# Impact of the use of digital media on secondary school students' lower order thinking (LOT) in Physics at district Peshawar

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## Abstract

Digital media has optimistically impacted classroom process of buying and selling in general and students' attainment in specific. However, the use of digitlamedia for teaching learning function in classroom has raised questions like how the use of digitalmedia influence lower order cognitive / thinking skills (LOTS), and if it has effect on LOTS, then how much? This experimental research was done to measure and gauge the impact of digital media on students' LOT. For this the two schools from Peshawar city were selected. Intact classes were purposely assigned on the basis of their pre-test through pair random sampling into experimental and control. Teacher-made Physics achievement test (based on questions of lower order thinking skills) with reliability coefficient of 0.83 was used. Through the tools the data were collected and analysed at significant level alpha: $\alpha = 0.05$. On the basis of post-test it was statistically concluded that digital media affected the performance of the students' significantly in comparison to those who were taught through tradition based instruction. It was recommended on the basis of this research study that technology education should be integrated across the teacher education and in our instruction for the purpose of change in LOT achievement.

**Keywords:** Effect, Digital media, teacher-made test, Performance in Physics, Traditional classroom, Digitalmedia based Classroom, Lower Order Thinking Skills (LOTS).

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## Introduction

In Pakistan, prospective and in-service teachers require both general and subject-specific digital competencies**,** yet the concern sources are still working and involved on non-specific skills. One of those skills is Digitalmedia competency that has a great impact on teaching learning process and great potential impact on education. It is the need to prepare our kids for future digital world and most of the countries are doing this. For this teacher training and creating environment is utmost important (Kraidy, 2002). The integration of instructional technology, especially digital media, in classrooms is becoming a common practice, offering significant potential benefits for both teachers and learners (Isman et al., 2012). According to Ozmen (2018), the use of information technology, particularly digital media, keeps both teachers and learners active, motivated, and engaged in learning. This approach enhances knowledge, comprehension, and the ability to explore various explanations. Technology plays a crucial role in education, making learning enjoyable and ensuring meaningful learning outcomes. The rapid progress of ICT, including hardware and software, has prompted educators to shift from traditional teaching methods to embrace emerging innovations for improved learner performance (Bitter & Pierson, 2018). Akinoso (2018) defines digital media as the computer-controlled integration of various elements like text, drawings, graphics, images, video,

animation, and audio. Digital media equipment, part of ICT facilities, stores and presents such content electronically. Recognizing the pivotal role of physics in the modern age of science and technology, Akinoso advocates for it to be a core subject at the secondary level in alignment with national education policies. To enhance performance in physics, the use of essential digital media components, such as text, graphics, video, sound, and animation, creates an interactive learning environment promoting deep reflective thinking for both teachers and students.

**Statement of the Problem**

The modern world is progressing and shifting to innovations very fast, so also the different sectors in the advancement of a country. Education being one of these segments and certainly, the tool per distinction for national progress also moves along within this line. Approaches of getting better the teaching/learning of Physics should be a massive concern of the education stakeholders/experts due to its advantages to the society. LOT that is the base for HOT, and because of tradition type approach our Pakistani students' lack of understanding in basic concept of physics that always a factor of hurdle in getting HOT. There is always a need to verify the declarative opinions through a systematic research process. Otherwise our opinion will not be in the category of establish category. This research is a way forward to sensitize the use of modern approach and also a way forward to modify the tradition approach of teaching physics.

**Involvement of the Paper to Existing Knowledge**

1. The present study exposed that there is space among the educational needs and available literature of this research study. Very few research studies conducted in the area especially in the context of our society, environment and schools. So, this research is an explanation and addition of literature to this field.
2. This study is really important for the betterment of our educational institutions across the globe.
3. The study under investigation has recommended some leading principles for upcoming research studies and suggestions for the improvement and betterment of our instruction.

**Objectives of the Study**

The reason of this study is to examine the effects of the use of digital media on learners' LOTS in Class-10 Physics. Main objectives are:-

1. To look into the effects of the use of digital media on lower order thinking skills augmentation of Physics male students
2. To unearth the effects of digital media on lower order cognitive skills improvement of girls in the subject of Physics.
3. To investigate the difference between the effects of digital media on lower order cognitive skills augmentation of both boys' students and female students.

**Research Hypothesis**

The null hypotheses were tested at significance level=0.05:-

**$H_o$1:** No significant difference exists between the LOTS augmentation of experimental male and female exposed to digital media and those learners who were exposed to traditional classroom at Class-10 level.

**$H_o$2:** No significant difference exists between the LOTS augmentation of experimental male and female (80) learners exposed to digital media and those control male and female (80) learners who were treated in traditional classroom at Class-10 level.

## Literature Review

### Digital literacy and competency:

The meaning behind this Digital literacy and competency word is how to operate and use the digital devices in the existing teaching learning environment with competency (Yildiz, 2020). This ability need mental abilities and necessary skills, comprehensive awareness, well defined attitude and the capability of using digital components. In addition, this term requires specific proficiency in accessing and utalizign relevant technologies within the teaching learning process (Isrokatun et al., 2022). Research revealed that technology has significantly affected the level of the students in achievement as well as in thinking. So, the need to integrate technology based pedagogical content knowledge in educator schooling and training programs is utmost integral (Khalil et al, 2018 & Khalil, 2017).

### The nature of Physics education

Science holds paramount importance as a fundamental component of school curricula. However, comprehending its essence precedes its study. Both educators and students must grasp its fundamental nature. Scientific knowledge, as elucidated by Schwartz (2012), is inherently provisional and subject to revision, yet rooted in empirical observation and inference. It emerges from a blend of creativity, theory-driven insights, and subjective interpretations. In the realm of education, students should actively engage in evaluating, validating, and engaging in critical discourse to solidify and ensure the integrity of their understanding." (Aydeniz & Bilican, 2014).

### Lower order thinking skills

Educationists have different inclination towards the higher order and low order thinking aspects in academic disciplines. Bloom taxonomy divided the cognitive level into six category and their main division is in LOT'S and HOT'S. The research of Muhayimana et al (2022) categorized LOT(Knowledge, understanding and application and HOT(analysis, synthesis and evaluation). To develop HOTS in students first in their schemata LOTS must be exist in compact form. To reach to high level concept students remembering, understanding and applying skill in this concept is a pre-requisite (Mustika & Susanti, 2020; Suherman et al., 2020). Learning process begins with first recalling or remembering and then sense of understanding takes place. Playing in these two domains the learning starts to apply his/her concept in new situation (Dahlan et al., 2020; Lau et al., 2018 & Armala et al., 2022).

### Teacher role in developing LOT skills through digital technology

Digital technology assist students in cultivating their skills those are essential for their coming future. The use of required technology is vital for their success and enhances classroom

different outputs. In addition, the recent advance technologies provide institutions with greate flexibility; customization of the curriculum objectives in order to meet students 21st century needs (Dufour et al., 2010 & Kosaretsky et al., 2022). Teacher role is important in digital environment, he/she must use in smart way, manage classroom and tailor the classroom activities according to the need of the studens and foster the learning outcomes. Along with academic he also includes in their objectives the motivation, cooperation, co-learner and a good communicator (Nguyen et al., 2022). Physics teacher must conserve his physics identity along with identities while teaching physics and to create thinking abilities in the students. Teacher must explore questions and offer opportunities to students to test their hypotheses. Students must avail the environment to reflect on their learning and understanding. The process of learning should be improved and the content must be integrated according to the nature of science (Kustijono & Hakim, 2020).

**Research related to the impact of technology on students**

Digital media has significantly improved classroom teaching, positively impacting student performance. Holmes and Gardner (2008) note that instructional technology fosters connectivity, enabling learners to trace information and educational resources. It contributes to skill development, enhances credibility and confidentiality through quality evaluation of digital education resources, and allows learners to assimilate relevant information from the vast cyberspace. In the view of Mayer (2001) instructional technology theory, rooted in cognitive science, underscores the effective use of digital media in learning through educational tools. Olojo (2012) extensive research from 1996 to 2008 revealed that students utilizing digital media achieved better results compared to those without it, emphasizing its vast potential. Akinoso (2018) argued that traditional lecture-based teaching has lost efficacy, and advancements in instructional tools, particularly digital media, have positively influenced education. Digital media's diverse modes of message delivery, including web-based audio, visuals, video, and animation, create an enriched learning environment. It not only imparts knowledge in unique ways but also allows students to create their own products, catering to diverse skills and learning styles. Another, well-designed use of digital media has a positive impact on education, potentially enhancing academic achievement compared to traditional teaching methods. The literature suggests that digital media not only facilitates learning but also actively engages learners, encouraging their active participation and contributing to a more interesting Physics learning experience (Ololube, 2007).

Scaffolding in software programs enhances cognitive skills and enables virtual engagement with variables beyond real-world possibilities (Scoter et al., 2001). Computer use in supportive activities enhances children's potential, fostering skills like logical thinking and teamwork (Polly, 2014). Positive impacts of digital technology on competencies such as teamwork self-regulated learning, higher-order thinking skills (HOTS) and lower-order thinking skills (LOTS) are highlighted by Balannskat (2006). A comprehensive study by Sivin-Kachala and Bialo (2000) reveals consistent positive effects of technology-rich environments on students, leading to notable achievements, improved performance for diverse student needs, and improved attitudes to learning with enhanced self-esteem, spanning from Pre School through high school.

Khuram & Ghulam (2015) case research on teachers' perspectives found that the purpose of visual gadgets like pictures, films animation videos, and projectors increased motivation and interest in literary texts. Most teachers reported positive opinions about using visual aids, leading to improved student attention and higher scores. The study suggests that exposure to

increased visual content may contribute to the rise in intellectual scores, as indicated in the previous century. Balanskat (2006) further revealed that learners perceive better learning outcomes when ICT tools function more freely and effectively.

**Research Design:** To look into the effectiveness of the use of digitalmedia on lower cognitive skills enhancement of class-10 level learners, an experimental research was carry out. The devise selected by the examiner of study is depicted in figurative form as:

| | | | |
|---|---|---|---|
| RSEG1 | Obs1 | EG | Obs2 |
| RSCG2 | Obs3 | CG | Obs4 |

"RSEG1 = Random selection of experimental group
RSCG2 = Random selection of control group
Obs1 = Observation of experimental group/test scores (on basis of pre-test)
Obs3 = Observation of control group / test scores (pre-test)
EG = (treatment with Digital media based classroom) : Experimental group treatment
CG = (treatment with Traditional classroom) : Traditional group treatment
Obs2 = examination of experimental group / test scores (post-test)
Obs4 = examination of control group / test scores (post-test)"

**Treatment**

This study examined the impact of Digital media-assisted instructions on students' LOT level. 160 students (80 male and 80 female) were divided into two groups, receiving traditional or technology based instructions. The experiment, conducted over six weeks, involved a teacher with expertise in technology assisted instructions. The study aimed to compare the effects of traditional and digital-based instruction on students' lower order thinking skills.

**Population/Sample**

Both male and female students as well as teachers of District Peshawar city of Physics groups of Class-10 level were taken. There were almost nearly 5645 students both female and male students in grade-10. Their respective teachers were also taken as a population for this study.

Purposive / convenience sampling technique was used to make the experiment authentic and this sample was restricted form Peshawar district. Total sample size of 160 of class-10 Physics students was taken. The whole sample was divided into two equal sets through pair random sampling. A total of 160 students, evenly distributed between genders (80 male and 80 female). Further the 80 male (40 for exp and 40 for control group) and similarly 80 female (40 for exp and 40 for control group) were subdivided for experimental purpose between the genders. Also 02 Physics trainers, alike in talent and training experience, were chosen as research associates for the teaching and treatment reason.

**Tools of the Study:**

(a) Pre-tests made by Teacher (PAT : Physics Achievement Test) consists of 40 MCQs in Physics of Class-10 was prepared and conducted.

(b) The researcher designed the test and administered to find out the differences of lower order thinking skills of Physics male and female students

## Findings

Collected data and then organized, studied, and explained it using numbers and statistics. To decide whether to accept or reject certain ideas, we looked at things like average scores, how much scores vary, and t-tests. We used a t-test because it's often used for comparing different groups. We set our significance level at 0.05, which means we were pretty strict about our decisions. For data analysis the researcher used SPSS and Excel to crunch the numbers and understand the data In this study, the researcher aimed to see how using digital media impacts the improvement of basic thinking skills (LOTS in physics among male and female students in Class 10. Through testing various hypotheses, and the results of data analysis represented in well structure table for meaningful information were interpreted for objective interpretations.

### (I) Testing of Hypotheses Based on Pre-Test Scores of Experimental and Control Groups

**Table 1:** *Significance of difference between the mean scores of experimental group and Control group on pre-test of* Physics *students*

| Groups | N | Mean | SD | df | p Value | t-value | |
|---|---|---|---|---|---|---|---|
| | | | | | | Table value | Calculated value |
| (Pre test)Male EG | 40 | 10.72 | 3.96 | 78 | 0.302 | 1.654 | 0.518 |
| (Pre test)Male CG | 40 | 11.03 | 3.66 | | | | |
| | | | | | | | |
| (Pre-test)Female EG | 40 | 11.76 | 3.24 | 78 | 0.391 | 1.654 | 0.276 |
| (Pre-test)Female CG | 40 | 11.91 | 3.60 | | | | |
| | | | | | | | |
| (Pre test)Male EG | 40 | 10.72 | 3.95 | 78 | 0.035 | 1.654 | 1.813 |
| (Pre test)Female EG | 40 | 11.76 | 3.24 | | | | |
| | | | | | | | |
| Male CG (Pre test) | 40 | 10.82 | 3.58 | 78 | 0.302 | 1.654 | 0.260 |
| Female CG (Pre test) | 40 | 11.04 | 3.71 | | | | |

To check the status of two different groups across the gender before the experiment, t-test of an independent sample was employed at significance 0.05. The result showed in the table. It clearly depicted that all the groups in every aspects are almost same. It was concluded that that there were no noteworthy differences in the mean scores of the two groups on the basis of their pre-score.

### (II) Testing of Hypotheses of Experimental & Control Groups on Post-Test Scores

**Table 2** *Significance of difference between the mean scores of the experimental and control male groups on post-test*

| Group | N | Mean | SD | df | p-value | t-value | |
|---|---|---|---|---|---|---|---|
| | | | | | | Table Value | Calculated Value |
| Male EG (Post Test) | 39 | 29.142 | 3.093 | 75 | $2.685^{-26}$ Appx=0 | 1.654 | 12.830 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Male CG (Post Test) | 38 | 21.987 | 3.792 | | | | |

Table 2 demonstrates, Cal t (12.830) is > the tab t (1.654). also, p < α = 0.05. so, hypothesis Ho1 was rejected because variation was found at higher distance between the scores of (exp and cont groups) male. The difference is (29.142-291.987=7.155).

**Table 3** P*ost-test* scores : D*ifference between the mean scores of the experimental and control female group*

| **Groups** | **N** | **Mean** | **SD** | **df** | **p Value** | **t-value** | |
|---|---|---|---|---|---|---|---|
| | | | | | | **Table value** | **Calculated value** |
| (Post Test)Female EG | 39 | 28.727 | 3.4778 | 75 | 1.47E-19 Appx= 0 | 1.654 | 10.321 |
| (Post Test)Female CG | 38 | 22.558 | 3.9252 | | | | |

Table 3 portrays that the cal t (10.321) is > the tab t (1.654). Also, p is < α. So, variation between the scores of female exp and female cont groups (28.727- 22.558= 6.169) were found at greatest distance. It shows that the digital media instruction improved the LOT level of experimental group in contrast to control group.

**Table 4 P***ost-test scores : Difference between the mean scores of the male experimental and female experimental groups on*

| **Groups** | **N** | **Mean** | **SD** | **df** | **p Value** | **t-value** | |
|---|---|---|---|---|---|---|---|
| | | | | | | **Table value** | **Calculated value** |
| (Post Test)Male EG | 38 | 29.142 | 3.093 | 75 | 0.217 | 1.654 | 0.783 |
| (Post Test)Female EG | 39 | 28.727 | 3.477 | | | | |

Table 4 demonstrates, the cal t (.783) is < the tab t (1.654). Also, p= 0.217 > α = 0.05. in additon to that the difference between the mean (29.142 -28.727= .41) and standard deviation of two groups (3.093-3.477=.38) is almost nothing. That implies that both group were almost equally affected by digital assisted instructions. Although male were slightly better improved their LOT level.

**Table 5** *Difference between the mean scores of the (Male and female) experimental and (male and female) control groups on post-test*

| Groups | N | Mean | SD | df | p Value | t-value | |
|---|---|---|---|---|---|---|---|
| | | | | | | Table value | Calculated value |
| (Post Test) Male and female EG | 77 | 28.935 | 3.091 | 151 | 0.00 | 1.648 | 12.790 |
| (Post Test)Male and female CG | 76 | 22.237 | 3.789 | | | | |

* Level of Significance: α = 0.05

Table 5, depicts that the calculated t (12.79) that is clearly greater than that of the table value t (1.648). Also, the value of p = 0.000000 is also less than that of significant α value = 0.05. In addition to that the experimental group average or mean vlaue ( 28.935) is also higherr than that of control gorup (22.237). So, it was concluded that the digital assisted treatment did significantly affect the performance of the experimental as a cobine (Exp mala and female) in comparison with control ( male and female) group. In nutshell , it can be said that all participants of the experimental group improved their LOT level due to th digital assisted instruction in comparison with control group.

**Study Discussion/Conclusions/Recommendations**

The discussion of the study on the impact of digital media on lower order thinking skills (LOTS) among Class 10 physics students revealed differences in performance between the experimental and control groups. The analysis relied on quantitative data and testing of null hypotheses, focusing solely on Class 10 physics students. This suggests a potential cause-and-effect relationship between digital media and the development of lower order cognitive skills. However, the topic of enhancing students' lower order cognitive skills is complex, requiring further research to uncover new insights. Interestingly, the study found no significant difference in the development of lower order thinking skills between male and female learners. This contrasts with previous findings that often show mixed outcomes regarding gender differences in academic performance. Some studies suggest substantial differences, while others find none. Nevertheless, this study aligns with researchers who argue that gender differences in performance are not surprising.

While this study and previous research support the positive effects of various digital media and ICT tools on student performance and skills development, it's important to interpret these findings cautiously. Each study may yield slightly different results, and generalizations should be made with care. Despite this, considering the collective findings of previous research in similar disciplines, it's reasonable to generalize the results of this study. Furthermore, ongoing research is needed to explore the relationship between lower order thinking skills and digital media, as well as the specific types of digital media that contribute to learning success. In today's technologically driven world, digital media tools play a crucial role in education. Therefore, this study offers valuable insights and guidance for future research endeavors in the field of learning and teaching.

**CONCLUSION**

The study finding revealed that, while using digital media integrated instructions in the classroom students got higher numerical achievement in Lower order thinking ability. Before the commencement of this experiment both the group were almost same but after the experiment and applying post-test to look into the effect of experimental treatment, it was observed statistically that the digital media increase the performance of the experimental group in comparison to control group in LOT. Another, if we look into table4, the experiment equally affected the performance of the male as well as female. That is gender is not a significant variable for difference. In summary, it could be declared that digital media has a significant role in the development of the LOT of students.

## STUDY RECOMMENDATIONS

On the basis of analyses and conclusion we can say that digital media must be used in classroom for teaching learning process. For which proper in-service training as well pre-service course inclusion should be taken in action. The lesson of physics should be properly integrated with digital media and it can be concretized with help of modern technological tool for improving LOT as well as HOT. Gov't should provide proper infrastructure to the schools and student must be facilitated to use relevant technological tools for improving their concept image and understanding.

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