# Using Some Mobile Applications for Teaching Mathematics During COVID-19 Pandemic Through Providing a Suitable Environment

**Fenk Khasraw Hussin**

Gawhar Preparatory School, Directorate of Erbil Education, Ministry of Education, Erbil, Kurdistan Region, Iraq.

**E-mail:** fkhh2009@yahoo.com

**Shuokr Qarani Aziz**

Department of Civil Engineering, College of Engineering, Salahaddin University, Erbil, Kurdistan Region, Iraq.

**E-mail:** shuokr.aziz@su.eu.krd

## Abstract:

The coronavirus disease 2019 (COVID-19) pandemic and other crises create problems for the normal teaching process in the class. In this case, alternate teaching techniques such as mobile applications are required for continuing the teaching and learning process. This research focuses on teaching mathematics in class 12 by using applications (available on mobiles, laptops, desk tops, iPads etc.), namely Phone, Viber, WhatsApp and Messenger so as to provide an appropriate teaching environment. Class 12 in Gawher Preparatory School (both scientific and literary branches) in Erbil City, Kurdistan Region-Iraq was selected for this study. The sample sizes for both scientific and literary branches during the academic year 2019-2020 were 31 and 53, respectively. Pre and post tests were administrated to check pupils' achievements. Videos were prepared and uploaded to the teaching groups in Viber and Messenger. Suitable environments for teaching mathematics to class 12 were provided via direct communication, and questions and answers were provided. The results revealed that average scores for pre and post tests for the scientific branch were 20 % and 63.33 %, respectively; while for the literary branch were 17.5 % and 50.83 %, respectively. The mobile applications experimented with have led to the enhancement of the mathematics teaching process outside normal classes and particularly during the COVID-19 lockdown periods and crisis. Also, COVID-19 lockdowns decreased noise pollution, water consumption, production of wastewater, generation of solid waste, and expenditures at schools. Additionally, a number of problems, benefits, and recommendations have been outlined; for instance, providing internet and continuous electricity for schools, supplying mobile phones or laptops for pupils with reasonable prices, and running training courses for teachers and pupils are essential.

**Keywords:** COVID-19, Mathematics, Mobile Applications, Teaching, School, Environment.

## 1. Introduction:

The coronavirus disease is a pandemic which took place due to an epidemic that ensued in late 2019 (COVID-19). It was initiated by the coronavirus-2 virus of the severe respiratory syndrome (SARSCoV-2). The COVID-19 was first documented in December 2019 in Wuhan-China (Aziz, 2020; Ibarra-Vega, 2020). COVID-19 has led to severe international socioeconomic confusion such as the postponement and stopping of politics, teaching process, sports, religious, and cultural activities worldwide (Aziz, 2020; Sarwar et al., 2020).

Over the past years, mobile applications have been noticeably used by many pupils and instructors all over the world and have become an essential part of the lives of many teachers and pupils. These devices have changed the way that people contact each other and search for knowledge and work. Mobile devices have increased the learning process (at any time and at any place) by providing flexible access to learning resources, inside and outside of school (Naismith et al., 2004). Online mobile applications related to mathematics have increased in the last decade. These technologies have offered support to mathematicians and pupils to solve problems, enhanced comprehension of mathematical ideas, provided concepts and encouraged common metacognitive abilities (Drigas & Pappas, 2015). Lack of training to use technology in teaching is one of the biggest challenges faced by teachers in the teaching process, especially in the domain of mobile applications (Burden & Hopkins, 2016; Ghavifekr et al., 2016; Johnson et al., 2016).

Ebner (2015) used mobile applications for teaching mathematics in primary schools. The researcher concluded that it can be briefly stated that the fruitful use of mathematic applications in classroom is in excess of only a playing with the first application that comes along; it is nearby a watchful design of a didactical method based on a suitable learning plan. Kiger et al. (2012) stated that mobiles are applied to improve situated learning. Parvez et al. (2019) examined mobile applications and the conventional method among 192 deaf students for learning basic mathematical concepts. The results revealed that teaching mathematical concepts by using mobile applications enhanced answering quizzes by 12 %, when compared with normal teaching methods.

Figueiredo et al. (2016) documented that mixed learning classes (i.e. using smartphones and tablets in schools) yielded statistically superior results than their face-to-face normal teaching process. Authors investigated the advantages and disadvantages of usual class and mobile applications teaching surroundings. The advantages of the normal class teaching process are: 1) direct teaching with the students, 2) direct questions and answers, and 3) attendance is obligatory. However, the shortcomings of this process are: 1) limited time for students' and teachers' attendance in the school and class, 2) repeating the lectures several times by the teacher is tedious, 3) it needs accepted clothes and other requirements, 4) transportation is costly, 5) pocket money and further expenditures are needed by the students, and 6) noise pollution occurs. Another study was carried out by Ghavifekr et al. (2016) in the state of Melaka, Malaysia. The aim of the research was to study teachers' perceptions of the challenges faced in application of information communication technology (ICT) tools in classrooms. A quantitative research design was applied to collect data randomly from 100 secondary school teachers. The researchers stated that key issues and challenges found to be significant in using ICT tools by teachers were: bounded accessibility and network connection, restricted technical support, nonexistence of effective training, limited time and lack of teachers' capability (Ghavifekr et al., 2016). Johnson et al. (2016) published a work on common challenges faced by educators when trying to integrate technology in the classroom, and they offer possible solutions to those problems. The authors started the work by introducing the challenges to technology integration that are external to the teacher, including access to resources, training, and support. Additionally, they


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presented barriers that are internal to teachers, including their attitudes and beliefs, resistance toward technology in the classroom, and their information and skills (Johnson et al., 2016). In another study by Fabian et al. (2018), the authors investigated influences of using mobile technologies on students' attitudes and achievement. They adopted a quasi-experimental mixed method design. Participants were 52 primary 6 and 7 students. The experimental group joined in weekly mobile-supported, cooperative learning activities spanning over three months. The results revealed that the use of mobile technologies promoted positive replies from students both in terms of how they identify the mobile activities and how it upgraded their performance, but its' impact on students' attitudes towards mathematics will need to be further investigated (Fabian et al., 2018). Alwia et al. (2019) studied mobile applications for teaching from primary schools up to higher institutions. The authors analyzed successful factors for teaching and learning using mobile applications. They found that mobile applications enhanced knowledge accessibility, arrangement of students, varieties of selections, borderless education and yet allowed collaboration among students and teachers (Alwia et al., 2019). Sunitah and Elina (2020) reported that integration of mobiles in teaching and learning processes generated a new period in education. It makes teaching and learning processes more interactive and efficient. It can assist to carry quality education to everyone from everywhere. The authors stated that the application of mobile apps and technologies as a whole can offer many benefits to the university learning environment (Sunitah and Elina, 2020).

Due to COVID 19 quarantine and lockdown conditions in Erbil City, normal teaching in classes has been impossible. Therefore, the use of modern technologies such as V, WhatsApp and Messenger is regarded as an alterative method in the teaching process. In addition, other crises and problems such as war, hot and very cold weather, economical and political problems, unavailability of sufficient school buildings etc. have led to inability to conduct normal class teaching processes. Therefore, investigating another teaching method like using mobile applications is necessary. Additionally, the current economic crisis is another issue for the pupils because of which all pupils could not purchase mobile phones, iPads, laptops etc.

Research questions for the present research were:

1) Is there any difference between pre and post tests for teaching mathematics using mobile applications?

2) Is there any variance for using mobile applications for teaching mathematics between scientific and literary branches?

3) What are the impacts of the COVID-19 pandemic lockdown on the teaching process and the school's environment?

Research hypotheses for the current work were:

1) There is difference between pre and post tests for teaching mathematic using mobile applications,

2) The COVID-19 pandemic lockdown impacted on the environment for mathematic teaching process and affected on the school's environment as well.

The significance of this research appears during COVID-19 pandemic lockdown and other crisis, an alternative teaching process such as using mobile applications should be available. In addition, knowing the influence of the COVID-19 pandemic and other disasters on the teaching process environment and the school's environment are another importance of this research. The outcomes of this research are significant for teachers, the General Directorate of Education in Erbil, and the Ministry of Education.


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Consequently, the aim of the current work was to investigate using mobile applications (Viber, WhatsApp and Messenger) during COVID-19 quarantine and lockdown periods for teaching mathematics in class 12 for both scientific and literary branches in Erbil City. To date, to the researcher's best knowledge, this kind of research has not been carried out in Erbil City.

## 2. Materials and Methods

### 2.1. Study Sample

Class 12 students in Gawher Preparatory School, Directorate of Education, Ministry of Education, Kurdistan Region-Iraq were selected as the sample of the study. Class 12 students for both scientific and literary branches in academic year 2019-2020 were selected. This school is located in Farmanbaran Quarter, Erbil City centre. This school is a public school and the preparatory part of it was opened in 2017. The numbers of pupils in both scientific and literary branches during the academic year 2019-2020 were 31 and 53, respectively. Normally, the income of the pupils' family is medium to low. Based on the general view of the pupils' life style, the average monthly salary of the pupils' families ranged between 500 to 1200 USD. The selection of this school is based on having it as a sample of a normal governmental school that is located in a usual quarter in Erbil City. In the statistical point of view, the selection of this school is regarded as a random collection sample, because all the public schools in Erbil City centre have the same chance for being chosen (Taherdoost, 2016a; Elfil and Negida, 2017). The sample is regarded as a random sample since all the samples have the same chance for selection (Taherdoost, 2016a; Elfil and Negida, 2017). Therefore, the sample of class 12 pupils in Gawher Preparatory School represents a random sample among class 12 pupils in public schools in Erbil City centre. Each population size (i.e. scientific and literary branches) was greater than 30 pupils.

### 2.2 Study Approach and Data Collection

Incomplete lockdown and closing of some sectors such as schools, universities, beauty saloons, car shows, etc. in Erbil City, Kurdistan Region-Iraq were initiated at the end of February 2020. Whereas, full lockdowns from 14 March 2020 to 23 April 2020, 24 to 26 May 2020, 1 to 3 June 2020 and 1 to 4 July 2020 were implemented in Erbil City. For the other times during 23 April 2020 to 2 September 2020, partial lockdowns were applied.

The Ministry of Education in Kurdistan Region-Iraq decided to close all schools on 25 February 2020, due to COVID-19 problems. Consequently, an alternate teaching process using mobile applications at homes instead of the normal teaching process in the classes was adopted. At the beginning of March 2020 and to conduct the current research, authors opened Viber and Messenger groups with class 12 pupils in Gawher Preparatory School . Additionally, direct calling, messages, and WhatsApp were used by the pupils and the teacher for explanations and further details. In mathematics, chapter 6 for the scientific branch and chapter 5 for the literary branch were not taught in the normal classes. Accordingly, a pre test (Q1) was prepared for the aforementioned chapters and was sent to the pupils. The pre test was extracted from national exams for the Ministry of Education from the previous years. After a period of time, the answers were sent to the teacher via personal phone number to avoid the spreading of answers among participants. Details of participant students and responses are shown in Table 1. After that, the teacher prepared the videos for the sections of chapter 6 (scientific branch) and chapter 5 (literary branch). The videos were sent to the students in the Viber and Messenger groups. The teacher gave the students a period of time for listening and understanding the recorded videos. Concurrently, the teacher gave instructions


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and assignments to the students, and answered their questions. After two weeks and as the pupils understood the prepared videos on the lectures, the teacher sent the same exam sheet (Q2) as a post-test. Again, the post-test was chosen from national exams from the previous years. The pre test was considered as the base (or control) for the pupils, and the post-test indicated achievements of the students through using mobile applications for learning mathematics. The researchers conducted a post-test to find out the difference in the level of pupils' achievement in terms of understanding, commitment, and application of Bloom's cognitive levels. In the related literature, the pre and post tests conducted by other researchers confirm the methodology of the present work (Supandi et al., 2017). After a period of time, the pupils returned the answers to the teacher via personal Viber and Messenger again, Table 1.

**Table 1. Distribution of participant students**

| Description | Scientific Branch | Literary Branch | Total |
|---|---|---|---|
| Total number of students | 31 | 53 | 84 |
| Total number of students in the Viber and messenger groups | 20 | 30 | 50 |
| Active students in the Viber and Messenger groups | 15 | 12 | 27 |
| Response ratio of students entering to the Viber and Messenger groups (%) | 64.52 | 56.60 | 59.52 |
| Active students in the Viber and Messenger groups (%) | 75 | 40 | 54 |
| Ratio of the active students in the Viber and Messenger groups to the total number of students (%) | 48.39 | 22.64 | 32.14 |

## 2.3 Study Design, Validity and Reliability

In this research, the authors applied the Experimental Method which describes a problem. To examine effect of using mobile applications on the students' achievements, pre and post tests were carried out. Both tests were applied on the same students, due to limitation of the student numbers and the COVID-19 pandemic lockdown. Later, impact of the independent variable was checked on the students. The current study followed the design of the one group, which is the experimental group with the pre test (Q1) and the post test (Q2). Further treatment for the experimental group was conducted. The study method consists of the pre and post achievement tests, where the test was prepared according to the criteria set by the Ministry of Education.

Validity clarifies how well the collected data covers the actual area of study. Validity fundamentally means "measure what is intended to be measured" (Taherdoost, 2016b). On the other hand, reliability states to the consistency of the outcomes obtained when the measuring instrument is carried out to the same sample group at various times (Sürücü & Maşlakçı, 2020). All the questions in the pre and post examinations were selected from the national exams for the Ministry of Education from the previous years. Normally, the national exams prepared by the experts in the Ministry of Education in Kurdistan Region pass through several filters. Since the pre and


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post tests were received from the national exams for the Ministry of Education from the previous years, they are formal exams and the exams did not need further checking. The questions were extracted from chapter 6 (scientific branch) and chapter 5 (literary branch). Ten multiple choice questions such as the national examination for each branch were prepared. The selected questions were evaluated by three experts in the field of teaching mathematics.

## ٢.4 Data Analysis and Statistical Techniques

Pre and post tests for class 12 pupils (scientific and literary branches) in Gawher Preparatory School were carried out. Codes were prepared for the pupils. Scores of the tests were arranged, tabulated, and presented graphically as shown in Table 2. Then, collected data were statistically analyzed. Values of average, standard deviation, minimum, maximum, correlation (r), and coefficient of determination ($R^2$) for pre and post test results for both scientific and literary branches were determined and illustrated in tables. Collected data were analyzed using Microsoft Excel and Statistical Package for the Social Sciences (SPSS) version 26.

## 2.5 Study Variables

The independent variable of the current research was using prepared videos through mobile applications. Dependent variables are the achievements of the students.

## 3. Results and Discussions

## 3.1 Mathematic Teaching Process Using Mobile Applications

The results of pre and post tests are illustrated in Figure 1, Table 2, and Table 3. The average scores for the pre and post tests for the scientific branch were 20 % and 63.33 %, respectively. A clear enhancement of students' ability is noticed. Videos and continuous communication with the teacher resulted in the upgrading the ability of students' learning of chapter 6 of mathematics.

Correlations for the pre and post tests for the scientific branch are given in Table 4. There is a statistically significant and moderate positive correlation between pre and post tests for the scientific branch, $r(13) = 0.584$, $p < 0.05$, and $R^2 = 0.3411$. It means that 34.11 % of the variance in the pre test are associated with the variance of the post test.

**Table 2. Pre and post test results-scientific branch**

| Student Code | Pre Test (%) | Post Test (%) |
|---|---|---|
| 1 | 20 | 80 |
| 2 | 30 | 70 |
| 3 | 10 | 40 |
| 4 | 20 | 80 |
| 5 | 10 | 70 |
| 6 | 10 | 60 |
| 7 | 20 | 60 |
| 8 | 20 | 60 |
| 9 | 10 | 60 |
| 10 | 10 | 40 |



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| | | |
|---|---|---|
| 11 | 10 | 60 |
| 12 | 30 | 80 |
| 13 | 10 | 50 |
| 14 | 60 | 80 |
| 15 | 30 | 60 |
| Average | 20.00 | 63.33 |

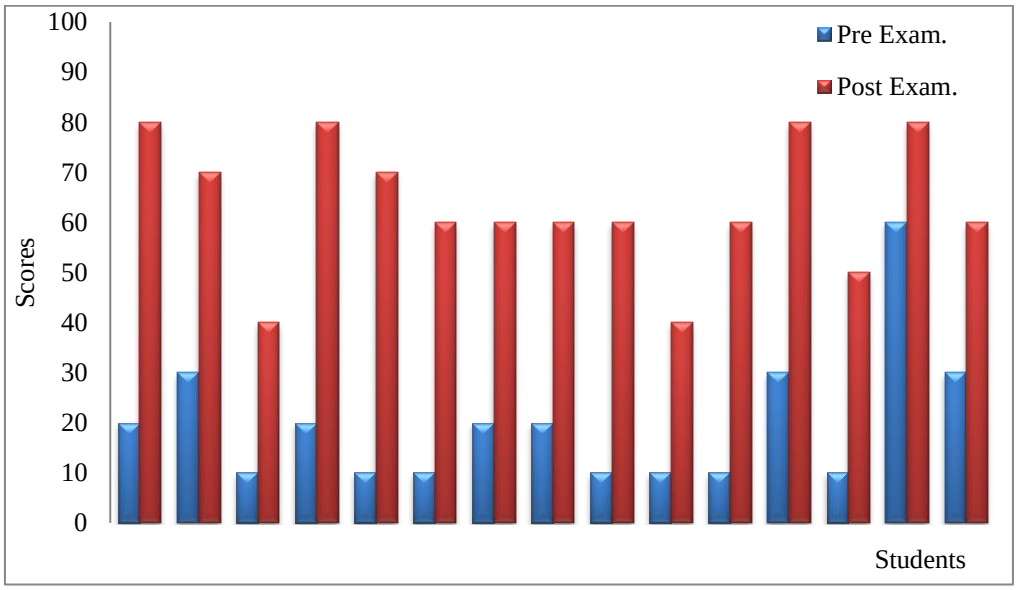


Figure 1: Pre and post test results-Scientific branch

Table ٣. Statistical analysis for the pre and post tests

| Group | Numbers | Pre test exam. | | | | Post test exam | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean (%) | Standard dev. | Min. (%) | Max. (%) | Mean (%) | Standard dev. | Min. (%) | Max. (%) |
| Scientific | 15 | 20 | 13.63 | 10 | 60 | 63.34 | 13.45 | 40 | 80 |
| Literary | 12 | 17.5 | 6.22 | 10 | 30 | 50.83 | 23.92 | 20 | 100 |

Table 4. Correlations for the pre and post tests for the scientific branch

| | Parameters | Pre test | Post test |
|---|---|---|---|
| Pre test | Pearson Correlation | 1 | 0.584* |
| | Sig. (2-tailed) | | 0.022 |
| | N | 15 | 15 |
| Post test | Pearson Correlation | 0.584* | 1 |
| | Sig. (2-tailed) | 0.022 | |
| | N | 15 | 15 |

*. Correlation is significant at the 0.05 level (2-tailed).


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On the other hand, the same procedure was followed for the literary branch. Pre and post test results for the literary branch are shown in Figure 2, Table 3, and Table 5. The average scores for the pre and post examinations were 17.5% and 50.83%, respectively. Again, a significant improvement noticed on the part of the students. Additionally, videos and communication with the teacher resulted in the enhancement of the students' ability as well.

Correlations for the pre and post tests for the literary branch are shown in Table 6. There is no statistically significant and very low positive correlation between pre test and post test for the literary branch, $r(10) = 0.138$, $p > 0.05$, and $R^2 = 0.019$. It means that 1.90% of the variance in the pre test are associated with the variance post test.

Table 5. Pre and post test results-literary branch

| Student Code | Pre Test | Post Test |
|---|---|---|
| 1 | 10 | 20 |
| 2 | 20 | 20 |
| 3 | 10 | 40 |
| 4 | 10 | 60 |
| 5 | 20 | 40 |
| 6 | 20 | 40 |
| 7 | 20 | 100 |
| 8 | 20 | 80 |
| 9 | 20 | 40 |
| 10 | 10 | 70 |
| 11 | 30 | 60 |
| 12 | 20 | 40 |
| Average | 17.5 | 50.83 |

Table 6. Correlations for the pre and post tests for the literary branch

| | Parameters | Pre test | Post test |
|---|---|---|---|
| Pre test | Pearson Correlation | 1 | 0.138 |
| | Sig. (2-tailed) | | 0.670 |
| | N | 12 | 12 |
| Post test | Pearson Correlation | 0.138 | 1 |
| | Sig. (2-tailed) | 0.670 | |
| | N | 12 | 12 |


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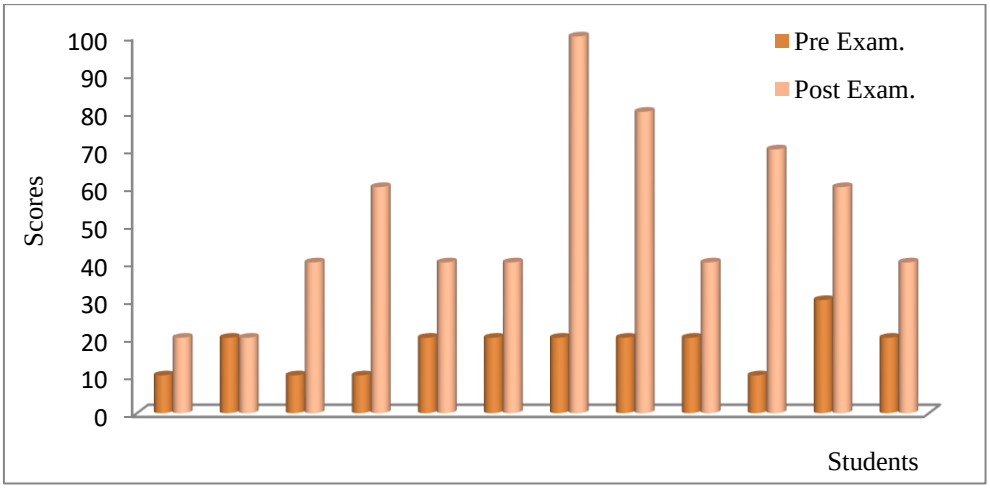


Figure 2. Pre and post test results-Literary branch

Figures 1 and 2 and Tables 2 and 5 demonstrate pre and post test results for both scientific and literary branches. Recording videos and opening groups for teaching mathematics improved the ability of scientific and literary students to understand mathematical chapters. The standard deviations for the scientific branch for both pre and post tests were commonly equal; As for the literary branch, the standard deviations for the post test were higher than those for the pre test. The wide range (20% to 100%) for the pre and post test scores led to the high standard deviation. The obtained results from the current work agree with those of the research on teaching mathematics for grade 8 conducted in the Philippines (Etcuban & Pantinople, 2018). Skillen (2015) reported that some schools were moving towards applying technology initiatives and Bring Your Own Device (BYOD) programs; others are supporting classroom learning knowledge through the purchase of mobile devices including iPads and tablets. The planned idea confirms this research yielded results.

The present results agree with those of research conducted by Supandi et al. (2017) who reported that students' interest in using mobile phone applications increased from 53.30% for the pre test to 63.64 % for the post test. The results published by Ebner (2015), Figueiredo et al. (2016), and Parvez et al. (2019) support the current work outcomes.

## 3.2 Class and Mobile Application Teaching Environments

Commonly, the benefits of the teaching process using mobile applications are: 1) the student can listen to the recorded videos and lectures at any time, 2) the student can repeat the lectures several times, 3) neither transportation nor new clothes are required, 4) there is less noise pollution when compared with the school classes, 5) enhancement of English Language occurs, and 6) it decreases administration problems and cost. On the other hand, generally the difficulties of this process are: 1) A mobile phone is required, 2) internet is essential, 3) social and family problems may occur, 4) technical and electricity problems can interrupt learning, and 5) it takes more time due to busyness with the students in the group and with other applications and programs (Fabian et al., 2018; Farrah and Abu-Dawood, 2018; Alwia et al., 2019; Sunitah and Elina, 2020).

Aziz (2020) stated that COVID-19 influenced several sectors such as politics, education, human activities, tourism, economics, sports, transportation, the environment, etc. As a result, COVID-19 affected the environment of the teaching process in the class and the environment of the school as well. Gawher Preparatory School, like other schools in Erbil City, was closed during the COVID-19 pandemic lockdown and the environment was


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impacted by the lockdown. In the current research, school environmental parameters such as noise pollution, water supply, wastewater production, and solid waste generation in Gawher Preparatory School were studied.

The researcher outlined that the noise pollution in the class rooms and corridors in the Department of Civil Engineering, College of Engineering, Salahaddin University-Erbil (SU-E) were 61 dB and 72 dB. While, noise inside library of College of Engineering- SU-E and Central Library of SU-E were 43 dB and 47 dB, respectively. Noise pollution inside bedroom was varied from 36 dB to 48 dB (Aziz, 2008; Aziz 2012). It is clear that the noise pollution inside classrooms is higher than libraries and bedrooms (Aziz, 2008; Davis & Cornwell, 2008). Figure 3 illustrates sound pressure levels of different sources. Students staying at home has led to minimum noise pollution.

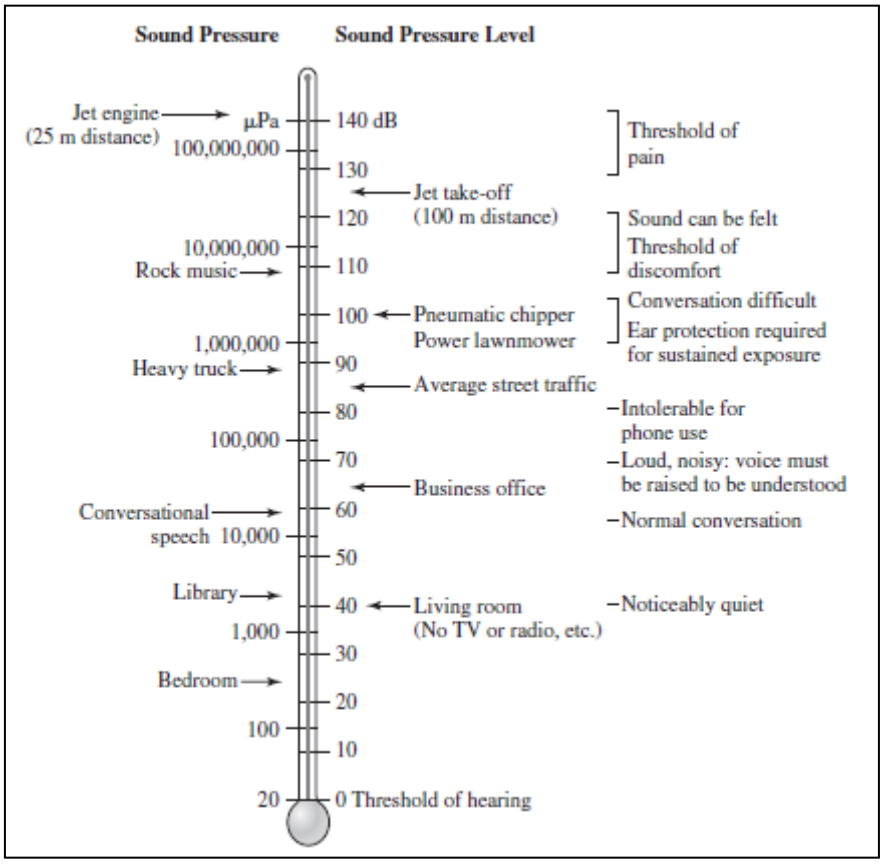


Figure 3: Relative scales of sound pressure levels (Davis and Cornwell, 2008).

Students, teachers and administration need water supply during working hours in the school. The amount of water required per capita in the school varies from 20 liters to 30 litres per capita per day (Wase and Swaffield, 2002; Hall and Greeno, 2009). The number of students for grade 7 to grade 12 in Gawher school is around 1000 students. Therefore, the quantity of water supply per day in this school varies from 20000 liters (20 $m^3$) to 30000 litres (30 $m^3$) per day. This amount of water is normally used for drinking, toilets, cafeteria, washing, and irrigation of gardens. Around 80 % of the water supply becomes wastewater (Tchobanoglous *et al.*, 2014). The quantity of wastewater produced throughout one day in the school ranged between 16 $m^3$ to 24 $m^3$. During COVID-19 lockdown periods, the water supply was saved in the school and wastewater was not produced because pupils didn't attend the classes.


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Solid waste is generated at schools during working hours. Each student generates approximately 110 gram/day. Components of solid waste in schools commonly contain glass, plastic, papers, metals, and tissues (Davis and Cornwell, 2008; Aziz et al., 2011). The quantity of solid waste produced for 1000 students is around 110 kg/d. Again, during lockdowns students and teachers stayed at home and they did not attend classes. Therefore, the amount of solid waste in the school approached zero. On the other hand, pupils and teachers stayed at home and generated solid waste at home.

Of course, administration of the school needs money for stationary, internet, cleaning, water, photocopying, printing, electricity, communication, furniture etc. COVID-19 lockdowns have led to minimizing the expenditures to zero.

## 3.3 Study Limitations and Benefits

Throughout the period of conducting this research, the teacher faced many problems. Problems related to the students were: 1) all pupils did not participate in the program because most of them do not own modern mobile devices, 2) some pupils did not know how to benefit from the program, 3) there were difficulties in providing internet for the pupils and it needs money, 4) some parents did not allow the pupils to participate in the online teaching groups because they thought that the mobile and internet led to wasting time, and 5) some pupils had restrictions to participate in the Messenger group. Difficulties related to the teacher were: 1) preparing and recording videos takes a long time and a huge hard drive/memory for saving the recorded videos, 2) uploading recorded videos to the Viber group was difficult and required a long time, 3) the capacity of Viber for uploading files is limited and it has to be less than 25 MB, 4) the internet was very slow because most of the people were at home during lockdown and they were busy with the internet, 5) Viber has a problem with videos of more than 5 minutes, sometimes it has problem with 2 minute recorded videos, 6) some students had problems with the Messenger group because their families did not allow them to register for many programs, 7) using both Viber and Messenger groups for uploading the recorded videos was time consuming, 8) some pupils did not participate in the online teaching process, 9) some students' follow-up was not good and sometimes they asked to upload the videos several times, and 10) pupils asked questions at any time, unlike classes when the working hours are specified.

Besides the problems, using mobile applications for explanation of mathematic subjects has a number of benefits such as: 1) the pupils can repeat the videos several times, especially for those who have problems with the mathematics and their understanding in the class is limited, 2) the pupils can see the videos at any time and anywhere, unlike class time in the school, 3) recorded materials and listening/watching several times reduces anxiety for some students, 4) it minimizes the fear/apprehension among some pupils, either from the mathematic subject, teacher, class, or administration, 5) it helps to remove shyness among some students, 6) it enhances the relationship between teacher and the pupils through asking many questions and interpretations, 7) it gives more opportunity to the teacher to know more things and some characteristics of some of the pupils, 8) the teachers try to find the method for teaching and recording the subjects so as to be easy for understanding by the pupils, 9) it gives more opportunity and time to the pupils for searching and finding new things and for answering the questions, 10) it increases the relationship between the teacher and the students, 11) the teacher discovers pupils' abilities quite easily, and 12) based on Mayar's cognitive theory, a student can benefit from more than one sense, which is the auditory and visual sense (Clark and Mayer, 2011). This helps information reach to long-term memory and integrates it with what is in the memory, and thus facilities simultaneous understanding, remembering and application.


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### 3.4 Recommendations

The researchers recommend the following: 1) solving electric and internet problems, 2) providing high speed internet for the schools, teachers, and pupils with a reasonable price, 3) supplying acceptable mobile phones or laptops for the pupils with reasonable price, 4) running training courses for the teachers to learn how to make videos, 5) running training courses for pupils to learn how to use the applications and avoid wasting time, 6) providing easy software for recording and uploading videos, 7) providing an electronic question bank for the teacher and pupils, 8) supplying schools with electronic libraries, 9) using an acceptable e-learning process for the Ministry of Education, Kurdistan Region, Iraq, and 10) establishing studios for recording videos for each subject.

## 4. Conclusions

Viber and Messenger groups with pupils were opened for teaching mathematics for both scientific and literary branches during the COVID-19 lockdown. Pre and post tests were carried out. Correlation between pre and post tests for the scientific branch was statistically significant. However, for the literary branch correlation was not statistically significant. Mobile applications have led to improvement in the mathematics teaching process outside the normal classes and particularly during the COVID-19 lockdown period. The COVID-19 lockdown caused a noticeable decrease in noise pollution, water consumption, production of wastewater, generation of solid waste, and expenditures in the schools. Furthermore, numerous problems, advantages, and suggestions have been reported for both normal and mobile applications teaching processes related to environments, teachers, pupils, school administration, and devices.

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# بە کارهێنانی هەندێک لە جێ بەجێکردنەکانی مۆبایل بۆ فێرکردنی ماتماتیک لەماوەی پەتای کۆڤید- ١٩ بە هۆی ڕەخساندنی ژینگەیەکی گونجاو

**فێنک خسرۆ حسێن**

قوتابخانەی ئامادەیی گەوهەرێکچان، بەڕێوەبەرایەتی پەروەردەی هەولێر، وەزارەتی پەروەردە، هەولێر، هەرێمی کوردستان، عێراق.

**ئیمەیڵ:** fkhh2009@yahoo.com

**شکر قرەنی عزیز**

بەشی ئەندازیاری شارستانی، کۆلیژی ئەندازیاری، زانکۆی سەلاحەددین، هەولێر، هەرێمی کوردستان، عێراق.

**ئیمەیڵ:** shuokr.aziz@su.eu.krd

## پوختە:

پەتای نەخۆشی ڤایرۆسی کۆرۆنا ٢٠١٩ (کۆڤید-١٩) وە قەیرانەکانی تر کێشە بۆ پرۆسەی ئاسایی خوێندن لە پۆل دەخولقێنن. لەو بارە دا، تە کنیکی فێرکردنی شوێن گرەوە وەکو جێ بە جێ کردنەکانی مۆبایل پێویستن بۆ بەردەوامي دان بە پرۆسەی فێرکردن. ئەو توێژینەوەیە تیشکی خستۆتە سەر فێرکردنی بیرکاری لە پۆلی ١٢بە هۆی بە کارهێنانی جێ بە جێ کردنە کان (کە لەمۆبایل، دیسک تۆپ و لاپ تۆپ و ئایپاد هەن) وەکو تەلەفۆن و ڤایبەرو وەتس ئەپ و ماسنجەر بەمەبەستی ڕەخساندنی ژینگەیەکی گونجاوی فێرکردن. پۆلی ١٢ لە قوتابخانەی ئامادەیی گەوهەری کچان (هەردوو بە شی زانستی و وویژەیی) لە شاری هەولێر، هە ڕێمی کوردستان- عێراق دەست نیشان کرا بۆ ئە و توێژینەوەیە. قە بارەی نموونە کان بۆ هە ردوو بە شی زانستی و وویژەیی بۆ ساڵی خوێندنی ٢٠١٩-٢٠٢٠ بریتی بوون لە ٣١ و ٥٣ قوتابي بۆهە ریە ک لە بە شەکان. تاقیکردنەوەی بەرایی وکۆتایی ئەنجام دران بۆ زانینی ئاستی دەست کەوتی خوێندکارەکان. ڤیدیۆیەکان ئامادەکران و ئەپلۆد کران لە گرووپە کانی فێرکردن لە ڤایبەرو ماسنجەر. ژینگەیەکی گونجاو بۆ فێرکردنی بیرکاری پۆلی ١٢ ڕەخسێنرا بە هۆی پەیوەندی کردن وپرسیارکردن و وەڵام دانەوە بە شێوازی ڕاستەوخۆ. ئەنجامەکان پیشانیان دا کە تێکڕای نمرەی تاقیکردنەوەکانی بەرایی و کۆتایی لە بەشی زانستی ٢٠٪ و ٦٣.٣٣٪ بوون، لە وکاتەی لە بە شي وویژەیی ١٧.٥٪



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و ٥٠.٨٣ % بوون. جێ بە جێ کردنەکانی مۆبایل بە ئەزموون پیشانیان دا کە بوونە هۆی بەرزکردنەوەی ئاستی پڕۆسەی فێرکردنی بیرکاری لە دەرەوەی پۆلەکانی خوێندن بە تایبەتی لە کاتەکانی قەدەغەی هاتوچۆبە هۆی کۆڤید-١٩ یاخود هەرقەیرانێکي تر. هەروەها، قەدەغەی هاتوچۆ بە هۆی کۆڤید-١٩ بووە هۆی کەم بوونەوەی ژاوەژاو، بەکارنە هێنانی ئاو، فڕێ نەدانی ئاوی پیس، ونەبوونی زبڵ وخاشاک وکەم بوونی مەسرووفات لە خوێندنگاکان. هەروەها، ژمارەیەک لە کێشە، سوود مەندبوون، و راسپاردە هە لێنجران، وەکو دابین کردنی ئینتەرنێت و کارەبای بەردەوام بۆ قوتابخانەکان، دابین کردنی تەلەفۆنی مۆبایل یاخود لاپتۆپ بۆخوێندکارەکان بە نرخێکی گونجاو، وە کردنەوەی خوولی راهێنان بۆ مامۆستایان و قوتابیان زۆر پێویستە.

**کلیلە ووشەکان:** کۆڤید-١٩، ماتماتیک، جێ بە جێکردنە کانی مۆبایل، فێرکردن، قوتابخانە، ژینگە.



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