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# Effects of blended teaching method on mathematics performance of students at primary level: A case study of district Dera Ghazi Khan, Punjab, Pakistan

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**ABSTRACT**

The objective of this investigation was to assess the effects of blended teaching method on Mathematics performance of 3rd grade learners at primary educational level. A quasi-experimental design of study was formulated to conduct this study. The convenient technique of sampling was employed to collect the required data as one of the researchers was working in the school from which data was collected. The population comprised of 53 three grade learners. The sample was separated into two groups. One group named as experimental group (n=28) and other group as a control group (n=25). The pretest and posttest tools were employed to collect the data. The SPSS was employed for the analysis of collected data. The results were significantly different for control and experimental groups in Mathematics performance of students at grade three. The results were supporting blended teaching method that had positive effect on the mathematics performance for both male and female students of grade three. The effect size was 1.6043 in favor of blended teaching method than that of traditional teaching method. The study also recommended to use the blended teaching method in other science course beside mathematics to find its effectiveness.

**Keywords:** effects, blended teaching method, mathematics, performance, primary level

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## INTRODUCTION

Due to the improvement of technological tools, the teaching and learning settings have totally changed. Now a vast range of mobile and internet devices are available that make the learning environment interesting, useful, and creative (Choshin and Ghaffari, 2017; Hafeez, 2021a; Qaddumi et al., 2021). One of the cutting-edge techniques utilized to provide meaningful learning experiences is creating a blended learning environment relevant to students' cognitive needs, interests, and capabilities (Seage and Türegün, 2020). The usage of blended teaching method is quickly increasing because instructors feel that a variety of delivery modalities can considerably improve learning results while also increasing student satisfaction with the learning experience (Ginaya et al., 2018). Numerous studies have so far demonstrated that students highly value and rate blended teaching method (Popolzina, 2014; Hafeez, 2021b; Maulida et al., 2022). Blended teaching method is a mixture of traditional teaching method with online (mobile based) teaching (Wong et al., 2020). A blended teaching method is a flexible learning approach that can be used to create a constructive learning environment according to the learner's cognitive abilities

and level (Qindah, 2018). The current educational system requires learner-centered instruction, and blended teaching method is the best way to meet this goal. Blended teaching method entails a transition away from primarily classroom contact, lecture-style instruction and toward a more student-centered approach. Blended teaching method involves a change from a solely lecture-style of training with just classroom contact to one that is more student-centered (Ceylan and Kesici, 2017). This is the case because students actively participate in their own learning and are not passive; this makes learning more meaningful for them (Asarta and Schmidt, 2020).

The advantage of the blended teaching method is that it shifts the emphasis of learning design from simply considering traditional teaching methods and online or mobile environments to design of issues, such as considering the process and synergy of blending between mobile based and traditional teaching environments. As a result, the blended teaching method is a blend in and of itself. It is a pedagogical strategy that blends the effectiveness and socialization chances of the classroom with the technical advances of mobile or online learning (Aswardi and Nellitawati, 2020; Chao et al., 2021).

Blended teaching method is an imperative method in learning in the current century as it has proved its effectiveness in various disciplines of sciences including Mathematics (Khalil et al., 2018; Rahim, 2019; Rasmitadila et al., 2020; Kadirbayeva et al., 2022). Nonetheless, there is a shortage of research on the actuality of using blended teaching methods in early grades Mathematics. The research problem is the urgent requirement for educational sectors to investigate the application of blended teaching techniques in mathematics and their effect on student performance in mathematics. So, the present research study was formulated to determine the effects of blended teaching method in Mathematics performance of grade three students at primary educational level.

The current age children called digital natives as these are born in technological advancement age. Due to the advancement in information and communication technology, the learning environment has also changed. In the present age, the educational system is transferring from traditional teaching methods to blended teaching methods. Now advanced teaching methods like game based and blended methods are becoming popular from early grades to higher educational levels due to their effectiveness. The traditional teaching method doesn't fulfil the learning requirements of the learners and society of the 21$^{st}$ century. So, the objective of present research was to find the effects of blended teaching method in Mathematics performance of three grade students in primary educational level. The researchers selected students of grade three as Piaget's stated that most of the three grade students belong to pre-operational and concrete operational stages of cognitive development from the age group of 5 to 10 years (Ahmad et al., 2016).

Mathematics:ance of the study is offer mathematics developers and specialists with a recent approach to teach Mathematics and use them in the design and improvement of Mathematics curriculum; discuss the similar difficulties in educational research that relates to teaching Mathematics; advance teaching approaches for Mathematics teachers that use new blended teaching tactics to replace older teaching methods that are still used in the classroom; improve the capability of three grade learners in the pre-operational and concrete stage to comprehend the areas of Mathematics by incorporating technological tools with traditional teaching methods; and inspire Mathematics instructors to use blended teaching methods to increase quality of education.

A traditional teaching method is one in which the lecturer frequently discusses a particular subject or topic with a class of students. The number of participants could be anywhere from 30 to 800. The entire subject matter information must be presented by the teacher. It is still in use today across all academic levels and subjects (Hafeez, 2021c). As it is a passive form of learning, many instructors and scholars believe that this method of teaching is ineffective in cognitive development of learners. It prevents students from taking part in class discussions. After receiving the lecture notes, the students get ready for the examination. The fundamental rationale for employing the traditional teaching approach is the capability to accommodate many students at one time (Giorgdze and Dgebuadze, 2017; Hafeez et al., 2022). Traditional teaching methods are considered uninteresting today since they do not actively engage students in lectures. However,

it can be improved by merging information and communication technology (Fulford & Mahon, 2018; Yasir et al., 2022).

The conceptual diagram of traditional teaching method is shown in Figure 1. Several researchers have stated blended teaching methods as an instructional teaching strategy that combines online or mobile based learning tools with traditional classroom teaching. Both instructors and students must be involved during the blended teaching. The blended teaching method is the shift of learning strategy from instructor-center to student-center (Hafeez, 2021b).

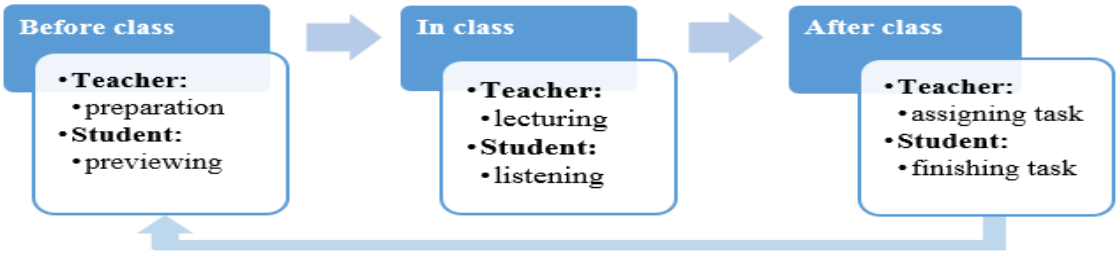


**Figure 1. Concept of Tradisional Teaching Method**

Now, there are various technological tools and models like tablets or online drivers are available to implement the blended teaching method in the classroom to increase the engagement of the learners in the educational process and to improve their skills for using mobile technology in learning (Aboraya, 2021). The concept of blended teaching method is shown in Figure 2.

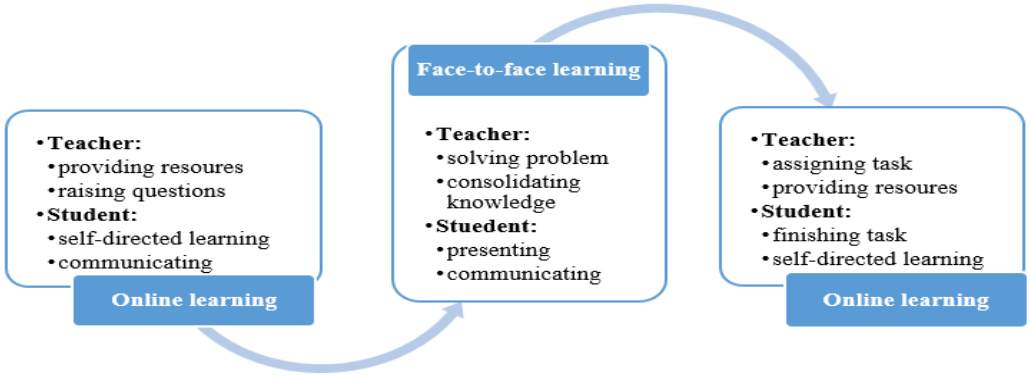


**Figure 2. Concept of Blended Teaching Method**

Soomro et al., (2018) stated in research that blended teaching method is the combination traditional and online or mobile based instructions. The blended teaching method is the integration of traditional teaching methods with online or mobile based teaching methods to prepare students for 21$^{st}$ century skills competency. Creativity, collaboration, and problem-solving skills are the main areas of the blended teaching method that make the students enable to compete in their practical educational life. The effects of blended teaching methods on academic achievements at different educational levels is discussed in Table 1.

Research Questions

RQ1: What is the effect of blended teaching method on Mathematics performance of grade 3 students?

RQ2: What is the effect of blended teaching method on male and female students in experimental group?

RQ3: What is the effect size between male and female students by using blended teaching method in the experimental group?

Hypotheses

$Ho_1$: No significant difference was detected between the control and experimental groups taught by traditional and blended teaching methods respectively.

$Ho_2$: No significant difference was detected between the male and female in Mathematics performance of experimental group for grade three students in post-test.

**Table 1. Effects of blended teaching method on academic achievements at different educational levels**

| References | Class | Discipline | Results |
|---|---|---|---|
| Oderinu et al., (2020) | Undergraduate | Dental | Blended teaching method improved the academic achievements of learners significantly. |
| Choi et al., (2014) | Undergraduate | Psychology | The learners learnt by blended teaching method got better scores than that of traditional teaching method. |
| Miller et al., (2013) | Undergraduate | Physiology | The learners learnt by blended teaching method scored 8.5% more than that of traditional teaching method. |
| Delialioğlu, (2012) | Undergraduate | Computer | Blended teaching method significantly develop the engagement skills in the learners. |
| Khalid and Azeem (2012) | Secondary | Biology | Blended teaching method improved the working efficiency of learners significantly. |
| Gholami et al. (2016) | Undergraduate | Nursing | Blended teaching method improved the learners' capabilities in learning. |
| Frame et al., (2015) | Undergraduate | Pharmacy | Blended teaching method proved to be a problem-solving method as it increased the engagement and critical thinking skills of the learners. |
| Hyun et al., (2017) | Undergraduate | Education | The learners did well in blended teaching method and stated that it is a flexible learning method. |
| Jusoh et al., (2016) | Graduate | Philosophy | The learners described that blended teaching method improved the communication and thinking levels and proved to be an active learning method in classroom. |
| Meguid and Collins (2017) | Undergraduate | Dental | Blended teaching method facilitated the learners to be more intent and more inspired in learning process. |
| Luna and Winters (2017) | Higher Secondary | Physics | Blended teaching method significantly enhanced the learners' achievements in Physics. |
| Shi et al., (2017) | Grade Eight | Mathematics | Blended and traditional teaching method had greater significance difference between the scores of learners of grade eight in mathematics. |
| Arias et al., (2016) | Undergraduate | Dental | The learners achieved better scores in blended teaching method than that of traditional teaching method. |
| Wong and Ng, (2016) | Undergraduate | Electronics Engineering | Blended teaching method proved to be a better learning approach significantly. |
| Jong, (2016) | Grade Ten | Chemistry | Application of blended teaching method increases the learning abilities of the learners. |
| Abedi et al., (2019) | Intermediate | English | The learners achieved better scores by blended teaching method. |
| Furió et al., (2015) | Primary | Computer | Blended teaching method significantly improved the academic scores of the students than that of traditional teaching method. |

Note: *In table 1, the results of various studies on blended teaching methods at different educational levels are shown. The results of most of the previous studies showed that blended teaching is an effective teaching method at all the levels of the studies including primary level*.

***Meaning of the terms used in the current study.***

Effect: The effect is the variation in something after applying some process (Nair and Bindu, 2016).

Blended Teaching Method: The method that is facilitated by combination of traditional teaching and integration of technology.
Achievement: The achievement is the result of students usually calculated at the end of the topic or unit by employing some teaching strategy calculated by achievement test (Khader, 2016).
Effect Size: The extent to which one group is different from another group.
Literacy and Numeracy Drive (LND) App: LND is an android based application use to make practice of Mathematics, English and Urdu for grade three in Punjab province of Pakistan (Ishaq et al., 2014).

## METHOD

### Research design of the study

The current study employed quantitative experimental approach due to its appropriateness and its capability to attain its objectives by pre and post achievement tests for control and experimental groups. In the control group, students were taught the topics of addition, subtraction and multiplication of unit-2 using lecture teaching method. Experimental groups were educated by teaching the same study material employing the blended teaching method (Lecture method+ practice on tablet Samsung Galaxy A6). The Literacy and Numeracy Derive (LND) Application was used for the practice of Mathematics on the tablet. The material was taught during the academic year 2022-2023. The traditional and blended teaching methods are shown in Figure 3,4 and 5.

### Participants of the Study

A sample of 53 students of grade three was taken as the main sample. The sample was divided into two groups named as Control group (n=23) and Experimental group (n=28).

### Sampling technique

The convenient sampling approach was employed to take the participants for sample as one of the researchers was working in the school selected for the study.

### Study variables

***Independent variables***

a) Blended teaching method
b) Traditional teaching method

***Dependent variables***

The mathematics performance marks of students in the pre and post-tests by traditional and blended teaching methods were selected as the dependent variables.

### Study tools

The pre and posttests were used as tools to collect the data and to determine the effects of blended teaching method on student's Mathematics performance of grade three at primary educational level.

### Performance tests (Pre and post tests)

The researchers prepared the Performance tests i-e pre and post-tests to assess the effects of blended teaching method on Mathematics performance of grade three students. The pretest and posttests consisted of 30 questions including 10 questions of addition, 10 questions of multiplication and 10 questions of subtraction. The correct response to each question on the pretest and posttest received one point, whereas the incorrect response received zero points. The test had a maximum score of 30 and a time limit of 90 minutes. The pre-test was taken at the start of the study from control and experimental groups. The teaching topics and demographic information of participants are given in Tables 2 and 3. Figure 6 depicts the study's experimental design.

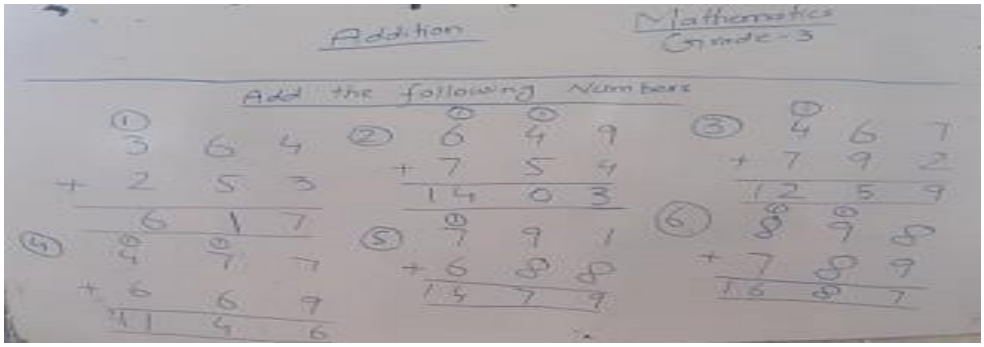


**Figure 3. Traditional Teaching Method of Current Study**

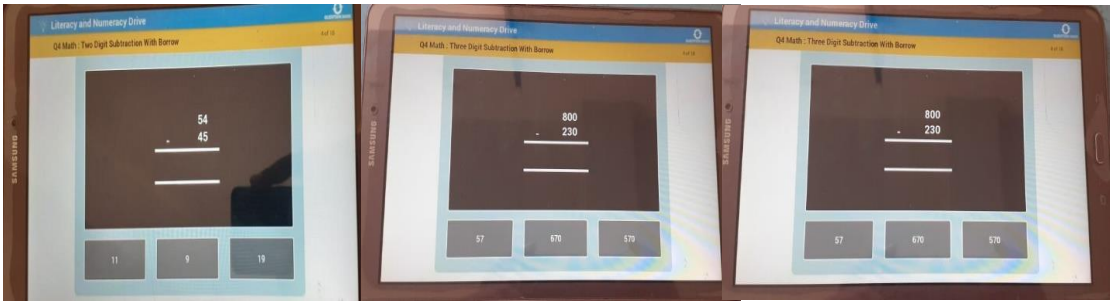


**Figure 4. Literacy and Numeracy Derive (LND) Application for Mathematics Practice on Samsung Galaxy Tab A6**

**Figure 5. Practice of Mathematics by Blended Teaching Method Through LND App on Samsung Galaxy Tab A6**

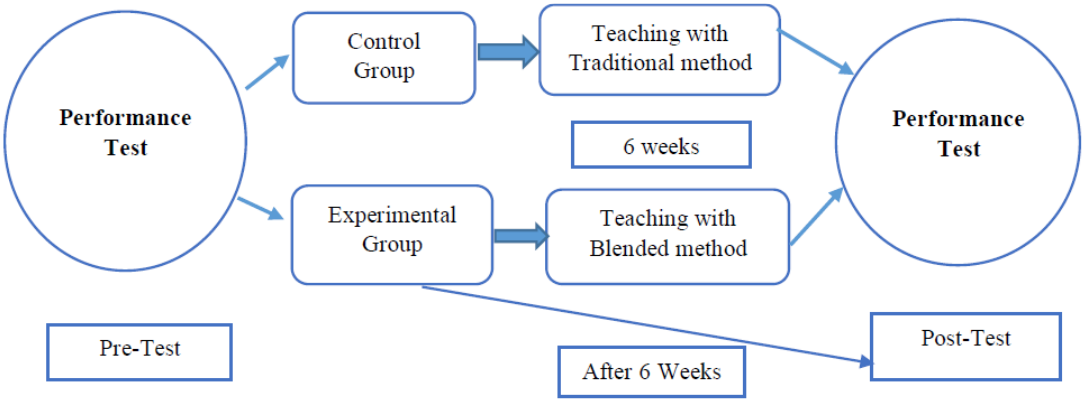


**Figure 6. Experiment Design of the Study**

**Table 2. Teaching topics**

| Unit No | Unit Name | Topic | Pages |
|---|---|---|---|
| 2 | Number Operations | Addition | 41-48 |
| 2 | Number Operations | Subtraction | 49-56 |
| 2 | Number Operations | Multiplication | 57-69 |

*Link for book and chapters: file:///C:/Users/wajid/Downloads/EWM-math-3.pdf*

**Table 3. Demographic information of participants**

| Group | N | Level | Grade | Age (Years) | Teaching Method |
|---|---|---|---|---|---|
| Experimental | 28 | Primary | Three | 05-Oct | Blended |
| Control | 23 | Primary | Three | 05-Oct | Traditional |
| Total | 53 | | | | |

**Procedure for conducting post-test.**

The participants were divided into two groups: the experimental group and control group. The control group was taught the addition, multiplication, and subtraction questions through traditional teaching method as shown in Figure 1. The experimental group was given extra time after teaching them with traditional teaching method to do the practice of addition, multiplication, and subtraction questions on the Tablet (Samsung Galaxy A6). After six weeks, the post test was conducted. A question paper consisted of 30 questions including 10 questions of addition, 10 questions of multiplication and 10 questions of subtraction. The correct response to each question on the post-test received one point, whereas the incorrect response received zero points. The test had a maximum score of 30 and a time limit of 90 minutes.

**Validity of data collection tools (Pre and post tests)**

The pre and post-tests were formulated from Unit-2 of a three class Mathematics book. The tests were then sent to five schoolteachers who had done their M.Phil. Degrees in Educational Technology and had been teaching Mathematics at primary level for the previous ten years. The correction of the tests was done according to their suggestions.

**Reliability of data collection tools (Pre and post tests)**

The reliability of the data collection tools (pre and posttests) was verified by the researchers by using test-retest procedure. The reliability coefficient of 0.86 was suitable for the current study.

**Statistical analysis**

The experimental and control groups' pre- and post-test results were gathered, and SPSS was used to analyze them. An independent samples t-test was conducted to assess the significant difference between control and experimental groups.

**Ethical consideration**

The data of the study was collected by taking the permission from the school’s principal Dr. Shoukat Mahmood Qureshi.

## FINDING AND DISCUSSION

### Finding

The gender wise frequency distribution, percentage of male and female learners and frequency of their marks distribution in mathematics performance in posttest of experimental group are shown in figure 7. From the total of 28 sample of experimental group, 16 were male students and 12 were female students. The percentage of male students was 57.14% and it was 42.86% for female students as shown in Figure 7 (a). The achievement in mathematics of the experimental group is also shown in figure 7 (b). The marks and levels were divided as: students who got 30/30 marks were replaced in super-excellent level, students who got the marks in the

range of 26-29 were replaced in excellent level, students who got the marks in the range of 22-25 were replaced in very good level and the students who got the marks in the range of 18-21 were replaced in good level. Figure 7 (b) shows that 21% of students got super-excellent marks, 36% students got excellent marks, 25% students got very good marks and remaining 18% students got good marks in post-test of experimental group.

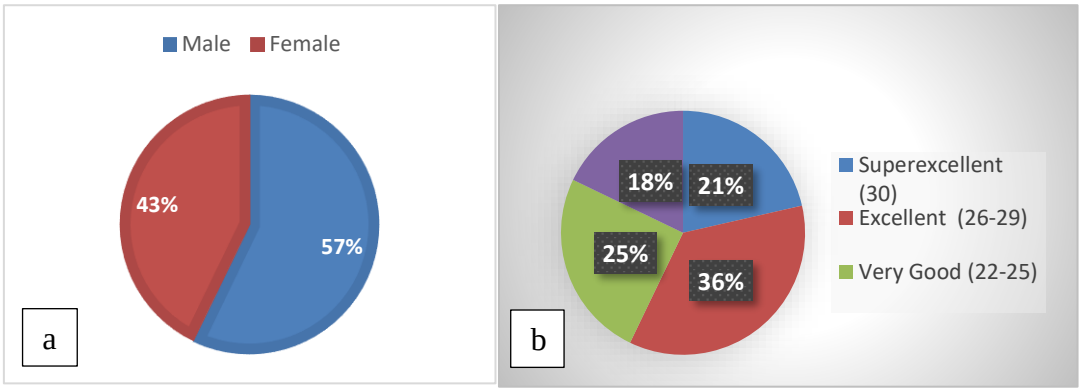


**Figure 7: (a) Percentage of male and female students in experimental group (b) Performance of Students of experimental group**

***Pre-test results***

The standard deviation and mean of pre-test for control and experimental groups are given in table 4. The table indicates that mean scores for experimental and control group are approximately the same. The standard deviation is also approximately the same for both the groups. So, it can be determined that before teaching the students with blended learning teaching methods, the students of control group and experimental group have same capability of mathematics learning. The students of control and experimental group were approximately equal.

**Table 4. Standard deviation and mean scores of pre-tests of experimental and control groups**

| Group | N | Mean | Standard Deviation |
|---|---|---|---|
| Experimental | 28 | 17.19 | 2.03 |
| Control | 23 | 17.37 | 2.22 |

***Post-test results***

The standard deviation and mean scores of post-tests for control and experimental groups are given in table 5. Table shows that mean scores for experimental group is 26.93 and the mean score of control group is 21.70. So, there is greater difference in the mean scores of experimental and control groups. It is revealed from the table that by teaching the students with blended learning teaching method, their mathematics performance capability has much increased as compared to the student who has learnt with the traditional lecture teaching method. There is also a greater difference in the standard deviation of the control and experimental groups.

**Table 5. Standard deviation and mean scores of post-tests for experimental and control groups**

| Group | N | Mean | Standard Deviation |
|---|---|---|---|
| Experimental | 28 | 26.93 | 2.493 |
| Control | 23 | 21.70 | 4.005 |

***Findings related to RQ1.***

Table 8 addresses the answer to research question 1 that was "What is the effect of using blended teaching method on Mathematics performance of 3rd grade students? A t-test was applied to find the effect of blended teaching method on mathematics performance of grade three students. To find the effect of this teaching method, we tested the hypothesis Ho1 that was no significant difference between the experimental group who taught by blended teaching method and control group who taught by traditional teaching method. The results of the t-test indicated that there was a significant difference between the experimental group who taught by blended teaching method and control group who taught by traditional teaching method. The t-value was obtained as -5.704 and p-value was 0.00001. As the p-value is very less than 0.05, the results are highly significant and proved that the blended teaching method had greatly affected the mathematics performance of students in grade three at a primary level. The blended teaching method really improved the students' academic achievement in mathematics. The result of the t-test is shown in Table 6.

**Table 6. Results of t-test for post- test between control and experimental group**

| Study Group | Sample (N) | Scores (Mean) | Standard Deviation | t | p | Result |
|---|---|---|---|---|---|---|
| Control | 23 | 21.70 | 4.005 | | | |
| | | | | -5.704 | 0.00001 | Significant |
| Experimental | 28 | 26.93 | 2.493 | | | |

*Significant at a significance level of 0.05*

***Findings related to RQ2.***

To find the answer of the research question 2, Ho2 was test to find the effect of blended teaching method on the male and female students of grade three. The statement of Ho2 was "There was no significant difference of male and female students in mathematics performance of experimental group in post-test". The results of t-test for post-test between male and female students for experimental group are shown in table 7. The table revealed that the t-value was -3.456 and the value of significance i-e p was 0.410. As, the value of p is more than 0.05, so statistically there was no significant different found in mathematics achievement of male and female students of grade three in experimental group. However, the blended teaching method significantly improved the mathematics performance of both male and female students of experimental group.

**Table 7. Independent samples t-test for post-test between male and female students of experimental group**

| Group | Gender | N | Mean | Standard Deviation | t | p |
|---|---|---|---|---|---|---|
| Experimental | Male | 16 | 26.87 | 2.76 | | |
| | Female | 12 | 26.06 | 2.98 | -3.456 | 0.410 |

***Findings related to RQ3.***

The effect size was calculated between the experimental and control groups by using Cohen's test. The Hedges' g value is used to determine the effect size when the sample size between two groups. If the value of Hedges' g is large than 0.5, then it shows large effect size between the two group. In the current study, the value of Hedges' g was obtained as 1.6043, that is more than 0.5 and it shows that there was a large effect size exist between the control and experimental group of post-tests as shown in Table 8.

**Discussion**

According to Hattie and Corwin (2018), the approach and quality of instruction that learners get is the single most critical aspect that influences the learning environment. The

advancements in ICT have altered the way teaching systems. In today's educational institutions, the blended teaching style has shown to be a successful learning strategy.

**Table 8. Effect size between experimental and control groups of post-tests**

| Group | N | Mean | Standard Deviation | Hedges' g Value |
|---|---|---|---|---|
| Experimental | 28 | 26.93 | 2.493 | 16.043 |
| Control | 23 | 21.70 | 4.005 | |

Much research has demonstrated the efficacy of the blended teaching method (Suryanti and Arifani, 2021; Shenkut et al., 2022). A variety of ICT tools are employed in the blended teaching method to increase its efficiency. This study was directed to discover the effects of blended teaching methods on Mathematics performance of 3rd grade students at primary educational level. Three research questions were formulated to conduct the research. The outcomes found concerning the first research question having statement "What is the effect of using blended teaching method on Mathematics performance of 3rd grade students?" showed that there was a significant difference between experimental and control groups taught by blended and traditional teaching methods. The results were favoring towards the blended teaching method. If we look at the consequences shown in table 6, we see that the average scores of the students for post-test of the experimental group is 26.93, compared to 21.70 for the control group students. There is a much difference in the mean scores of experimental and control groups so, it is concluded that blended teaching method has a positive effect on Mathematics of 3rd grade students. These results are steady with several preceding research in which blended teaching method showed positive effect on the academic performance than that of traditional learning (Almasaeid, 2014; Maccoun, 2016; Bakeer, 2018; Hafeez and Akhter, 2021).

The second research question concerned about the effect of blended teaching method on male and female students in experimental group. If we look at the results of table 7 in which the mean score of male students is 26.87 and the mean score of female students is 26.09 of experimental group. The difference in mean scores between male and female students is only 0.78. This small difference indicates that the effect of blended teaching method on male and female students is approximately the same of the experimental group. Also, there is no statistically significant difference between male and females scores of the experimental group. These findings are also similar to the several previous studies that showed the positive effect of blended teaching method on both male and female students in their academic achievements (Lin et al., 2016; Ceylan and Kesici, 2017; Bazelais and Doleck, 2018; Sablan and Prudente, 2022). The third research question was about the effect size between the experimental and control group of post-tests. If we look at the results of table 8, there is a huge difference in the mean scores of experimental and control groups. Cohen's test was used to the effect size between the experimental and control group of post-tests. The Hedges' g value is used to find the effect size when the sample size is not equal as in the current study. The Hedges' g value is obtained as 1.6043 which is high and indicates large effect size between mean scores of experimental and control of post-test. It also indicates the positive effect of blended teaching method on the experimental group.

The results presented in this study indicated that blended teaching method is one of the effective teaching and learning methods at primary education level. The results were very significant for the students of experimental groups in posttest as compared to the students who were taught with the traditional teaching method. The results of this study are like the many previous studies done on the blended teaching method **(**Aboraya, 2021; Chao et al., 2021; Hafeez & Akhter, 2021).

This research study was done on the grade three students at a public school with village background of district Dera Ghazi Khan, Punjab, Pakistan. So, the results of this study were only generalized to the schools having village background of district Dera Ghazi Khan. Also, the students required many efforts to make them efficient in using Tab A6 to make the blended teaching method effective. The results of the study will be useful for teachers, school managers, and parents of the students. It is because these findings may help them to improve Mathematics

learning of the students. Furthermore, the study may help school administrators for planning purposes of the educational needs of students. The study recommends based on results that future research may be done in the schools of other districts of Punjab on the primary level to generalize the results for the whole Province of Punjab.

## CONCLUSION

This study was conducted to find the effects of blended teaching method on mathematics performance for 3rd students at primary educational level. The outcomes showed that the usage of blended teaching method had a positive impact on 3rd grade student's Mathematics performance. The effect was statistically significant between the control and experimental group favoring the experimental group who were taught with blended teaching method. The male and female students of experimental group in post-test showed approximately same performance in Mathematics taught by blended teaching method. The current study is significant as it indicates that blended teaching methods are very effective in primary education. It means that the blended teaching method can be more useful and practicable if it is integrated with traditional teaching method. Based on results, the current study recommends that the teachers should encourage to apply the blended teaching method by integration of technology in traditional teaching method. Moreover, the curriculum should be designed in a way that supports blended learning. This can be achieved by conducting more studies on the integration of blended teaching methods in Mathematics teaching.

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