



A Study on the HOTS Awareness Level of Secondary School Students of Kerala

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ABSTRACT

The level of thinking depends upon the context, with a real-world situation offering multiple variables to challenge thinking processes. Successful higher order thinking depends upon an individual's ability to apply, reorganize, and embellish knowledge in the context of the thinking situation. Dewey (1933) described HOTS as a sequenced chaining of events. According to Dewey, this productive process moves from reflection to inquiry, then to critical thought processes that, in turn, lead to a conclusion that can be substantiated by more than personal beliefs and images. The present paper tries to check the present level of awareness about HOTS among secondary school students of Kerala. Moreover the study also tries to check whether there exists any difference in the level of awareness about HOTS among secondary school students based on Gender.

Keywords: - HOTS, HOTS awareness, Secondary school students

1.1 Introduction

Barak and Dori (2009) explained that higher-order thinking can be viewed as a complex mode of thinking that often generates multiple solutions, without reliance on the application of specific sets of procedures. Some of these skills are included at the upper end of Bloom's taxonomy of the cognitive domain, such as synthesis, application and evaluation. Other writers include critical thinking, creating, and problem solving. Miri, Ben-Chaim and Zoller (2007) explained that HOTS involve complex thinking, multiple solutions, uncertainty, application of multiple criteria, reflection and self-regulation. Although the literature describes many elements of higher order-skills, here we will focus on critical thinking, creative thinking, problem solving and reasoning.

Definition to HOTS according to MOE (2015) is the ability to apply knowledge, skills and values in making sense and reflect to solve problems, make decisions, innovate and create something. In order to implement HOTS effectively, the resource materials must be structured so that they can realize the application of knowledge, skills and values that students acquire to help them understand, reflect and solve problems, make decisions, innovate and create.

1.2 Need and Significance of the Study

Physics is a school subject that involves complex scientific concepts that requires proper development of higher order thinking to grasp the inner concepts. Barak and Dori (2009) defines higher order thinking as a complete mode of thinking that often generate multiple solutions without reliance on the application of specific sets of procedures. Miri, Ben – Chaim and Zoller (2007) explained that HOTS involve complex thinking, multiple solutions, uncertainty, application of multiple criteria, reflection and self regulation. Barak and Dori (2009) regarded critical thinking as a skill that requires taking responsibility and control of one's own mind. It involves logical and reflective thought prior to deciding what to believe and what action to take. Pithers and Soden (2000) found that critical thinking means being able to judge the validity and reliability of one's assumptions and also the various sources of information that are available. According to Vockell (2001), problem solving is a process of finding information, a strategy to achieve a goal, or to overcome an obstacle. It involves describing the problem, anticipating the desired result or solved condition, generating alternative approaches to a solution, selecting likely solutions, testing the possible solutions, evaluating the results of these tests and revising the steps for continuous improvement of the solution. Creativity is linked to problem solving because the realization of a solution often requires original thinking. Zohar, Degani and Vaaknin (2001) opined that students are not getting to the point where they have the opportunity to engage in HOTS due to the traditional concept of learning being sequential and linear.

From the studies, the investigator realized the importance of Higher order thinking skills in developing abstract concepts related to subjects

among secondary school students as a must for effective learning to happen. So he decided to check the present level of HOTS awareness among secondary school students so that it will help the investigator to develop strategies and techniques for fostering HOTS among learners through teaching learning process.

1.3 Objectives of the Study

The major objectives selected for the present study are;

- To find out the existing level of awareness about HOTS among secondary school students of Kerala
- To find out whether there exist any significant difference in the HOTS awareness level of secondary school students based on the sub sample Gender

1.4 Hypothesis of the Study

The major hypotheses formulated for the present study are the following:

- There exists significant difference in the level of awareness about HOTS among secondary school students of Kerala
- There exist significant difference in the HOTS awareness level of secondary school student ts of Kerala based on the subsample Gender

1.5 Sample for the Study

The sample selected for the present study consists of 150 secondary school students from Thrissur District selected using stratified random sampling technique. Here samples are selected by giving due weightage to the strata Gender.

1.6 Tools used for the Study

The tool used for the present study was HOTS level awareness scale prepared and standardized by the Investigator. The tool consists of 25 items following Likert 5 point scale. The value of correlation coefficient is obtained as 0.66. Reliability of HOTS level awareness scale was ensured using Test – re test reliability. The correlation coefficients for various components of HOTS level awareness scale are General awareness (0.60), Reasoning skills (0.47), Problem solving skills (0.54), Critical thinking skills (0.56) and Creative thinking skills (0.57). The values of correlation coefficients show that the HOTS level awareness scale is highly reliable. Content validity was also established for the tool.

1.7 Methodology

Survey method was used for the present study. The investigator collected data using HOTS awareness level scale from 150 secondary school students. Scores were calculated and suitable statistical techniques were used for the analysis of data. Quantitative method was used for analyzing and interpreting the data so as to reach valuable conclusions pertaining to the theme of the paper.

1.8 Statistical Techniques used for the Study

The major statistical techniques used for the present study are;

- Descriptive Statistics
- Test of significance of difference between means
- Percentage analysis
- ANOVA
- Scheffe's post – hoc test

1.9 Limitations and Delimitations of the Study

The major limitations of the present study include nature of the students, time of the study and the environmental factors. The major delimitations are as follows;

- The study was delimited to Thrissur district only
- The Study was delimited to secondary school level only
- The study was delimited to check the level of only one variable

- The study considered only one sub sample namely Gender of the students

2. Analysis and Discussion

2.1 The level of awareness about HOTS among secondary school students of Kerala

The descriptive statistics for the total scores of secondary school students regarding the awareness on HOTS were tabulated as shown in the table 1.1

Table 1 - Descriptive statistics for the total scores of awareness on HOTS for the whole sample

Item	Mean	Median	SD	Skewness	Kurtosis
Awareness on HOTS AMONG Secondary school students	42.49	42.0	6.71	0.308	- 0.087

From table 1, the Arithmetic Mean and Median values of total scores of secondary school students regarding the awareness on HOTS are almost same. The Standard Deviation value shows that the values are not much dispersed from the central value. The total scores of secondary school students regarding awareness on HOTS are positively skewed. It indicates that the scores are massed at the lower end of the scale. This means that the number of students who got low scores is comparatively higher than the number of students who got high scores. The Kurtosis value of total scores of secondary school students regarding the awareness on HOTS is greater than 0.263. Hence the distribution is platykurtic.

The results were clearly explained with the help of histogram given in figure 1 as shown below.

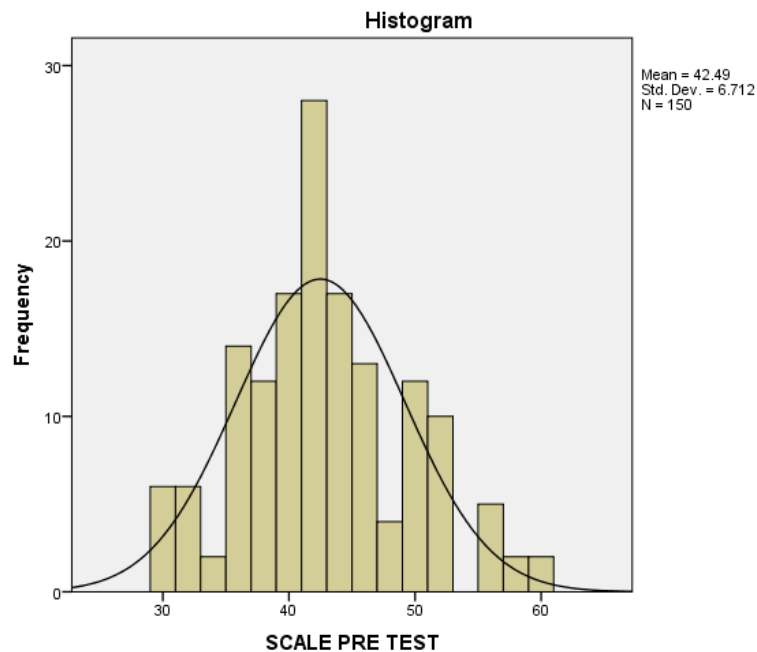


Figure 1 - Histogram for the total scores of Secondary school students about awareness on HOTS

From the figure 1, it is clear that more scores of secondary school students regarding the awareness on HOTS are on the lower end of the scale and the distribution is platykurtic in nature.

Percentage analysis was conducted to find out the extent or level of secondary school students regarding the awareness on HOTS. The results were as shown in the table 2.

Table 2 - Level of awareness on HOTS among secondary school students for the whole sample

Item	Low Level	Average Level	High Level
No. of Students	33	87	30
Percentage	22	58	20

From the table 2, it is evident that there exists significant difference in the level of awareness of secondary school students regarding the awareness on HOTS.

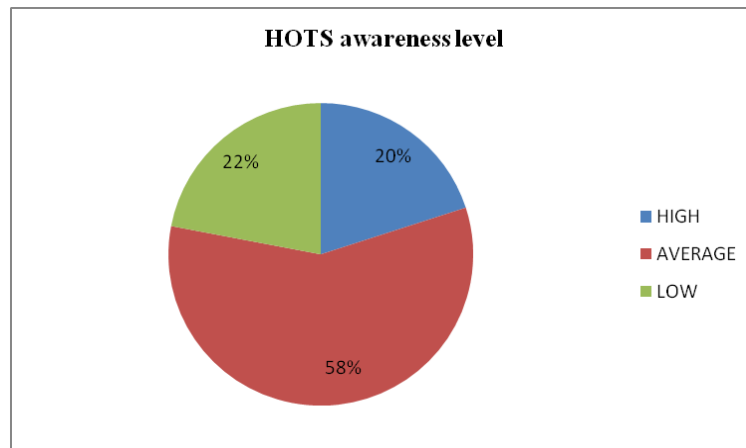


Figure 2 - Pie – diagram for the level of awareness on HOTS among secondary school students for the whole sample

Figure 2 clearly depicts the finding that the level of awareness on HOTS among secondary school students for the whole sample is at an average level.

The obtained data were further subjected to the treatment of ANOVA. The summary of the data and result obtained for the one way ANOVA for the level of awareness of secondary school students regarding the awareness on HOTS is given in table 3.

Table 3 - Summary of one way ANOVA on the awareness on HOTS among secondary school students for the whole sample

Component	Source of Variation	Sum of Squares	Degrees of Freedom	Mean squares (Variance)	F value
Awareness on HOTS among secondary school students	Between Groups	10.021	2	5.010	0.110
	Within Groups	6703.452	147	45.602	

The F value is 0.110 which is less than the table value for corresponding degrees of freedom at 0.01 level. This shows that the secondary school students does not possess categorical differences regarding the awareness on HOTS.

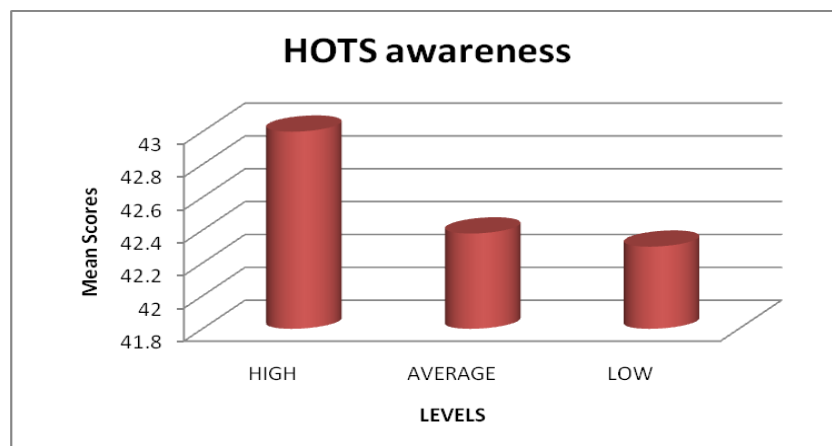


Figure 3 - Comparison of Mean scores of different levels of awareness among secondary school students on HOTS

From figure 3, it is clear that the mean scores are high for high level secondary school students regarding awareness on HOTS. Hence from Tables 2 and from figures 2 and 3, it can be concluded that secondary school students differ in their level of awareness on HOTS. Hence hypothesis I is accepted and it is inferred that there is more of an average awareness on HOTS among secondary school students.

2.2 HOTS awareness level of secondary school students based on the sub sample Gender

The significance of difference between the mean scores of secondary school students about awareness on HOTS for the subsample – Gender is given in table 5.

Table 4 - Comparison of Mean Scores of secondary school students about awareness on HOTS for the subsample - Gender

Groups	N	Mean	Standard Deviation	t- value
Male	90	40.7	6.04	4.211**
Female	60	45.17	6.83	

** - Significant at .01 level

Table 5 shows that the t – value found out is significant at .01 level. The mean values of Girl secondary school students are found to be higher than Boys secondary school students. The comparison of mean scores of male secondary school students and female secondary school students are clearly depicted in figure 4.

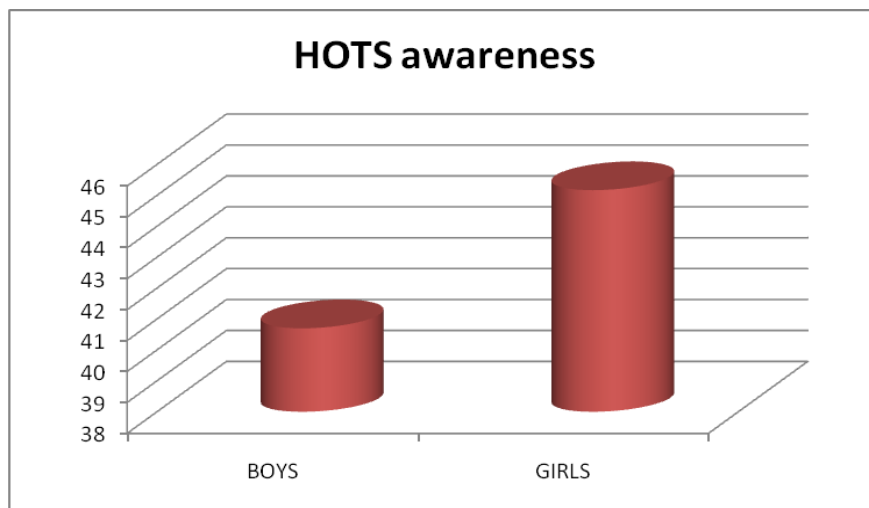


Figure 4 - Comparison of Mean scores of Male and Female secondary school students about awareness on HOTS

From the figure 4, it is clear that the mean scores of Boys are lower than Girls. Hence from the table 5 and figure 4, it can be concluded that there is significant difference between male and female secondary school students about awareness on HOTS. Hence Hypothesis II is rejected. So it can be inferred that there is significant difference between mean score of awareness on HOTS among male and female secondary school students.

3. Major Findings

- There is significant difference in the level of awareness about HOTS among secondary school students
- There is significant difference in the HOTS awareness level among secondary school students of Kerala for the subsample Gender

4. Conclusion

The present study revealed that secondary school students of Kerala are average at their awareness regarding HOTS. This is not a desired outcome. Higher order thinking skills must be properly developed in secondary school students so as to enhance critical thinking, creative thinking, logical reasoning and problem solving ability among secondary school students to excel in their studies especially in science learning. Then only the students will develop ability to compete well in examinations, both academic and career related. Higher order thinking skills will enable students to look at scientific concepts with multi perspectives and to think at a superficial level

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Appendix A – HOTS Awareness level scale

Dimensions	SLNo	Item	Strongly agree	Agree	Not Decided	Disagree	Strongly Disagree
GENERAL AWARENESS	1	I feel boredom while learning Physics					
	2	The Physics class room creates more intense interest in me to know more					
	3	I have the opinion that Physics learning will become more interesting on the use of divergent learning methods					
	4	I participate actively during Physics classes					
	5	I often think of becoming Physics classes more interesting					
PROBLEM SOLVING SKILLS	6	I the ability to organize data appropriately for solving a problem					
	7	I have the ability to identify patterns or common concepts underlying a problem					
	8	I have the ability to identify my own ways for finding solution to a problematic situation in Physics					
	9	I have the ability to analyze important informations before solving a problem					
	10	I have the ability to find out simple methods or matrices to solve the problems in an easier way					
REASONING SKILLS	11	I have the opportunity to raise and rectify doubts in physics class					
	12	I am utilizing different sources for clarifying doubts					
	13	I have the ability to argument while discussions are going in a physics class room					
	14	I have the ability to check the credibility of the learning resources obtained for a particular concept					
	15	I have the ability to make proper decisions in the concepts taught in the classroom related to Physics					
CRITICAL THINKING SKILLS	16	I have the ability to identify the central theme underlying a particular situation or issue					
	17	I always make bias free decisions in Physics classes					
	18	I always make bias free inferences from the data obtained?					
	19	I am able to distinguish between relevant and irrelevant data related to a concept in Physics					
	20	I have the ability to identify errors in the data obtained or concepts in resource materials					
CREATIVE THINKING SKILLS	21	I get opportunities for presenting own ideas during science learning in classroom					
	22	I always feel to do the learned concepts myself during Physics classes					
	23	I am trying to find out own techniques for understanding Physics concepts easily					
	24	I am trying to rethink about the learned concepts and ideas					
	25	I have the tendency to look for many possible answers rather than one for a particular problem					