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Enhancing 10th Grade Students' Scores in Physics: A Case of M-Learning

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The present research aimed to examine the effectiveness of M-learning on 10th-grade student's achievement in physics. The research design used in this research was the Pre-test - Post-test control group. A public school was conveniently selected for conducting the experiment. Using a random sampling technique, forty 10th grade students were selected from the school. These were equally assigned to two groups randomly. A test was developed and validated by two subject experts. It consisted of 30 MCQs covering two units of Punjab Text Book of 10th-grade Physics i.e. Simple Harmonic Motion and Waves & Sound. The test was conducted before and after the treatment of M-learning. The time allowed for the test was 35minutes. The duration of the experiment was 26 days. Nineteen lessons were developed of 45minutes each. The findings revealed that mobile learning was effective to improve Physics students' scores at the the10th-grade level.

Keywords: *10th grade, m-learning, public school, Pakistan, physics*

Introduction

People from all over the world are using mobile devices and applications. According to the search conducted by "Portio Research" (2013), 1.2 million people used mobile applications worldwide in 2012 and 4.4 million are assumed in 2017. Mobile devices entered in the school and classroom as graphics calculators in 1985 and later on as an aid to learning in 2001(Shin, Norris, & Soloway, 2006). M-learning is the learning with the use of mobile devices; it can be happened anywhere without considering time and location. The term can be defined as "learning across multiple contexts, through social and content interactions, using personal electronic devices" (Crompton, 2013, p.4). M-learning provides a learning process to gain knowledge that cannot be obtained from tradition settings of a classroom (Blackboard, 2011). According to UNESCO (2013), Netbooks and laptops can also be added to this category as the tools that enable mobile learning and teaching are ' mobile phones, tablet computers, e-readers, portable audio players and handheld gaming consoles. 'According to Kneedler (1993), Mobile devices provide in-depth information on key topics in a format that is interesting to the student. These work more efficiently if these are used positively in the field of teaching and learning (Moallan, Kermani, & Chen, 2005). Learner interacts with portable technologies and learns Physics concepts with the access of internet. A learner with required skills and certain strategies can take full advantage of the applications and share content and resources in a self-determined way (Brown & Mbati, 2015). According to Fasimpaur (2003), Modern mobile devices are more

efficient as compare to the past. These can work as a phone, explore sites, and act as a mini-computer, play multimedia, possesses Bluetooth access, memory and multi cards. The mobile device contains word processing, graphics, video viewers, and some other educational programs. A learner can explore information regarding any problem from different search engines like Google, Yahoo, and Ask.com etc. and through different websites such as YouTube, Eric, Wikipedia, etc. There is need internet access for exploration. The devices for example Mobiles, Tablets, I-phones, laptops, notepads and common computers can be used as a transportable device for the learning of Physics.

According to Cavanaugh, Kim, Wanzek, and Vaughn (2004), "M-learning is effective, delivered systematically, intensively and explicitly.", But in the classroom, there can be a challenge to manage to learn using mobile devices (Vahey & Crawford, 2003). Mostly teaching of Physics in Pakistani classrooms is done in a traditional monologue session i.e. lecture method. Physics Textbooks are used in schools for information transmission. These textbooks cover many topics superficially. The students sit quietly in the classroom and speak only when called on to and do exactly as they are told. Contrary to textbooks knowledge, mobile devices provide detail knowledge on a particular topic in an interesting way (Kneedler, 1993). Additionally, students learn by themselves about facts with more focus on comprehension than memorization (Kneedler, 1993; Royer & Royer, 2004). Many schools in Pakistan have IT labs and they have tried to deliver lectures at targeted secondary level students on desktop computers. New educators have already skills to use of computer devices in their instruction, and it is a paragon parameter for m-learning. Secondary level students are already well attached to mobile devices. They have craze to explore more and more by these mobile appliances. They share a lot of things, files and audio-video clips with the help of these mobile devices. They can deal with these appliances carefully, install different applications by internet access, and install games to play. When a user plans, organizes, performs and evaluates his learning while using M-learning technology because he is the controller of mobile-based activities. Therefore he is not a passive person who takes the information required, but he is the person who uses cognitive and meta-cognitive skills to accomplish the task that improves his thinking skills (McQuiggan, McQuiggan, Kosturko, & Sabourin, 2015). Most often, in the world science concepts are always learnt through observations, analysis and experiments. Students can learn the Physics concepts by using M-devices like watching videos and reading details about an experiment on a particular topic that experiment in real may be expensive, lengthy, and dangerous (Howson & Davis, 1992). Mobile devices were found as effective as tools for learning science (Vahey & Crawford, 2003). Additionally, students become highly motivated to complete their assignment, when leaning take place using mobile devices (Connor, Morrison, & Katch, 2004; Norris & Soloway, 2008; Royer & Royer, 2004).

Hwanga and Chang (2011) did research on M-learning and their experimental results showed the effectiveness of M-learning approach in increasing students' interest and attitude towards learning and their academic achievement. Though schools and teachers are increasing in the use of mobile devices still there is need to investigate their effectiveness (Chang, Mullen, & Stuve, n.d.; Shin et al., 2006). Shin et al. (2006) suggested that by using mobile devices one can enhance students' achievement. As already mentioned, there is a high penetration of mobile phones in Pakistan; therefore this study was designed to examine the effectiveness of M-learning to enhance students' achievement scores in physics at10th-grade level. The objectives of the study were to:

- Examine the effect of M-learning on 10th-grade students' scores in Physics
- Examine and compare the effect of M-learning on students' scores as per cognitive domains (knowledge, comprehension, and application) in Units 10 & 11 of Physics textbook.
- Examine and compare the effect of M-learning on students' scores in Units 10 & 11 of Physics textbook.

Null Hypotheses

Following were the null hypotheses of the study:

$H_{01.}$ Scores of students do not differ significantly on items of Simple Harmonic Motion and Waves taught lecture method and mobile learning.

$H_{02.}$ Scores of students do not differ significantly on items of Sound taught lecture method and mobile learning.

$H_{03.}$ Scores of students do not differ significantly on knowledge level items of Simple Harmonic Motion and Waves taught lecture method and mobile learning.

$H_{04.}$ Scores of students do not differ significantly on comprehension level items of Simple Harmonic Motion and Waves taught lecture method and mobile learning.

$H_{05.}$ Scores of students do not differ significantly on application-level items of Simple Harmonic Motion and Waves taught lecture method and mobile learning.

$H_{06.}$ Scores of students do not differ significantly on knowledge level items of Sound taught lecture method and mobile learning.

$H_{07.}$ Scores of students do not differ significantly on comprehension level items of Sound taught lecture method and mobile learning.

$H_{08.}$ Scores of students do not differ significantly on application-level items of Sound taught lecture method and mobile learning.

Methodology

The nature of the study was quantitative. The experimental research design was used to conduct this study. The research design used by the researchers was Pre-test Post-test control group to explore M-learning effectiveness to enhance Physics students' scores. It consists of two groups i.e. experimental & control. A pre-test was given to both the groups at the start of the experiment. No significant difference was found between the mean scores of both group students on the pre-test. The featured part of this design is the random assignment of participants into groups (Gay, 2000). Fraenkel and Wallen (2006) described that

for a true experimental design it is must to assign subjects randomly to the groups. Threats to internal validity i.e. regression, subjects selection, maturation, history, testing, and instrumentation of an experiment can be best controlled using random assignment (Best & Kahn, 2008). Lecture method was used in the control group to teach10th-grade Physics and experimental group students were taught by using mobile learning devices. The population consisted of all 10th-grade physics students in high schools in Tehsil and District Khushab. Permission from a public school head was taken to conduct the experiment. For this research out of 80 students, 40 were selected randomly for conducting an experiment. At the second stage, they assigned the 40, 10th-grade Physics students into two groups randomly. SPSS was used for random selection and assignment of subjects into two groups. The two teachers participated in the experiment were with the qualification of M.Sc. Physics and M.Ed. One was teaching to the students by using the lecture method and the other was teaching to experimental group students using mobile devices. The students of the experimental group were trained by a computer teacher so that they might be able to get information from the explorers or the internet. The duration of the experiment was 26 days started from 05-10-2017 to 31-10-2017. The researchers developed 19 lessons of 45minutes each. These lessons were developed on the basis of mobile devices such as laptops, mobiles, tablets, phones, and notepads; the content of the lessons was validated by two experts. To measure the academic achievement of students in Physics an achievement test of 10th-grade Physics was developed by the researchers. Physics Achievement Test (PAT) was the appropriate tool to assess the academic achievement of students. The details of the test were given in table 1.

Table 1

Chart of Specification

Unit	Knowledge	Comprehension	Application	No. of Items
10(Simple Harmonic Wave)	5	5	7	17(60%)
11(Sound)	4	4	5	13(40%)
Total	9(30%)	9(30%)	12(40%)	30(100%)

The time allowed to solve the test was 35minutes. Two units were selected from the Punjab Textbook of 10th grade Physics i.e. Unit 10 (Simple Harmonic Motion and Waves) & 11(Sound). It was reviewed by two public schools 10th-grade Physics teachers. The effectiveness of m-devices is determined by comparing the scores of the two groups as measured by Physics achievement test. It consisted of 30 MCQs type items (17 from unit 10 and 13 for unit 11). Each correct response was awarded one mark. In this research, Mobiles, Laptops, Notepads, I-phones, and Tablets were used. In this study, ethics followed such as informed consent, privacy, avoiding any risk of considerably harming students, anonymity, and exact reporting of the

results. The data were analyzed by using SPSS version 21.

Results of the Study

The research findings were presented in the form of tables and figures. The data were collected by a pre-post test from the students. The analysis supported the process of organizing, verifying, and interpretation of data. Gain scores were calculated as Gain scores = Post-test scores – Pre-test scores

Table 2

Comparison of controlled and experimental group students' means gain scores on items from unit 10 of 10th-grade physics textbook

Unit	Group	N	Mean gain score	SD	Df	t	p
10	CG	20	2.77	0.97	38	-2.59	0.12
	EG	20	3.80	1.95			
11	CG	20	2.83	1.09	38	-2.18	0.03
	EG	20	3.53	1.38			

Note. CG=Control group, EG=Experimental group
*p< 0.05

Table 2 shows that t-values i.e. -2.59 and -2.18> 1.960 at 5% level of significance. Hence the null hypotheses H_{01} & H_{02}were not accepted which means that students' scores differ significantly by using lecture and m-learning methods on items from units 10 & 11 of 10th grade Physics. The mean scores of the controlled group were 2.77 & 3.80 and experimental group were 2.83 & 3.53 for the unit 10 & 11 respectively, which shows that the students taught by using mobile devices performed better than students taught by lecture method. It was also illustrated in figure 1.

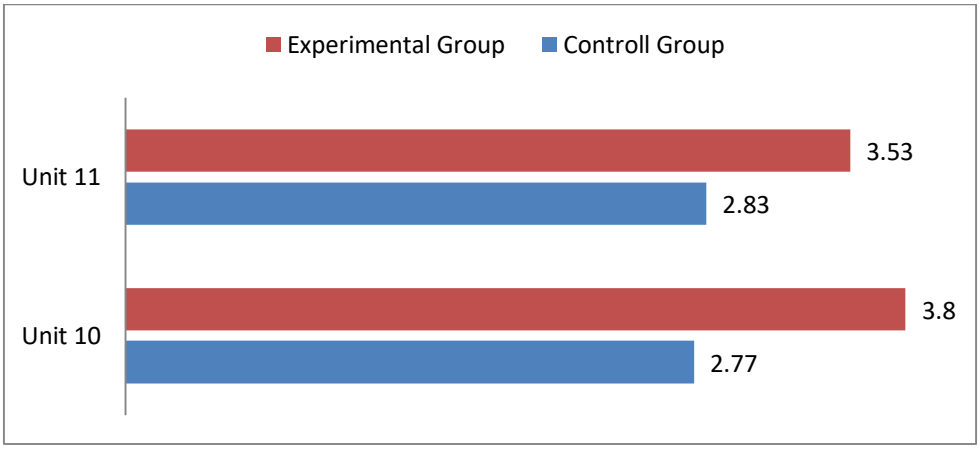

Figure 1: Mean gain Scores of Controlled and Experimental Group Students on items of Unit 10 & 11

Table 3

Comparison of controlled and experimental group students' means gain scores on knowledge, comprehension, and application-level items from unit 10 of 10th-grade physics textbook

Unit 10	Group	N	Mean gain scores	SD	df	t	P
Knowledge	CG	20	0.97	0.65	38	-2.45	0.02
	EG	20	1.36	0.81			
Comprehension	CG	20	0.93	0.78	38	-1.62	0.9
	EG	20	0.97	0.82			
Application	CG	20	1.03	0.67	38	-2.24	0.03
	EG	20	1.47	0.82			

Note. CG=Control group, EG=Experimental group
*p< 0.05

Table 3 shows that t-values i.e. -2.45 and -2.24> 1.960 at 5% level of significance. Hence the null hypothesis H_{03} and H_{05} were not accepted which means that student scores significantly different by using mobile devices and lecture method at knowledge and application level item from unit 10. Furthermore, the t-value for comprehension level items i.e. -1.62< 1.960 at 5% level of significance. Hence H_{04} was accepted. The mean gain scores of controlled group students i.e. 0.97, 0.93, and 1.03 were less than experimental group students mean gain scores i.e. 1.36, 0.97, and 1.47 on knowledge, comprehension, and application level items respectively which shows that students taught by using mobile devices performed better than students taught by lecture method. It was illustrated in figure 2.

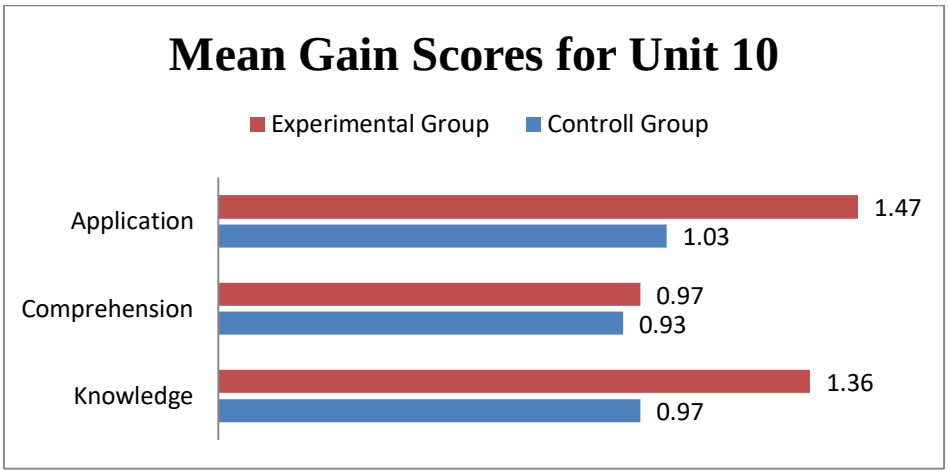

Figure 2: Comparison of mean gain scores of control and experimental group students on knowledge, comprehension, and application items of unit 10

Table 4

Comparison of controlled and experimental group students' means gain scores on knowledge, comprehension, and application level items from unit 11 of 10th-grade physics textbook

Unit 11	Group	N	Mean Gain Scores	SD	df	t	p
Knowledge	CG	20	0.77	0.50	38	-2.88	0.005
	EG	20	1.23	0.73			
Comprehension	CG	20	0.56	0.57	38	-2.62	0.01
	EG	20	0.97	0.62			
Application	CG	20	1.46	0.86	38	0.40	0.691
	EG	20	1.36	1.07			

Note. CG=Control group, EG=Experimental group

*p< 0.05

Table 4 shows that t-values i.e. -2.88 and -2.62 >1.960 at 5% level of significance. Hence the null hypothesis H_{06} &H_{07} were not accepted which means that students scores significantly different by using m-learning and lecture method at knowledge, comprehension, and application level items from unit 11. The mean gain scores of control group students i.e. 0.77 and 0.56 were less than experimental group students mean gain scores i.e. 1.23 and 0.97 on knowledge and comprehension level items of unit 11 in 10th-grade Physics textbook respectively which shows that students taught through m-learning performed better than students taught through lecture method. Moreover, H_{08} was accepted as t-value was less than 1.960 at 5% level of significance. Further, mean gain scores of control and experimental group students on application level items were as 1.46 and 1.36, which shows that students of the control group

performed slightly better than students taught through m-learning. It was illustrated in figure 3.

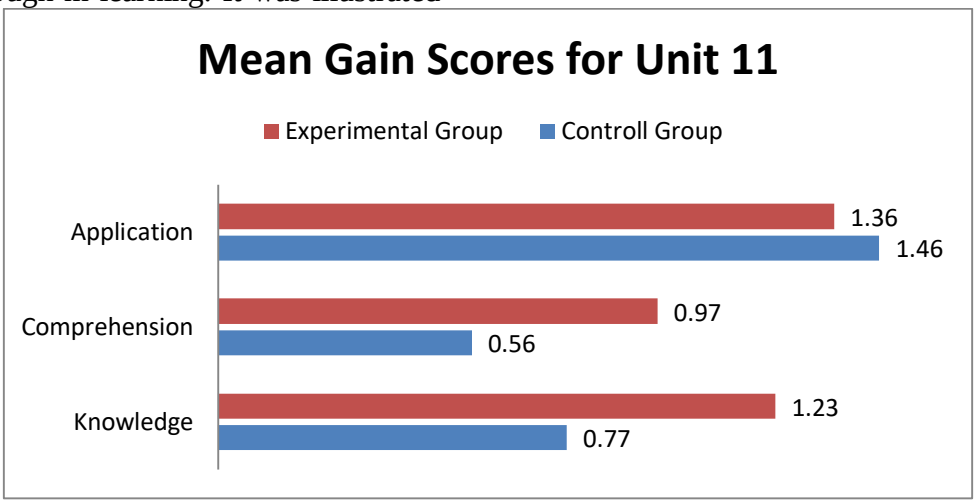

Figure 3: Comparison of mean gain scores of control and experimental group students at knowledge, comprehension, and application level.

Conclusion

It was concluded that mobiles do not remain the luxury but the necessity of life in the modern era. They are enhancing the quality of life as well as taking part in the field of education for its betterment. M-learning may be one of the strategies that will prove beneficial for the students to enhance their knowledge, make effective understanding and able them to do applications in real life world. There is a need to inculcate M-learning in the classroom of Pakistan for the improvement in the field of education.

Discussion

By and large, mobiles are in the use for different purposes worldwide, but the need in education is the demand of time. Their affectivity has been approved by researches (Cavanaugh et al., 2004; Hwanga & Chang, 2011; Moallan et al., 2005). This study also revealed that how M-learning can be beneficial for the learner in the classroom setting. Results showed a significant difference between the learning done by mobile and traditional method. Students showed improvements on the levels of knowledge, comprehension, and application by using M-learning in the classroom as compared to the traditional method used by most of the teachers in Pakistan and it was previously be mentioned in the research of blackboard (2011). This study revealed the need for modern times that M-learning can enhance the certain skill which will enhance its effectivity as it was also shown by Brown & Mbati (2015). Students will be able to plan, organize and evaluate the activities by using mobile that will improve their thinking skills as it was also proposed by McQuiggan et al. (2015). As the use of mobile is increasing day by day in Pakistan, so this study is suggesting for use of M-learning in the field of education and bring them into the classroom for the improvement in academic achievement as it was previously suggested by Shin et al. (2006). Due to the rapid development of mobile technologies, there is a need for investigating effective

strategies through M-learning in a classroom setting.

Suggestions and Recommendations

The present study put forward the following recommendations:

1. Findings showed that m-learning was better to teach physics as compared to the traditional lecture method. So, it was recommended that m-learning may be included in the course of "Methods of Teaching".
2. In the middle-level country, like Pakistan, Govt. may provide the funds and facilities to the schools to support m-learning, because it is very difficult to arrange all the accessories containing modern devices from the present funding or income of the schools.
3. It may be suggested that further research on mobile learning may be mixed-method research to determine the effectiveness of using mobile devices in Pakistan's schools across different grades and on all topics of Physics.

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