

**EFFECT OF COMPUTER MEDIATED INSTRUCTIONS ON ACHIEVEMENT
IN GEOGRAPHY IN RELATION TO CREATIVITY**

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ABSTRACT

The present study investigates the effect of computer mediated instructions on achievement in Geography in relation to creativity. The sample consists of 120 students was drawn of IXth class taken from two different schools of Chandigarh (UT) affiliated to CBSE, New Delhi. Instructional material based on computer mediated instructions were prepared and implemented to the experimental group after pre-testing and gain scores were computed after post-test for all the students. Creativity test by Mehdi (1973) was also administered. In order to analyze the data, descriptive statistics such as mean and standard deviation and inferential statistics such as Analysis of Variance (2×3) and t-ratio were used. and following conclusions were drawn: (i) The computer mediated instructions group was found to attain significantly higher achievement scores as compared to control group (ii) The performance of high creativity group of students were higher than that of average and low creativity group. (iii) There was no interaction effect between the computer mediated instructions and creativity levels in geography.

Keywords-Computer Mediated Instruction ;Achievement; Creativity.

Introduction

The use of technologies in education has increased in recent years with the need to provide learner-centred education. These technologies when used in the classroom setting can positively affect learning outcomes. Education is a lifelong process and it permeates every aspect of an individual's life. Education is the process to shape the quality of life which in turn enhances the quality of the society and the universe as a whole. A school is an institution designed for teaching the students under the direction of teachers.

In ancient times, students used to stay in Gurukuls where the teacher had full time and responsibility to shape their life for their betterment and the society (Zeichner & Liston, 1987). Then the system changed with the time to schooling where students went for specific period and teacher delivered lecture and used blackboard and chalk for making the students

understand the subject better. With the passage of time and technological enhancement, education system has undergone various changes. Teachers started experimenting the change in teaching method and methodology (Bansal, 2009). The traditional blackboard approach is gradually giving way to more interactive session between the instructor and students. Dynamic progress in information technologies has necessitated the change in educational process, its purpose, in developing new pedagogical technologies and to introduce more effective methods and means of teaching. These days teachers have great possibilities, in terms of teaching methods, seating arrangement, visual aids (Mishra & Koehler, 2006). The math, science and technology standards are the driving force for our educational system today. That is why, most advanced educational systems have put aside the traditional approaches to education such as teacher-centered methods turning to new ways of teaching-learning in which students play an important role. One of the approaches to achieve such objective is computer based instruction which is exceedingly beneficial in teaching methods (Davis, 2003).

Educational technology in terms of terminology and structural composition may carry out two basic components namely 'education' and 'technology'. Although both components are in a continuous process of evolution, the emphasis here is more on the evolutionary trend of the second component that is 'technology'. This is simply on the ground that educational technology as a course of study has its fundamental concern with the task of identifying the most suitable, appropriate and developed technology (both hardware and software) for serving the educational needs and purposes of the students and the society at a particular time and place (Mangal & Mangal, 2009). It is a matter of fact that all over the world, there has been a continuous shift in the nature of the utilization of technological means, products and measures for advancing educational products and processes. This is also dependent and determined by the type and nature of excellence attained by the members of the societies in terms of scientific, philosophical, psychological and technological advancements. This is actually one of the reasons why there have been a continual shift in the modes and means of technology being used for serving the course of education in different parts of the world and in different periods of human history and civilization.

Educational technology has been seen as the latest innovation in our educational practice. A lot of efforts have been made to define it. Abimbade (2006) defined educational technology as "a field involved in the facilitation of human learning through the systematic identification,

development, organization and utilization of learning resources and through the management of these processes”. To Aniah and Tukura (2011), Educational Technology is “essentially concerned with finding solutions to problems of teaching and learning in education through the application of appropriate media or modern technologies especially electronic media (hardware and software devices)”. Educational technology is concerned with the systematic application of science and technology in the field of education and thus may be defined as the application of technology to education in order to further the course of the latter. Just as science and technology help in carrying out the practical task in general, educational technology helps in providing efficiency to the task of teaching and learning.

Computer mediated instruction is one of the earliest applications of computers in education. Computer mediated instruction is a narrower term and most often refers to use of computers to present drill-and-practice, tutorial or simulation activities offered either by themselves or as supplements to traditional, teacher directed instruction. Some types of computer mediated instructions provide learning environments that engage students in creative tasks and problem solving mostly reflects the real-world assumptions (Goodyear & Retalis, 2010). With the powerful growth of the computer technology in the recent years, most of the mathematical concepts can be redefined and simulated by means of software use. In this way, many mathematical concepts, electronically, can become concrete, clear, and encouraging for the students. The evolution of the information technologies causes the rapid changes in societies (Doyle, 1994). The inadequacy of traditional teaching methods to overwhelm the obstructions in the instruction process, one of the best solutions is the use of information technology. Although, there are enough research studies that indicate the effectiveness of the technology usage in mathematics classes, integration of computers in mathematics classrooms can provide an effective learning environment for students to enhance their mathematical skills by engaging them with “real world” conditions to make the abstract concepts concrete and clear. In this way, students can have a meaningful and retentive learning and they will be much more ready for their future education life such as university education or even their professional life (Gibson, 2001).

Computers have played a major role in human society. Computers do not mean just a machine for doing word processors or solving complex math equations but a broad medium for our social communications. One of the major implementations of computers is as an efficient

tool for education. Through the combination of technology and communication, computer mediated instruction in education stimulates learner-centered learning environments (Agre,1997). A computer-mediated teaching system has been developed, that incorporates a social constructivist approach. This educational philosophy maintains that human learning occurs primarily through a socially interactive process. In this, the course material is divided into study units, and the instructor prepares study questions on each unit. The study questions require verbally composed answers. In addition, the study questions often do not specify any one correct answer; instead the quality of the answer depends on how well it is argued as judged by the feedback (Pear & Crone-Todd, 2002).

The use of technologies in education has increased in recent years and there has been widespread interest in using computers to enhance learning processes. This is due to the rapid growth of computer technology, which led to more sophisticated, more user-friendly, more manageable in terms of size and weight, and much cheaper machines (Tutty & Klein, 2008).Computer mediated instruction is an interactive instructional technique that utilizes a computer to present instructional material, monitor learning, and select additional instructional material in accordance with individual learner needs. Computer mediated instruction might also include computer supported learning resources which is the use of a computer as an access point for information. It is a tool used by a learner in the learning process. In general, the literature suggests that the use of computer mediated instruction such as computer-based applications and the internet produce achievement effects superior to those produced through traditional instructional techniques (Cain & Pitre, 2008).

The recent directions in computer-mediated tools and instructional technologies have been from individually centered to socially-oriented environments and closed systems to generically-based tools. For example, in the past, many computer-based applications are individualized tutorial, drill and practice, and simulation software, whereas in recent times, we are beginning to see environments that enable interact ants to communicate with one another. Tutorial and drill and practice software are usually closed-ended, bounded by the content and context defined by the software in contrary to simulations, collaborative environments and tools (Hung, 2001).Computer mediated instruction/learning is an umbrella term that describes the efficient and effective use of computer or technology to support and facilitate teaching and learning activities. The traditional classroom paradigm is being challenged today, not so much by

professors who have by and large optimized their teaching efforts and their time commitments to a lecture format, but by our students, the higher education has experienced notable changes driven by accelerated advances in computer technology, the same force that has reshaped our society and many aspects of life. Such changes include a very heavy dependence on schools' management and administration systems. In terms of teaching and scholarship, it is believed by many that more promising results can be seen and that students are better served in a computer mediated learning environment (Yu, Lin & Wang, 2012).

Computer mediated instructions provide us many techniques to present useful knowledge through various sources. One of the important means is power point presentation. Slide presentation software such as Power Point has become an ingrained part of many instructional settings, particularly in large classes and in courses more geared toward information exchange than skill development. Effective presentations are about clear communication. To present well, we need to understand when and why to use visual aids. Presentations work well when slides and presenter work together. As technology enters the classroom more and more each year, there are always new innovations being brought into the fold that can help teachers to get their points across better, and help students learn more efficiently (Baron, 2009). This program is one that enables teachers and students alike to prepare presentations. Power Point can really enhance teacher presentations and the overall comprehension of students. It is a program that allows teachers to present their lessons in a more dynamic way than simply lecturing and writing on the blackboard (Bonk & Zhang, 2006). PowerPoint has become very popular because it's easy to learn and widely available. It provides the ability to equip your presentations with different types of media - including images, sounds, animations, and much more. This enhances the students' abilities to retain what they're being taught, especially those who are visual learners. Teachers can focus on the class and interacting with the students instead of writing on a board, because the text and the entire presentation is already there in the form of a Power Point file (Thompson & Lee, 2012).

Achievement represents performance outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in school, college and university. School systems mostly define cognitive goals that either apply across multiple subject areas (e.g., critical thinking) or include the acquisition of knowledge and understanding in a specific intellectual domain. Academic achievement

generally refers to the degree or level of success or proficiency attained in some specific area concerning scholastic or academic work (Purkey & Smith, 1985).

The word "creativity" in itself is meaningful. However, we have grown accustomed to offer an explanations and elaboration of an already familiar term. Whatever is novel, unique, unconventional, original is considered creative. To quote foster, it is like letting down a bucket into the subconscious and bringing up things you knew, and mixing them with things of ordinary day life that maximize you make a work of art (Crotty, 1998). Creativity can be defined as "the ability and disposition to produce novelty". The almighty God, the creator of the universe is the supreme mind who possesses the finest creative abilities. Each one of us is a unique creation, but we do not possess the same creative abilities as our peers. Some of us are endowed with high creative talents and possess the creative abilities to contribute to the achievement in different fields. Good education, proper care, and provision of opportunities for creative expression inspire, teachers make a significant contribution. They are required to help the children in nourishing their creative abilities to the utmost. The educational process, therefore, should be aimed at developing creative abilities among children (Hart, 1982).

Need and Significance of the Study

Education is not merely the acquisition of knowledge but also includes proper utilization of knowledge for the improvement of quality of human life. Both achievement and creativity play a very important role in the process of learning. It is shown that if a student lacks an urge to achieve, his performance will be hampered. Needless to mention, if we are really interested to improve the quality of education in our schools, then we have to pay proper attention to the potentialities of our students by raising their level of achievement. Present era is the era of competition and each one of us tries to compete with the other. Achievement is the main basis of success in the life. Human beings are doing a lot to achieve more academically. There are many factors which contribute to their academic achievement such as concentration, hard work, aptitude, interest and creativity. Out of all, creativity is a factor which distinguishes an average performance from the best one. No one can deny the importance of teaching and learning in the whole process of education. The process can only become successful when teachers fully know their subject matter and effectively communicate it to the students through an appropriate method of teaching. By using

technology in the field of education, we can try to improve the academic achievement of the student along with their creativity. Looking to the importance of these variables and lack of research in this area, the investigator got motivated to study the effect of computer mediated instruction on achievement in geography in relation to creativity. It is hoped that the result of present study will be of immense value for guidance worker, teachers and students for raising the level of their performance in different pursuit of life.

Objectives

1. To compare the performance of groups taught through computer mediated instructions and conventional method of teaching.
2. To study the performance of students having different group of creativity.
3. To examine the interaction effect between instructional approach and creativity.

Hypotheses

H₁: The performance of group taught through computer mediated instructions group will be higher than that of conventional teaching group in geography.

H₂: The performance of high creativity group will be higher than that of average and low creativity group.

H₃: The performance through computer mediated instructions of teaching will be interact with creativity groups.

Sample

The study was conducted on a random sample of 120 students of IXth class, both boys and girls geography students from two schools of Chandigarh (UT). It was random and purposive sample. The study was conducted on two intact groups viz. one is experimental group and other is control group in each school. The two schools (Government Model Senior Secondary School Sector, 23 and Government Model Senior Secondary School Sector, 37) were randomly selected from the total school of Chandigarh from each school the two intact sections of 30 students were selected.

Design

For the purpose of present investigation a pre and post-test factorial design was employed. In order to analyze the data a Analysis of Variance (2×3) was used for the two independent variables viz. instructional strategies and creativity levels. The impact of instructional strategies was examined at two levels, namely computer mediated instructions and conventional teaching strategy. The classification was done for creativity variable operating at three levels viz.

high, average and low creativity group. The main dependent variable was performance gain which was calculated as the difference in post- test and pre-test scores for the subject.

Tools Used

The following tools were used for the collection of data:

1. Standard Progressive Matrices (SPM) by Raven, Raven and Court (2000) will be used for matching the groups.
2. Verbal Test of Creativity Thinking by Mehdi (1973) was used to identify the creative group of the students.
3. Achievement Test in Geography was prepared by the investigator.
4. Five Lessons in Geography based on computer mediated instructions and conventional teaching instructions prepared by the investigator.

Procedure

After the selection of the sample and allocation of students for the two instructional strategies, the experiment was conducted in five phases. Firstly, Intelligence test will be administered for matching of the both groups. Secondly, the verbal test of creative thinking was administered in each school, in order to identify the creativity group of the students. Thirdly, a pre-test was administered to the students of both the treatment and control groups. The answer-sheets were scored to obtain information regarding the previous knowledge of the students. Fourthly, one group was taught through computer mediated instructions and control group was taught through conventional method of teaching by the investigator. Fifthly, after the completion of the course, the post- test was administered to the students of both the groups. The answer-sheets were scored with the help of scoring key.

Analysis and Interpretation of the Results

Analysis of Descriptive Statistics

The data were analyzed to determine the nature of the distribution of scores by employing mean and standard deviation. The two way Analysis of Variance was used to test the hypotheses related to strategies of teaching and creativity group. The mean and standard deviation of different sub groups have been presented in table- 1,2,3& 4

Table- 1: Means and SD of Achievement Scores for the Different Sub Groups

Creativity Levels	Teaching						Total		
	ComputerMediated Instruction			Conventional Teaching			N	Mean	SD
	N	Mean	SD	N	Mean	SD			
High Creativity	16	9.94	1.75	16	7.63	1.93	32	8.78	2.18
Average Creativity	28	6.61	2.50	28	5.54	2.51	56	6.07	2.56
Low Creativity	16	4.31	2.11	16	3.13	1.17	32	3.72	1.81
Total	60	6.88	3.04	60	5.45	2.65	N=120		

Source: Field Study, 2018

It may be observed from the table-1 that the mean of computer mediated instructions of experimental group was 6.88 and that of control group was 5.45. The result indicates that the computer mediated instructions are more effective than the traditional method of teaching in Geography. Further the above table reveals that the mean gain scores of high, average and low creativity group is 8.78, 6.07 and 3.72 respectively. This shows that the mean gain score of high creativity group was higher than that of average and low creativity group in Geography.

Analysis of Variance on Gain Achievement Scores

The mean of different sub group, sum of squares, degree of freedom, mean of sum of square and F-ratio have been presented in table- 2

Table- 2: Summary of Analysis of Variance (2×3) factorial design

Source of Variation	Sum of Square	df	Mean of Sum of Square	F-ratio
Computer Mediated Instructions (A)	61.63	1	91.88	12.68**
Creativity (B)	411.01	2	205.51	42.28**
Interaction (A×B)	8.5	2	4.25	0.88
Error Term	553.52	114	4.86	

**Significant at 0.01 level

(Critical Value 3.93 at 0.05 and 6.88 at 0.01 levels, df 1,114)

(Critical Value 3.08 at 0.05 and 4.80 at 0.01 level, df 2,114)

Computer Mediated Instructions (A)

Table-2 reveals that the F-ratio for the difference of means of computer mediated instructions and traditional method teaching group is 12.68, which in comparison to the table value was found significant at 0.01 level of significance. It shows that the groups were different beyond the contribution of chance. Hence, the Hypothesis **H₁**: The performance of groups taught through computer mediated instructions will be higher than that of the traditional method of teaching in Geography, is accepted. Hence, the results indicate that the performance of computer mediated instructions group is higher than that of traditional method of teaching in Geography.

In order to probe deeper, F-ratio is followed by t-test. The values of the t-ratio for different combinations have been given in the table-3.

Table-3: t-ratios for mean gain achievement scores of experimental and control group

Variable	Experimental Group			Control Group			SE _D	t-value
	N	Mean	SD	N	Mean	SD		
Gain Achievement Scores	60	6.88	3.04	60	5.45	2.65	0.52	2.75**

***Significant at 0.01 level*

(Critical Value 1.98 at 0.05 and 2.63 at 0.01 level, df =118)

Table-3 shows that the mean gain achievement scores of experimental group taught through computer mediated instructional strategy is 6.88, which is higher than the corresponding mean gain scores of 5.45 for the control group taught through conventional teaching strategy in Geography. The t-value testing the significance of mean gain difference on achievement in Geography of experimental and control group is 2.75, which in comparison to the table value was found significant at 0.01 levels of significance. Hence, the hypothesis **H₁** of significant difference is accepted. The result indicates that the students taught through computer mediated instructional strategy perform significantly better than that of conventional teaching strategy in Geography.

Creativity Group (B)

Table- 2 shows that the F-ratio for the difference of means of three groups on creativity levels is 42.28, which is comparison to the table of value was found significant at 0.01 level of significance. Hence, the Hypothesis **H₂**: The performance of high creativity group will be higher than that of average and low creativity group, is accepted. The result indicates that three creativity levels groups are different in respect of achievement scores. So, this was further confirmed through the mean of the high creativity group is higher than that of average and low creativity group in Geography.

In order to probe deeper, f-ratio was followed by t-test. The value of the t-ratio for the three groups of creativity has been given in the table- 4

Table -4:t-ratio for different combinations of different creativity group

Variables	High Creativity			Average Creativity			Low Creativity		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
	32	8.78	2.18	56	6.07	2.56	32	3.72	1.81
High Creativity N Mean SD 32 8.78 2.18	---			5.21**			10.12**		
Average Creativity N Mean SD 56 6.07 2.56	---			---			5.00**		
Low Creativity N Mean SD 32 3.72 1.81	---			---			---		

***Significance at 0.01 levels*

(Critical Value 2.00 at 0.05 level and 2.66 at 0.01 level, df 62)

(Critical Value 1.99 at 0.05 level and 2.64 at 0.01 level, df 86)

Table- 4 shows that the mean gain achievement score of high creativity group is 8.78, which is higher than the corresponding mean gain achievement scores of 6.07 for average creativity group . The t-ratio for difference in gain scores of high and average creativity group is 5.21, which in comparison to the table value was found significant at 0.01 level of significance. The results indicate that high creativity group was more effective than that of average creativity group.

Table- 4 shows that the mean gain achievement score of high creativity group is 8.78, which is higher than the corresponding mean gain achievement scores of 3.72 for low creativity group . The t-ratio for difference in gain scores of high and low creativity group is 10.12, which in comparison to the table value was found significant at 0.01 level of significance. The results indicate that high creativity group was more effective than that of low creativity group.

Table- 4 shows that the mean gain achievement score of average creativity group is 6.07, which is higher than the corresponding mean gain achievement scores of 3.72 for low creativity group . The t-ratio for difference in gain scores of average and low creativity group is 5.00, which in comparison to the table value was found significant at 0.01 level of significance. The results indicate that average creativity group was more effective than that of low creativity group.

Interaction Effect (A×B)

Table -2 reveals that the F-ratio for the interaction between computer mediated instructions and creativity group is 0.88, which in comparison to the table value was not found significant even at 0.05 level of significance. It indicates that the two variables do not interact with each other. Thus, the Hypothesis **H₃** : The performance through computer mediated instructions of teaching will be interact with creativity groups, is rejected. The result indicates that the computer mediated instructions and creativity groups do not interact with each other.

Discussion

The results of the present investigation have lead to the conclusion that computer mediated instructions group was more effective as compared to the traditional method of teaching group in Geography. Hence, the hypothesis **H₁** was accepted. The results are consistent with the findings of Soe, koki and Chang (2000) revealed that computer mediated instruction does have a positive effect on reading achievement. Ash (2005), Bayrak (2008), Serin (2011) and Kaur (2013) indicated that the use of computer mediated instruction was more effective than traditional teaching methods. Mehar and Kumar (2013) found use of audio-visual aids was more effective

than the traditional method of teaching. Oyedele, Munasirei, Oyedele and Chikwara (2014) showed that the computer-assisted instruction gave a higher student performance rate in comparison to those who used expository traditional instructional strategy. Gungadeen (2015) revealed that the pupils who used computer mediated instruction performed significantly better than those who used traditional book instruction in terms of achievement and motivation. Mehar (2016) found that achievement in English of group taught through computer-assisted instruction was found significantly higher than that of traditional method of teaching. Mehar and Kaur (2017) investigated that achievement in mathematics of group taught through flipped classroom model was found significantly higher than that of traditional method of teaching. The performance of high creativity group was higher as compare to average and low creativity group. Hence, the hypothesis **H₂** was accepted. Most of empirical evidence leads to that conclusion the computer mediated instructions group is significant at different dimension of creativity level. The result indicates that three creativity groups are different in respect of achievement in Geography. So, this was further confirmed through the mean of the high creativity group was higher than that of average and low creativity group. The results are consistent with the findings of Mehar and Kumar (2013) found that high creativity group was more effective than that of average and low creativity group. Mehar (2016) found that high creativity groups of students is significantly higher than that of average and low creativity group of students in English. Mehar and Kaur (2017) found that high mathematical creativity groups of students is significantly higher than that of average and low mathematical creativity students.

The performance through computer mediated instructions of teaching do not interact with high, low and average creativity group of Geography students. Hence, hypothesis **H₃** was rejected. The results are consistent by the findings of Mehar and Kaur (2017) revealed that no interaction effect was found between flipped classroom model and mathematical creativity to each other. The results are contradicted by the findings of Mehar and Kumar (2013) shows that significant interaction was found between audio visual aids and creativity in Physics. Mehar (2016) revealed that significant interaction was found between computer assisted instruction and creativity in English.

Findings

- 1 The performance of computer mediated instruction was more effective than that of traditional method of teaching in Geography.

- 2 The performance of high creativity groups was higher than that of average and low creativity group in Geography. Further analysis reveals that:
- (i) The mean gain scores of high creativity group was significantly higher than that of average creativity group.
 - (ii) The mean gain scores of high creativity group was significantly higher than that of low creativity group.
 - (iii) The mean gain scores of average creativity group was significantly higher than that of low creativity group.
- 3 There was no significant interaction effect of computer mediated instructions and creativity group in Geography.

Educational Implications

The computer mediated instructions will encourage the students to engage in learning activities with maximum enthusiasm and this will help them to understand the subject matter more vividly. The method also helps to correlate the theoretical concepts of Geography and its application, which is not so effective in the traditional method of teaching. The computer mediated instructions will help the students to learn the theory and apply the newly acquired knowledge simultaneously. The conclusions of the study prove that the computer mediated instructions has helped the students to score better in the achievement. The teachers were also encouraged to learn more and test their knowledge when computer mediated instructions are used. The teachers should have a thorough knowledge in the subject to conduct such classes. The teacher should be able to clear all the doubts of students. The classes will be lively and there will be good teacher- pupil interaction. Since the results of the present study prove the effectiveness of the computer mediated instructions in teaching Geography, it may help in selecting suitable activities to attain specific objectives for 9th standard students.

References

- Abimbade, A. (2006). *Principles and practice of educational technology*. Ghana: Woeli Publishing Services.
- Agre, P. (1997). *Computation and human experience*. Cambridge: Cambridge University Press.
- Aniah, A. & Tukura, C. S. (2011). Educational technology: the imperative of ICT improving tertiary education in Nigeria. In the proceedings of 32nd International Conference of NAEMT. 19th – 23rd September, Owerri.

- Ash, J. E. (2005). The effects of computer-assisted instruction on middle school mathematics achievement. *Dissertation Abstracts International*, 66(8), 2871-A.
- Bansal, H. (2009). *Modern methods of teacher training*. New Delhi: APH Publishing corporation.
- Baron, D. (2009). *A better pencil: Readers, writers, and the digital revolution*. Oxford: Oxford University Press.
- Bayrak, C. (2008). Effects of computer simulation programmes on university students' achievement in physics. *The Turkish Online Journal of Distance Education*, 9(4), 53-62.
- Bonk, C. J., & Zhang, K. (2006). Introducing the R2D2 model: Online learning for the diverse learners of this world. *Distance Education*, 27(2), 249-264.
- Cain, D. L., & Pitre, P. E. (2008). The Effect of computer mediated conferencing and computer mediated instruction on student learning outcomes. *Journal of Asynchronous Learning Networks*, 12(3&4), 31-52.
- Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process*. California : Sage Publications.
- Davis, K. S. (2003). "Change is hard": What science teachers are telling us about reform and teacher learning of innovative practices. *Science Education*, 87(1), 3-30.
- Doyle, C. S. (1994). *Information literacy in an information society: A concept for the information age*. United State : Diane Publishing.
- Gibson, I. W. (2001). At the intersection of technology and pedagogy: Considering styles of learning and teaching. *Journal of Information Technology for Teacher Education*, 10(1-2), 37-61.
- Goodyear, P., & Retalis, S. (2010). *Technology-enhanced learning*. Rotterdam: Sense Publishers.
- Gungadeen, A. (2015). The effect of computer mediated instruction on the motivation and achievement of science students in mainstream zone education prioritaire schools. *Malaysian Journal of Distance Education*, 17(1), 41-63.
- Hart, J. F. (1982). The highest form of the geographer's art. *Annals of the Association of American Geographers*, 72(1), 1-29.
- Hung, D. (2001). Theories of learning and computer-mediated instructional technologies. *Educational Media International*, 38(4), 281-287.
- Kaur, S. (2013). Computer based instruction and its effectiveness on achievement of students in mathematics. *International Journal of Computer Science and Technology*, 4(1), 29-31.

- Mangal, S. K., & Mangal, U. (2009). *Essentials of educational technology*. New Delhi: PHI Learning Private Ltd.
- Mehdi, B. (1973). *Verbal Test of Creativity*. Agra : National Psychological Corporation.
- Mehar, R., & Kumar, V. (2013). Effect of audio visual aids on achievement in physics in relation to creativity. *Edutracks*, 12 (12), 32-35.
- Mehar, R. & Kaur, G. (2017). Effect of flipped classroom model on achievement in mathematics in relation to mathematical creativity. *The Asian Journal of Psychology and Education*, 50 (3&4), 30-44.
- Mehar, R. (2016). Effect of computer assisted instructions on achievement in English in relation to creativity. *The Educational Beckon: A Peer Reviewed Referred Research Journal*, 1(5), 177-185.
- Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017-1048.
- Oyedele, V., Munasirei, D., Oyedele, Y., & Chikwara, S. (2014). The impact of computer-assisted instruction on secondary school students' achievement in geography. *Zimbabwe Journal of Educational Research*, 26(1), 73-87
- Pear, J. J., & Crone-Todd, D. E. (2002). A social constructivist approach to computer-mediated instruction. *Computers & Education*, 38(1), 221-231.
- Purkey, S. C., & Smith, M. S. (1985). School reform: The district policy implications of the effective schools literature. *The Elementary School Journal*, 85(3), 353-389.
- Thompson, R., & Lee, M. J. (2012). Talking with students through screencasting: Experimentations with video feedback to improve student learning. *The Journal of Interactive Technology and Pedagogy*, 1(1), 34-37.
- Tutty, J. I., & Klein, J. D. (2008). Computer-mediated instruction: A comparison of online and face-to-face collaboration. *Educational Technology Research and Development*, 56(2), 101-124.
- Raven, J., Raven, J. C., & Court, J. H. (2000). *Raven's progressive matrices test*. New Delhi: Manasayan.
- Serin, O. (2011). The effects of the computer-based instruction on the achievement and problem solving skills of the science and technology students. *The Turkish Online Journal of Educational Technology*, 10(1), 183-201.
- Soe, K., Koki, S., & Chang, J. M. (2000). Effect of computer mediated instruction on reading achievement: A meta analysis: Retrieved September 14, 2018 from <http://>

nichcy.org/research /summaries/ abstract12.

Yu, W. C. W., Lin, C. F. C., & Wang, J. (2012). An examination of university students' views on computer-mediated instruction/learning and its impact on their academic achievement. *Journal of Media and Communication Studies*, 4(6), 110-122.

Zeichner, K., & Liston, D. (1987). Teaching student teachers to reflect. *Harvard Educational Review*, 57(1), 23-49.