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An Analysis of Present Secondary School Science Textbooks in Developing The Components of Logical-Mathematical Intelligence

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Abstract

The objectives of this research is to study what extent the content of a secondary school science textbook in schools of Kerala are helpful to develop Logical mathematical intelligence. The methodology applied for this study is Analysis -cum survey method. The analytical method was used to analyse the chemistry portions of eighth grade science textbook in developing the components of logical-Mathematical intelligence. The survey method was used to collect the response of teachers regarding the components of LMI in the chemistry portions of VIII standard science textbook. For the sake of clarity, each component was divided into several traits. The opinionnaire were administered in secondary school teachers and training college teachers working in three districts of Kerala. The data were analysed by simple percentage and critical ratio. The findings of the study were; 1. Chemistry portions of VIII standard Science Text Book has significant influence in developing the components of logical mathematical intelligence. 2.Follow up activities of chemistry portion of VIII standard Science text book has more significant influence than its content in developing the components of logical mathematical intelligence. There is no significant difference between the opinion of teachers and the investigator regarding the component of Logical-Mathematical Intelligence in the chemistry portions of VIII standard science textbook.

Keywords: *Logical mathematical intelligence, reasoning, handle logical thinking, calculating, recognize pattern*

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I. INTRODUCTION

A study of science is of immense value both for individual and for the society because of its capacity for wide application. The study of science imparts training in scientific method and develops scientific attitude in the learner. Education commission has emphasized at the secondary stage it recommends that the acquistition of knowledge together with the ability to think logically, to draw conclusions and to make decisions at a higher level. The science curriculum aims at the development of thirteen process skills such as observing, classifying, measuring, communication, using number relations, using spatial relations, Inferring, predicting, making operational definition, identifying and controlling variables, interpreting data, and experimenting and those skills one approved by UNESCO.

The modern studies on intelligence are especially relevant to science education. The traditional view is that intelligence is hereditary does not change modern theories however consider that by giving suitable environments and through continued efforts such students can improve the intelligence relating to the specific area. According to Howard Gardner, human intelligence has different components and all these components and present in all individuals in different proportions. All components of intelligence can be developed to a certain extent in each individual. The teachers may ensure that learning activities that cater to all the components of intelligence are provided to the student. Logical mathematical intelligence is one of the main components of multiple intelligence is the capacity to use numbers effectively and to reason well. This intelligence includes sensitivity to logical patterns and relationships, statements and proportions, functions and other related abstractions. People who are strong in logical-mathematical intelligence are good at reasoning, recognize patterns and logically analyse problems. These individuals tend to think conceptually about numbers, relationships and patterns.

II. NEED AND SIGNIFICANCE OF THE STUDY

With the advancement in science and technology the world we live is rapidly changing. The developing country like India is hardly trying to compete with the developed nations. Science occupies a vital position, in the progress of our life. Science helps to remove superstitions and fears of the unknown science and technology revolutionized all walks of life. Science practice and enhance the many intellectual activities. According to the theory of Howard Gardner, all the components of multiple intelligence can be developed to a certain extent in each individual. Multiple intelligence theory however considers that by giving suitable environments and through continued efforts such students can improve the influence relating to the specific area. Multiple intelligence theory stresses the importance of skills being used in specific

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cultural contexts. For example, Language and History subject matters stress linguistic intelligence, mathematics and science subject matters stress logical-mathematical intelligence. On the basis of their ideas, our state curriculum can be restructured by SCERT in Kerala after 2003.The investigator is very much fascinated by Gardner's theory of multiple Intelligences and its impact on the teaching learning process. The investigator interested to know what extent the above ideas of MI theory one implemented in new curriculum and also determined its impact in the students. Due to the time limits the investigator should select implementation of components of Logical mathematical intelligence in the science education. The components of Logical Mathematical intelligence are reasoning, recognizing pattern, handle logical thinking and calculating. These abilities involved in the formal operational stage of Piaget is highly developed at adolescent stage. So, the investigator selected the secondary school science textbook for the content analysis. Content analysis of science textbook in developing the logical – mathematical intelligence reveals that only few researches were undergone in the area of LMI and science education. This calls for research efforts in this area on a priority basis.

III. HYPOTHESES OF THE STUDY

(1) The content of the chemistry portions of VII Std. has significant influence in developing the components of LMI.

(2) The follow up activities of chemistry portions of VIII Std. has significant influence in developing the components of LMI.

(3) Follow up activities of Chemistry portions of VIII std. Science textbook has more significant. Influence than the content in developing the components of LMI.

(4) The chemistry portions of VIII standard science textbook helps to develop the components of LMI.

(5) There is no significant difference between the opinion of teachers and the investigator regarding the component of logical-mathematical intelligence in the chemistry portions ofVIII standard science textbook

IV. METHODOLOGY

The investigator adopted analysis-cum-survey method. The analytical method was used to analyses the chemistry portions of science textbook in developing the components of logical-Mathematical intelligence. The survey method was used to collects the response of teachers regarding the components of LMI in the chemistry portions of VIII standard science textbooks.In the present study, each unit of chemistry portions of VIII standard science textbook is analysed based on the components of logical-Mathematical intelligence. For the sake of clarity, each component was divided into several traits. The details of traits listed by the investigator on the basis of components of logical-mathematical intelligence with the assistance of the guide is given below in the table . Opinionnaire of the teachers was used to collect the response of teachers regarding the components of LMI in the in the chemistry portions of VIII standard science textbook. For the sake of clarity, what are the exercises used to strengthen the different components of logical-mathematical intelligence in the content and follow up activities of the chemistry portions of standard VIII science textbook is given.

List of traits of the components of LMI

Components of Logical-Mathematical intelligence	Traits of the components of Logical-Mathematical intelligence
Reasoning	1. good at Reasoning 1. good at problem solving
Recognize pattern	1. likes to be organized 1. Recognize pattern
Handle logical thinking	1. likes to experiment 1. ability for abstract thinking 2. problem solving
Calculating	1. likes to count

The type of items used in the opinionnaire is presented below by means of two topics.

Unit	Topics	Exercise to strengthen the components of Logical-Mathematical intelligence													
		Use deductive thinking		Use reasoning		Use production		Practice sequential step-by-step thinking		Get organized and ***place for everything		Do practical experiment		Analyse and interpret data	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Speed chemical reaction	Energy and chemical reactions														
	Electric current and chemical reaction														

SAMPLE SELECTED FOR THE STUDY

Since the present study aimed to find out the opinion of teachers to know what exert the content of the chemistry portions of standard VIII science textbook in developing the components of Logical-Mathematical intelligence. The sample of the study comprised of hundred science teachers from various institutions in three districts of the kerala state.

The important statistical techniques used in the study are

- Computation of simple percentage
- Critical ratio

In order to find the significant difference between the percentages of situations identified by the investigator and teachers, the following formula of critical ratio is used

Part A : Content analysis of topics of VIII standard science text book

Part B : Statistical analysis of data

Section : I - Statistical analysis of data collected from the chemistry topics of VIII standard. based on the traits of Logical-Mathematical Intelligence.

Section : II - Analysis of data collected from the opinion of teachers based on the exercises to strengthen the Logical-Mathematical Intelligence.

Section : III - Comparison of percentage for all the component of Logical-Mathematical Intelligence find out from textbook analysis and from the opinion of teachers

CR= P1-P2/vPQ

Statistical analysis of data

The data collected from the analysis and from the opinion of teachers are statistically analysed in this section. In this part B has 3 sections. Section I deals with the statistical analysis of data collected from textbooks analysis on the basis of components of Logical-Mathematical Intelligence. Section II does with the statistical analysis of data collected from the teachers of high schools. Section III deals with the comparison of data collected from textbook analysis and from opinion of teachers. Each components of Logical-Mathematical Intelligence is analysed separately in appropriate heading.

The traits of the reasoning component are good at reasoning and good at problem solving. The percentage of reasoning components is analysed through the percentage of the above traits. The trait is revealed in the table.

Percentage of reasoning and its traits identified.

Sl. No.	Traits practiced	Situations used to practice the particular traits					
		In the content			In the follow up activities		
		In numbers		In percentage	In numbers		In percentage
		Total situations for LMI	identified		Total situations for LMI	identified	
1	Good at reasoning	182	69	38%	182	25	57%
2	Good at problem solving	44	41	23%	44	17	37%
Reasoning components of LMI		182	110	61%	44	42	94%

PERCENTAGE OF RECOGNIZING PATTERN AND ITS TRAITS IDENTIFIED

The traits of the recognizing pattern are likes to be organized and recognizing pattern. The percentage of recognizing pattern component is analysed through the percentage of the above traits. The traits revealed in the table.

Percentage recognizing pattern and its traits identified.

Sl. No.	Traits practiced	Situations used to practice the particular traits					
		In content			In follow up activities		
		In numbers		In percentage	In numbers		In percentage
		Total situations for LMI	identified		Total situations for LMI	identified	
1	Likes to be organized	182	41	23	44	28	64%
2	Recognizing pattern	182	42	23	44	10	23%
Recognizing pattern components of LMI		182	83	467	44	38	86%

PERCENTAGE OF HANDLE LOGICAL THINKING AND ITS TRAITS IDENTIFIED

The traits of the handle logical thinking component of Logical-Mathematical Intelligence are likes to experiment, ability for abstract thinking and good at problem solving. The percentage of handle logical thinking is analyzed through the percentage of above traits. The trait is revealed in the table.

Percentage of handle logical thinking and its traits identified.

Sl. No.	Traits practiced	Situations used to practice the particular traits					
		In content			In follow up activities		
		In numbers		In percentage	In numbers		In percentage
		Total situations for LMI	Identified		Total situations for LMI	identified	
1	Likes to experiment	182	38	21%	44	2	1%
2	Ability for abstract thinking	182	60	33%	44	18	4%
3	Good at problem solving	182	41	23%	44	17	38%
Handle logical thinking		182	139	77%	44	37	80%

PERCENTAGE OF CALCULATING AND ITS TRAIT IDENTIFIED

The traits of the calculating is like to count. The percentage of calculating is analyzed through the percentage of likes to count – trait. The trait is revealed in the table. Percentage of handle logical thinking and its traits identified.

Serial No.	Traits practiced	Situations used to practice the particular traits					
		In content			In follow up activities		
		In numbers		In percentage	In numbers		In percentage
		Total situation for LMI	identified		Total situations for LMI	identified	
1	Likes to count	182	29	16%	44	10	23%
	Calculating component of LMI	182	29	16%	44	10	23%

Percentage of the components of Logical-Mathematical Intelligence identified.

Serial No.	Components of Logical-Mathematical Intelligence	Percentage of situations used to develop the particular components of Logical-Mathematical Intelligence		
		In numbers		in percentage
		Total Situations For Logical-Mathematical Intelligence	Identified in Total content	
1	**Reasoning**	226	152	67%
2	**Recognizing pattern**	226	121	50%
3	**Handle logical thinking**	226	176	77%
4	**Calculating**	226	39	17%

Compare the percentages for all the components of Logical-Mathematical Intelligence from the content analysis and from the opinion of teachers and find out the critical ratio, and level of significance between the two.

Comparison of Percentage for all the components of Logical-Mathematical Intelligence find out from textbook analysis and from the opinion of teachers.

Sl No.	Components of Logical-Mathematical Intelligence	Percentage of situations used to develop the particular component of Logical-Mathematical Intelligence						Critical Ratio	Level of significance
		From textbook analysis			From the opinion of teachers				
		Content	follow up activities	Total Content	Content	Follow up activities	Total		
1	**Reasoning**	61%	94%	67%	63%	92%	68%	0.208	not significant
2	**Recognizing pattern**	43%	86%	50%	47%	82%	53%	0.414	not significant
3	**Handle logical thinking**	76%	80%	77%	72%	74%	73%	0.905	not significant
4	**Calculating**	16%	23%	17%	29%	31%	29%	1.915	not significant

This table reveals that situations identified by the investigator and teachers for developing the calculating – component Logical-Mathematical Intelligence are almost the same. Even though the number of situations identified by the teacher is slightly higher (29%) than that of the investigator (17%) there is no significant different between the two scores.

From the above companion, it is clear that, the identification of the investigator regarding the component of Logical-Mathematical Intelligence in the chemistry portions of standard VIII science textbook is supported by the teachers.So it can be calculated that, chemistry portions of VIII standard science textbook helps to develop the components of Logical-Mathematical Intelligence (handle logical thinking 77%, Reasoning 67%, recognizing pattern 50%, and calculating 17%) and the component most developed is handle logical thinking and least developed is calculating. So totally chemistry portions of VIII standard science textbook has significant influence in developing the components of Logical-Mathematical Intelligence. So it can be calculated that, chemistry portions of VIII standard science textbook helps to develop the components of Logical-Mathematical Intelligence (handle logical thinking 77%, Reasoning 67%, recognizing pattern 50%, and calculating 17%) and the component most developed is handle logical thinking and least developed is calculating. So totally chemistry portions of VIII standard science textbook has significant influence in developing the components of Logical-Mathematical Intelligence.

V. CONCLUSIONS

The conclusions that have emerged from the present study are summarized under appropriate headings. Conclusions drawn based on the percentage for the components of Logical Mathematical Intelligence find out from text book analysis and from the opinion of teachers.

(1) content of chemistry topics of VIII std. science text book has significant influence in developing the component of Logical Mathematical Intelligence concept calculating and recognizing pattern)

(2) he follow up activities of chemistry topics of VIII standard Science text book has significant influence in developing the components of Logical Mathematical Intelligence(except calculating).

(3) Chemistry portions of VIII standard Science Text Book has significant influence in developing the components of logical mathematical intelligence. In developing the components of logical mathematical intelligence.

(4) Follow up activities of chemistry portion of VIII standard Science text book has more significant influence than it's content in developing the components of logical mathematical intelligence.

(5) Among the situations that exist in chemistry portions of VIII standard Science text book the prominent components that can be developed are reasoning and handle logical thinking (from).

(6) Among the situations that exist in chemistry portions of VIII standard Science text book, the least developed component is calculating.

(7) There is no significant difference between the opinion of teachers and the investigating regarding the component of logical -mathematical -intelligence in the chemistry portions of standard VIII Science text book.

VI. RECOMMENDATIONS

(1) The formal thinking abilities attains maximum at the Secondary stage. So the harmonious situations are to be used for developing the component of Logical Mathematical Intelligence in Science text book is essential.

(2) Care should be given to include more situations which can develop the component of logical -mathematical -intelligence calculating by the SCERT in the construction of new curriculum.

(3) Training programme should be given to the chemistry teachers for adopting adequate techniques for developing the components of logical mathematical intelligence.

(4) Chemistry teachers should adopt innovative teaching methods for the proper development of logical mathematical intelligence.

(5) Steps should be taken to provide adequate opportunities for developing the component calculating through the subject matter of chemistry text book.

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