Investigating Student's Motivation and Learning Performance Using Technology Integrated Model

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Abstract- In Pakistan, students do not perform well in science subjects at primary and middle levels due to obsolete teaching methods in public schools, which gives rise to difficulty in understanding science concepts. The reason behind carrying out this study is to investigate the effectiveness of technology on the motivation of middle school students using a quasi-experimental pretest-post-test design. The middle school students aged 12–14 years studying in an urban public school were selected. To discover any significant difference in motivation and learning performance of students in the technology-driven constructivist environment as compared to the traditional group, data was collected through the Students Motivation toward Science Learning Questionnaire. When compared to students in the traditional context, quantitative data showed a statistically significant difference in the levels of students' interest in science-related activities. The learning performance in the post-test significantly increased with the experimental group M=17.156. The findings revealed an increase in the levels of students' science motivation in a technology-driven environment.

Keywords: Science Motivation; Learning Performance; Technology; Middle School; Pakistan.

I. INTRODUCTION

In developing nations like Pakistan where adoption of new technology is critically low in public schools, science subjects are thought to be difficult to understand and teach. As a result, science lessons are taught through rote memorization at the primary and middle school levels due to which students lack interest and motivation in learning. It is widely acknowledged that student motivation is a critical component of the learning process. More specifically, understanding science necessitates that the students play an active role in class (Dermitzaki et al., 2013). Due to the emergence of new technology, lifestyle changes are occurring quickly in the twenty-first century. Science fiction has entered a new era in which the fusion of technology and science serves as the primary driving force (Akgunduz et al., 2022). The constructivist learning approach invites students to participate in a cognitive process involving negotiation in the choices made regarding their learning. According to the constructivist approach, students should be perceived as active builders of information rather than passive recipients because their conscious processes have an impact on what they learn and comprehend. Students who learn to use techniques of active learning gain more applicable information (Ocak et al., 2017).

Additionally, the contribution of technology in assisting in the conceptual understanding of scientific concepts cannot be understated. Most aspects of life have been significantly impacted by the technological revolution, it plays a vital role in education because it is dedicated to classroom activities and acts as the students' support network for the learning process. The motivation and engagement of students increase by integrating technology to create authentic learning experiences inside the classroom. Utilizing constructivist learning strategies is one way to learn, when students use their prior knowledge to address problems and increase their understanding of the new information rather than becoming the passive recipient of knowledge (Warliani et al., 2017). Furthermore, the constructivist teaching utilizing technology is proved to increase the learning outcomes of the students and is successful in achieving better results as compared to the constructivist teaching (Miadi et al., 2018). Helpful teaching strategies must also incorporate tools that students may use in their everyday life to enhance learner performance, provide feasible hands-on activities , encourage learners to express their thoughts and ask questions, and provide explanations (Zenda, 2017).

Science teachers must engage classroom activities utilizing technology, such as digital education, by addressing students' needs, interests, and declining motivation, which is an evident-based behaviour among students, to achieve a comprehensive understanding of the subject (Migalang & Azuelo, 2020).The online paradigm offers useful tools that acts as a supplement to traditional lecture-based instruction (Stockwell et al., 2015). Science educators are constantly looking for effective strategies to teach science concepts to increase learners' motivation and performance in classroom. The digital native generation has grown up using technology; teachers are very concerned about motivation. Policymakers and curriculum planners are still primarily concerned with the issue of motivating students. There are approaches that can assist the teacher in handling the situation (Juma'h Ahmed & Ismail, 2021). With an innovative emphasis on interactive, more student-centered learning over the past two decades, pedagogy has undergone an unprecedented change. These have been significantly influenced by technological innovation. Additionally, research reveals that collaborative experiences stimulate students to succeed, stating that motivation while

working in groups was positively associated to learners' initiative, including setting up the environment, scheduling study time, and asking for assistance in collaborative tasks online (Carroll et al., 2019).

The current study explores middle school students' science motivation in one of the government schools of Sialkot, Pakistan through active learning strategies.

The study's goal is to give educators and students insightful information on the potential advantages and constraints of using technology to support the creation of an active learning environment in a South Asian context by conducting an experiment and examining students' science motivation using the technological tool. The current study addresses_the following research questions:

1. Does the use of Edmodo in science subject enhanced learners' achievement as compared to the traditional teaching model?
2. Does the use of Edmodo in science subject lead to enhanced learners' motivation as compared to the traditional teaching model?

The current research's primary focus is on enhancing students' understanding of science by addressing their motivation to learn satisfying self-efficacy values and implementing active strategies in a hybrid learning environment to increase the learner's performance. By creating a blended learning environment, learners' engagement, and motivation increase. Unfortunately, many countries are suffering and are hesitant to adopt this instructional strategy even though it has a lot of potential and Pakistan is one of them still trying to adopt technology in learning. This study's significance is focused on the implementation of technology-based teaching strategies for middle school students in public schools to develop motivated, self-reliant, and content individuals. It has been suggested that implementing technology will not make abstract scientific concepts easy to understand but also provide teachers with a way to simplify complex ideas for students to understand. The technology used in the study is the learning management system Edmodo for the exploration and evaluation phase of the learning model.

Additionally, the findings of this study encourage administrators to hold training sessions for teachers to assist them to integrate technology into the learning environment, which will in turn enable them to use student-centered learning strategies. The theoretical underpinnings of the study are drawn from the social constructivist learning paradigm put forth by (Vygotsky,1978). The constructivist learning theory emphasizes the active construction of knowledge based on students' prior learning experiences through negotiation, collaboration, and interaction**.** Computers have a growing significance and impact on the learning process. Science students perform better and are more motivated when using computers that are integrated with instructional materials like videos, simulations, and exercises. The use of blended learning could encourage students to be more engaged, imaginative, and independent in their search for knowledge so they can learn on their own and comprehend the concept completely (Suana et al., 2017)

Many researchers have looked into student motivation using specialized assessment tools, focusing on either the general field of science or more focused fields like chemistry, biology, and physics in elementary, secondary, and collegiate students (Dermitzaki et al., 2013). However, not enough research is carried out on middle school students' motivation toward science learning differences in traditional and technology-driven classrooms. Su and Cheng (2015) showed that gamification and mobile technologies could be used to enhance student performance and motivation in a botanical learning process compared to traditional instruction. In a study on educational robotics, Park (2015) found that both motivation and academic achievement had significantly improved (p 0.05). Moreover, Several motivational factors, such as self-efficacy, active learning strategies, the significance of science learning, performance goals, achievement goals, and the learning environment situation, affect student learning in science, according to research done in 15 senior high schools in central Taiwan with science students in grades 8 and 9 (Tuan et al., 2005).

According to the literature, several definitions can be found related to students' motivation toward science learning (SMTSL). It can be defined as the active participation of students in a scientifically relevant task to gain a deeper understanding of science (Lee & Brophy, 1996). Furthermore, motivation for science learning is an internal state that fosters, maintains, and instructs a learning-focused attitude to learning science (Glynn et al., 2011).Student motivation is a term that describes how motivated a person is to learn depending on the learning activities and experiences and how that motivation varies. Motivation can be influenced by a variety of factors, including extrinsic incentives, individual beliefs, individual goals, and individual interests, as noted by (Lin-Siegler et al., 2016). Working with students' beliefs may therefore improve their academic motivation and performance. According to a study conducted on Pakistani students, motivation is a fundamental element in increasing academic performance (Ayub, 2010). Motivation is one of the most significant and fundamental factors influencing students' achievement (Jen & Yong, 2013). Combining constructivist learning and motivation theories, self-efficacy, science learning value (or task values), learning strategies, personal learning objectives, and the learning environment are crucial motivating factors that makeup students' motivation for science learning (Tuan et al., 2005).

However, there is little research carried out in Pakistan, on middle-level students' science motivation in a constructivist learning environment. In this digital era, it is essential to develop 21st-century skills among learners to compete therefore, it is crucial to investigate the impact of a technology-integrated learning environment on students' motivation toward science.

Most Pakistani private schools make efficient use of advanced classroom technology, such as PCs, interactive whiteboards, projectors, and tablets, to enhance student learning. Nevertheless, most government schools still employ the traditional teaching approach for learning and teaching science, where rote learning is very common, and students act as passive recipients of knowledge with no other option but to conform to the teacher's method of learning and gaining information. This teacher-centered method demotivates and disengages students in

the classroom, which impairs their capacity for scientific inquiry (Rehmani, 2006).

Therefore, it is assumed that the current study findings will provide suggestions for educators and policymakers to incorporate technology in public schools of Pakistan at middle school for increasing motivation levels in students resulting in increased learning performance.

2. Methodology

To investigate student motivation and learning performance, a quasi-experimental design was utilized. The participants were divided into a control class that received traditional teaching instructions and an experimental class that received unconventional instructions.Prior to conducting the research, the school's authorization was obtained.The questionnaire was accompanied by a consent letter that explained the purpose of the study and guaranteed the anonymity of the research participants.The experimental group was subjected to online learning activities utilising the digital instrument, while the control group was exposed to the conventional method of instruction delivery.However, the instructional content for both groups was identical.The sequential data capture procedure consisted of a Pretest to assess students' prior knowledge, an Intervention, and a Post-test.

A. Sampling

For the research investigation, 90 middle school science students aged 11 to 13 were selected. The students were randomly allocated to either the control or experimental group, with 45 students assigned to the control group and 45 to the experimental group., as described in Table 1.

	Control Group	Experimental Group
No. of participants	45	45

Table 1. Sample distribution in Control and Experimental Group

B. Instruments

The first instrument used to collect quantitative data was the student's motivation towards scientific learning, derived from the study by Loorbach, Peters, Karreman, and Steehoudt (2015). Analyses were conducted on the internal validity and reliability of the scale.It contained twelve statements.Scale items were developed to assess the learning motivation of learners in relation to the instructional material developed for this study.It is based on Keller's (1987) ARCS Model of Motivational Design with four subscales.The Cronbach's alpha reliability scores for each subscale ranged between 0.67 and 0.90 (Loorbach, Peters, Karreman, and Steehoudt, 2015), ensuring the internal consistency of this scale. Examples of such items include:The quality of the lecture kept my attention; the lecture's content and class activities will be beneficial to me.I felt secure in my ability to solve realworld problems after working with these instructional materials; I thoroughly relished working with this instructional material.The scale consists of 5 points (strongly agree, somewhat agree, neutral, somewhat disagree, and strongly disagree).In addition, academic assessment was used to evaluate the students' learning performance; the instructor created the examination, which consists of 20 multiple-choice questions based on activities-related topics. The devised exam was initially validated and evaluated by expert.

Procedure

A pretest Before the implementation, a pretest was administered to the students to evaluate their prior conceptual understanding. The researcher facilitated an orientation meeting during which the experimental group discussed the science lesson that would be taught in a technology-enabled environment. Accounts were created for students so they could investigate the interface of the learning portal. Throughout the actual implementation process, students were exposed to hands-on, mind-boggling classroom activities. The lesson plans were founded on a four-week activity schedule and were divided into multiple initiatives. The topics were extracted from a science textbook. Edmodo was the basis for every instruction plan. The detailed activity schedule is described in Table 2. In addition, the PowerPoint presentations and YouTube links were uploaded online for future use. Students' conceptual comprehension was evaluated through formative assessment in the form of a learning platform-based exam.

Table 2. Lesson plan Activities in 4 weeks.

Week/ Topic	Objectives	Edmodo Activities	Assessment
1.Introduction to Scientific Inquiry	Introduce scientific method and inquiry skills	Edmodo Virtual Science Lab: Perform virtual. Engage in discussions and reflections.	Online Quiz Edmodo
2.Forces and Motion	Explore forces and motion concepts Newton's Law	Feedback and Reflection: Engage in peer discussions on Edmodo	Performance-based Task on Edmodo
3.Ecosystems and Interactions	- Explore ecosystems and ecological relationships	Collaborate on ecosystem research Online	Individual Research Report
4.Energy and Resources	- Investigate energy and resource concepts	Engage in interactive problem-solving Explore energy transformations	Final Project Presentation

Analysis and Interpretations

Data was analyzed using SPSS- Statistical Package for Social Sciences to explore the pre and post-test scores of the learning performance and post-test motivation scores in the control and experimental group. Independent sample t-tests, and paired sample t-tests for the collected data were conducted.

Pre-Test Academic Performance

An independent sample t-test was performed on the pre-test dataset before carrying out the intervention to show the similarity pd the groups. outcomes are shown in Table 3:

Table 3

Academic achievement in Pre-Test

Groups	M	SD	t	p	df
ControlGroup (n=45)	10.11	1.323	.042	0.966	45
Experimental Group (n=45)	10.45	1.136			

p<0.05

The results illustrated that there is no significant difference between the mean score of both the groups in pre-test before carrying out the intervention (p>0.001). Both the groups were at the same level.

Post-Test Academic Performance

An independent sample t-test was performed on the post-test dataset after the intervention to show the effect of Edmodo in science learning Table 4:

Table 4

Academic achievement in Post-Test

Groups	M	SD	t	p	df
ControlGroup (n=45)	11.25	3.323	8.941	.000	45
Experimental Group (n=45)	18.61	4.816			

p<0.05

The results illustrated that there is a significant difference between the mean score of both the groups in post-test after cathe intervention (p<0.001). Experimental group learners show a huge change in their learning performance by using Edmodo in their science subject.

Learning Motivation by using Edmodo in science subject

An independent two-sample t-test was performed on the motivation scale score dataset of both groups to contrast the learning motivation of learners In control group with learning motivation of learners in experimental group. The results are displayed in Table 4:

Table 4

Motivation independent sample t-test

Groups	M	SD	*t*	*p*	*df*
Control Group (n=48)	29.16	7.24	6.18	.000	45
Experimental Group (n=52)	49.61	5.21			

p<0.05

The test results revealed a huge difference between mean scores of motivational scales (p<0.001). The mean value highlights that learners in experimental group are much more motivated to learn by using Edmodo in science classroom.

4. Discussion

The purpose of this study was to examine the effect of using Edmodo on the motivation and academic performance of middle school science students. The results of this study support the hypothesis that Edmodo improves the motivation and academic performance of science students. This section will analyse and interpret the results in light of prior research, discuss the implications of the findings, and recommend future research directions. The results of this study indicate that the use of Edmodo significantly increases student motivation. This finding is consistent with prior studies that have highlighted the positive effects of technology-enhanced learning platforms on student motivation (Shernoff et al., 2016; Chen et al., 2018). Edmodo's collaborative and interactive features appear to have contributed to increased student engagement and motivation. Edmodo facilitates motivation and active participation in the learning process by enabling students to communicate with their peers and teachers, share resources, and partake in discussions.

In addition, the results of this study demonstrate that Edmodo positively affects students' science subject learning performance. Students who used Edmodo had higher test scores and a deeper comprehension of scientific concepts than their counterparts who did not use the platform. Previous research (Papastergiou, 2010; Lee et al., 2014) has demonstrated that technology-enhanced learning platforms have the potential to improve students' academic performance. Edmodo's incorporation of multimedia resources, interactive assessments, and real-time feedback likely contributed to the improved learning outcomes observed in this study. Access to a diversity of learning materials, self-paced learning, and timely feedback facilitated students' comprehension and retention of scientific knowledge. The positive effects of Edmodo on both motivation and learning performance suggest that it may be a useful tool for teaching science in middle schools. Teachers can use Edmodo to create an engaging and interactive learning environment that motivates students and improves learning outcomes. By integrating Edmodo into their teaching practises, educators can encourage students' active participation, collaboration, and self-directed learning, thereby nurturing a deeper comprehension of scientific concepts.

Despite the fact that this study provides valuable insights into the benefits of using Edmodo in middle school science education, it is important to acknowledge several limitations. First, the study focused on a specific context, so the findings may not be applicable to other educational settings. To validate the efficacy of Edmodo across diverse populations and subject areas, replication studies in a variety of contexts are required. Second, the study lacked a control group and employed a pretest-posttest design. Future research could utilise a randomised controlled design to establish a more definitive causative link between Edmodo usage and student outcomes. In addition, qualitative data such as student interviews or observations could provide a

deeper understanding of the mechanisms by which Edmodo affects motivation and learning performance.

In conclusion, this study demonstrates the positive impact of Edmodo on the motivation and academic performance of middle school science pupils. In providing an interactive, collaborative, and engaging learning environment, technology-enhanced learning platforms such as Edmodo have the potential to revolutionise education. To enhance student motivation and academic achievement in science education, educators should consider integrating Edmodo into their teaching practises. Future research should continue to investigate the efficacy of Edmodo in various educational contexts and the underlying mechanisms by which it affects student outcomes.

5. Conclusion

This research's Incorporating technology into a middle school science classroom, the purpose of this study was to address a research void. In the majority of Pakistani institutions, the traditional lecture method is still used to teach science. In the classroom, students are forced to conform to their teacher's constrained methodology and predetermined lesson plans in order to learn. The feeble learning process, in which students are less encouraged to develop their critical thinking and learning only occurs through direct memorization without comprehending the information memorised, is one of the factors contributing to the lack of interest in the field of science. In a blended learning environment, both learning performance and student motivation increased substantially, indicating that the use of effective educational instruments increases students' motivation to learn. Therefore, this strategy has been demonstrated to be effective in achieving high academic performance by imparting science to school students. The current research was limited to eighth-grade pupils at one of the public institutions in Sialkot, Pakistan, for the 2021-2020 school year. This study focused solely on students' motivation and science learning performance; however, researchers should also investigate teachers' motivation to teach and perceptions of their use of digital technology in the classroom. Furthermore, since the research data were quantitative in nature, qualitative data in the form of interviews with students and teachers regarding motivation in science learning should be explored.

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