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RESEARCH PAPER

A Study of Cognitive Preference styles in Chemistry of Secondary Students of Kota City

* **Dr. Shrikant Bhartiya**
Associate Professor
JLNPGTT College, Sakatpura, Kota (Raj.)

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1.0 INTRODUCTION

Science education is fundamental to the technological development of any nation. The future of a nation depends on the performance and achievement of students in science and its related faculties.

The Secondary Education Commission Report (1952), National Policy on Education (1986) and Yashpal Committee (1994) recommended the reorientation of curriculum to cope up with the advancement of science and technology in schools. Based on the recommendations, the content of science is enriched and brought into operation through appropriate and new methods of teaching science.

Weinstein: 1982, Mayer:1984, Jones et. al. 1985 found that science instruction in majority of the classrooms continues to be traditional and text book oriented. The learner is seldom seemed as an active participant in the teaching learning process. The effect of teaching depends partly on what the learner knows i.e. the learners prior knowledge and what the learner thinks about the learning. It is observed that teachers by and large attempt to pass on all the information from text books to the students through lectures, which do not satisfy the objectives and needs of the learners. Besides, teachers rush up the content to complete the syllabus in time, making the learners passive, without any active involvement, and force them to memorise the content without developing any science competencies, leading to rote and meaningless learning. The quality of teaching is very important in effective learning and good academic performance of learners. Efforts to improve teaching and learning in education have received widespread attention in recent years. Cognitive style refers to the

information processing habits that indicate an individual's mode of perceiving, thinking, problem-solving and remembering.

Every individual differs in their ability, motivation, creative expression, cognitive styles and these differences have important effects on which an individual thinks, learns and performs. Every student learns in different ways, their styles are unique, their approaches are typical and their methods have a touch of their individuality. Most significant aspect of learning and teaching is the inclusion of cognitive styles in classroom activities. It has been observed that the cognitive styles also influence the ways in which teachers and students interact during the teaching and learning process. The concept of cognitive preference styles differs from intelligence ability of a student to adopt and learn. Contrarily the cognitive preference styles attempt to describe differences in the ways in which an individual thinks and learns. Heath (1964) introduced the concept of Cognitive Preference. His four modes of "attaining scientific information" have been used by different researchers ever since in cognitive preference tests by slight modifications. They are recall, principle, questioning and application.

1.1 SIGNIFICANCE OF THE PROBLEM

The aim is to study "The Cognitive Preference Styles in Chemistry of 'Secondary Students'". It shows that teaching is dominantly concentrated on the development of cognitive domain of a person. The cognitive styles describe differences in ways in which individual thinks and learns. So, the researcher has made an attempt to study the context and content of Chemistry by determining student's mode of processing information and search for perspectives. In order to, make chemistry teaching more effective and performance oriented, new innovations are necessary in the process of teaching and learning. It is essential to evolve new models which are in consonance with the cognitive needs and preferences of the students.

It is observed that the students differ in their cognitive preferences. Some are interested in factual informations, others in principles, while some emphasize on applications. This inclination led to the systematic study of Cognitive Preference Styles of Chemistry students studying in secondary classes. The researcher has attempted to find out the manner in which a student acquires knowledge and his characteristic modes of processing information.

1.2 STATEMENT OF THE PROBLEM

A Study of Cognitive Preference Styles in Chemistry of Secondary Students of Kota City

1.3 OBJECTIVES

1. To find out the cognitive preference styles in chemistry of the secondary students studying in Government and Private schools.
2. To find out the cognitive preference styles in chemistry of Boys.
3. To find out the cognitive preference styles in chemistry of Girls.
4. To find out the cognitive preference styles in chemistry of the secondary students studying in Government schools..
5. To find out the cognitive preference styles in chemistry of the secondary students studying in Private schools.
6. To compare the cognitive preference styles in chemistry of the secondary students studying in Government and Private schools.
7. To compare the cognitive preference styles in chemistry of Boys and Girls.

1.4 HYPOTHESES

1. There is no significant difference in the cognitive preference styles in chemistry of the secondary students studying in Government and Private schools.
2. There is no significant difference in the cognitive preference styles in chemistry of Boys and Girls

1.5 OPERATIONAL DEFINITION OF THE TERMS USED

1. Cognitive styles :-

Cognitive styles are the distinctive patterns of cognition which characterize individual's way of thinking and learning. The concept of cognitive styles differs from intelligence, ability to adapt and learn.

According to Messick (1970)- “Cognitive styles as usually conceived as habits that are spontaneously applied without conscious choice in a wide varieties of situations.”

He suggested that “Cognitive styles appear to be particular important dimensions to assess educational purposes since they can provide a basis for

improved instructional practices such as matching the student teacher interaction and teaching methods." He concluded that cognitive styles by embracing both perceptual and intellectual domains promises to provide a more effective characterization of the student that could not be obtained from intellectual tests.

2. Cognitive Preference

Cognitive preferences constitute a kind of cognitive style that deals with attributes of special relevance to the learning of science. Essentially they represent what a person typically 'does do' rather than what he 'can do'. Harris (1974), Tamir (1977) and Kempa (1978) did various researches on this subject and regarded cognitive preferences as a variant of cognitive styles.

3. Modes of Cognitive Preference

Heath (1964) introduced the concept of Cognitive Preferences. The four modes of preference used for the study are as follows –

- (a) **RECALL (R)** -Acceptance of scientific information for its own sake i.e. without consideration of its implications, applications or limitations. It is just a form, of remembering which refers to the retrieval of factual information on demand from memory storage.
- (b) **PRINCIPLE (P)**- Acceptance of information for representation or explanation of fundamental scientific principles, concepts or relationships.
- (c) **QUESTIONING (Q)**- Critical questioning based on the information for the satisfaction of their curiosity, completeness, general validity and limitations.
- (d) **APPLICATION (A)**- Application of scientific information in problem solving in real life situations. Emphasis is on the usefulness and applicability of information's in a general, social or scientific context.

1.6 DELIMITATION

- 1. The study is restricted to secondary students ie class X, who have chemistry as a subpart of science subject; other subjects are not studied.
- 2. The study is restricted to secondary students studying in Government and Private schools situated in Kota city.

3. The size of sample is restricted to 100 students studying in Government and Private schools situated in Kota city.

1.7 RESEARCH METHOD

The normative survey method was used for the study.

1.8 SAMPLE

The 100 students of Class-X studying in Government and Private schools following RBSE curriculum constituted the sample. The random sampling procedure had been used for selection of the sample.

1.9 TOOL USED

To determine the cognitive preference styles in chemistry of the secondary student, "Cognitive Preference Test in Chemistry" was developed by the Researcher.

1.10 STATISTICS USED

(1) Means (2) Standard Deviation (3)t-test.

1.11 ANALYSIS AND INTERPRETATION OF DATA

1.11.1 Analysis of the four dimensions of cognitive preference styles in chemistry of the whole sample (N=100)

**Table - 1 Cognitive preference styles in chemistry of whole sample
(N=100)**

Dimension	Total Score	Mean Score	Standard Deviation
Recall (R)	5410	54.10	09.73
Principle (P)	5220	52.20	07.97
Questioning (Q)	4610	46.10	10.14
Application (A)	4760	47.60	10.36

Analysis and interpretation

1. The students of secondary class (whole sample) have given first preference to Recall and least preference to Questioning.

2. A low Q and high R preference shows that the students are interested only in factual information's in chemistry but may not have a real desire to expand their knowledge.
3. A low preference for Q and a high preference for R shows that students are satisfied with the acceptance of scientific information and are not curious to know more and therefore, they do not search for new knowledge and new explanations.

Conclusion

The order of Cognitive preference style in chemistry of whole sample R>P>A>Q.

Suggestion

The students are given fundamental information's in chemistry in schools. The students do not know why, how etc. Students have less curiosity in reasoning and application. So, the teachers should teach the students in such way that they become curious.

1.11.2 Analysis of the four dimensions of cognitive preference styles in chemistry of the Boys (N=50)

Table – 2 Cognitive preference styles in chemistry of boys (N=50)

Dimension	Total Score	Mean Score	Standard Deviation
Recall (R)	2546	50.92	9.98
Principle (P)	2488	49.76	8.14
Questioning (Q)	2479	49.58	9.56
Application (A)	2487	49.74	10.29

Analysis and interpretation

1. The boys of secondary class have given first preference to Recall and least preference to Questioning.

2. High R and P scores indicate a preference for fundamental scientific knowledge and principle information that stands by itself and that it is not generalized. It indicates a preference for information given by the teachers.
3. A low preference for A and Q shows that boys may not have a real desire to expand their knowledge, so they are less curious in critical questioning and application.

Conclusion

The order of Cognitive preference style in chemistry of boys R>P>A>Q.

Suggestion

The boys were found to be less curious towards content of chemistry. They are bound to rote memorization. The teachers should teach in a manner to make the students more curious.

1.11.3 Analysis of the four dimensions of cognitive preference styles in chemistry of the Girls (N=50)

Table – 3 Cognitive preference styles in chemistry of girls (N=50)

Dimension	Total Score	Mean Score	Standard Deviation
Recall (R)	2866	57.32	10.02
Principle (P)	2727	54.54	7.52
Questioning (Q)	2129	42.58	11.25
Application (A)	2278	45.56	10.66

Analysis and interpretation

1. The girls of secondary class have given first preference to Recall and least preference to Questioning.
2. High R and P scores indicate a preference for fundamental scientific knowledge and principle information that stands by itself and that it is not generalized.
3. A low preference for A and Q shows that girls may not have a real desire to expand their knowledge, so they are less curious in critical questioning and application.

Conclusion

Order of Cognitive preference style in chemistry of girls R>P>A>Q.

Suggestion

The girls were found to be curious only for factual information's and scientific principles. They are interested only in memorization of facts but not interested in critical questioning.

1.11.4 Analysis of the four dimensions of cognitive preference styles in chemistry of secondary students of Government schools. (N=50)

Table - 4 Cognitive preference styles in chemistry of secondary students studying in Government school (N=50)

Dimension	Total Score	Mean Score	Standard Deviation
Recall (R)	2897	55.94	09.21
Principle (P)	2660	53.20	07.87
Questioning (Q)	2181	43.02	10.07
Application (A)	2362	47.24	10.27

Analysis and interpretation

1. The Government schools students have shown highest preference for Recall, then to Principles, third to Applications and least to Questioning.
2. High R and P scores indicate a preference for acceptance for scientific knowledge information and principles for its own sake. Least preference for Q shows very less curiosity to know the depth of the concept.

Conclusion :-

Order of Cognitive preference style in chemistry of secondary students studying in Government school R>P>A>Q.

Suggestion

The secondary students of Government schools were found to be less curious about the mysteries of chemistry. The teachers are expected to possess the ability to make students active participants rather than passive recipients.

1.11.5 Analysis of the four dimensions of cognitive preference styles in chemistry of the private school students. (N=50)

Table – 5Cognitive preference styles in chemistry of secondary schools studying in private school (N=50)

Dimension	Total Score	Mean Score	Standard Deviation
Recall (R)	2612	52.24	9.74
Principle (P)	2557	51.14	8.32
Questioning (Q)	2428	48.56	10.61
Application (A)	2403	48.06	10.21

Analysis and interpretation

1. The students of private schools have given the first preference for Recall and least preference for Application.
2. The third preference to Questioning shows their certain interest in critical questioning which is different from other three groups.

Conclusion :-

Order of Cognitive preference style in chemistry of secondary schools studying in private school R>P>Q>A.

Suggestion

The students of Private schools were found least curious in application but have shown some inclination towards the critical questioning. This means the students are curious, so the teachers must satisfy their curiosity and help them to search some new knowledge.

1.11.6 Comparison of the four dimensions of cognitive preference styles in chemistry of students of Government and private schools (N₁=50, N₂=50)

Table – 6 Means, S.D. and t-value of scores of government and private school students (N₁=50, N₂=50)

Dimension	Government School		Private School		t-value	Significance
	Mean	S.D.	Mean	S.D.		
Recall (R)	55.94	9.21	52.24	9.74	1.95	nsd
Principle (P)	53.20	7.87	51.14	8.32	1.76	nsd
Questioning (Q)	43.62	10.07	48.56	10.61	2.39	nsd
Application (A)	47.24	10.27	48.06	10.21	0.40	nsd

Level of significance 0.01 Table value 2.63

nsd = No significant difference

sd= Significant difference

Analysis and interpretation:

1. Recall -

The calculated 't-value' between students studying in Government schools and Private schools is 1.95. This value is less than the table value of 2.63 at 0.01 level. It concluded that the mean difference is significant at 0.01 level, which means that there is no significant difference in cognitive preference styles in the R-scores between students studying in Government schools and Private schools.

2. Principle-

The calculated 't-value' between students studying in Government and Private schools is 1.76. This value is less than the table value of 2.63 at 0.01 level. This concluded that the mean difference is significant at 0.01 level, which means that there is no significant difference in cognitive preference styles in the P-scores between secondary class students studying in Government and Private schools.

3. Questioning -

The calculated 't-value' between students studying in Government and Private schools is 2.39. This value is less than the table value of 2.63 at 0.01 level. This concluded that the mean difference is significant at 0.01 level, which means that there is no significant difference in cognitive preference styles in the Q-scores between secondary class students studying in Government and Private schools.

4. Application -

The calculated 't-value' between students studying in Government and Private schools is 0.40. This value is less than the table value of 2.63 at 0.01 level. This concluded that the mean difference is significant at 0.01 level, which means that there is no significant difference in cognitive preference styles in the A-scores between tenth class students studying in Government and Private schools.

1.11.7 Comparison of the four dimensions of cognitive preference style in chemistry of Boys and Girls ($N_1=50$, $N_2=50$)

Table - 7 Mean, SD and t-value of scores of Boys and Girls ($N_1=50$, $N_2=50$)

Dimension	Boys		Girls		t-value	Significance
	Mean	S.D.	Mean	S.D.		
Recall (R)	50.92	9.98	57.32	10.02	03.21	sd
Principle (P)	49.76	8.14	54.54	07.52	03.06	sd
Questioning (Q)	49.58	9.56	42.58	10.25	03.55	sd
Application (A)	49.74	10.29	45.56	10.66	02.00	nsd

Level of significance 0.01 Table value 2.63

nsd = No significant difference

sd= Significant difference

Analysis and interpretation:

1. Recall -

The calculated 't-value' between Boys and Girls of secondary schools is 3.21. This value is more than the table value of 2.63 at 0.01 level. This concluded that their mean difference is not significant at 0.01 level, which means that there is a significant difference in a significant difference in means in cognitive preference styles in the R-scores between Boys and Girls studying in secondary schools.

2. Principle-

The calculated 't-value' between Boys and Girls of secondary schools is 3.06. This value is more than the table value of 2.63 at 0.01 level. This concluded that their mean difference is not significant at 0.01 level, which means that there is a significant difference in means in

cognitive preference styles in the P-scores between Boys and Girls studying in secondary schools.

3. Questioning -

The calculated 't-value' between Boys and Girls of secondary schools is 3.55. This value is more than the table value of 2.63 at 0.01 level. This concluded that their mean difference is not significant at 0.01 level. This means that there is a significant difference in the means values in cognitive preference styles in the Q-scores between Boys and Girls studying in secondary schools.

4. Application -

The calculated 't-value' between Boys and Girls of secondary schools is 2.00. This value is less than the table value of 2.63 at 0.01 level. This concluded that their mean difference is significant at 0.01 level. which means that there is no significant difference in cognitive preference styles in the A-scores between Boys and Girls studying in secondary schools.

Conclusions :-

1. The comparative analysis between Government and Private school students as well as Boys and Girls have been done and it is found that the students of different groups have given first preference to Recall and then second preference to Principle. The third preference was Application for all the groups except private school students which preferred Questioning. The majority of groups selected Questioning as their least preferred option.
2. The comparative study has shown that the different groups are more curious about the Recall of general scientific information's and the fundamental Principles. They are less curious about the Application of scientific knowledge and critical questioning of mysteries.

1.12 MAJOR FINDINGS :-

1. The cognitive preference styles in chemistry of the whole sample was found to be R>P>A>Q.
2. The cognitive preference styles in chemistry of Boys secondary schools were found to be R>P>A>Q.
3. The cognitive preference styles in chemistry of Girls secondary schools were found to be R>P>A>Q.

4. The cognitive preference styles in chemistry of secondary students studying in Government schools were found to be R>P>A>Q.
5. The cognitive preference styles in chemistry of secondary students studying in Private schools were found to be R>P>Q>A.
6. There is no significant difference in cognitive preference styles in chemistry was R, P, Q and A – scores between the students studying in Government and Private schools.
7. There is no significant difference in cognitive preference styles in chemistry was R, P, A and Q – scores between boys and girls.

1.13 EDUCATIONAL IMPLICATIONS :-

1. Cognitive styles tests may help the teachers to find out the preference styles of their students and then teach them accordingly.
2. Through cognitive preference styles testing, the teachers may plan their instructions for developing strong preference for 'Application' and 'Questioning' modes, which are very essential elements of science instructions.
3. This study revealed that the main mode of acquiring knowledge by students is 'Recall' and 'Principle', thus neglecting the 'Application' and 'Questioning' modes. An effort must be made in every way to develop these less preferred modes.
4. To develop 'Questioning' and 'Application' modes it is essential that the subject matter may be presented in a more effective manner. Hence the text-books should be revised and illustrations pertaining to 'Application' aspect of subject matter should be included.
5. This study has revealed that there is a need for child centered and activity based methods for developing critical thinking in students.

1.14 SUGGESTIONS FOR FURTHER RESEARCH

1. The further study may be conducted by taking teachers' attitude towards achievement and cognitive preference style of students.
2. The further study can be conducted in different types of schools such as Government schools of State and Central Schools.
3. The further study may be conducted by taking different classes such as Secondary, Senior Secondary, Graduation level, Post Graduation level and Teacher's Trainees.

4. Relationships between teachers 'cognitive preference styles to that of students' cognitive preference styles can be studied.
5. The tools for the evaluation of cognitive preference styles for different classes and different subjects can be standardised.

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*** Corresponding Author:**

Dr. Shrikant Bhartiya

Associate Professor

JLNPGTT College, Sakatpura, Kota (Rajasthan)