terms during their classes of study. In the course of time, students might have received several opportunities to come across with the same geometric terms again and again as a part of learning new knowledge and skills. Because of the frequent use of these geometric terms and intentional support that the students of both groups received from school, it is obvious that, they were equally familiar with the terms selected for the present study.

Gagne, Bell, Donald, Yarbrough and Weidemann (1985) in their study determined whether, familiarity affects retrieval of information independently of its well-documented effect on learning. The results indicated that familiarity affected both speed of original learning and amount of recall. The researcher interpreted that, highly familiar material is stored more elaborately in long-term memory and is therefore easier to recall than is moderately familiar material.

Concreteness of geometric terms and recalling ability

Concreteness is defined as the real or actual thing that can be felt with the hands and seen with the eyes. Generally in special and mainstream schools, teachers use the common strategy of experience based learning to teach students with and without hearing impairment. Wherever possible, explanations of the geometric terms are given either through simulation or direct experience for both the groups. Learning becomes permanent when the students have the opportunity to experience. Concreteness of the terms enables the students to experience and learn. Hence, concreteness of an object accelerated the learning process, which in turn contributes to better recall. The exposure and experience of students with and without hearing impairment might have enabled both the groups to rate each of the given mathematics terms equally on the basis of concreteness. Hence the result.

Sadoski, Goetz, Fritz (1993) conducted a research study on the effects of familiarity, concreteness, comprehensibility, and interestingness. The study found concreteness as the cause of comprehensibility. The result obtained further revealed that, concreteness has a potential impact on both immediate and delayed recall.

Imagery of geometric terms and recalling ability

Imagery was defined as the formation of mental image in human mind. It also shows the ability of an individual to develop a mental picture of the word when presented auditory or visually. As mentioned earlier, the methods and techniques followed for teaching geometry in special and mainstream schools are more or less the same. However; the hearing status, reading abilities etc. might have given the students without hearing impairment an added advantage in learning the geometric terms and developing mental images of those terms as compared to their hearing impaired peers. The strategies of learning the terms also vary from individuals to individuals. Some of them learn with the support of verbal language, some with the support of developing their own mental pictures, some with the support of experience. However it is often observed that, as compared to students without hearing impairment, students with hearing impairment are at a disadvantageous stage. They experience difficulty in developing mental pictures because of the language involved in these terms. Hence it is obvious that, deaf and hard of hearing students' rating of words based on imagery of words was below the ratings of their hearing peers.

Heinen, Cobb, Pollard (1976), conducted a study on 'word imagery modalities and learning in the deaf and hearing' to explore the modality specific hypothesis of imagery and concreteness. Twenty-four male and female deaf and hearing adolescents learned lists of paired associates that were either high visual and low auditory imagery words or the reverse. It was predicted that the deaf group would perform as well as the hearing group with pairs of high visual imagery, but worse with materials of high auditory imagery. The results failed to demonstrate the expected interaction.

Signability of geometric terms and recalling ability

Review of literature revealed that, students with hearing impairment encounter difficulties in education due to their hearing loss (Mathew & Mishra, 2010). The hearing loss cuts of them from the hearing world. Though, efforts are made to make use of the residual hearing, majority of students with hearing impairment predominantly use visual strategies for learning from inside and outside the schools. Right from young ages, they look for and utilize visual clues for learning. In special schools, teachers also teach geometry through various methods like inductive and deductive. However, teachers adapt these methods to suit the needs of these differently abled learners. Many teachers provide auditory and visual input (sign) while teaching. Hence, students with hearing impairment are exposed to signs right from the beginning. On the other hand, such opportunities are not provided to hearing students by their teachers and they focus more on auditory input and some signs and symbols. Hence, it is obvious that, the ratings of students with hearing impairment on signability of geometric terms were found better than that of their hearing peers. Additionally the students with hearing impairment participated in the study were selected from special school follow the philosophy of total communication as a method. Hence these students had the added

advantage of having sign language.

CONCLUSION

The present study thus concluded that the ratings on imagery of the geometric terms among students without hearing impairment was found better than that of the students with hearing impairment. On the other hand, signability of the geometric terms among students with hearing impairment was found better than that of the students without hearing impairment .No significant difference was found in ratings for familiarity and concreteness of the geometric terms among students with and without hearing impairment

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