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Impact of Affective use of ICT in Teaching Mathematics at Secondary Level

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Abstract

The government of Punjab Pakistan is taking steps to keep up the quality of education particularly at school level. There are three steps in school education in Punjab. First is Primary second is elementary and third is high school education of secondary level education. Initially government has taken steps for provision of information communication technology to its secondary level education. Almost all high schools of the government of Punjab have now been ornamented with IT labs. Most of which have smart board facility and Tabs for transmission of information. The government is working on regular basis on the task to provide numerous schemes of information communication technologies to schools particularly at secondary level. However proper teaching of every subject specially mathematics through information communication technologies is still lacking in the country especially in Punjab. Through this paper we have indicated some aspects through which we are able to decrease rote habits through Information Communication Technology. The IT Labs in the schools of Punjab is not being used by the teachers of the other subjects. So, there is very least use of IT Labs in teaching process of the other subjects in the secondary school. This paper presents the need of using ICT in other subjects especially in mathematics to build up the confidence in the teachers using ICT in teaching of mathematics. Some sort of lacking of time to the teachers in the classroom is also a base of poor teaching. Giving access to IT labs and their use to the non-IT teachers as well can be helpful in achieving the quality education at High school level. The conclusion of this paper drawn from collected data and after statistical analysis of it, suggestions have been indicated to keep up the concept building approach of mathematics students through ICT in Punjab through district Gujranwala.

Keywords: Information Communications Technology (ICT) & Mathematics Teaching (MT)

Introduction

The world has become a global village in the present era with the invention of the internet, social media, and different information and communication technologies. In today's digital life we are using Smart Board, Tablets, Smart Phones, Computers, LCDs, and the Internet. Similarly, these IT tools have become common in educational institutions. According to John Pisapia (1994), Pedagogy has to be improved in many ways in the education system through ICT. With the use of ICT anyone re-apply the process of learning for teaching. The motivation of learner commitment for restoration of knowledge collective and individual learning can be improved whereas students and teachers prepared various skills of ICT. In this modern age, the classroom is still incomplete if the use of ICT is not appropriate. All the authorities related to the education system in Punjab launched different projects like the installation of IT Labs, the facility of smart boards, tablets for the communication of information, LED overhead projectors, and Internet facilities at the Secondary level for the enhancement of quality in education. However, we are concerned herewith about mathematics teaching through ICT in Punjab like the Gujranwala district.

For the amalgamation of ICT in mathematics teachings, numerous findings are there by researchers around the World. Some of which are reviewed before the presentation of this paper. During the literature review, it was pointed out that rareness was like in the literature exclusively in the teaching of mathematics. So, some findings will be suggested for the amalgamation of ICT in mathematics teachings for the sake of concept building approach of the students as well as the teachers. Simultaneously this paper is to suggest remedial measures to erase the causes which hinder the integration of ICT in mathematics teachings at the Secondary level. Also, suggestions for remedies on inadequate use of ICT in mathematics teaching.

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Statement of the Problem

It has been measured that Mathematics is a one of tough subjects especially at Secondary Level. Most of the students prepare for Mathematics Examination by selective study due to which lacks of concept building appeared. As in classical teaching and rote habits the conceptual study become weaker. The secondary level is a bridge from where students turn towards conceptual study. Due to this the topic of my article is "Impact of Effective use of ICT in Teaching Mathematics at Secondary Level".

Significance of Study

It is well established in the modern world that education in any field is incomplete without ICT. Information Communication Technology is a tool for conceptual learning in pedagogy. This article can help institutions / teachers to convey healthier approaches of conceptual learning by amalgamation of ICT in teaching of Mathematics at Secondary Level

Objectives of the Study

The main objectives were:

1. To highlight the roll of ICT in mathematics teaching at Secondary level.

2. To suggest the remedies to remove the element causing the hurdles in the use of ICT in mathematics teaching.

Research Questions

1. How can improve Mathematics Teaching by amalgamation of ICT at Secondary Level?

2. How to improve student conceptual learning with integration of ICT in Mathematics Teaching at Secondary Level?

Methodology

The survey method was adopted to achieve the objectives of the study. The objectives of the study were 1) to highlight the roll of ICT in mathematics teaching at Secondary level. 2) to suggest the remedies to remove the element causing the hurdles in the use of ICT in mathematics teaching.

District Gujranwala was selected for the study. 107 High/Higher Secondary schools of District Gujranwala were chosen for the study. For the researcher's convenience, all schools were selected from the city of Gujranwala. The selection was made irrespective of the management of the schools either Government or Private. All selected schools offered mathematics teachings up to Higher Secondary level. The survey was conducted only from the schools that were conducting mathematics teachings to class IX. A total number of schools narrated above is divided as listed below.

I)	Government Higher Secondary Schools	13
II)	Government High Schools	56
III)	Government High Schools (Aided)	06
IV)	Higher Secondary Schools (Private)	09
V)	High Schools (Private)	23

Population and Sample

All mathematics teachers of 107 Government, Private, Aided High/ Higher Secondary Schools of District Gujranwala were the population of the study. 400 teachers were teaching mathematics in the above 107 High/ Higher Secondary Schools. A sample of 150 teachers of mathematics was selected based on convenient sampling from the population selected for the study. It is worth mentioning here the statistics applied were on the basis 95% confidence level and a 05% error margin. These two levels were calculated with the use of the formula given below.

$$\text{Sample size} = \frac{\frac{z^2 \times p\,(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p\,(1-p)}{e^2 N}\right)}$$

Where,

N = Population size – 400
e = Margin of error = ±0.05
z = z-score
P = Precision value=0.5, q=1-p

Data Collection

A questionnaire was structured to collect initial data from the respondents by making close questions. The questionnaire was prepared for investigation of the elements for enhancement of the council building approach and the factors being the cause of losses due to not use of ICT in mathematics teaching. The questionnaire was designed in parts taking different aspects through which the objectives of the study could be achieved. Some of the data were taken from different records journals and Government institutions.

Results and Discussion

Accessibility to ICT Hardware

Available resources and equipment of ICT in the school commonly were the beyond of access of the teachers. By this questionnaire researchers decided whether ICT equipment were available in class room where mathematics teachings were in way. The mathematics teachers were requested to reply about their regular approach to ICT and equipment. The answers made by two categories that is 1. Yes and 2.No. the frequency on the basis of replies by the mathematics teachers given in table 1.

Table-1: Frequency of Respondents on Accessibility to ICT Hardware

Response	Frequency	Percentage
Yes (Had access to ICT)	103	68.67
No (Did not have access to ICT)	47	31.33
Total	**150**	**100**

68.67% mathematics teachers replied that they had appropriate approach of ICT and equipment at their place of postings. On the other hand, 31.33% teachers replied complaining in adequate access of ICT equipment/ software. According to the above table double of the mathematics teachers had appropriate approach to ICT software/ hardware. But they have be integrated mathematics teachings with ICT. According to the above indicated results it proved that non availability of ICT was not the factor to integrate the ICT in mathematics teachings in the selected schools.

Use of ICT by Teacher in Class Room

Besides of living in Global Village most of teachers used ICT in their practical life including some personal affairs. But in the class room nothing was seen like use ICT in the teaching and learning purpose. The teachers who were in use of ICT in their practical lives were inquired about the rule of ICT in class room. Their replies were indicated in five categories. 1. Very smoothly, 2. Smoothly, 3. Occasionally, 4. Some times, 5. Never. Table-2 given below is showing the replies frequencies of mathematics teachers as well as percentage. According the above table only 10.67% mathematics teachers were using laptop/ computer smoothly in teaching mathematics in the class room whereas 0.00% replies were received about the use of laptop/ computer very smoothly in class room. 17.33% of respondents used occasionally and 16.67% used some time and 55.33% had never used laptop or computer in the teaching of mathematics in class rooms. Only 01.33% were using LED projector very smoothly and 12.67% smoothly used LED projectors in mathematics teaching in class room whereas heavy number of percentages that is 58.00% never used LED projector for the purpose. A heavy number of percentage i.e. 63.33% of mathematics teachers have no usage of Smart Board, 92.67% of respondents have no use of mathematical software and 82.67% have no idea to use graphical applications in mathematics class. A least number of replies like 10.95% were received who used courseware very smoothly in the class, like wise a little number of percentage that is 2.38% were in use of PPT and 10.31% used materials in the class room extracted from online sources.

Table-2: Distribution of Respondents on their ICT usage in Class

ICTs	Very Smoothly (%)	Smoothly(%)	Occasionally (%)	Some Times (%)	Never(%)
Computer /Laptop	00 (00.00)	16 (10.67)	26 (17.33)	25 (16.67)	83 (55.33)
LCD projector	02 (01.33)	19 (12.67)	32 (21.33)	10 (06.67)	87 (58.00)
Smart Board	05 (03.33)	16 (10.67)	26 (17.33)	08 (05.33)	95 (63.33)
PPT	03 (02.00)	26 (17.33)	28(18.67)	03 (02.00)	90 (60.00)
Audio and Video	00 (00.00)	15 (10.00)	25 (16.67)	17 (11.33)	93 (62.00)
Courseware	16 (10.67)	19 (12.67)	32 (21.33)	24 (16.00)	59 (39.33)
Mathematics Software	00 (00.00)	00 (00.00)	08 (05.33)	03 (02.00)	139 (92.67)
Practice tutorials prog.	00 (00.00)	17 (11.33)	26 (17.33)	03 (02.00)	104 (69.33)
Graphical Applications	00 (00.00)	15 (10.00)	08 (05.33)	03 (02.00)	124 (82.67)
Simulations programs	00 (00.00)	00 (00.00)	05 (03.33)	16 (10.67)	129 (86.00)

Online Materials	15 (10.00)	26 (17.33)	46 (30.67)	20 (13.33)	43(28.67)

Degree of Amalgamation of ICT in Teaching:

Different ICT tools were used by the different mathematic teachers due to which the degree of amalgamation of ICT in mathematics teaching varies from one respondent to another respondent. Mathematics teachers explored the degree of ICT amalgamation in their mathematics teaching. The categories of responses were established as 1. Fully Amalgamated, 2. Amalgamated to some extent, 3. Not amalgamated at all. The result distributed in the above three categories along with the percentage is given below in table-3.

Table-3: Distribution of Respondents on the Degree of Amalgamation of ICT In Teaching

Response	Frequency	Percentage
Fully Amalgamated	00	00.00
Amalgamated to some extent	20	13.33
Not Amalgamated at all	130	86.67
Total	**150**	**100**

The above table shows the data of responses with frequencies and percentages. According to the data, a very low number of mathematics teachers use ICT in mathematics teachings and nothing was integrated as full ICT in the class of mathematics. Most of the mathematics teachers (86.67% replied that they have not amalgamated ICT in their teaching classroom at all while 13.49% replied saying they have amalgamated up to some extent specific

Proficiency of Teachers in ICT

The most important thing is the skill, proficiency, and ability of the teachers to use ICT in mathematics teachers, which can be upgraded either by training or by motivation. Similarly, the lack of proficiency and ability to use skills discourage the whole system. Some motivational steps enhanced the ability of understanding for use of ICT in mathematics teaching. Having the appropriate ability, the teacher can intergrade ICT in mathematics teaching for the best results of the council building approach. The sample teachers were inquired to indicate their proficiencies in the use of ICT in teaching mathematics without having training on the task.

Question closed with 1. Very Good, 2. Good and 3. Poor. The frequencies with percentages are given in table-4.

Table-4: Proficiency of Teachers in ICT

Response	Frequency	Percentage
Very good	08	05.33
Good	35	23.33
Poor	107	71.33
Total	**150**	**100**

The table-4 shows (71.33%) of the mathematics teachers replied and indicated about their poor skills in ICT whereas (23.33%) of which said by informing that they had good proficiency in use ICT. While only (5.33%) of the sample teachers replied that they have very good skills for use of ICT.

Capacity Building Training on Integration of ICT

IT labs and provision of IT tools/ equipment and hardware do not mean the achievement of amalgamation of ICT in the teaching system of mathematics teachers. Software along with hardware could not enable the proper purpose of grant of these tools. Only the availability of all infrastructures could not achieve the goods for which these have been provided. For the complete fruitful amalgamation of ICT training attitude of the mathematical teachers is very much essential. The teachers in the sample were asked if they have training on ICT amalgamation and then how to enhance the quality of the concept building approach. The answers of mathematics teachers were close to 1. Yes, 2. No. According to the opinions received from the sample, the frequency along with the percentage is given below.

Table-5: Frequency of Respondents on Training on ICT Integration

Got training on ICT usage	Frequency	Percentage
Yes	55	36.67
No	95	63.33
Total	**150**	**100**

The researcher seems to that 63.33% of the opinion airs of the sample did not have any sort of training on the task. Whereas 36.67 percent of respondents were in view that they have been offered the opportunity of training on an amalgamation of ICT in mathematics teaching.

On the other hand, the researcher examined the institutional arrangement for the training on the amalgamation of ICT in teaching. Some institutions found a little bit of arrangement for the training on the task. There was a very much notable difference found between the teachers/ students having training on amalgamation and those who were not provided training on this project. Respondents orally believed that they ever never used ICT in classroom teaching due to the non-availability of proper training. All part studies also recommended training on ICT amalgamation in teaching. The findings of this study also consolidated with the opinion of part studies.

Detailed Training on ICT Used in Mathematics.

For the amalgamation of ICT in Mathematics, Teaching teachers should have a facility of continuous training programs either at the level of institution or with collaboration. As in the field of ICT, every minute is full of inventions and up gradation. So, for the amalgamation of ICT in teaching in classrooms the skills of the teachers must be according to the ICT requirements. Specific training on the use of ICT in Mathematics teaching should be a base to keep up the conceptual approach to understanding the teachings and learning. The teachers in the sample were asked that whether they have mathematical-based training in ICT or never. The replies are shown in table 6 below.

Table-6: Detailed training on ICT use in Mathematics

Training Specific ICT Integration	Frequency	Percentage
Yes	28	18.67
No	122	81.33
Total	**150**	**100**

According to the figures shown in table all responses have been bifurcated as 18.67% of the sample teachers replies that they have not any specific / up to the mark training on ICT whereas 81.33% of the responses were to have ICT training keeping the target mathematics teaching. On the basics of this study the researcher revealed that adequate training on ICT especially for the mathematics teaching should enhance the quality of concept building approach.

Teachers approach of ICT use in Mathematics Teaching

One of the deficiencies in the system of education teaching is a lack of interest towards use of ICT in mathematics teaching. The teachers in sample were asked their opinions on ICT amalgamation in teaching while in Classrooms. The answers have been closed on 1. Positive 2. No response 3. Negative.

Figure with percentages given below in table-7

Table-7: Respondents' Teachers approach of ICT use in Mathematics Teaching

Attitudes towards ICT Use inClassroom	Frequency	Percentage
Positive	38	25.33
Neutral	21	14.00
Negative	91	60.67
Total	**150**	**100**

According to study narrated above most of the respondent (60.67%) showed negative approaches on the ICT used in mathematics teaching.25.33% of the total sample were in positive approach towards task. Where as 14.00% of replies showed no concerned with positivity or negativity. Hence, we have to upgrade teachers approach towards use of ICT in Mathematical Teaching in class rooms. The findings of this step proved that along with other investigations the teacher approach towards use of ICT in mathematics teaching leaving is unavoidable.

Hindrances in the System towards amalgamation of ICT.

All of the above discussion and studies showed most of the things affecting ICT-I in Mathematics Teaching the teacher's teaching mathematics has facing hindrances towards ICT in Math Teaching besides of all other qualities. At the end of the sample teachers were asked about the hindrance which has to restrict them in the process of integration. Seven types of information were gotten from the sample teachers via closed question which is given below in table 8.

Table-8: Hindrances Faced by Respondents in the System towards amalgamation of ICT.

Response	Frequency	Percentage
Unavailability of adequate ICT tools at School	44	29.37
Unavailability of adequate software at School	55	37.30
Time constraint in using ICT in allotted duration of a class	108	72.22
Unavailability of necessary resources at home	126	84.13
Lack of technical support for ICT integration	128	85.71
Lack of teacher training for ICT integration	94	62.70

Lack of knowledge about how to integrate ICT	141	94.44

The above study reveals that a major part of respondents i.e 94.44% facing lack of appropriate knowledge of ICT which was the main hindrance to accompanied ICT with teaching of Mathematics. As concerned with technical support by the institution and government etc.85.71% replied that there is very least support towards integration of ICT in teaching of Mathematics. While 84.13 % have not related resources to keep up them at home. According to the replies of 72.22 percent the duration of period was not sufficient integration of ICT in mathematics teaching in the classrooms. Under the discussion with research, it was also revealed that the curriculum could not permit them to switch over from classical teaching to the teaching of mathematics along with integration of the ICT. In case of ICT tools /equipment's and hardware unavailability only.29.37% teachers replied. Whereas according to 37.30% replied insufficient provision of software was the cause have to be erased.

Conclusions

The amalgamation of ICT in Mathematics Teaching is unavoidable in the present era of the institutions. This amalgamation will be very much fruitful to the students as well as the teachers for the clearance of concepts to breading of knowledge. For the advancement of the skills of leaving in the students, this amalgamation is also unavoidable.

On the other hand, there are some factors that seem to have the most complications in the process. It was established factor after the study that approximately all high school has proper hardware of ICT but nothing like a policy for the amalgamation of ICT into the teaching of Mathematics at the school level.

Similarly inadequate training on ICT, lack of proper mathematical training about ICT, and the encouragement attitude towards teaching without ICT being badly affected the collaboration of ICT in Mathematics pedagogy. Similarly, a little bit of knowledge about what way teaching can be advanced with ICT seems deficiency in confidence in teaching mathematics. It was concluded from the study that material which was very much necessary and was a basic need for the concept building of the students and teachers was not available.

The duration allocated to the mathematics teacher to teach mathematics in a day or an education calendar was not appropriate so that ICT could be amalgamated. It also came to the notice of the researcher that the friendly factors which were available in the schools in adequately operated. Moreover, the mathematics teachers were not independent to take steps for the amalgamation of ICT in mathematics teaching. So, summing up the discussion it was concluded that the amalgamation of ICT in Mathematics teaching must be fruitful in the concept building of students and teachers if all discouraging factors are vacated. Steps should be adopted to address harmful things will go proper and long-lasting ways to achieve effective and fruitful ICT amalgamation in Mathematics teaching.

Recommendations

In support of responses to the study, the study recommends some efforts for the successful amalgamation of ICT in mathematics teaching at the Secondary level of High Schools.

- Mathematics teachers must have friendly conditions towards the collaboration of ICT with mathematics teachers for the reasons that appropriate ICT hardware/ equipment and knowledge of ICT would be tools to travel ICT towards mathematics teaching.
- The amalgamation of ICT is required for sufficient pedagogical methods and technical advancement in the educational system.
- According to the environment of institutions areas mathematics, teachers must know to indicate the best ICT practices. As the ICT hardware has been provided to the schools, adequate software should also be provided to the schools along with mathematics-cantered ICT training for the teachers.
- Advanced training on ICT amalgamation should be arranged for the development of professional teachers and their issues regarding lack of confidence.
- The teacher's attitude to encourage the classical way of teaching is also a negative factor towards the collaboration of ICT which must be flourished as according to the present needs.
- Most of the schools either Government or others have the very least use of ICT in general subjects and particularly in the teaching of mathematics. The competent authorities in Districts, divisions, and provinces should take steps for the collaboration of ICT with general education and particularly with mathematics teaching.

- The study suggests providing appropriate facilities and illuminating negative factors because all of the lapses and negativities should be removable in given resources.

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