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# ISSUES FACED BY MATHEMATICS TEACHERS TO DEVELOP THE HIGHER ORDER THINKING SKILLS OF SECONDARY SCHOOL STUDENTS

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## Abstract

*The cognitive abilities of the students are evaluated by the higher order thinking skills which is a major tool for the enhancement of academic achievement. The main objective of this research was to identify the issues faced by mathematics teachers to develop the HOTS of students. The mathematics teachers from public secondary school in Lahore were the population and 218 (Male 113 & Female 105) participants were selected as sample by simple random sampling technique. A self-administered questionnaire was administered for data collection by survey method. The findings identified a significant difference in the dimensions of instructional skills and students' attitude. The study is beneficial for the educationists to adopt innovative strategies for enhancement of higher order critical thinking skills among students.*

**Keywords:** *Issues, SSTs, HOTs, Students*

## Introduction

The main objective of the education department is the success of students to gain objectives. The education department has applied many theories to polish the skills of teachers. These purposes can only be obtained when the tutors produce the creative thinking in pupils (Brown, 2013; Wilson & Narasuman, 2020). Living in 21st century, most of organizations get developed and the education sector has also developed the teaching learning process. From last many years, the critical thinking of the pupils has become the task issue for educationists (Fareed et al., 2018). It is said that the secondary levels of education not producing creativity in pupils Majority pupils faced multi problems in mathematics and as result failed to achieve the main objectives (Ibrahim et al., 2019; McKenney & Reeves 2014). The tutors make their useful efforts to share their practical experiences with pupils so that the pupils feel attentive for their objectives (Ali et., 2021; Tabassum et al., 2022).

Mathematics is necessary for the whole levels of education in Pakistan. Pupils show more interest in this subject to get good grades. Mathematics played a vital role for the development of a bright future. The agenda of educational curriculum is of behavior and thinking skills of the pupils (Ellis, 2011; Parveen et al., 2021). Creative thinking skills cannot be produced due to several reasons such as rush in classes, extra work, lack of professionals' staff, lack of effective curriculum and unproductive inspection system (Nitsch et al., 2013). Living in the modern world, the new education system stresses producing creativity in pupils. Teaching methods

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played a vital role in maintaining the interests of pupils in the subject. Tutor inspiration enhances the interest of pupils in creative work. By doing all these still there exist hurdles for students in mathematical learning (Jacobs et al., 2010). It considered the seven best skills for solving the problem, critical thinking is the best skill for the development of cognitive ability of the pupils. Tutors must adopt various approaches to create HOTS in pupils. To develop these skills, it is necessary to get specific information and knowledge to utilize these updated strategies (Malik et al., 2016; Hanif et al., 2022).

**Research Questions**

1. Is there a significant difference between male and female participants to enhance higher order thinking skills of students?

1.1 Is there a significant difference between male and female participants about incompatible curriculum?

1.2 Is there a significant difference between male and female participants about instructional environment?

1.3 Is there a significant difference between male and female participants about instructional skills?

1.4 Is there a significant difference between male and female participants about students' attitude?

1.5 Is there a significant difference between male and female participants about examination system?

**Literature Review**

Teaching staff perform different activities during their class i.e., teaching, providing feedback, group activities and checking the homework. Due to the number of pupils, there are many problems to manage all these activities within a short time. To enhance higher order thinking skills requires individual interaction towards the pupils to understand the rules and mathematics concepts (Doganay & Bal, 2010; McKenney, & Reeves, 2014). To develop HOTS in pupils there is also a lack of professional knowledge. The tutors of mathematics also behave like other subjects but the teaching in mathematics is completely different as compared to other subjects. On the other hand, the pupils also fond of cramming rather than understanding the concepts. The pupils have a fear and feel insecure in this subject. To develop the level of confidence among pupils it can be useful, but it is possible if the tutors can manage all these issues effectively (Opfer, & Pedder, 2011; Fatima et al., 2022). Knowledge sharing between tutor and pupils during creative activities and in group learning develops the real sense of creativity in mathematics. During this process, pupils share their ideas, feelings and knowledge and it is the best tool for the development of higher order abilities. Lack of cooperation among pupils and tutors creates lack of interest and confidence among pupils (Van Driel, & Berry, 2012; Butt et al., 2022).

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**Incompatible Curriculum**

Tutors' knowledge and pupils' higher order thinking skills have positive relationship between each other. Curriculum development is a fundamental key for successful teaching. The content of the syllabus must be based on the tutors' knowledge and the potential of the pupils. Using different strategies, tutors make it more effective and useful for pupils (Ball et al., 2008). The instructional activities in the course are helpful for tutors to develop pupils' HOTS especially in mathematics subject. Pedagogical content matters provide the proper guidelines and instructions for teaching. All these various kinds of subject material support the good ideas of teaching methods and helpful for the selection of effective strategies (Brown, 2015). The syllabus is the vital instrument for the accomplishment of tutoring procedures. Without teaching materials, the teaching process cannot be completed effectively. The instructional material makes the teaching fruitful. If the syllabus is standardized to a high level of creativity and critical thinking skills then it will meet the tasks (Al-Enezi, Farahan, 2008; ***Jabbar et al., 2019***).

From the past years, educationists had brought many changes in the development of mathematics, the council has also recommended that curriculum is effective when met to the new policies. The tutor reads the thought of pupils and makes strategies accordingly. The tutors put different constructional problems before pupils for generating HOTS that they can answer the rational problems (Confrey et al., 2012). Curriculum based assessment and core activities play a vital role in creating pupils' HOTS. It is the best source to convey new knowledge to the learner. The effective transition towards the pupils through curriculum has key of success for the academic achievement of the pupils in mathematics (Corcoran et al., 2009).

**Instructional Environment**

The directions and procedures of tutors play an important role in developing reasoning and analogical skills of pupils. The scholars are of the view that transformational leadership style enhancing the skills of pupils (Chamosa, et, al., 2012). He further suggested that tutors' instructional behavior support the pupils' HOTS in mathematics. Instructional environment ensures to eradicate the issues that are faced by pupils. For generating pupils' HOTS in mathematics is a chief competition in 21$^{st}$ century. Instructional atmosphere is marching stone for this concern in class. Tutors adopt various methods to enhance the logical and analytical skills of the pupils (Purnomo, 2017). Confrey (2012) stated how to enhance the pupils understanding of analytical and logical reasoning? It is often noticed as an interdisciplinary action in social sciences subjects and IT subjects. The researchers pointed out that these robotic actions were used to develop classroom coaching. Instructional activities assist them from passive to dynamic learning and by sharing information with their fellows will enhance their logical and thinking skills (Anwar et al., 2022).

**Instructional Skills**

Instructional skills are the practical skills that can be demonstrated during teaching. In assisting the pupils in their curricular and learning abilities leads to HOTS. These activities will improve the thinking skills of the pupils (Bielaczyc, 2013). Furthermore, the directions are inspiring

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pupils to acquire the rational wisdom, yet it is a grounding to rubbish the distinguishing and opportunities and to make them more fruitful and strengthen (English, & Kirshner, 2016). Previous literature suggested that the good instructional skills of the tutors are major components of teaching for the development of the thinking abilities of the pupils, especially in mathematics. The National Research Council 2003 reported that teaching instructional skills based on the tutors' subject knowledge and the best element of pupils-tutors interaction for solving the pupils' problems.

Past studies emphasized innovation based professional development. It also suggested that the tutors must have some knowledge about creating pupils' HOTS. To create HOTS, it requires a new approach based on cording and analytical skills. (Haydar, 2002) further posited that the effects of training are more informative for informing tutors' interpretations of pupils' learning. Moreover, McDonough et al (2002) stated that tutor's pedagogy skills are helpful for effective teaching. Tutors should have maximum knowledge of their subject, to deliver the knowledge and adopt various techniques according to the situation and context where they are teaching.

**Students' Attitude**

Theoretically, discipline is a guide way and precise process to brand the coaching in classroom environment for collective objectives of pupils and tutors and alteration in the attitudes and conduct of pupils consequently (Drijvers, & Trouche, 2008; ***Jabbar et al., 2021***). Thus, it mandatory to maintain the discipline within classroom environment to keep social communication for education purposes. It suggested to attain the main purpose of classroom environment and essential to maintain the discipline in the class. Good discipline not only makes the pupils solve the problems but also helps in making the pupils the good citizens of society. Without good discipline, the thinking skills of pupils cannot be developed. Attitudes are good or bad behavior towards the work or task. The academic achievements of pupils relate to the pupils' attitude during class activities. The positive attitudes and behavior of pupils with other class fellows and tutors provides several chances for creating HOTS through positive interaction. Positive attitude of the pupils is an important tool for obtaining the maximum academic achievement (Drijvers et al., 2010).

Both the tutors and pupils have the thrust for new learning. They are interested to implement the changes in at school level. Therefore, the victory lies in the smooth relation of tutors and pupils. (English, & Kirshner, 2016). Previous literature suggested that lack of interaction between pupils and tutors creates issues. It is stated that effective classroom management makes school the best place to eradicate violence and disruption and to make a place safe for the growth of higher order thinking skills (Drijvers et al., 2010).

**Examination System**

The assessment of the pupils after solving the exercises in mathematics is a development tool for practice of the concepts. Tutors enforce various activities to observe the thinking skills of pupils' i.e., daily based feedback, weekend test, and monthly test. These activities are also performed by the school after completion of the specific part of the syllabus like as exams after 6 months, 9

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months and annually. These tests must be based on the evaluation of pupils' HOTS pupils (Irwin, 2003; ***Jabbar et al., 2022*).**

The project-based valuation is an essential factor for increasing the HOTS of pupils in mathematics. It is sad to mention that this action can be seen at a very low secondary level. Project based learning stress the pupils to solve the queries by HOTS (Furtak, 2009). It is mostly seen that tutors, prospectus creators, and textbook writers flop to identify that over-all mathematical designs are not directly appreciable. Mathematics pupils do not solve their questions and problems based on experience rather, they need to be focused on and directed to identify what is applicable in and across circumstances (Ruthven, 2014).

## Methodology

The study was conducted in quantitative and casual comparative research design. A descriptive study was adopted based on quantitative research design to find out the problems faced by mathematics teachers. The population of the study was secondary school teachers of mathematics from Lahore whereas, 218 (Male= 113, Female= 105) respondents were selected as sample of this study through simple random sampling technique. For this study self-administered questionnaire was administered and questionnaire was divided into two parts; the first part was comprised on the demographic variables of the respondents and second part was comprised on the items related to the variable of the study problem faced by the SSTs to develop the HOT skills of students. Data was collected by using a questionnaire through survey method based on five points 1. SDA to 5. SA. During data collection it was followed the research ethics. The purpose of the study was briefly discussed with the respondents and given the instructions to fill the questionnaire. The researcher personally visited the sample institution, and it was ensured to the respondents the collected data will be kept confidential and will be purely used for academic purposes. Moreover, the data was collected from the respondents without being given any rewards. The reliability is a process to assess the consistency of the questionnaire when applied more time (Creswell, 2014). For this study the Cronbach's Alpha Coefficient was applied to analyze the reliability of the questionnaire that was greater than 0.7 (Nunnally 1978). Statistical package for social science (SPSS). The descriptive statistics; Mean, Standard Deviation and inferential statistics; independent sample t-test was used to find the positive difference in male and female teachers' problems in creating higher order critical thinking skills of the students.

## Analysis

Table 1. Descriptive Statistics

| *Dimensions* | *M* | *SD* |
|---|---|---|
| Incompatible Curriculum | 3.18 | .95 |
| Instructional Environment | 3.65 | .93 |
| Instructional Skills | 3.69 | .96 |
| Students' Attitude | 3.55 | .96 |

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| | | |
|---|---|---|
| Examination System | 3.61 | .93 |

***Overall= M= 3.53, SD= .94***

To evaluate the level of secondary school teachers about the issues related to HOTS of students. Statistical findings show that the mean of the statements was from 3.18 to 3.69 and overall M= 3.53, SD= .94. It means the respondents agreed about all the dimensions of HOTS.

Table 2. *Independent Sample t-test (Male= 113, Female= 105)*

| *Dimensions* | *Gender* | *M* | *SD* | *t* | *Sig.* |
|---|---|---|---|---|---|
| Incompatible Curriculum | Female | 3.83 | 1.11 | .29 | .41 |
| | Male | 3.92 | 1.06 | | |
| Instructional Environment | Female | 4.01 | 1.02 | -.69 | .48 |
| | Male | 4.07 | .91 | | |
| Instructional Skills | Female | 3.57 | 1.28 | -1.80 | .01* |
| | Male | 3.91 | 1.13 | | |
| Students' Attitude | Female | 3.32 | 1.19 | -1.39 | .05* |
| | Male | 3.97 | 1.09 | | |
| Examination System | Female | 3.55 | 1.24 | -1.17 | .18 |
| | Male | 3.76 | 1.16 | | |
| ***Overall*** | ***Female*** | ***3.65*** | ***1.16*** | ***-.95*** | ***.22*** |
| | ***Male*** | ***3.92*** | ***1.10*** | | |

*Significance level <.05*

To examine the difference of opinion of the male and female respondents regarding the development of HOTS of the students. The statistical analysis indicated a significant difference in the dimensions about instructional skills and students' attitude, while overall there was not shown a significant difference. The significant acceptable value was less than .05 and except of incompatible curriculum mean score of male respondents were greater than female respondents.

## Conclusions

It was found that secondary school mathematics tutors are well conscious about the issues faced by secondary school tutors for generating the higher order thinking skills of the pupils in Math subject. This research investigated that there was found positive statistical difference in mean score of male and female tutors about the dimensions of variable and except of incompatible curriculum mean score of male respondents were greater than female respondents. Furthermore, a significant difference in the dimensions about instructional skills and students' attitude.

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## Discussion and Recommendations

Mathematics is a compulsory and unique subject among all the compulsory and optional subjects at secondary level. It also requires embracing the various techniques and teaching methods. Both the tutors and pupils are interested in enhancing their skills and knowledge. Both want to bring changes at the school level. It is need of time to enhance the higher order thinking skills of pupils at secondary school level in the mathematics subject. The tutors play important role in this regard. The pupils can use more fruitful their skill in mathematics when they have higher order critical thinking. This research is also helpful for those who are interpreted in to enhance their skills in future. The study is helpful for the policy makers and curriculum planners for the development of HOTS among the secondary school pupils. The research is also productive for the educational staff to increase the instructional skills among the tutors during tutor training programs.

This research gives awareness of problems faced by secondary school mathematics tutors for developing HOTS to pupils. This study highlights issues and challenges raised in the classroom for learning HOTS in mathematics. The research is helpful for tutors to provide ways how they may overcome these challenges, how they can effectively handle pupils and change their behavior and attitudes. This research is helpful for educationist, curriculum designers and policy makers to frame policies and design curriculum aligned with content provided for higher order critical thinking skills.

Following are the recommendation presented based on findings:

1. The further studies should be conducted for the public and private secondary school tutors and, also for the urban and rural secondary school tutors.
2. Several workshops and seminars should be conducted for the awareness of tutors and parents to develop the higher order critical thinking among pupils.
3. It is recommended that the curriculum development, instructional skills, pupils' attitude, instructional environment, and system of examination should be based on the creating higher order critical thinking of the pupils.

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