APPLICATION OF ONLINE LEARNING BY SCIENCES TEACHERS IN PRIVATE MIDDLE SCHOOLS IN LEBANON DURING COVID-19 PANDEMIC: CHALLENGES AND LESSONS LEARNED

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APPLICATION OF ONLINE LEARNING BY SCIENCES TEACHERS IN PRIVATE MIDDLE SCHOOLS IN LEBANON DURING COVID-19 PANDEMIC: CHALLENGES AND LESSONS LEARNED

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Dedication

I am sincerely grateful to the Almighty God and the Holy Mary, mother of God, for their protection and guidance. I dedicate this project to my parents for their love and care. I am thankful to my brother and my sister for their constant support and sleepless dedication to my growth and education up to today. To my friends, each of whom has contributed to my life to become who I am today.

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List of Abbreviations and Acronyms

COVID-19	Coronavirus Disease 2019
EiE	Education in Emergencies
GOL	Government of Lebanon
ICT	Information and Communication Technology
LMS	Learning Management System
MEHE	Ministry of Education and Higher Education
MOE	Ministry of Education
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
UNESCO	United Nation Education and Scientific Cultural Organization

Abstract

The purpose of this qualitative study was to assess the application of online learning during Covid-19 pandemic from sciences educators' perspective in private middle schools in the Keserwan community of Lebanon. Questionnaires and interviews were the main instruments used. Eight private middle schools were purposively selected to conduct the study. Data was analyzed using descriptive statistics through the use of Statistical Package for Social Sciences (SPSS 24 version) and results were presented in tables and charts. Eighty participants were sampled from eight private middle schools. Participants included four principal participants, eleven sciences coordinator participants, and sixty-nine sciences teacher participants. The findings established that schools did not have a strategic plan for application of online learning as a result of an education in emergency, for that reason teachers unprepared to conduct online learning effectively. It was also found that lack of digital competence to apply online learning, lack of interaction between teachers and students, lack of assessment tools to evaluate students' learning, heavy workload for teachers, internet connection, external distractions, and others were the challenges faced by sciences teachers in the implementation of online learning. Moreover, the application of online learning made available opportunities for sciences teachers including novel teaching methods, using various online resources, recording class session, giving instant feedback to students, developing teachers' technology and communication skills, and save teachers' commute time. As a result of the challenges faced by sciences teachers, several instructional approaches were adopted which included YouTube videos, pictures, students' participation in explaining parts of the lessons, giving problem solving, giving practical experiments to do at home, multiple choice questions, project presentation, etc. To address the application of online learning problems, the study recommended an establishment of strategical plan to integrate certain advantageous items used during online learning in normal learning. It was also recommended that teachers should be

supported by schools to provide them with appropriate technologies needed, training programs for teachers to know what and how features in online learning to integrate in conventional learning to be beneficial for students. The participation in decision making concerning what items from online learning could be integrated in normal learning should be applied towards all teachers, there should be awareness program about new learning methodologies combined between traditional learning and online learning among students and parents at the beginning of the school year. It was suggested that future research be carried in the following areas: examination of sciences teachers' perspectives among private and public primary, middle, and secondary schools on the implementation of online learning during Covid-19, the experience of parents in the implementation of online learning during pandemic, and the involvement of students' perception toward implementation of online learning.

Keywords: Application of online learning, Covid-19 pandemic, Sciences teachers, Private Middle school, Lebanon

CHAPTER ONE

Introduction and background of the study

Introduction

The purpose of this study was to assess the application of online learning during Covid-19 pandemic in private middle school in Lebanon. This chapter presented the background of the study, statement of the problem, objectives of the study and research questions. Also, it dealt with the research framework, significance of the study, the scope of the study, delimitations of the study, definitions of operational terms, organization of the study and summary of the chapter.

Background of the study

The World Health Organization has declared that coronavirus disease (COVID-19) is a pandemic and an infectious disease caused by a new strain of coronavirus. The transmission of this pandemic from humans to humans have imposed many restriction measures such as social distancing and avoidance of crowded places. For that, most governments in different countries have shut down schools, universities and vocational institutions to contain the virus. The unprecedented closure of educational institutions urged the leaders to apply online learning as a replacement mode of learning to carry on teaching and learning activities (Aboagye, Yawson, & Appiah, 2021). From this perspective, the spread of the Covid-19 pandemic has caused a sudden emergency situation in education sector where no one was prepared. The online learning as a response to this situation has been applied in order to maintain continuity of education during the Covid-19 crisis (Assunção Flores & Gago, 2020). That was why Mcrel and Chhetri (2021) stated that the implementation of restrictive measures as lockdown and social distancing due to the Covid-19 pandemic have led to closures of schools, colleges and universities in most countries.

This produces a fundamental change in the way of educators delivering education through using online platforms. The online learning has become the best solution for this unprecedented global pandemic, despite the challenges posed to both teachers and students (Pokhrel & Chhetri, 2021).

Many schools were forced to close due to the Covid-19 pandemic to prevent its spread in the society. Online learning was the main solution that schools applied to connect teachers to students. Schools by the adaptation of this solution have made a fast transition from traditional mode to online mode and have ensured the necessary support needed for the teachers to provide learning to students. This sudden and unplanned move to online environment brought many challenges for teachers such as the need to modify all lesson plans which are already prepared so they can go with the online learning methodology. Also, teachers and students needed to learn quickly the use of the new technologies, needed to make learning meaningful to students, and get used to the new way of interaction in the absence of face to face contact with students (Kaden, 2020). Setiawan and Iasha (2020) defined online learning as "a kind of learning method that is conducted using the internet so teachers and students do not need to face-to-face in the learning process. Online learning can be done using various electronic devices that are connected to the internet through the existence of supporting software such as Google Classroom, Moodle, Zoom Meeting, and others" (Setiawan & Iasha, 2020).

According to Priyadarshini, and Bhaumik (2020), application of online learning became mandatory for schools during the outbreak of Covid-19 pandemic to enable students to attend virtually their classes to prevent losing their academic year. This sudden move from conventional learning to online learning did not provide teachers with sufficient time to prepare themselves to be acquainted with online learning tools and skills (Priyadarshini & Bhaumik, 2020). The government in developing countries including Lebanon, declared application of online learning in

academic institutions but limited technologies, facilities, and teachers experience with this mode of learning created several challenges (Abdulkareem & Eidan, 2020). Fauzi and Khusuma (2020) contended that application of online learning was the unique choice for schools during this emergency situation to help teachers through technology convey learning to students. However, teachers considered with the application of online learning in the learning process can not achieve the same level of effectiveness because of the constraints of the teachers in implementing this online mode of teaching. Application of online learning, according to Ali (2020), due to Covid-19 pandemic and social restrictions has caused many challenges for teachers, as they are asked to teach online without preparedness time and availability of suitable resources. Consequently, challenges faced by teachers due to the adoption of online learning by schools are not only technical issues but also are pedagogical and instructional problems.

Because of the emergency situation which have led to apply online learning without any prior preparation and practices, as result both teachers and students faced many difficulties in implementing it. Fatoni et al. (2020) argued that school institutions operating online teaching should provide a strong support for teachers and students so it can be easy to use and effective. In addition schools must address all the different aspects of online learning in order to meet all the teachers and student's needs (Fatonia et al., 2020) .

The Lebanese Ministry of Education and Higher Education

The ministry of education and higher education (MEHE) is the umbrella that guides schools, universities, colleges, and vocational institutions in Lebanon and directs them on how they should operate. Based on the fundamental principles in the Lebanese Constitution and the National Accord Convention as well as on the laws and regulations governing educational matters, the stipulation that: "Freedom of and right to education and ensuring the accessibility and equality

in opportunities and requirements of education to all. Those principles have also been emphasized in international convention that Lebanon abides by; the most of these are: Declaration of Human rights; the International Convention of economic, social, and cultural rights; and the International Agreement on the Rights of the Child" (MEHE, 2010).

Online Learning is not a new idea in Lebanon where in October 2011, the MEHE initiated the Information and Communication Technology (ICT) to improve the quality of education in Lebanese educational institutions. Those ICT tools such as computers, tablets, interactive smartboards and high-speed Internet connection can be integrated in schools to increase teachers' effectiveness in the classroom to maximum students' learning benefits and get used to the digital age. Because of the high budget needed to integrate ICT in schools, the ICT tools were not implemented in all private school and none implemented in public schools in Lebanon. If ICT tools in schools were used before, it could have been advantageous during the Covid-19 crisis when they closed and relied on online learning (Khafaja, Zoghby, & Barakat, 2020).

To date the MEHE in Lebanon does not accept online education degrees obtained by students abroad and rejects equivalent to traditional degrees. This indicates that online teaching and learning still remains unrecognized as a credible way of teaching in Lebanon which can be the reason why educators in most Lebanese schools use only the traditional teaching approach where students attend classes in person (Rouadi & Anouti, 2020). However, Covid-19 pandemic forced MEHE to adopt online teaching in Lebanon in order to save the schooling year during this emergency situation (Rouadi & Anouti, 2020).

Despite the initiation of "the National Distance Learning project" by the MEHE in Lebanon in the middle of 2020 due to Covid-19 disadvantage, to provide support for school stakeholders and to make usage of free applications and LMS platforms available for them to facilitate online

teaching and learning, there has still been numerous challenges faced by schools, teachers, and students that hinder the application of online learning in Lebanese schools (Hamade, 2020). According to Khafaja et al. (2020), application of online learning is not effective in Lebanon due to the many obstacles faced by teachers such as instructional techniques, accessibility and availability of ICT, and limited funding school support, and the lack of accreditation of online learning by the Lebanese government and the absence of legal structure and policies of online learning. This was why Ferri et al. (2020), concluded that it was an emergency application of online teaching to provide learning and to stop disruption of attending classes for students due to Covid-19 pandemic, whereas there are several technological, pedagogical and social challenges faced by teachers and students in conducting online learning, particularly in developing countries like Ghana, Malaysia. In Lebanon given the discrepancies both in switching to online learning after the Covid-19 and the quality of infrastructure needed and the know-how for the application, the success of distance learning programs was not uniform (Rahhal, 2020). The current research has investigated how Lebanese schools approached distance learning and what were the main challenges and lessons learned.

Statement of the problem

Covid-19 affected the face-to-face learning method of educational institutions across the world. The administrations of schools, colleges and universities decided to apply online learning as a unique alternative way to resume education and to reduce the risk of Covid-19 infection for students and teachers (Adnan & Anwar, 2020). Online learning becomes a must for schools to use even with all the limitations imposed on teachers and students. Therefore, there is a lack of teachers' online learning skills since they are not accustomed to teach online before the pandemic and a difficulty of students' internet connection and availability of devices in their home (Hamid,

Sentryo, & Hasan, 2020). This was why Dhawan (2020) in his study on "Online Learning: A Panacea in the Time of Covid-19 Crisis", stated that the sudden outbreak of infectious disease Covid-19 in all countries made online learning as a relevant solution during this crisis time where many academic institutions adopted it to keep continuity of teaching and learning processes. Indeed, online learning support and facilitate learning and teaching activities for both teachers and students, but there is a dire teachers' need to pedagogical competency, technical capability, preparedness to online teaching, and the presence and the usage of technology tools more efficiently. However, online mode of teaching and learning in Lebanese schools were never applied before as most teachers still accustomed to use the traditional teaching approach. Online learning was completely new for Lebanese teachers who did their best to teach online in efficient possible way but various difficulties faced them in implementing it (Rouadi & Anouti, 2020).

Even though the GOL through the Ministry of Education and Higher Education launched National Distance Learning projects to provide online learning services for schools and universities via a range of online platforms including YouTube, Zoom, and Microsoft Teams (Wazzan, 2020), it remained dealing teachers with the sudden move to online learning that require to review and reorganize their lesson plan application without minimal technical, educational and administrative support, was most challenging (Mirza, 2021). However, accumulated evidence demonstrated that implementation of online learning due to Covid-19 pandemic has a strong impact on learning activities for teachers. This online mode requires teachers to change in instructional strategies, to possess suitable technology tools, and to have knowledge in using applications (Aliyyah et al., 2020). For instance, according to Rahayu's & Wirza's (2020) observation of teachers' perception of application of online learning, teachers express a negative attitude toward online teaching because of several problems faced including availability and usage

of technologies, designing of lesson materials, explanation of lessons, assessing students, and giving feedbacks (Rahayu & Wirza, 2020). The question was: Why were various challenges faced teachers in application of online learning?

Hence, the current study examined the teachers preparedness for online learning, challenges faced by the implementers, opportunities acquired by educators, instructional approaches employed to implement the online learning, ability of integration online learning by teachers in conventional learning and solutions to increase effectiveness implementation of online learning. Moreover, exploring online learning application during the Covid-19 pandemic filled the gap that existed in the Lebanese education literature, which had overlooked the importance of soliciting the views of school science teachers about their use of online learning during the Covid-19 pandemic.

Research objectives

The study sought to fulfil the following objectives:

1. To find out if the online learning initiated by schools as an emergency response due to Covid-19 an alternative education platform to allow students to pursue their academic year.
2. To examine the challenges faced by sciences teachers at middle school in implementing online learning.
3. To find out the opportunities for science teachers at middle school in implementing online learning.
4. To investigate the instructional approaches used by science teachers at middle school in implementing online learning.
5. To recommend an effective implementation of online learning.

Research questions

This study answered the following research questions:

1. To what extent was the online learning initiated by schools as an emergency response due to Covid-19 an alternative education platform to allow students to pursue their academic year?
2. What were the challenges faced by science teachers at middle school in implementing online learning?
3. What were the opportunities for science teachers at middle school in implementing online learning?
4. By using the instructional approaches in implementing online learning could science teachers at middle school achieve their learning objectives more easily?
5. What were the recommendations for implementing effective online learning?

The study framework

The study determined the relevance of challenges faced, opportunities acquired, and instructional approaches used in making online learning utilized in conventional learning among science teachers in middle school in Lebanon. It was believed that improved online learning would be helpful in integrating, if not be a part of schools' curriculum and teachers' lesson plans. Also, it was hoped that if the challenges faced by science teachers were properly managed and the proper strategies employed, it would equally facilitate integration of online learning in school curriculum and lesson plans of teachers. As well, it was expected that if the instructional approaches used by science teachers were more developed, structured and planned, it would closely encourage integration of online learning in school curriculum and lesson plans of teachers. Thus, the study

investigated the challenges faced, opportunities acquired, and instructional approaches used by science teachers in online learning during Covid-19 pandemic in middle schools in Lebanon.

Significance of the study

The importance of the study stemmed from its contribution to knowledge, particularly its generation of useful information to support future using of online learning by science teachers during conventional learning in middle schools in Lebanon. After analyzing the data, it was hoped that the results of this study would:

- provide principals and teachers with information to develop strategies to support and promote the integration of online learning in face to face learning in middle schools.
- help education policy makers, planners and the GOL (government of Lebanon) to develop a new structure of framework on effective integration of online learning in conventional learning in Schools.
- create awareness in parents, students and other stakeholders to understand and embrace the value of integration online learning in conventional learning in schools.

This study has the potential to be significant to other Lebanese researchers because there is currently a lack of research on the topic of online learning application during Covid-19 pandemic in schools in Lebanon.

Scope of the study

The current study covered the subject of assessing the online learning application during the Covid-19 pandemic in private middle schools in Lebanon. This study was a case study that was carried out in eight private middle schools in the Keserwan community. The areas of concentration for the study were challenges faced by science teachers in the implementation of

online learning, the opportunities acquired by science teachers in the implementation of online learning, the instructional approaches used by science teachers in implementing the online learning in Middle schools and recommendations for implementing effective online learning.

Delimitations of the study

Lebanon has a total geographical area of 10,452 square kilometers with a population of approximately 6.01 million people (Jaafar, Ahmad, Holtmeier, & King-Okumu, 2020). There are around 1442 private schools across the country (Bahou & Zakharia, 2019). The geographical dimension of the country and numerous private schools makes it impossible to study all the private schools in a single research study. This investigation was therefore, delimited to eight private schools in the Keserwan community, located in Jounieh, Zouk Mikael, Aintoura, and Zouk Mosbeh county, where the researcher restricted himself to study the problem of online learning application during the Covid-19 pandemic only in private middle schools. This research was delimited to the purposive sample population which included sciences coordinators, sciences teachers, Biology teachers, Chemistry teachers, and Physics teachers in the eight selected private middle schools.

The operational definition of terms

Online learning: Online learning is a form of teaching and learning through some platforms or learning management systems on which both teachers and students get together online synchronously through using different devices with internet access.

Covid-19: Coronavirus disease 2019 (COVID-19) is a contagious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).

Challenges: This is defined as lack of knowledge, interaction, relationship, and materials in the online teaching work of educators. In other words, it is the inexperience of a teacher to teach online which is something new and difficult requiring great effort and determination.

Opportunities: Opportunities refer to positive factors that aim to enable teachers to acquire knowledge and certain skills, and to cultivate certain capacities.

Instructional approaches: In this study, instructional approaches would mean teaching methods, assignments, and assessments used by teachers in online learning to show how teachers explain lessons, provide assignments for reviewing materials and practicing theory learned, and evaluate students for providing credible information about student learning.

Lebanon: Officially The Lebanese Republic, is a country on the Western Asia. It is bordered by Syria to the north and east and Israel to the south, while Cyprus lies to its west across the Mediterranean Sea.

Online learning application: It is the delivery of instruction by teachers through using different web-based technologies from the Internet that enable students to participate in learning activities beyond the schools and ensure continuity of teaching and learning.

Effectiveness: The degree to which something is successful in producing a desired result; success.

Online learning integration: In this study, online learning integration would mean involving online learning in face-to-face learning by including online learning in school curriculum and lesson plans of teachers.

Organization of the study

The research was organized into five chapters. Chapter one covered the introduction, background, specific objectives, research questions, research framework, the significance of the study, definition of key terms and its organization. Chapter two dealt with the review of related

studies on application of online learning during Covid-19 pandemic. The researcher read through the various studies conducted by others and identified the knowledge gaps, which this study intends to bridge. Chapter three presented the research methodology, which included an introduction, design of the study, the study location, the participants, the sample and sampling strategy, the development of research instruments, procedures and adherence to research ethics. Chapter four reported the findings of the study in line with the research objectives and questions. Chapter five presented the summary, conclusions, implications, limitations, recommendations for practical actions and suggested areas for further research.

Summary of Chapter One

This chapter provided the reader with an introduction to the study. A statement of the research problem, key definitions of operational terms, conceptual framework, the research objectives and questions, and the significance of the study were presented and finally the structure of the research was also described. The next chapter embarked on the review of related literature.

CHAPTER TWO

Literature Review

Introduction

The literature review was organized in relation to the research purpose which was to assess the application of online learning during Covid-19 pandemic in private middle schools in Lebanon. Throughout the literature review, the research questions were followed and literature relevant to them presented. Because of the limited amount of research in this particular field (application of online learning during Covid-19 pandemic) in Lebanon, the literature reviewed was a combination of relevant studies and scholarly publications from different countries and very little from Lebanon. Issues related to online learning teachers' preparedness to implement it, challenges facing and opportunities acquiring the science teachers, and instructional approaches used by science teachers to implementing online learning were discussed in order to cover issues investigated in other studies relevance to the current research questions.

Education in Emergencies (EiE): Application and its impact on teachers and students

Application of EiE in crisis situations

"The Inter-Agency Network for Education in Emergency (INEE) describes EiE as quality learning opportunities for all ages in situations of crisis, including early childhood development, primary, secondary, non-formal, technical, vocational, higher and adult education providing physical, psychosocial and cognitive protection that can sustain and save lives" (COOPI, 2018). Conflicts, situations of violence, forced displacement, natural disasters, and public health emergencies are common situations of crisis in which education in emergencies is necessary to provide access to education for every child. EiE support the Ministry of Education and the National Institute of Education to develop program that fit the emergency situation lived by the country to allow students to continue to follow the school curriculum and to reach the required level of

learning achievement despite being unable to attend school normally (Creed & Morpeth, 2014). EiE aim to develop education systems that are more strong and suitable in the face of war, pandemics and natural disasters, and to ensure that education is sustained during disasters, crisis and post-crisis situations (UNESCO, 2017).

Since the start of the civil war in Syria in 2011, many Syrians have been displaced either internally or as refugees. Turkey, one of the leading host of substantial number Syrian refugees, has made educational problems to accommodate the needs of Syrians. This prompted the fact that the current system of education for refugees differ in Turkey. Syrian refugee children living in camps near the border receive official education operated by the Turkish Ministry of Education and AFAD through attending camp schools that follow the Syrian curriculum. Syrian refugee children living outside the camps with residence permits can enroll in Turkish schools and receive formal education. Those who do not have residence permits are still able to attend schools unregistered as guests but are not able to receive a diploma. Therefore, the large numbers of Syrian refugees living in bordering cities such as Gaziantep that is estimated to be hosting more than 400,000 refugees push many NGOs, municipalities and other community organizations to operate and fund schools for Syrians living outside of camps. These schools use the Syrian curriculum but not officially certified by the Ministry of Education (Hos, 2016).

The World Health Organization has announced Covid-19 as a global pandemic that create a current threat to humanity. This pandemic has successfully forced many countries to follow strict protocols to complete lockdowns of several activities including educational activities to slow down and curb its spread. This emergency situation has resulted in enormous crisis-response movement of educational institutions with online learning serving as the alternative educational platform (Bozkurt & Sharma, 2020).

Hurricane Katrina that caused an internal movement of families and students to Mobile and Baldwin counties, forced primary and secondary schools in these counties into a pattern of immediate and ongoing accommodation to thousands of evacuees. The largest numbers of student displaced enrolled throughout grades K–12 in Mobile County schools make the educational resource impacts were more severe in this County that added new demands on teachers and strained educational resources (Picou & Marshall, 2007).

Negative impact of EiE on teachers and students

Although the Turkish government have made the public schools accessible to Syrian children, the enrollment number of refugees was fewer and many of the Syrian school-aged children were not attending the public schools. There were various reasons for non-enrollment of Syrian children in schools. The first one was the limited resources of schools located in the east and south-east part of Turkey not have made it possible for the refugee children who are largely living in this region to enroll in public schools. The second one was financial difficulties where many young children work as child laborers to provide for their families. Last reason is the Turkish curriculum and the fact that is brings a language barrier for learners to access the curriculum. There were not any accelerated language literacy programs in the Turkish schools to provide support for the refugee children, thus it made it difficult for them to enroll in the school system (Hos, 2016).

The predominance of Syrian refugees in Turkey live outside of the camps, and they suffered from the need for educational and social support. The quality of education was problematic because of teachers' limited competence, lack of pay for teaching and limited support from the Ministry of National Education in Turkey. Inadequate school facilities, overcrowded classrooms, financial needs, long distances to school, a shortage of teachers and the lack of funds for teachers' salaries were major obstacles. Another problem was the preparation of an appropriate curriculum design for the students' situation, such as special training and events targeting the

selected group to ensure the students' social and cultural orientation, along with psychosocial support services for the students, the majority of whom have been traumatized (Alpaydin, 2017).

Due to the Covid-19 outbreak, the Ministry of Education in China initiated an emergency policy called "Suspending Classes Without Stopping Learning" to switch teaching activities into large-scale online teaching while schools were locked. The implementation of this policy still faces several difficulties. One of the problem is the effect of online education that is contingent on teachers' online teaching ability and experience. Online teaching was not yet a major form of education in Chinese schools; many teachers had no previous experience in online teaching. Further difficulty is related to students and teachers that face problems when studying and teaching at home. First, there are a wide range of distractions from teaching and studying at home. Second, not all teachers and students are able to find suitable spaces for teaching and studying at home. Third, teaching and studying can be constrained by insufficient hardware and an unstable network at home (Zhang, Wang, Yang, & Wang, 2020).

Positive impact of EiE on teachers and students

EiE prioritize and ensure the right to education for children during emergencies (Winthrop & Mendenhall, 2006). It imposes instant physical, psychosocial and cognitive protection in time of crisis. Not attending school children are more endangered and subject to gender-based violence, early marriage, early pregnancy, child labor and forced recruitment (ECHO, 2019).

EiE is a main contributor to individual, community and societal resilience. Access to safe, and quality education can help children and adolescents to cope with, and recover from, crises and can acquire them the needed skills to rebuild their country once peace has been procured (ECHO, 2019).

EiE support teachers to increase the education quality for better learning outcomes not only by compensation but also by wellbeing plans, groups support, and training programs since teachers have been also subjected to the effects of humanitarian crisis.

- Wellbeing plans is needed to ensure that teachers receive the emotional and psycho-social support needed to be effective educators and caregivers for children.
- Mentorship and establishment of support groups is necessary to provide peer support in both technical and pedagogical areas, and in terms of providing psychosocial and emotional support.
- Training support for teachers in crisis provide specific, crisis-related content while orienting educators on effective teaching methodologies aligned with capacities and classroom needs. In cases of displacement, teachers may require additional orientation to language, culture, and educational practices of displaced communities, including refugees, to support transition of children into new classrooms and curriculum (ECHO, 2019).

Covid-19 pandemic: Precaution measures and impact on schools

Covid-19 pandemic and safety precautions

"Coronavirus disease 2019 (COVID-19), the illness caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) emerged in Wuhan, China in December 2019 and was declared a pandemic by the World Health Organization in March 2020" (Scannell Bryan et al., 2020). The clinical trial determines that the patients with Covid-19 infection range from mild or non- specific symptoms of acute respiratory illness such as fever, cough, running nose, malaise, breathlessness, to severe pneumonia with respiratory failure and septic shock. Although those symptoms look similar to other coronavirus diseases. This infectious virus Covid-19 can be transmitted from person to person due to close contact with infected people exposed to coughing,

sneezing, respiratory droplets or aerosols (Chakraborty & Maity, 2020). SARS-CoV-2, which caused Covid-19 infection, was a new strain of coronavirus appeared in 2019 to which the human population has no immunity (Chhikara, Rathi, Singh, & Poonam, 2020). The novel coronavirus disease 2019 has characterized by high human-to-human transmission and quick spread to every province of China and subsequently to 213 other countries (Lin et al., 2020). Between December 2019 and December 2020, no specific medical cures or efficient vaccines are available for COVID-19 infection. The only effective tools applied to prevent and to control the spread of the epidemic are classical public health measures such as social distancing, isolation and quarantine, and personal hygiene (Soofi, Najafi, & Karami-Matin, 2020). Each measure will be discussed to highlight on the necessity to apply this tool to curb the Covid-19 epidemic.

Social distancing is arranged to avoid interactions between people in crowded areas, in which individuals may be infectious but not identified yet hence have not been isolated. As diseases transmitted by respiratory droplets require a proper distance among people, social distancing of persons will reduce the risk of Covid-19 transmission. This prevention measure includes closure of schools and workplaces, suspension of public market, cancellation of public gathering and temporary restrictions on free internal movements of the citizens (Wilder-Smith & Freedman, 2020). Community wide containment is a precautionary measure applied to a whole community, city or region, that it is designed to prevent personal interactions and to permit minimal interaction to ensure vital supplies. It is a care continuum to expand from social distancing to community-wide quarantine with strict restrictions of movement of everyone (Wilder-Smith & Freedman, 2020). China has issued the largest community containment effort in history. This public health practice has helped China to succeed at containing the outbreak, and since mid-February, the daily number of new COVID-19 cases has been declining in China (Lee, Chiew, &

Khong, 2020). The prevention and control measures such as social distancing and community containment are important strategies to break the chain of Covid-19 infection and flattening the recovering curve of Covid-19 patients (Liang, Tang, Luo, Zhang, & Feng, 2020).

Isolation/Quarantine is one of the oldest and most effective public health strategy to combat with the pandemics (Ganesh et al., 2021). Isolation separates sick people with a contagious disease from healthy people to protect non-infected people; whereas, quarantine is designed to separate and restrict the movement of people who are not ill but who may have been exposed to an infectious disease, with the objective of monitoring if they become sick and ensuring the early diagnosis of symptomatic cases. Quarantine usually applies at the individual or group level and imposes restriction either at home or in an appropriate care facility (Wilder-Smith & Freedman, 2020). To prevent widespread community transmission, travelers leaving China and other countries affected with COVID-19 were asked to report their travel history and asked to self-isolation for 14 days. Moreover, both the confirmed and suspected cases should be immediately isolated and treated in the designated medical facilities in efficient isolation and defensive conditions to interrupt person-to-person transmission of virus (Ganesh et al., 2021). Quarantine and isolation together with contact tracing and medical treatment has proven to be functional in controlling the COVID-19 transmission (Shah, Shah, & Shah, 2020).

Personal hygiene such as using masks and washing hands is needed for prevention since Covid-19 transmission is spread through droplets to other people in a direct contact or through touching contaminated surfaces of an object in an indirect contact (Purnama & Susanna, 2020). World Health Organization recommends that it is required to wash with soap and water or

disinfectant the hands with an alcohol-based sanitizer frequently to decrease the transmission rate of Covid-19 from person to person. (Pradhan, Biswasroy, Kumar Naik, Ghosh, & Rath, 2020). Using of face masks is the first step that helped in mitigating Covid-19 infection via direct transmission. World Health Organization recommends that public mask use is a requirement from everyone. This contributes greatly to limiting contacts of Covid-19 infected individuals to others and also to controlling the Covid-19 transmission to others. So in principle, wearing masks is necessity to protect each other (Purnama & Susanna, 2020). Those precautionary measures of hand hygiene and face masks work efficiently to prevent transmission of Covid-19 infection from one to another. Implementation of this strategy helps to restrict the spread ability of Covid-19 epidemic and reduce the risk of health impact of Covid-19 infection on the community by working upon the transmissibility and clinical effect of Covid-19, the vulnerability of the population, the morbidity, the mortality, and the disorganization of the healthcare system (Lepelletier et al., 2020).

Although these non-pharmaceutical measures are effective measures for containing the spread of Covid-19 at a decrease in economic status, the development and deployment of effective therapies, antivirals, and vaccines to prevent infections and interrupt disease transmission are highly needed (Shih, Wu, Tu, & Chi, 2020).

Impact of Covid-19 on schools in different countries around the world

In Sweden, equity is a fundamental policy in social systems that ensure providing of both universal education and healthcare. Consequently, in its response to COVID-19, Sweden has attempted to mitigate the inequities that result from universal lockdown obligations, since those obligations make the socioeconomic low level communities at highest risk from Covid-19 across the socioeconomic high level classes that are definitely able to work remotely (Baral et al., 2021). Based on the policy of equity, the Swedish government decision concerning the schools was to keep childcare and elementary schools open throughout the height of the Covid-19 pandemic, for

children ages 1 to 15, while most secondary schools and universities used online teaching until mid-June. In contrast, a common prevention strategy in many countries included the closure of all schools for classroom teaching with exclusive reliance on online education. This creates significant inequities with childcare and school closures which is more difficult for low-income families to support home education; they may be forced to quit work to stay home with young children, leave them with other families, or ask grandparents who are particularly vulnerable to COVID-19 to help (Baral et al., 2021). In Spring 2020, The Public Health Agency of Sweden provide a reliable data of the Covid-19 infected cases among school age children and the proportional risk for Covid-19 infection among teachers. Despite the opening of daycare and schools (ages 1-15) continuously, the percentage of reported cases among schoolchildren is only one tenth of their percentage of the total population. As well, fewer cases have been accepted to intensive care unit and there has been no deaths reported in cases aged 1-19 years. Comparing with other careers, the relative risk among teachers in day care, primary and secondary school were very close to one that indicate no increased risk of exposure and infection in this group (Folkhälsomyndigheten, 2020).

In Nigeria to curb the quick spread of Covid-19 across 29 out the 36 states, including the Federal Capital Territory and to control the spate of virus transmission from person to person, caution has to be taken. This enforced the government of Nigeria to shutdown educational institutions, worship places, and other social activities. Besides, during the lockdown, restrictions in mobility and social activities made in-person classes at schools impossible. Consequently, the Minister of Education in Nigeria initiated an online learning schooling arrangement, across radio, television and the internet to maintain continuity of schooling and learning from home (Olaseni & Olaseni, 2020). A research studied the possible effect of COVID-19 on the performance of

Nigerian senior secondary school students in class 3 (SS3) in the science subjects namely Biology, Physics and Chemistry who are going to write their 2020 West Africa Senior Secondary Certificate Examination. The results from this study done revealed that COVID-19 will negatively affect the education system in Nigeria, due to the loss of contact hours of teaching as a result of early closure of schools across the Nation. The loss of contact hours between teachers and students refers to the two main reasons that they expressed by the majority of the participants in this study are the lack of online learning facilities in schools and the instability and consistent power failure in the country. Therefore, majority of the schools in Nigeria lack online learning facilities to enable teachers interact with their students during the pandemic period, even the few schools that have such facilities, majority of the students are unable to access it as a result of electricity failure. Furthermore, it is possible that if COVID-19 is not contained soon, it could destabilize the senior secondary school students in class 3 and result in mass failure in science subjects in the 2020 West Africa Senior Secondary Certificate Examination. Added to this, many of the parents who work with the government have not been paid their salary while the majority of those working with the private establishment are been paid-off due to the catastrophic results and negative economic impact caused by COVID-19 pandemic. This has contributed in no small measure to low income families. Therefore, it becomes difficult for many parents to feed their family and hence they cannot afford to buy learning supplies for the children to participate in online classes and also download educational materials sent to them by their teachers (Oyinloye, 2020).

After declaration of the Ministry of Education in Ontario, **Canada** the closure of the schools effective 17 March until students and faculty could return safely in September 2020, teacher educators faced a lot of barriers of online learning presented by the COVID-19 crisis. The

most obstacles that affected teachers are the weakness of access to effective online connection and support, the lack of educator professional development for online learning, the difficulties of conversion of face-to-face lessons to successful online lessons, and the loss of the recognition of student teachers' practical experiences (Van Nuland, Mandzuk, Tucker Petrick, & Cooper, 2020).

The findings of the research that studied the impact of the Covid-19 pandemic on learning and teaching activities in elementary schools in Tangerang, **Indonesia** showed that several challenges faced students, parents, and teachers from the sudden shift face-to-face class to online home learning. Those barriers related to parents, teachers and students were, first the online learning demands time parents have to spend assisting their children in home learning especially for students in primary schools. Second, students and teachers have limited access to adequate facilities to run the online learning from home and are faced unstable and low internet access. Third, parents and teachers have additional expenses result from the prolonged hours in internet access. Fourth, teachers have prolonged work hours as online content creators, teaching, assessing, and communication and coordination with parents, teaching teams, and principals. Finally, teachers' limited technical skills to respond to the need for online home learning (Putri et al., 2020). Like the rest of the world, Lebanon has been affected by the Covid19 pandemic. Since the beginning of the health crisis, successive confinements and distance learning have had a significant impact on the smooth running of classes. While different measure has been adapted for the education sector in different countries to confront the Covid epidemic, Lebanon is quite unique in the fact that the country also faces an unprecedented economic crisis that weighs heavily on the proper functioning of its school system.

In Lebanon, the Covid-19 pandemic forced all students to stay at home due to lockdown measures since March 3, 2020. Alternative solutions were needed to be taken into consideration to save the education year especially that teaching in the classroom was not an option anymore (Rouadi & Anouti, 2020).

Lebanon is located on the eastern side of the Mediterranean Sea with an area of 10,452 square kilometers and is divided into eight governorates (Beirut, North, Akkar, South, Nabatiye, Beqaa, Baalbeck-Hermel, and Mount Lebanon). It has a population of about 6.01 million people and an annual population growth rate of 1.46% (Jaafar et al., 2020).

Historically, Lebanon became an independent state in 1943 as a result of the accomplishment of the French mandate in Lebanon who has colonized Lebanese and Syrian governments and territories since 1920 during the World War II (Traboulsi, 2012).

Figure 1: *Map of Lebanon*

The education system in Lebanon is similar to the French model, is made up of two years of pre-school, six years of primary education, three years of middle education and three years of secondary education. One examination is held at the middle school part of the cycle, after grade 9, called Brevet or Baccalauréat I (Nassar, 2021). Students, who pass the official exam after grade 9, have the opportunity to continue their secondary education or to transit to the technical/vocational education system (Nassar, 2021). Another examination is held at the secondary school part of the cycle, after grade 12, called Lebanese Baccalaureate II Certificate of Secondary Education or the Technical Baccalaureate II of Vocational Education (Nassar, 2021). The Lebanese curriculum includes history, geographic, civics, chemistry, physics, biology, Arabic, and a second language, which is either English or French. Both Science and Mathematics subjects are taught either in English or in French while the remaining subjects are taught in Arabic (Shuayb, 2016). Therefore if the curriculum majority uses French as the medium of instruction, students are called French educated and if majority use English, they are called English educated (Bacha & Bahous, 2011).

Students are required to pass the Lebanese official examinations or to provide an equivalation to pursue their higher education in universities or in technical institutions. The options for the tertiary education include three years of university or three years of vocational/technical skills or teacher training programs (Nassar, 2021). Public primary and middle educations are free under the law (beginning at age 6), but students are expected to purchase school materials. The MOE under the law of 1998 makes education compulsory in Government owned schools at the primary levels (grades 1-9), from the age of 6 to 15 years (Crul et al., 2019), but there has been negligence of integration of online learning in school curriculum. The COVID-19 outbreak in Lebanon has translated into a major education crisis due to schools and universities closure. As part of its response to the crisis, Lebanon's Ministry of Education and Higher Education has

adapted distance learning to ensure the continuity of learning. Online teaching and learning met several challenges, mainly internet access and internet infrastructure in the country, the availability of online/digital teaching material, and teachers' preparedness to switch to this kind of teaching. Due to this pandemic most educational establishments in Lebanon including schools and higher education institutions have moved to online learning (Mouchantaf, 2020). These educational institutions were supported by The Ministry of Education and Higher Education that launched National Distance Learning projects to provide online learning services for schools and universities via a range of online platforms including YouTube, Zoom, and Microsoft Teams (Wazzan, 2020). The findings of the study done by Rouadi and Anouti showed that the online learning experiment in Lebanon was considered as a failure by 78.2% of the participants, including schools principals, teachers and students in the sample of the study, during the Covid-19 crisis. However, this results cannot be generalized since there were 21.8% of participants who considered the online learning successful which opposed to others. The results of this study revealed that the diversity of the explanation techniques, such as usage of educational videos, teacher's ability to teach online, the good communication between the teacher and his students, students' commitment to participate and teacher's adequate evaluation of his students were the main factors that led to considering the online learning a success by the majority of schools principals, teachers and students. Furthermore, the results of this study revealed that a slow internet connection, the electricity outages, students' lack of participation, not having more than one phone or laptop at home, and not having room in the house dedicated for teaching online were the main factors that led to considering the online learning a failure by the minority of schools principals, teachers and students (Rouadi & Anouti, 2020). Therefore, this research report examines the education

provisions during the COVID-19 crisis and the impact of the different challenges with focusing on science teachers at middle school.

Online learning tools (Hardware and Software):

One of the different tools of remote learning, ones that rely on technology in education. Information and communications technology (ICT) have the potential to be the most interactive and therefore the most effective learning tools. According to the World Economic Forum, international adoption of educational technologies such as language apps, virtual tutoring, and video conferencing tools was increased especially after COVID-19.

ICT for an effective application of the online learning

Online learning is a method of teaching where a teacher and students are physically separated and technology is used to overcome the instructional challenges (Çaldağ, Gökalp, & Alkış, 2021; Kentnor, 2015) . Online learning required an internet connection during instruction and a use of online tools which include a platform that provides online classes to allow interaction between teachers and students, devices as computers, smartphones, or tablets that include tools needed to run the platform, and access that connects to the platform (Shin, 2020). Online learning is an effective way of restricting the COVID-19 outbreak since this mode of education does not require from the teachers and students to come together physically at the same place, they can stay at their home being isolated from other people while involving an online learning program. Consequently, the online learning is inevitable to use it during this pandemic crisis to alleviate the spread rate of the COVID-19 (Çaldağ et al., 2021).

Information and communication technology (ICT) "refers to technologies that provide access to information through telecommunication. This includes the internet, wireless networks, cell phones, web-based system and other communication mediums" (Ratheeswari, 2018). Using

ICT tools, equipment, and internet accessibility will make the teaching and learning knowledge borderless and create an interesting and active learning environment for both teachers and students (Ghavifekr et al., 2014). The teaching and learning with ICT is driven by advanced technology and communication devices that should be available to students wherever they are either at school or home. Moreover, the main needs for teachers to be literate and have good skills and knowledge in using ICT to improve their teaching methods and approach are required to promote effective learning as well as to meet the demand of the 21st century teaching skills (Ghavifekr & Rosdy, 2015). Information Communication Technology (ICT) has become a significant usage component in online learning during the Covid-19 pandemic. ICT competencies and literacy, such as using computers and surfing in cyberspace, are the basic computer skills required in the implementation of online learning (Al Kodri, 2021). It is necessary to indicate that to deliver effective online and blended learning there must be available of adequate ICT support in way of infrastructure and learning tools as well as hardware and software support system (Ali, 2020). When teachers and students possess good basic ICT literacy and capability, such as knowing the technology system and map operating it, the online learning process will definitely run smoothly and effectively. However, teachers and learners need to be made aware that technical problems are a major barrier that makes online learning not run effectively as scheduled (Al Kodri, 2021). Furthermore, ICT plays a role in the process of interaction and communication during the learning process that support teachers and learners who have ICT literacy to provide interactions during learning even though they are physically located in different places (Al Kodri, 2021). It is necessary to use ICT tools that provide two-way communication between teachers and students via videoconferencing technologies in an effective manner and interaction between teachers and students, students and students, and students and learning materials leading to an efficient learning environment (Çaldağ

et al., 2021). The implementation of online learning during the Covid-19 pandemic showed that students who have good ability to master technology will make it easier for them to follow every learning process, even with an online classroom system rather than students who do not master technology their involvement in the learning process will be faced with barriers (Al Kodri, 2021). Digital technology and ICT literacy have become media and ways for teachers and students that permit collaboration and communication in the online learning (Al Kodri, 2021). One of the ICT based online education tools is the Learning Management System (LMS), which is the main of running blended learning and online learning process. One of the popular utilized ICT-based LMS is the Modular Object-Oriented Dynamic Learning Environment (Moodle) (Patel & Patel, 2017), although there exist other LMSs, such as Blackboard and several local LMSs produced in one's own country (Andrews & Tynan, 2012).

Online learning platforms

"**Learning Management System** (LMS) is a software application developed to manage online courses, share learning materials, and permits collaboration between students and students or between students and teachers" (Mohammed, Kumar, Saleh, & Shuaibu, 2017). This application not only allows sharing of resources between instructors and learners but also provides instructors and teacher principals platform for assessment and evaluation. The teachers can assess the performance of learners once they submit the assignment or work task given to them. As well, subject and class evaluation can be done on the LMS that gives both teachers and students access to these facilities. The students can only read and print the outcome of the assessment, while the teachers can assess and grade the performance of the students at individual subjects' level and the class coordinator can assess and evaluate the entire class (Mohammed et al., 2017). Using LMS in the learning process facilitates online learning and allows educators to interact with their students via the internet, provide students with resources, share lesson-related information, give

assignment, communicate changes in subjects, create collaborations in the class, monitor student goals, facilitate discussions among students, and post grades. Some examples of LMS used in educational institutions include Blackboard, Moodle, Brightspace, Canvas, and Schoology (Murphy, Eduljee, & Croteau, 2020). This indicates the urgent needs that the use of this technology during the COVID-19 pandemic is necessity to keep the learning process continued (Raza, Qazi, Khan, & Salam, 2021).

Microsoft Teams is an online learning platform that is integrated with Microsoft Office 365 (Wea & Kuki, 2021). This application as not only can be used as a learning management system by the instructors but it works in a synchronous as well as an asynchronous learning, depending upon the choice and preference of the students and the instructors. First, using Microsoft Teams it is possible to take live online classes for multiple students at a pre-scheduled time. Second, it allows teachers to record their videos and upload those to the application for the students to view. Third, it provides teachers with the option of file sharing to upload any type of files (power-points, word or pdf documents, and video lessons) that they want the students to refer to. Fourth, it permits teachers to prepare quizzes and tests for the students to take, and the application can automatically grade the students based on some pre-defined rubric. Finally, social networking features are also exist in the Teams software by allowing personalized as well as group chat facilities (Pal & Vanijja, 2020). Microsoft Teams application helps students extremely to continue learning during Covid-19 pandemic, in addition, this application is a great place to create interaction with teachers (Wea & Kuki, 2021). Rojabi research found that using Microsoft Teams in online learning supports student learning environments optimally. Furthermore, the researcher also finds out that most of students have positive perspective on learning using Microsoft Teams (Rojabi, 2020).

Google classroom is an online learning platform that used as an online learning delivery in secondary schools during COVID-19 pandemic in Nigeria. The result of this study found that google classroom was a relevant platform for both teachers and students in secondary schools during pandemic to utilize digital technological tools for creating a motivational online learning environment to students. Google classroom learning platform is very easy to set up and offers assistance to both students and teachers to connect, work together, create assignments, grade students, upload lesson materials for students to view and interact in the class stream, submit students' assignments, and send teachers' feedback, which makes the class engaging and satisfying (Oyarinde & Komolafe, 2020). In addition, Noah and Gbemisola study revealed that Google classroom promotes independent learning, critical thinking, revision of lesson materials, collaboration among students, continuous assessment with immediate feedback from teachers, and social interactions with students and teachers on academic activities (Oyarinde & Komolafe, 2020).

Two weeks after schools were closed due to the Covid-19 pandemic, the Turkish government planned to use the **Education Information Network** (EBA) platform (www.eba.gov.tr) for online learning by giving synchronous lessons daily for all students from the third to the twelfth grade five days a week at different hours for each grade level. The times of the synchronous lessons were determined by the Ministry as one hour of synchronous streaming for primary schools, two lesson hours for secondary schools and four lesson hours for high schools every day, whilst the sessions were activated by school principals. In order to have access to synchronous lessons, teachers and students create an EBA user account for themselves. In the synchronous lesson software opened to teachers, the Whiteboard application can be used, features

such as turning on/off student voices, sharing screens, managing students' sharing and drawing permissions, and managing students' camera use. After sessions, teachers given assignment to students by sending lecture videos, question–answer activities and multiple-choice questions via the EBA (Fiş Erümit, 2020). The study findings reveal that the students' perspective of online learning on the EBA were positive because they provided advantages such as social interactions with peers and teachers, motivation learning environment, and opportunities to ask questions. As well, the EBA proved effective due to relevant content could be accessed easily, teachers could use this website for evaluating learning, assigning homework, answering questions, creating forums and students could access content in different modes such as videos, animation, questions and answers (Fiş Erümit, 2020).

After the sudden shift from traditional learning to online education system due to Covid-19, students and teachers who had to adapt to technology faced several challenges, such as a lack of eLearning experience, lack of logistics, too little time to prepare online courses and many more. Deploying the new educational delivery system using online techniques and materials demands from teachers and students big efforts which can affected their performance. However, technology could also allow students to achieve better learning outcomes since e-learning is a new mode of education that accommodates the different requirements and expectations of different users (Mushtaha, Dabous, Alsyouf, Ahmed, & Abdraboh, 2022).

Challenges and opportunities in implementing online learning from teachers' perspective

Challenges faced by teachers in implementing online learning

New teaching planning for online learning

The sudden moving from the face-to-face learning mode in the classroom to an online mode is a challenge for teachers that requires changing in their teaching methodologies and managing in their time (Dhawan, 2020). In the normal time of Georgia schools without any pandemic situation the class period is 45 minutes for the II-XII grades. In case, when the online teaching has started, the changes in the duration of the online lessons and in the number of lessons given per day are done directly. The duration of the classes was reduced to 30 minutes for all of the grades to avoid the prolonged contact of the students with a computer and the number of lessons had been decreased such as, for Grade I-II, students have 2-3 lessons a day, Grade III-VII, students have 3-4 lessons, Grade VIII-XII, students have 4-5 lessons a day (Basilaia & Kvavadze, 2020). Developing the strategies needed to teach and learn online successfully demands to have an understanding of learning styles and how they can be applied effectively in the online environment (Lewis, Whiteside, & Dikkers, 2015). A teacher must overcome all the barriers that occur in online learning responsively in order to keep the learning process on the right track towards to achieve the targets set (Aliyyah et al., 2020).

Digital competence know-how

The impact of the Covid-19 pandemic and the complete lockdown of schools since March 2020 has forced the abrupt development of the Digital Competence of Educators for active teachers. But this situation has also posed an issue for teachers that is the needs to develop some key aspects of Digital Competence of Educators. Before the pandemic, teachers had improved

their Digital Competence of Educators in their daily basis work through interaction with technology, but the pandemic situation has pushed them to increase the use of digital resources abruptly in order to deal with changes in the teaching – learning process in a very short period of time and adapt to teaching online (Portillo, Garay, Tejada, & Bilbao, 2020). The findings of a research that studied how teachers in middle school in Afghanistan, Libya and Palestine as developing countries responded to school closure to fight the spread of Covid-19 revealed that those countries faced two main challenges are infrastructure and teachers' technology knowledge and competencies, which are two major components of online learning, and without them, online learning can rarely happen. Some teachers from these countries reported that they learned how to create video infographic and how to present it to their students since it facilitates transferring the knowledge to students in using online learning platform. Also, they indicated that it was an amazing experience but it was difficult to them that in a limited time to learn new technology and use it. Besides, some teachers from the three countries stated that they attended online training sessions to boost their competencies on how to teach online and develop digital teaching materials (Khlaif, Salha, Affouneh, Rashed, & ElKimishy, 2020). Finally, the need for proper Digital Competence for Educators is a major requirement to avoid the disruption in teaching-learning processes via online learning during the pandemic (Portillo et al., 2020).

Interaction between teachers and students

Going to online learning due to Covid-19 pandemic required from teachers a rapid transition to a new mode of teaching. This transition caused a main challenge was interaction with students, and teachers missed the spontaneity of interaction that face-to-face teaching provided. To teachers, an active interaction was a necessary requirement for learning and could not be replaced by online learning (Niemi & Kousa, 2020). This is because in a classroom management

a teacher can perceive student's body language and these non-verbal signs helps the teacher to immediately make the suitable adjustment in their teaching approach to meet students' needs (Nambiar, 2020).

In a study that investigate the views of secondary school teachers and high school teachers on distance education practices during the COVID-19 pandemic showed that the most frequently expressed problems by the teachers toward online learning are the lack of interaction and productivity problems. Emphasizing the importance of teacher and student being in the same environment which in fact the online learning makes it impossible (Hebebci, Bertiz, & Alan, 2020). In previous studies, researchers agreed that it is difficult to achieve high level of interaction and social communication in online education as in face-to-face education (Kaya & Önder, 2002). Online learning makes teachers less enthusiastic with School from Home (SFH) than face-to-face teaching. The fact that teachers cannot interact directly physically with students, so teachers cannot measure the level of students understanding when learning online (Aliyyah et al., 2020). This absence of physical interaction has directly led to a reduce in teachers' enthusiasm to teach (Hennessy, Ruthven, & Brindley, 2005). However, teacher enthusiasm plays an important role in achieving high level of teacher performance (Patrick, Hisley, & Kempler, 2000). Finally, teaching and learning occurs with the interaction between teachers and students inside the classroom. This interaction creates interpersonal relationships that are the core of successful teaching and learning (Sepulveda-Escobar & Morrison, 2020).

Heavy workload

The workload of teachers in using online learning during the Covid-19 pandemic has been increased due to the need to make videos, Power Point presentations and e-notes for students (Khan, Kamal, Illiyan, & Asif, 2021). In addition, this high workload is described by teachers that

they were spending more time on administrative work and preparation of lessons than on normal teaching days. Preparation of lessons to be given online demands new design that includes sourcing for suitable teaching resources for online teaching and setting up appropriate platforms for delivery (See, Wardle, & Collie, 2020). The result of a study that carried out on the effects of the Covid-19 pandemic on Italian learning ecosystems: the school teachers' perspective at the steady state showed that low percentage of school teachers organized learning activities to be applied during online classes as collaborative work among students and limited percentage of them planned learning activities for enactment in asynchronous mode. Adding the fact that planning and implementing collaborative learning in online mode increased workload of teachers (Giovannella, Marcello, & Donatella, 2020). Furthermore, teaching from home increased workload of teachers causing stress for them that has bad consequence on teachers' health and work performance (Ozamiz-Etxebarria, Santxo, Mondragon, & Santamaría, 2020). Teaching during Covid-19 lockdown from home made teachers answer emails and calls all day long and work much more hours than usual. The increase of teachers' workload is due to the fact that teachers did not know how to manage their work, and schools did not have experience in regulating teaching from home to avoid excessive and uncontrolled workloads. Even though some teachers self-regulated after the initial workload, and some schools published schedules to regulate this problem, but this situation happened in an unexpected manner and working from home was complicated and raised workload for teachers for different reasons: organization, work schedules, family coexistence (Palau, Fuentes, Mogas, & Cebrián, 2021).

Effective students' assessment and supervision

Students' assessment is considered the most challenging part of the transition to online learning for a teacher used to face-to-face oral or written exam, as the limited teachers' supervision

for their students makes it impossible to ensure that students are not cheating (Rapanta, Botturi, Goodyear, Guàrdia, & Koole, 2020). Teachers were concerned about how assessment could be conducted when teacher-student interaction was absent or limited during online learning. For teachers, online assessment is a necessity because as long as teachers do not conduct online formative assessments, it will be difficult for them to determine student needs regarding online learning and to construct adequate lesson plans in the long run. So that formative assessments, such as online quizzes, may have been applied, at least on a voluntary basis during the lockdown period (König, Jäger-Biela, & Glutsch, 2020). In a study that revealed secondary school teachers' perceptions during the Covid-19 pandemic, the most of teachers expressed two aspects of worries or issues related to assessing learning and learning outcomes. The first worry was reliability of students' performances when they are doing examinations and tests at home. The lack of supervision makes impossible for teachers to control if students do not use the book or dictionary as an aid during their exams. The second worry was about formative assessment during learning process. Online learning impedes teachers to follow the learning process in the same way as in an ordinary classroom. Consequently, teachers commented that there is no certainty about student learning which it became very difficult to assess students' real learning (Niemi & Kousa, 2020). Online learning barriers related to teachers include technology and internet accessibility and lack of a suitable online learning curriculum and an effective assessment tools to evaluate student growth. Those barriers limit teachers' ability, what and how to teach, and how to know if students will learn (Almanthari, Maulina, & Bruce, 2020).

Reliable internet connection and devices

The entire online system of learning is dependent on technological devices and internet, teachers and students without good internet connections and availability of technological

equipment are liable to lose accessibility to online leaning. Those dependencies of online learning created a big challenge for schools, teachers and students (Adedoyin & Soykan, 2020). Teachers agreed that the lack of adequate computer equipment, alongside with a low internet connectivity, are the major barriers for successful online teaching. Because such barriers decrease teachers' ability to facilitate online learning and to overcome technological limitations that overstrained students by online teaching and learning. The challenges of online learning, including limited technology tools and poor Wi-Fi access, experienced by teachers result in a low motivation of students which in turn prevent them for reaching learning goals and a high level stress of teachers (Klapproth, Federkeil, Heinschke, & Jungmann, 2020). The findings of a study conducted on examined strategies and problems faced by Indonesian junior and senior high school teachers in conducting e-learning system during Covid-19 outbreak displayed that the most of the teachers faced a difficulty in conducting video conferences due to the impact of internet access and the low supporting of technological devices. This hinder the work of the teachers in having interaction with their students and in explaining the material of the lessons effectively through using video conferences (Lestiyanawati, 2020). The lack of facilities, equipment, and capacity building to online learning education, such as having stable internet access, presence of phones, laptops, and tablets or any devices, existence of Learning Management System, and attending a training or workshop on online learning education management, affect teachers' readiness to online learning education. If teachers are not well-equipped and not ready for online learning, this results in limit their ability to offer online learning education successfully (Alea, Fabrea, Roldan, & Farooqi, 2020).

Lots of distraction for teachers when teaching from home

One of the issues encountered by teachers in offering online learning education is the continuous external distractions due to noise from the neighborhood or interruption by family members during the teaching period that negatively affected the continuity of sessions. This issue makes teachers feel exhausted and demotivated to deliver education through the online system (Joshi, Vinay, & Bhaskar, 2020). The result of a research that studied the impact of Work from Home on Indonesian elementary teachers performance during the Covid-19 pandemic proved that the teachers' performance in online learning is low due to the working environment at home is not like a classroom, distracted by social network and other entertainment, and interruption of parents, siblings, friends and / or pets. Distraction during online teaching is liable to lose teachers the mood for work. When losing mood to work, the teachers need to rest for a while and not push themselves in order to regain the mood for work which is a disadvantage for them (Purwanto et al., 2020). Teachers' job satisfaction and performance is associated with a suitable working environment, for that teachers need an optimum working environment at home to ensure the effectivity of online teaching and learning. In fact, teachers who work from home are distracted by their housework and childcare. This issue decreases teachers' ability to focus on online education that put the effectiveness of emergency online teaching in jeopardy and affects teachers' readiness to adopt online educational technologies from emergency online teaching (Wen & Kim Hua, 2020). Several teachers confirm that an adequate atmosphere for teaching online at home without distraction from family members is a necessity for them to be comfortable in an online class and to decrease insignificance of online class (Priyadarshani & Jesuiya, 2021).

Opportunities for teachers in implementing online learning

New tools for instructional delivery (Videos, Power point, Video games)

Teachers approved that conducting online classes during Covid-19 pandemic has an advantage by helping them to learn and apply innovative teaching methods such as using graphs, charts, and videos to increase their confidence, and to develop their technical skills (Nambiar, 2020). Online learning provides teachers an opportunity to use technology and to create various flexible teaching approaches for students' better understanding. This innovative pedagogical approaches developed and applied by teachers to teach via online methodology enhance problem-solving skills, critical thinking abilities, and adaptability among the students (Dhawan, 2020). In a study some Mathematics teachers of junior, senior, and vocational high school stated that online learning opens for them an opportunity to design their mathematics lessons in a way to facilitate mathematics learning to develop students' problem-solving skills. This opportunity drives teachers to apply new teaching methods through using, YouTube videos; digital worksheets designed to guide students in solving problems that contain several questions with different difficulty levels; diagram design is giving to students and asking them to use several diagrams to present the conditional statement in solving geometric problems, to promote the development of students' thinking ability (Fakhrunisa & Prabawanto, 2020). Online learning acquires teachers an opportunity to integrate more media such as video, images, graphs, audio, in their teaching methods but teachers should produce good teaching materials and be able to leverage on them to help students actually learn. Teachers should think carefully about what students should do to learn effectively and what novel instructional methods can include listening to a podcast, reading a text or watching a video to maintain student-centered design, which is a requirement for successful online learning (Rapanta et al., 2020).

Record teachers' explanation

One of the positive aspects of online learning is that it allows teachers to preserve the content of the classes through recording for future reference and for the use of students who missed the class period (Nambiar, 2020). Some teachers benefit from the recording opportunity offered by online teaching to record their video classes and upload to WhatsApp group and on LMS portal for students who missed the classes due to some mandatory circumstances in order to provide all students with equal opportunity to access learning (Mishra, Gupta, & Shree, 2020). The majority of primary and secondary teachers in a study revealed that they recorded their online sessions for those who have difficulty in joining the real-time online classes. This can lead to increase the chance for more students to access learning. Recording lessons in teachers' opinion is an effective solution to the problem, which it is not all students have their own PC or tablet, since all parents and their children are living in a situation where everyone needs a device to work, two devices in a family of four will not be enough. This solution supports students to follow the recorded instructional videos at their computers in their own time (Busuttil & Farrugia, 2020). Science teachers find that using recorded explanation videos and simulated experimental teaching through online learning is advantageous for them to improve students' understanding of the material lesson and students' familiarity and proficiency in the experiment in an autonomous learning way. This is beneficial for teachers to ensure that students cover all aspects of the lesson from theory explanation to experiment observation (Guo & Li, 2020).

Flexibility

An advantage of online learning is providing teachers with flexibility in determining learning time and in using various learning media, mostly web-based, that facilitates the learning process for students (Fakhrunisa & Prabawanto, 2020). The most advantages of online learning

are continuity and flexibility of the teaching process through overcoming of space-time barriers and increasing flexibility in the ways and styles of learning. This opens possibility to use various online resources that permits teachers to apply different teaching methods focusing on certain skills and lesson objectives needed to be achieved by each student (Ferri, Grifoni, & Guzzo, 2020). Elementary school teachers in Tangerang, Indonesia, revealed that online learning offers them a flexibility to choose any place at home where they feel more comfortable to work. This increases teachers' ability to complete their teaching activities specified for that day. In regular classes teachers have a desk and a chair as their workplace, but at a certain time they feel bored and need a new teaching environment. Changing working atmosphere is a necessity to boost teacher performance (Purwanto et al., 2020). Most of the teachers asserted that online learning was flexible and convenient for them. Because of providing educators with a benefit to have easy access to different websites that help them to learn innovative teaching strategies and to use innovative tools like screen share. This leading teachers for organizing very well their online classes and upgrading their teaching skills (Nambiar, 2020).

Encourage teachers to develop technology skills

Online teaching acquires teachers an opportunity to use different online platforms to upload lesson materials, to integrate multimedia resources in their explanation, to set deadlines for exams and assignments submission, to conduct different types of class activities and to communicate with their students. This is an advantage for teachers to become a facilitator and to increase their professional development in technology (Almazova, Krylova, Rubtsova, & Odinokaya, 2020). Online learning supports teachers to use educational technology to develop innovative pedagogical approaches to cover subjects content during the outbreak of Covid-19 crisis. Using these technologies assist teachers to impart education to their students and to increase their digital

literacy (Dhawan, 2020). Primary and secondary school teachers, who are participants in a research, confirmed that applying online learning enable them to experience a broadening of own knowledge and competence with digital technologies because of the familiar use of synchronous and asynchronous approaches during this emergency situation. This opportunity makes teachers to discover existent technology which with a good planning can be integrated also in normal circumstances in order to renew or use new and innovative pedagogies (Busuttil & Farrugia, 2020). Covid-19 pandemic induced educators and learners to adopt digital technologies to ensure transmission of teaching and learning through online learning. This results in increasing technology knowledge of teachers and students. Using online learning provides teachers a chance to acquire new skills and improve their professional experience in technology to become more effective and productive in teaching. Applying new ways of teaching delivery and assessments of learning through online learning produce a positive change in the area of curriculum development and pedagogy (Jena, 2020a).

Save teachers' time

Online learning provides teachers with tools and system that save their time spending on academic work. These technology tools and programs allow teachers to use a new process to correct and grade students' assignment, to monitor and check students' learning progress, to apply teaching methods to meet students' needs, with less time (Singh & Phirriyalatha, 2020). Online learning permits teachers to save time of their class period through enabling them to create learning groups. Each group has its own class activity and its team leader who monitor the work of the group to maintain their completion the task on time. The teacher from the group leaders can know the strengthen and the weaknesses learning areas of all students (Cai & Wang, 2020). In a research most of the teachers in Haryana schools in India found that one of the positive outcome of online

learning is saving commute time. Teaching online benefits teachers to save on travel time to and from school which allows them to use that time according to their need and convenience, and feel relax from their mandatory presence in class (Verma & Priyamvada, 2020). The advantage of online learning is when working from home teachers can save money on transportation, save time on travel, and be exempted from following office hours. Saving travel time lead to decrease the level of stress for teachers who experience to traffic jams on the road from home to school. When teachers fell free of stress, certainly their teaching productivity will increase (Purwanto et al., 2020).

Improve teachers' communication skills

Online learning provides teachers with many free downloaded live-video communication platforms such as Zoom, Team, Google Meet, YouTube Live, Facebook Live, and UberConference that enhances their communication with the students. Good communication increases teachers' interaction with students and gains them interactive distance learning experience (Jena, 2020b). Teachers can use various digital advance technologies in the online classes to maintain the social distancing interaction communication with their students and to develop instructional designs and materials in online learning process for effective online lesson among students. This feature improves teachers' communication and collaboration skills among students to support properly online learning process and keep them safe from the pandemic (Mallillin, Mallillin, Carag, Collado, & Largo, 2020). Indonesian elementary school teachers used Google applications for online learning because it maintains interactive online learning and contains material that develop two-way of communication in synchronous and asynchronous online learning. This study revealed that using google application enable teachers to boost their communication skills through expanding communication in different direction and to direct

students to the material related to the lesson objectives through giving them appropriate links in class assignments. Ability of using applications and communication skills are requirement from teachers to carry out online learning efficiently (Lagandesa, 2021). Using online learning change the teacher's communication style routines that impose them to communicate with students via the internet. It produces structure to assist teachers' development in communication by allowing them to do discussion in online classes, use verbal and non-verbal expressions as emoticons, stickers, or sentences in providing feedback, reward, and punishment, apply video or animation in explanation of the subject material, that motivate students' learning and create effective online communication (Elfrianto, Dahnial, & Tanjung, 2020).

Give teachers instant feedback

Online learning gives teachers a chance to use social media applications to provide feedback to students that build effective online communication between them. Using WhatsApp facilitate for teachers to provide students with individual feedback immediately through answering students' question and exchanging text one-on-one to meet students' needs, and to notify them about discussions, lesson updates, assignment, and submission deadlines. Giving teachers' feedback is very important to students that creates a good interaction and relationship between them and develop their social skills (Famularsih, 2020). The use of online learning authorizes teachers to monitor students' learning process based on formal and informal feedbacks as the outcomes of different instruments and strategies of assessment available in online learning platform applied by them to assess their students. Suitable feedback on questions and as evaluations helps students progress in their learning every time and support teachers to evaluate their teaching strategies (Rapanta et al., 2020). English teachers of secondary schools in Indonesia declared that each class period includes a class activity, or an online quiz, or a project presentation

as an assignment given by teachers, to encourage students' participation and engage them in the learning process. At the end of class period teachers give personal feedback in a private to each students on their work performance during the online session through Google Classroom and WhatsApp. Those feedbacks empower teachers to let students aware what to improve and how to improve to make better achievement and to give students grade on their academic work to allow students to assess themselves on how much they reach the lesson objectives (Atmojo & Nugroho, 2020). Online learning puts on disposition of teachers several strategies to apply, as given assignments aligned with students' interests and skills, posting pictures or short videos of students' work, and providing instant and motivating feedback to students on their performance, to engage students in online classes. Feedbacks from teachers are essential to know the level of understanding of students and to keep them on the right track (Kaden, 2020).

Online learning is an evolving process and with this evolution comes the need to develop and evaluate instructional strategies in order stay update it and efficient (Perry & Edwards, 2019). In addition to the challenges and opportunities of online learning, this research features a description of different instructional approaches used mainly by sciences teachers. These newly adapted instructional strategies encouraged interaction, enhanced social presence, and facilitated community.

Instructional approaches used mainly by sciences teachers

Teaching methods approaches used

Different teaching methods and techniques are used by Biology teachers in online learning as direct instruction, sharing of explanation lesson notes, demonstration method, and audio and visual materials through a specified online platform. Those teaching methods enable teachers to establish a positive relationship with their students and to increase their effectiveness in online

learning by using audio and visual teaching materials. The use of technology tools to apply those teaching methods helps students to boost their understanding and skills in the lesson learned (Karakaya, Selçuk, Cimen, & Yilmaz, 2020). Teachers in online learning applied certain teaching methods which can be adopted or created by themselves in the forms of PowerPoint slides, YouTube videos, pictures, Word documents, and PDF documents. Teachers upload the teaching materials into online platform to use it in their explanation of the lessons and share it with students via WhatsApp to allow them to review and ask questions if there is a lack of understanding in any area in the lessons being taught (Atmojo & Nugroho, 2020). Class discussions and gamification are class activities applied by teachers in online learning to teach students theory and do practice in an active and fun way. Well-organized online class discussions enable teachers to maintain orderly participation of all students and to manage an active student engagement. This leads to create an enjoyable learning environment where students felt as individual learning rather than studying group. Gamification is a competitive class activity either between students or against themselves. Students enjoy this activity because they found amusing to play a game with peers and to test their knowledge. This activity makes learning fun, encourages social interaction, and gives feedback on students' learning improvement (Yates, Starkey, Egerton, & Flueggen, 2021). Creating of different types of audio-visual media are teaching methods used by the most of the teachers in implementing online learning because it enables them to design a very effective and engaging teaching strategy to explain lessons to students. Using Audio visual media creates positive change and acquires experience in the learning process where teachers can employ animated images and graphic items as diagram, chart, graph in their teaching procedure that make learning more interesting for students (Fauzi & Khusuma, 2020). YouTube videos played a vital role in helping teachers to provide students flexible teaching during online learning. The use of

YouTube is a good teaching material that facilitate for teachers to ensure students' understanding of the lesson explanation and to keep their students motivated to learn online (Lestiyanawati, 2020). During online classes, teachers applied an arranged class activity that asked from some students chosen randomly to present and explain their solutions of the problems solved to their classmates and answer their questions. This lead to increase students' participation, engagement, critical thinking, and possibility to find alternative solutions to a problem. Teachers monitor the work of their students and interfere to correct a solution or an answer that were given by the students and to answer any other questions on the problems. Applying this class activity provides teachers an opportunity to reach the high levels of learning objectives of Bloom's taxonomy which are, applying, analyzing, and evaluating (Lapitan Jr, Tiangco, Sumalinog, Sabarillo, & Diaz, 2021).

Assignment approaches given

Teachers through google classroom online learning platform give students problems solving assignment as an individual work to do and provide them with the support needed to complete the homework. Teachers check each assignment submitted, send to students their feedback for improvement, and grade students based on their work performance. This assignment invests in students self-directed learning and creates an appropriate learning environment to develop students' knowledge and competencies required to be achieved in the subject learned (Oyarinde & Komolafe, 2020). Chemistry and Physics teachers give their students assignments as practical experiments to do in a safe way by asking them to use available and simple household products or objects. This type of assignment is authentic learning activities that allow students to put theory into practice which maximize their learning (Yates et al., 2021). At the end of each unit in Chemistry subject, teachers provide students with problem sets assignment that included a group

of basic level questions and another group of difficult level questions. This assignment supports students to develop their critical thinking and to become familiar with solving model exam questions. Teachers posted the solution of the problem sets assignment on online platform, which enabled students by checking their answers with teachers' answers to know if they had reached the intended lesson objectives of the chapters (Sunasee, 2020). Teachers can ask students to do a project assignment during their online learning. Project assignments might be difficult to be applied, but this difficulty is removed when teachers put a plan how the project should be implemented by students in order to assess their learning objectives and to encourage them to work collaboratively. All the platforms used in online learning contain online tools that students can use them easily to accomplish the project assignment (Sutadji, Susilo, Wibawa, Jabari, & Rohmad, 2021). Online learning environment consists of two learning contexts related to teachers: the lessons setting and assignments setting. The lesson setting is a platform used by teachers to deliver information and the lesson materials to the students. The assignment setting includes exercises, solving problems, or tasks given by teachers to assess the level of students' understanding required to be achieved in the lesson learned (Tang et al., 2021). Secondary school teachers in Indonesia provide students assignments in written form or video form. They ask from their students to answer a set of question or to do a practical task related to the lesson learned by videotaping their work and then sent to the class teacher. Those types of assignment support teachers to evaluate students' understanding of the lessons through giving written assignments and videotaping practical assignments to students (Wardany, Anjarwati, & Qulubi, 2021). Online assignments are a model of assignment prepared by teachers on the online platform used, where students are asked to do and submit the assignment at a particular time. The request assignments include answering a number of questions as written tests; participating in online discussion related to the lesson

materials as assessment of interaction among peers and between students and teachers; writing the learning objectives of the lesson; analyzing experiment results through giving verification (Sutadji et al., 2021).

Assessment approaches applied

Multiple choice questions as single best answer, one correct response, extended matching is an assessment method used in online learning to maintain equivalent assessment of traditional methods. Multiple choice questions applied by teachers online on a prearranged date and for a specific duration of time to assess students' knowledge. This method helps teachers assess the level of cognitive thinking skills of students depending on how they construct their multiple choice items (Jawaid & Khan, 2020). Online quiz is one of the assessment types that support teachers to evaluate students' performance toward achieving the lesson objectives. Online quizzes provide teachers with continuous information about students' understanding of the material of the lessons, enhance learning activities used by teachers, and aid teachers to give a feedback for students' improvement. Application online quizzes can easy randomize the questions by using various educational software platform that decrease the risk of cheating among students (Guangul, Suhail, Khalit, & Khidhir, 2020). Assignments and portfolios are asynchronous assessment methods applied by teachers to assess students' knowledge and skills during online learning. Each online platform includes characteristics that facilitate for teachers to collect the submission of assignments or portfolios and to give their assessment feedbacks on the work accomplished by students (Sutadji et al., 2021). Biology teachers applied in online learning several measurement techniques and assessment methods as multiple-choice tests, true-false tests and matching for summative evaluation, and project presentation and online exams for formative evaluation, to assess the level of students' learning and their competencies (Karakaya et al., 2020). Teachers in

Chemistry subject to evaluate their students during online learning, used problem sets as an individual assignment given to the students that contains a certain number of questions to solve in a fixed time then send to teacher. This kind of self-assessment allow students to understand theory, practice problem solving and develop knowledge in Chemistry field. Those assessment questions are aligned with lesson objectives that enable teachers from each student outcome to know the level of assimilation of the material lessons (Lapitan Jr et al., 2021). Discussion forum is an open discussion in online learning can be done by teachers to assess students. Discussion forums allow students to exchange information related to the lesson learned through posting messages and giving oral comments where the time and the class activity are organized by teachers in a way to give each student an opportunity to participate. This evaluation method improves interaction among peers and between teachers and students and assesses students' learning (Sutadji et al., 2021).

Knowledge gap

It is widely acknowledged that several studies have been done in many countries on online in the intermediate and secondary schools and in higher education institutions. Some of the studies have been carried out on the experience of teachers' in the application of online learning in middle schools, the impact of implementation of online learning on teaching and the learning during Covid-19 in schools. Others, have focused on the effect of application of online learning on teachers' academic performance, administrative role in managing application of online learning during Covid-19 and many more. In Lebanon, different research has discussed the impact of Covid-19 on the education system with a focus on the accessibility, quality of education and the different challenges faced. In addition to examine the level of preparedness of teachers and students to the online learning practices.

Most of these studies, however, only attempted to establish the level of impact of implementation of online learning during Covid-19 in teaching and learning without paying specific attention on how beneficial was the online learning in dealing with the integration of online learning in teachers academic work during the conventional learning and this is called for the current study. The question was despite the challenges faced by teachers in implementing online learning, how was the use of online learning beneficial for teachers to enable them to create innovative instructional approaches which could be integrated in conventional learning in middle schools in Lebanon?

However, a critical review of the above studies did not provide a clear answer to the question raised. Even though the researchers had studied the experiment of application of online learning in schools from teachers' perspective, a gap remained undiscovered on how the using of online learning facilitate the modernization of the school curriculum through integration new instructional methods that could be applied by teachers when return to face-to-face learning. This study thus investigated the existing relationship between the benefit of application of online learning during Covid-19 pandemic despite the challenges faced by teachers on integration new instructional strategies in curriculum which could be used in ordinary classes in middle schools in Lebanon.

Moreover, these studies laid much emphasis on the issue of application of online learning without key attention on it's positive effect on education, yet it is the benefit of application of online learning that may enhance school curriculum as they remain unchanged since 2000 in our middle schools in Lebanon. Another pitfall evident from the studies reviewed was the failure to focus on the benefit provided teachers in implementing online learning despite the challenges faced and assessing if the instructional approaches used in online learning could be integrated in normal learning made improvement in school curriculum. This study therefore intended at filling this gap.

Finally, it should be noted that most of the studies reviewed above were carried out in different geographical settings. For example, the studies by Aliyyah (2020) in Indonesia and Palau (2021) in the Spain and many more, which are different countries from Lebanon. In all the reviewed studies, there appeared to be a gap in terms of examining the benefit of application of online learning despite the challenges faced by teachers in improving curriculum in middle schools. As the result of this, there was a need to assess the benefit of application of online learning on teachers' instructional approaches to be integrated in school curriculum to make improvement and to use them in normal learning within the Lebanese geographical sitting.

Conclusion of Chapter Two

This chapter reviewed relevant literature on the application of online learning during Covid-19 pandemic to set the research context, laid the foundation upon which this research is based, and defined the academic and research areas of relevance to the research focus. Research evidence has indicated that teachers in developing countries around Asia and the world faced several and same challenges such as unprepared to online learning, school curriculum not designed to online mode, infrastructure, internet connectivity, availability of ICT tools, and knowledge on the use of ICT. Therefore, teachers in the developed world only faced two main challenges as not prepared to teach in online mode and school curriculum not structured to online mode. Instructional approaches both teachers in developed and developing countries applied the same teaching, assessment, assignment approaches but it depends on the online platforms, the ICT tools, and the internet speed available for them to conduct the online teaching. However, the literature reviewed has shown that Lebanon, which is one of the developing country, were still far behind the process of effective application of online learning during the Covid-19 pandemic given the numerous challenges they faced by science teachers.

The next chapter dealt with the research design and methodology.

CHAPTER THREE

Research Methodology

Introduction

As stated in Chapter 1, the purpose of this study was to assess the application of online learning during Covid-19 pandemic in private middle school in Lebanon. This chapter presented the methodology and the procedures necessary to attain the set objectives for the study. Thus, it discussed the research design, participants, sampling techniques, location of the study, research instruments, procedures, ethical issues and summary of the chapter.

The participants

Eight Catholic middle schools in Kesserwan district was purposively selected at random for this study. Jounieh, Zouk Mikael, Aintoura, and Zouk Mosbeh are the biggest coastal area in this district and includes 8 private schools.

The principals of the eight schools were approached to solicit their participation in the study. Eight schools approved to participate and a contact list of their sciences coordinators and science teachers for Grade 7, 8 and 9 was communicated. The study targeted 87 participants which included eighteen sciences coordinator participants and sixty-nine teacher participants from the eight sampled schools. Following the first communication with the selected schools, a digital form of the survey was sent to the sciences coordinators and teachers.

Participants demographic included gender, age, working experience, and the highest level of academic qualification, were asked in this study. The importance of including these variables in the study was to reveal a clear description of the study sample and enable a clear understanding of the background characteristics of every participant. In addition, such information helped to

understand the status of each participant. Other characteristics like gender provided a bearing on the way teachers handled application of online learning during covid-19 pandemic in the subject teaching. Work experience helped to determine the participants' exposure to online learning application during Covid-19 pandemic. The researcher solicited information on the academic qualification of participants as it had an impact on the way they accepted, applied, and interpreted the online learning application procedures based on their personal experience as well as integration the online learning in conventional learning.

The participants' gender characteristics indicated that males made up 5% while females made up 95% of the total participants. This could be attributed to the fact that more females work in middle school than males. Concerning the age range of coordinator and teacher participants, the data showed that the majority of were the age range of 36-40. With their educational qualifications, 91.25% of the coordinators or and teacher participants had Bachelor of Science qualification across the eight schools. Regarding working their experience, the coordinator and teacher participants had varying lengths of experience. However, the majority of them worked in their current schools between 11-15 years.

Research design

The research design for the study was a qualitative case study using a descriptive survey design which allowed the use of questionnaires and interview guide. Abutabenjeh and Jaradat (2018) defined research design as a comprehensive plan that describes how data relating to a given problem should be collected and analyzed in order to offer a better understanding of the proposal topic (Abutabenjeh & Jaradat, 2018). A qualitative research design was deemed appropriate to this study because it facilitated adequate data collection and interpretation using descriptive statistics.

Study location

The three areas of this study was Jounieh, Zouk Mikael, Aintoura, and Zouk Mosbeh located in Keserwan district, north of Beirut. According to Levitt et al. (2018), the context of a study placed the case in its setting. Setting the location of this study confirmed Levitt et al. (2018) observation that qualitative researchers tend to collect data in the field where participants experienced the issue under investigation. This is a strength for the study where data are placed in their context, data collection are given a wide information to analyze, and results obtained from analyzing are addressed the goals of the study and differences in results are explained (Levitt et al., 2018). The location was selected on the principle that no study of the same nature had been conducted in this area.

Research instruments

Apart from the consent form for participants to sign, the researcher used two tools: A questionnaires and interview questions for data collection. The instruments were developed by the researcher because of the absence of an existing questionnaire that addressed application of online learning specific to Lebanon during Covid-19 pandemic. The questionnaire was used to solicit qualitative and quantitative data from sciences coordinators participants, sciences teachers participants, Biology teachers participants, Chemistry teachers participants, and Physics teachers participants, and the interview questions were used to collect data from school principals and coordinators participants, to support the data collected from questionnaire.

Questionnaire

The purpose of the questionnaire was to find out if sciences teachers had preparedness to online learning, challenges facing by sciences teachers in implementing online learning,

opportunities for sciences teachers in implementing online learning, the instructional approaches used by sciences teachers in implementing online learning, and recommendations to have an effective implementation of online learning in schools.

A self-developed questionnaire titled Assessing the Application of Online Learning during Covid-19 pandemic from Sciences Teachers' Perspective. Questionnaire was administered to seek the opinions of the schools' sciences coordinators and sciences teachers about the application of online learning during Covid-19 pandemic in private middle schools in Lebanon. The survey consisted of Sections A, B, C, D, E and F. In all, there were 81 closed and open-ended items. Section A, contained items 1 to 5 required the participants to provide their demographical information and Section B, which contained items 6 to 11, was about teachers' preparedness for online learning; Section C, which consisted of items 12 through 22 dealt with challenges faced by teachers in implementing online learning; Section D, items 23 through 34 was more about the opportunities for teachers in implementing online learning; Section E, items 35 through 68 treated the instructional approaches used by teachers in implementing online learning, also if those approaches improve the achievement of learning objectives compared to conventional learning.

Finally, section F, items 69 through 81 solicited for solutions to implementing effective online learning. The questionnaire sections C, D and E made use of Likert Scale. In sections C and D, the points from one to five represented very low, low, average, high and very high, respectively. While in section E, points one to five represented strongly disagree, disagree, neutral, agree and strongly agree, in that order. Selecting an appropriate Likert Scale for this research was very important to the results the researcher hoped to obtain. The reason for selecting this particular Likert Scale was to allow participants to make a choice and think about what they believe. Section

F was a list of options that requested participants to recommend the way forward to implement effective online learning in schools. (See Appendix B for the complete questionnaire form).

Interview Questions

The interview consisted of interview questions. According to Corbin and Strauss (2008), an interview is a conversation in which one person; the interviewer seeks responses for a particular purpose from another person, the interviewee (Corbin & Strauss, 2008). In this research, a semi-formal interview was used to collect information from the principal participants and sciences coordinator participants who were directly involved in the implementation of online learning during Covid-19. Interviews were used to inquire about online learning implementation by sciences teachers at the eight schools, including challenges the participants faced, available opportunities for participants, instructional approaches used by participants and recommendation to integrate effectively online learning in conventional learning. The items in the interview were designed in such a way that they provided the participants with the freedom to answer the research questions as efficiently as possible and with maximum flexibility. The interview comprised of 10 items. Items 1 to 2 were about personal data, while items 3 to 10 respondents were asked on the challenges, opportunities, instructional approaches and possible solutions to effective integration of online learning in normal classes.

Content analysis was used to discuss the conducted interviews. The analysis included bringing together the emerging themes that were given in the same or similar way by the principal participants and sciences coordinator participants. The results of the interviews were used to support the information generated from the questionnaires. (**See Appendix C for complete interview questions**).

Procedure

Parties signed consent forms and filled out question or were interviewed.

- A total of 11 (eleven) coordinator participants (Physic, Chemistry, and Biology coordinators) filled out the survey questionnaire that assessed the application of online learning during Covid-19 pandemic.
- A total of 69 (sixty-nine) teacher participants from the eight schools filled out the survey questionnaire that assessed the application of online learning during Covid-19 pandemic.
- WhatsApp call individual interviews were conducted with the principal participants and coordinators participants from the eight selected schools.

Measures for Ethical Protection

Ethical principles are centered on four fundamental overlapping contemplations; that no harm is done to participants, that there is informed consent, that there is no invasion of privacy and that there is no deception, portraying something to be what it is not (Brinkmann & Kvale, 2008). It was paramount for the researcher to give serious thought to ethical aspects in every stage of this study because any action regarded as unethical could have jeopardized the study's authenticity. In connection to this, the researcher duly informed the participants in the study that their participation was voluntary. This was in line with Wester (2011) who argued that voluntary participation requires that respondents in the study are not pressurized into participating in the research (Wester, 2011). The study also considered the issues of confidentiality and informed consent **(See appendix A)**.

Summary of Chapter Three

In this chapter, the research design and methodology were described. It also presented a detailed account of how the research work was carried out, survey development and administration. The researcher also described the procedures employed in collecting the data to arrive at answers to the research questions. The ethical measures which were taken into consideration before and during the research were also outlined.

The next chapter presented the results and discussion that derived from the questionnaires.

CHAPTER FOUR

Results and Discussion

Introduction

The purpose of the study was to assess the application of online learning during Covid-19 pandemic in middle schools. The previous chapter outlined the research design and methodology. This chapter presents the results and discussion of the data that emanated from the questionnaires and interview guide about the application of online learning during Covid-19 pandemic from sciences teachers', coordinators', and middle school principals' perspective.

Characteristics of the data

The data collection for this study was carried out by the researcher in Lebanon. A total of 95 Biology, Physics and Chemistry teachers and coordinators were selected for this study. Of the 95 participants, 80 completed and returned their surveys, which constituted 84.21% response rate. There was a failure rate of 15.79% (15 participants). Nevertheless, this response rate was considered very good to provide useful data. Mugenda and Mugenda (2003) observed that a 50% response rate is adequate, 60% is good, while 70% rate is very good (Mugenda & Mugenda, 2003). This concurs with Coppen and Bailey (2000)'s assertion that a response rate of 50% is adequate, while a response rate greater than 70% is very good (Coppen & Bailey, 2000). This implies that based on this assertion, the response rate in this case of 84.21% was therefore very good to make reliable analysis and conclusion. Similarly, out of the eight planned interviews, two coordinator participants and four principal participants from private middle schools accepted to be as result a total of six interviews were conducted.

The data collected was used to address the following research questions:

Question 1: To what extent was the online learning initiated by schools as an emergency response due to Covid-19 an alternative education platform to allow students to pursue their academic year?

Question 2: What were the challenges faced by science teachers at middle school in implementing online learning?

Question 3: What were the opportunities for science teachers at middle school in implementing online learning?

Question 4: By using the instructional approaches in implementing online learning would science teachers at middle school achieve their learning objectives more easily? improve the achievement of learning objectives by comparing to conventional learning method.

Question 5: What recommendations could be made to implement an effective online learning?

Research Question 1: To what extent was the online learning initiated by schools as an emergency response due to Covid-19 an alternative education platform to allow students to pursue their academic year?

Research Question One addressed: to what extent was the online learning initiated by schools as an emergency response due to Covid-19 an alternative education platform to allow students to pursue their academic year. The purpose of this question was to verify if sciences teachers in the eight middle schools considered that Covid-19 caused an education in emergency where application of online learning was a need to continue the learning process, if sciences teachers had an experience in application of online learning, and if they possessed the required tools to deal with application of online learning. The answers were that after the application of online education in response to the pandemic crisis, sciences teachers find it as an effective solution to pursue student learning despite that it was totally a new challenging experience to them and they need to adapt very fast to these new circumstances. Moreover, tools for online learning are software and hardware were moderately available which it made a difficult mission for teachers to implement online learning.

The application of online learning as a response to Covid-19 pandemic

From the data available, it was revealed that the sciences teacher participants and sciences coordinator participants from the eight private middle schools agreed that the application of online learning was a result of EiE due to Covid-19 pandemic in order to mitigate the impact of this crisis on teaching and learning process. Information on the implementation of online learning as a consequence of the emergency situation was collected by the use of questionnaire and interview guide. However, despite the presence of opportunities in the use of online learning as a unique

solution of EiE during the Covid-19 pandemic, challenges of application of online learning among sciences teachers were still a concern in the sampled schools.

During the interviews with all the principal participants of private middle schools, it was confirmed that each school did not have a strategic plan for application of online learning as an education in emergencies before Covid-19 crisis. Similarly, all of the teacher coordinator participants that were interviewed agreed that continuity of teaching and learning process could not take place if the school did not apply the online learning even though it was a first experience for educators to provide access to education for students in the time of crisis. However, they identified several common shortcomings and directly linked them to the challenges mentioned in the subsequent sections. These shortcomings included:

- Lack of awareness and understanding of application of online learning on the part of teachers, students, and parents during Covid-19 crisis.
- Lebanese ministry of education before Covid-19 did not legalize teaching and learning process through online mode.
- Teachers were not given any training in terms of how to benefit to implement online learning concerning students' engagement in online learning before Covid-19.
- Lack of support from the Ministry of Education in terms of updating school curriculum by integration of technology tools in teaching and learning process.
- Lack of guidance catalogue or policy for schools of instruction and assessment strategies by application of online learning.

Figure 1, table 1 and table 2 below revealed sciences teacher participants' and coordinator participants' responses on the application of online learning as a unique solution of EiE during Covid-19 pandemic across private middle schools involved in this study.

Figure 1: Sciences coordinators and teacher participants' responses on how define education in emergencies (EiE)

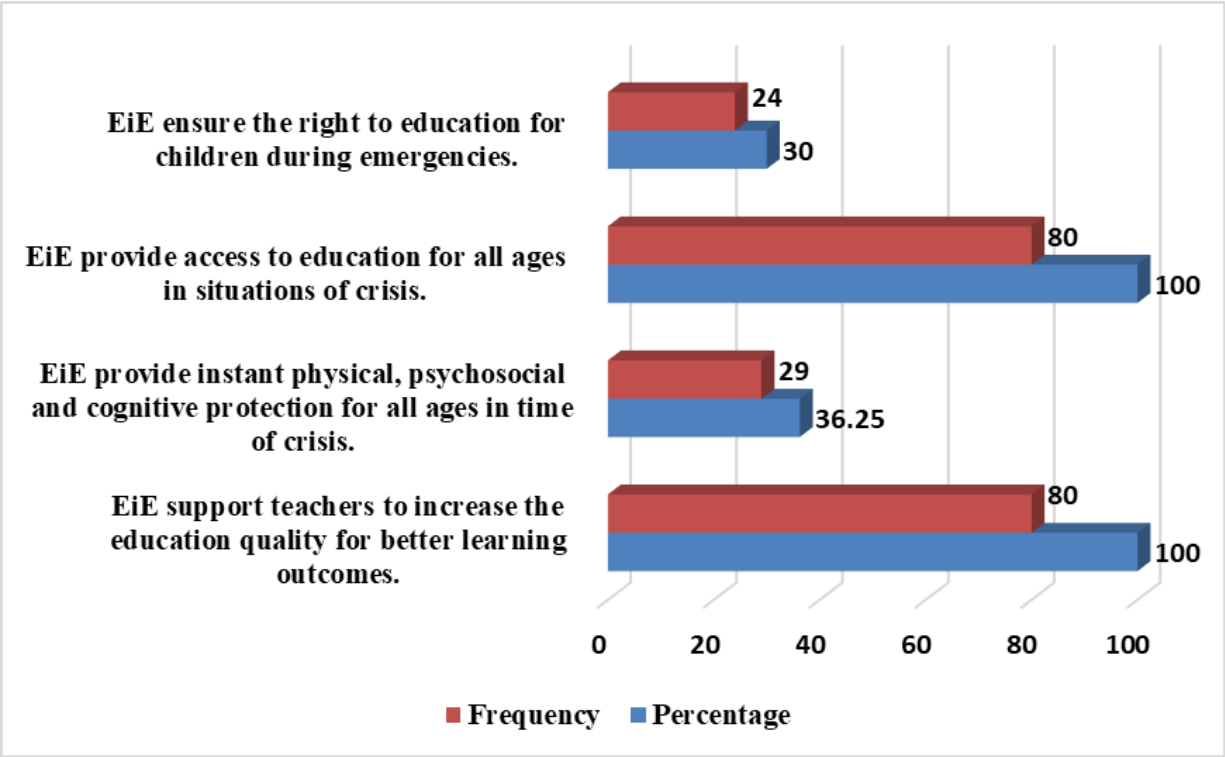


Table 1: *Distribution of sciences coordinators and teacher participants' responses on whether there consider Covid-19 as a crisis where education in emergencies needs to be applied to continue the learning process.*

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	80	100	100	100
No	0	0		
Total	80	100		

Table 2: *Distribution of sciences coordinators and teacher participants' responses to online learning effective as a tool to mitigate the impact of Covid-19 on the education system.*

	Frequency	Percent	Valid Percent	Cumulative Percent
Very highly effective	0	0		
Highly effective	76	95	95	95
Moderately effective	4	5	5	100
Not effective	0	0		

Total	80	100	100

Eighty of the sciences coordinator participants and sciences teacher participants (100%) agreed that Covid-19 pandemic created a crisis in education system where EiE needed to be applied to continue the learning process, see table 1. Similarly, the results in figure 1 showed that 100% of the sciences coordinator participants and sciences teacher participants were aware of the necessity of EiE to be applied in crisis situation since it provides access to education for students and it supports teachers to increase their education quality during emergencies. Accordingly, the results in Table 2 showed that the majority of the sciences coordinator participants and sciences teacher participants, 76 (95%) indicated that online learning as a response of EiE was highly effective as a tool to mitigate the impact of Covid-19 on the education system. Even though there was a general acceptance amongst all participants that application of online learning as a result of EiE due to Covid-19 pandemic to ensure the continuity of teaching and learning process, The question remained, did the application of online learning pose any challenges for sciences teachers to maintain continuous learning among middle school students?

All the findings regarding defining the EiE, the needs of application EiE and the effectiveness of the use of online learning (figure 1, table 1 and 2) were in agreement with those of other studies which revealed that the application of online learning was the only option imposed by education in emergencies due to Covid-19 pandemic. For instance, Creed and Morpeth (2014), mentioned that conflicts, situations of violence, forced displacement, natural disasters, and public health emergencies are common situations of crisis in which education in emergencies is necessary to provide access to education for every child. EiE support the Ministry of Education and the National Institute of Education to develop programs that fit the emergency situation lived by the country to allow students to continue to follow the school curriculum and to reach the required

level of learning achievement despite being unable to attend school normally. The theories also corroborated the declaration of Bozkurt and Sharma (2020). In their study into emergency remote teaching in a time of global crisis due to Coronavirus pandemic, Bozkurt and Sharma indicated that The World Health Organization has announced Covid-19 as a global pandemic that created a current threat to humanity. This pandemic has successfully forced many countries to follow strict protocols to complete lockdowns of several activities including educational activities to slow down and curb spread of the virus. This emergency situation has resulted in enormous crisis-response movement of educational institutions with online learning serving as the alternative educational platform.

Similarly, Zhang et al. (2020) conducted a study on suspending classes without stopping learning: China's education emergency management policy in the Covid-19 outbreak, and indicated that due to the Covid-19 outbreak, the Ministry of Education in China initiated an emergency policy called "Suspending Classes Without Stopping Learning" to switch teaching activities into large-scale online teaching while schools were locked. The implementation of this policy still faces several difficulties. The same action was stated by Olaseni and Olaseni (2020), when they carried out a study on the Covid-19 pandemic: Impact of socio-demographic factors and parent's life orientation on enforced learning in pupils during lock-down in Nigeria. They pointed out that in Nigeria to curb the quick spread of Covid-19 across 29 out of the 36 states, including the Federal Capital Territory and to control the spate of virus transmission from person to person, caution has to be taken. This enforced the government of Nigeria to shut down educational institutions, worship places, and other social activities. Besides, during the lockdown, restrictions in mobility and social activities made in-person classes at schools impossible. Consequently, the Minister of Education in Nigeria initiated an online learning schooling

arrangement, across radio, television and the internet to maintain continuity of schooling and learning from home. The findings were supported by Van Nuland et al. (2020) who found the same practice in Canada in their study on Covid-19 and its effects on teacher education in Ontario: a complex adaptive systems perspective. They showed that after declaration of the Ministry of Education in Ontario, Canada the closure of the schools effective 17 March until students and faculty could return safely in September 2020, teacher educators faced a lot of barriers of online learning presented by the Covid-19 crisis. The same decision was found in Lebanon, according to Rouadi and Anouti (2020), in Lebanon, the Covid-19 pandemic forced all students to stay at home due to lockdown measures since March 3, 2020. Alternative solutions were needed to be taken into consideration to save the educational year especially that teaching in the classroom was not an option anymore. Mouchantaf (2020) affirmed that due to this pandemic, most educational establishments in Lebanon, including schools and higher education institutions, have moved to online learning.

Using of online mode during the conventional learning

To understand the implementation of online learning before the emergency situation imposed by Covid-19 pandemic, participants were asked about the frequency of the use of the online learning before Covid-19 pandemic. The sciences coordinators and teachers participants were asked to classify their answers by using a scale ranging from 4 to 1 in which 4 for 'Never', 3 for 'Rarely (Once or twice per year)', 2 for 'Sometimes (Once or twice per month)' and 1 for 'Always (Every week)'.

The answer to this section was obtained through a questionnaire and interview schedule. While no two interviews were the same, reoccurring themes emerged through the 6 interviews. The information gathered from four principal participants and two coordinator participants through

interviews indicated the school curriculum lacked an application plan of online learning to make teachers ready for online mode. It was further revealed among all of the principal and coordinator participants that application of online learning activities in ordinary classes such as teaching methods to explain lessons, assignments given to students, and assessments to support teachers to be accustomed and prepared to online mode was not a part of school curriculum.

From the data collected across the eight schools, limitations of the application of online learning was identified. In addition, this data revealed gaps in the implementation of the online mode of learning during crisis. Also it studied the level of usage of online learning before the pandemic and evaluate the effectiveness of managing application of online learning by sciences teachers and coordinators during Covid-19 pandemic.

The results shown in Table 3 were the responses of sciences coordinator and sciences teacher participants on using of online mode during the conventional learning. Seventy-four (92.5%) of the participants indicated that application of online learning before Covid-19 were not been used. From this percentage, one can deduce that the application of online learning was only during the pandemic which could reveal the level of experience of coordinators and teachers in the effective application of online learning.

Table 3: *Distribution of participants' response to how often online learning is used before the Covid-19 pandemic.*

	Frequency	Percent	Valid Percent	Cumulative Percent
Always (Every week)	0	0		
Sometimes (Once or twice per month)	0	0		
Rarely (Once or twice per year)	6	7.5	7.5	7.5
Never	74	92.5	92.5	100
Total	80	100		

Moreover, 6 (7.5%) of the participants indicated that online learning were rarely used before Covid-19. From the available statistics, one can infer that application of online learning were not been planned and consistently practiced before pandemic based on the majority opinion.

The findings of the study were in agreement with of that of Rouadi and Anouti (2020) who noted that online mode of teaching and learning in Lebanese schools were never applied before as most teachers still accustomed to use the traditional teaching approach. Online learning was completely new for Lebanese teachers who did their best to teach online in efficient possible way but various difficulties faced them in implementing it.

Other researchers in separate studies have proven that Covid-19 pandemic was the rise of implementation of online learning in schools. For instance, Dhawan's (2020) study on online learning: a Panacea in the time of Covid-19 crisis, confirmed that the sudden outbreak of infectious disease Covid-19 in all countries made online learning as a relevant solution during this crisis time where many academic institutions adopted it to keep continuity of teaching and learning processes. The same was reported by Niemi and Kousa (2020) in Finland. They examined students' and teachers' perceptions in a Finnish high school during the Covid pandemic, going to online learning due to Covid-19 pandemic required from teachers a rapid transition to a new mode of teaching. Their result are supported by Portillo et al. (2020), who also recommended in their study on self-perception of the digital competence of educators during the Covid-19 pandemic: a cross-analysis of different educational stages, that before the pandemic, teachers had improved their digital competence of educators in their daily basis work through interaction with technology, but the pandemic situation has pushed them to increase the use of digital resources abruptly in order to deal with changes in the teaching – learning process in a very short period of time and adapt to teaching online.

The extent of teachers' readiness for application of online learning

This section aimed to find out if the sciences coordinators and teachers participants were prepared to apply online learning and if they were supported by their school, which facilitate the adaptation of online learning when their schools implemented it during pandemic. Table 4 and table 5 present the point of view of the sciences coordinators and teachers participants' on their readiness for application of online learning in their respective schools during the Covid-19 pandemic. The results showed that the majority of the sciences coordinators and teachers participants did not start using the online mode promptly to teach students after the Lebanese government declared school closure. In addition, table 5 showed us if the availability of tools was the main factor that facilitate the fast application of online learning mode (within the first week).

According to the interviews with principal and coordinator participants, the following explanations emerge to clarify on the reasons why the majority of the sciences coordinators and teachers participants had limitations for the proper and fast implementation of online learning.

First, school curriculum did not contain an outline for application of online learning to simplify their use among teachers since the official school curriculum initiated by the Ministry of Education was based on face-to-face learning.

Second, the integration of technological tools in the lesson plan was limited. It was believed that the usage of technological tools by educators in explanation, assignment, and assessment could help to create awareness among teachers about how to apply online learning.

Third, the proper training and orientation of teachers on how to use technological tools in teaching at the beginning of every academic year was missing, thereby lacking the employment of technological tools in teaching strategies which could promote the effectiveness of teachers in implementing online learning. When they are not aware of using technological tools, it becomes

hard for them to conduct online mode that ensures the continuity of learning process for their students during Covid-19 pandemic.

The last finding was that the school curriculum structure was not well defined since application of online learning lacked plans and practices. Because plans and practices were not clearly stated in curriculum documents, the procedures in dealing with implementation of online learning issues were difficult which contributed to a lack of online mode awareness and ineffectiveness.

In the interview with one of the principal participants, when asked about the main difficulties in terms of administration in applying online learning, it was obvious that the administrators had a limited teachers' awareness on the application of online learning. According to the administrator the application of online learning wasn't directly after the Ministry of Education announced school closure and shifting to online education.

> *There was a delay for two weeks to implement online learning to set a strategic plan that aims to orient teachers on how to use online mode and to provide all the needed logistics.*
>
> On the other hand, regarding the limitation of application of online learning, the administrator stated that "*teachers should have knowledge and skills in using technology tools for online learning. Most of them usually use the conventional learning and have limited knowledge of using online platform and technology tools which mean they need orientation to apply effectively online learning".*

The teachers have a very essential role to play in the implementation of online learning during Covid-19 pandemic to ensure continuity of the school curriculum. Dhawan (2020) argued that the sudden outbreak of infectious disease Covid-19 in all countries made online learning as a relevant solution during this crisis time where many academic institutions adopted it to keep

continuity of teaching and learning processes. Indeed, online learning supports and facilitates learning and teaching activities for both teachers and students, but there is a dire teachers' need to pedagogical competency, technical capability, preparedness to online teaching, and the presence and the usage of technology tools more efficiently. Besides, Fiş Erümit (2020) stated that two weeks after schools were closed due to the Covid-19 pandemic, the Turkish government planned to use the Education Information Network (EBA) platform (www.eba.gov.tr) for online learning by giving synchronous lessons daily for all students from the third to the twelfth grade five days a week at different hours for each grade level.

Table 4: *Distribution of Participants' response to starting time applying online learning after school closure due to Covid-19 pandemic.*

	Frequency	Percent	Valid Percent	Cumulative Percent
During first week	0	0		
After 2-3 weeks	64	80	80	80
After 4-6 weeks	11	13.75	13.75	93.75
Above 7 weeks	5	6.25	6.25	100
Total	80	100		

Table 5: *Distribution of Participants' responses on the availability extent of the tools for online learning (Hardware, Learning Management System-Software, Internet Access, and Technology Tools).*

	Frequency	Percent	Valid Percent	Cumulative Percent
Very highly available	2	2.5	2.5	
Highly available	3	3.75	3.75	6.25
Moderately available	68	85	85	91.25
Not available	7	8.75	8.75	100
Total	80	100		

Concerning the starting time for applying online learning after school closure due to Covid-19 (see table 4), most of the participants, 64 (80%) assured that application of online learning was after 2-3 weeks of declaration of Lebanese Ministry of Education school closure, followed by 11 (13.75%)

who affirmed that application of online learning was after 4-6 weeks and 5 (6.25%) was above 7 weeks.

These results were aligned with the results found in table 5 that the majority of the participants 68 (85%) stated the tools for online learning (Hardware, LMS-software, Internet access, and technology tools) were moderately available, followed by 7 (8.75%) who said that the tools for online learning were not available. The minority of the participants 3 (3.75%) and 2 (2.5%) said that the tools for online learning were highly available and very highly available in terms of application of online learning, correspondingly.

The results in table 4 proved that the application of online learning did not take place before Covid-19 due to the school curriculum did not contain a strategic plan for application of online learning. This confirmed why the majority of the participants indicated that the application of online learning was done after 2-3 weeks because of unpreparedness of schools for online learning that made online learning totally a new process of teaching and learning for teachers.

Accordingly, the reasons why application of online learning did not occur immediately after school closure are shown in table 5 based on the response of the participant on the availability extent of the different tools for online learning. Online learning not only needed a plan to be applied but also relied on hardware, LMS-software, internet access, and technology tools to be conducted. Before Covid-19 some school principals integrated technologies in school curriculum that allow teachers to use technologies in face to face learning in simple way in their class activities. However, application of online learning during Covid-19 required from teachers more skills to use technologies and more equipment as technology tools to provide them readiness to this online mode. Technologies as hardware and software needed to be available to make the online learning done this support the result in table 5 why the majority of the participants pointed that tools for

online learning was moderately available. It was imperative that school curriculum contained a strategic plan for online learning as response of EiE to ensure that application of online learning by coordinators and teachers were done during the first week of school closure and tools for online learning were made highly available if not very highly available for coordinators and teachers to apply easier and faster the online learning.

The findings in Table 4 and Table 5 were similar to the results of Priyadarshini and Bhaumik (2020)'s study in India when they found out that application of online learning became mandatory for schools during the outbreak of Covid-19 pandemic to enable students to attend their classes virtually to prevent losing their academic year. This sudden move from conventional learning to online learning did not provide teachers with sufficient time to prepare themselves to be acquainted with online learning tools and skills. Their argument was supported by that of Abdulkareem, and Eidan (2020) who carried out a similar study on the online learning for Higher Education Continuity (during COVID-19 Pandemic) in Iraq. Their finding testified that the government in developing countries including Lebanon, declared application of online learning in academic institutions but limited technologies, facilities, and teachers experience with this mode of learning created several challenges.

The same view about the unpreparedness of teachers of application of online learning was upheld by Putri et al. (2020), who maintained that, several challenges faced students, parents, and teachers from the sudden shift face-to-face class to online home learning. Those barriers related to parents, teachers and students were, first the online learning demands time parents have to spend assisting their children in home learning especially for students in primary schools. Second, students and teachers have limited access to adequate facilities to run the online learning from home and faced unstable and low internet access. Finally, teachers also have limited technical

skills to respond to the need for online home learning. It was in this relation that Ali (2020) indicated that to deliver effective online and blended learning adequate ICT support should be available in way of infrastructure and learning tools as well as hardware and software support system. As a result, Shin (2020) explained that online learning requires an internet connection during instruction and a use of online tools which include a platform that provides online classes to allow interaction between teachers and students, devices as computers, smartphones, or tablets that include tools needed to run the platform, and access that connects to the platform.

Similarly, Kaden (2020)'s study on COVID-19 School Closure-Related Changes to the Professional Life of a K–12 Teacher in Alaska (United States), showed that schools were forced to close due to Covid-19 pandemic to prevent its spread in the society. Online learning was the main solution that schools applied to connect teachers to students. Schools by the adaptation of this solution have made a fast transition from traditional mode to online mode and have ensured the necessary support needed for the teachers to provide learning to students. This sudden and unplanned move to online environment brought many challenges for teachers such as the need to modify all lesson plans which are already prepared so they can go with the online learning methodology. In addition, teachers and students need to learn quickly the use of the new technologies, need to make learning meaningful to students, and get used to the new way of interaction in the absence of face-to-face contact with students. It was in this connection that Al Kodri (2021) pointed out that when teachers and students possess good basic ICT literacy and capability, such as knowing the technology system and map operating it, the online learning process will definitely run smoothly and effectively. However, teachers and learners need to be made aware that technical problems are a major barrier that makes online learning not run effectively as scheduled.

By extension, it was imperative to note that an application of online learning with presence of a strategical plan in the school curriculum for education in emergencies aim to resolve a problem that has been defined as academically relevant to the sciences coordinators and teachers in middle schools. Once a school application of online learning before crises situation is being planned and implemented, this application is or should be subject to systematic evaluation by coordinators and teachers. During this final stage of the application of online learning domain, the school principals of academic affairs and school administrators focus on the effects generated by the objective measures. In this view, it entails establishing whether the benefits and costs of the application of online learning, including where applicable whether coordinators and teachers have effectively achieved or reached their learning objectives in line with what is expected of them through conventional learning method. In summary, application of online learning evaluation involves the empirical testing of the level of educational sustainability on which the application of online learning is based. Thus, the analysis concerns both the relevance of action and the scope of its practical application.

Conclusion of Research Question One

Research Question One provided an answer to the initiation of schools of implementing online learning as a result to Covid-19 pandemic that create a crisis in education sector to ensure continuity of students' learning by sciences coordinators and teachers in middle schools in Lebanon. Results obtained from survey questionnaires and interviews indicated that there applied online learning during Covid-19 in all the sampled schools that were investigated.

According to the findings from the questionnaires as shown in Table 2, the majority of the participants (95%) were in agreement that there applied online learning in their respective schools

which was highly effective as a tool to mitigate the impact of Covid-19 on the education system. It was revealed that though online mode applied in schools, it was challenged for sciences coordinators and teachers because it was not programmed and implemented before Covid-19. While it was true that online learning applied in schools to continue the teaching and learning process during the emergency situation imposed by Covid-19, majority of the coordinator and teacher participants started online learning after 2-3 weeks of school closure and the majority admitted that online learning tools as software and hardware were moderately available which could relate to teachers' inability to implement online learning efficiently. Also, it was reported that application of online learning was not tested and experienced by coordinators and teachers before Covid-19. Because of the fact that school curriculum did not contain a strategic plan for the application of online learning as a response to EiE before Covid-19 and the Lebanese school curriculum was not updated since 1997, where technology tools were limited integrated in teaching and learning process in private schools.

The general findings in this section were supported by the views of other researchers. For instance, Ferri et al. (2020) confirmed that it was an emergency application of online teaching to provide learning and to stop disruption of attending classes for students due to Covid-19 pandemic, whereas there are several technological, pedagogical and social challenges faced by teachers and students in conducting online learning, particularly in developing countries like Ghana, Malaysia. As well, Ali (2020) assured that to deliver effective online and blended learning there must be available of adequate ICT support in way of infrastructure and learning tools as well as hardware and software support system. Similarly, the lack of teachers' awareness of conducting online mode and lack of online learning tools did not go in line with that of Al Kodri (2021) who recommended that when teachers and students possess good basic ICT literacy and capability, such as knowing

the technology system and map operating it, the online learning process will definitely run smoothly and effectively. Next, the researcher investigated Research Question two the extent to which the application of online learning during Covid-19 caused various challenges among Lebanese sciences teachers in middle school.

The challenges faced by sciences teachers in implementing online learning

Research Question 2: What were the challenges faced by sciences teachers at middle school in implementing online learning?

Research Question Two assessed the challenges that were faced by sciences teachers at private middle schools in the implementing of online learning. From the questionnaire and interview guide, it was established that sciences teachers encountered problems in managing students' class activities through online learning implementation. Here, challenges identified by the participants centered around modifying lesson plan, digital competence to apply online learning, heavy workload for teachers, getting credible data on students' performance, external distractions, interaction between teachers and students, build interpersonal relationships between teachers and students, effective assessment tools to evaluate students' learning, internet connection, and equipment for online learning.

Ten items were given to participants to get their experiences regarding challenges faced by sciences teachers in middle schools when implementing online learning. Their responses were assessed on a five-point Likert scale with the choices: Very low challenging (VLC), Low challenging (LC), Average challenging (AC), High challenging (HC), Very high challenging (VHC).

Table 6: *Distribution of participants' response to problems faced by sciences teachers in implementing online learning*

Statements	VHC (%)	HC (%)	AC (%)	LC (%)	VLC (%)
Modify lesson plan		100			
Digital competence to apply online learning		80		20	
Heavy workload for teachers		100			
Get credible data on students' performance		100			
External distractions		78		22	
Interaction between teachers and students		51.25		48.75	
Build interpersonal relationships between teachers and students		50		50	
Effective assessment tools to evaluate students' learning	100				
Internet connection	100				
Equipment for online learning	98.75	1.25			

The responses to problems faced by sciences teachers in implementing online learning (see table 6), all of the participants indicated that one of the most common very high challenging set was found teachers' tools for application of online learning with a percentage prevalence of (100%) including effective assessment tools to evaluate students' learning, internet connection, and equipment for online learning. This shows that a large percentage of the sciences coordinators and teachers suffered from having effective assessment tools to evaluate students' learning, bad internet connection and scarcity in equipment for online learning across the eight schools. It is evident from the statistics that tools for application of online learning were a serious challenge faced by sciences coordinators and teachers. This implies that the consequence for very high challenging tools for application of online learning was inexperienced or tools for application of online learning was unpracticed by sciences coordinators and teachers in normal learning. This also could mean that tools for application of online learning increased at a high rate of challenging because there was no integration in the school curriculum in which educational technologies as

hardware, software, and apps were to be used by educators to update the process of teaching and learning at school in an effective way.

Very high challenging teachers' tools for application of online learning as it concurred to restricted teachers' ability in conducting online learning is rampant among sciences teachers in middle schools in Lebanon. Availability and accessibility of technology tools, and good internet connection need to be offered not only to teachers but also to students in an educational institution. Alea, et al (2020) supported this assertion and argued that, the lack of facilities, equipment, and capacity building to online learning education, such as having stable internet access, presence of phones, laptops, and tablets or any devices, existence of Learning Management System, and attending a training or workshop on online learning education management, affect teachers' readiness to online learning education. If teachers are not well-equipped and not ready for online learning, this results in limiting their ability to offer online learning education successfully.

Teachers' academic work is another major area raising concern in many institutions in Lebanon containing modify lesson plan, digital competence to apply online learning, heavy workload for teachers, get credible data on students' performance, and external distractions. It was observed from the data collected that teachers' academic work set was highly challenging mentioned by the majority of the participants. It was indicated that 20% of the participants disagreed that digital competence to apply online learning had a high rate of challenge, and 80% agreed. It is also noted that all the participants 100% believed that modifying lesson plan to give online classes is highly challenging. The implication was that this unreadiness of teachers to online classes needed a serious attention. Similarly, all the respondents 100% across the eight schools agreed that heavy workload for teachers was a challenge facing the implementation of online learning.

During an interview with one of the teacher's coordinator participants, she recognized that her school was not creating awareness and practicing among teachers how to implement online learning which meant that teachers did not have much digital competence to apply online learning, had the know how to modify their lesson plan to be suitable with the time period of online class and which class activities to choose, and did not know how to manage their time to avoid heavy workload. Furthermore, during the interview, when one of the school's principal participants was asked about the main difficulties in terms of administration in applying online learning, he identified heavy workload on school administrative and teachers. He said, "We need educators' assistance in the application of online learning that forced by Covid-19, but most of the teachers are cooperative by meeting the deadlines, answering calls, replying to emails, attending meetings and workshops sometimes not during working hours, and they develop much interest in the application of online learning to be effective for students' learning despite the pressure of work put on their shoulders". The preparedness requests a complete overhaul of the whole issue of application of online learning. Teachers should be well trained by schools in conducting online learning because when they are trained, the application of online learning will run effectively and consequently provide power to teachers to overcome all academic work barriers.

Those issues raised by participants as challenges were supported by Dhawan (2020) who stated that the sudden moving from the face-to-face learning mode in the classroom to an online mode was a challenge for teachers that requires changing in their teaching methodologies and managing in their time. Besides, Portillo et al. (2020) asserted that the impact of the Covid-19 pandemic and the complete lockdown of schools since March 2020 has forced the abrupt development of the Digital Competence of Educators for active teachers. But this situation has also posed an issue for teachers that is the need to develop some key aspects of Digital Competence

of Educators. Finally, Palau et al. (2021) revealed that teaching during Covid-19 lockdown from home made teachers answer emails and calls all day long and work much more hours than usual. The increase of teachers' workload is due to the fact that teachers did not know how to manage their work, and schools did not have experience in regulating teaching from home to avoid excessive and uncontrolled workloads. Even though some teachers self-regulated after the initial workload, and some schools published schedules to regulate this problem, but this situation happened in an unexpected manner and working from home was complicated and raised workload for teachers for different reasons: organization, work schedules, family coexistence.

Moreover, getting a credible data on students' performance in the subject learned was listed as a challenge among participants. 100% of the total participants reported lack of reliable data on students' achievement of the lesson objectives of Biology, Physics, and Chemistry explained and practiced by teachers in class and studied and exercised by students at home as a major threat to the teachers' effectiveness of application of online learning. Assessment tools to evaluate students' learning are necessity for educators to update or modify lesson plans to increase students' assimilation of the material of the lessons, but when it became difficult to apply in online classes to have a valid data about students' understanding, it developed a source of severe challenge that was faced by teachers. The majority of teachers have concerns regarding assessment tools that could be used in online learning to get credible data on students' learning. According to Niemi and Kousa (2020), they indicated in their study about secondary school teachers' perceptions during the Covid-19 pandemic that most teachers expressed two aspects of worries or issues related to assessing learning and learning outcomes. The first worry was reliability of students' performances when they are doing examinations and tests at home. The lack of supervision makes it impossible for teachers to control if students do not use the book or dictionary as an aid during their exams.

The second worry was about formative assessment during learning process. Online learning impedes teachers to follow the learning process in the same way as in an ordinary classroom. Consequently, teachers commented that there is no certainty about student learning which it became very difficult to assess students' real learning.

Similarly, another serious challenge that was reported among participants across the eight schools was the issue of teachers' external distraction while giving online classes. 78% of the respondents noted that this factor was a big challenge to the educators in application of online learning from home while 22% of the participants disagreed with them. The observation of the participants concurred with Purwanto et al. (2020) in an article "Impact of Work from Home on Indonesian elementary teachers' performance during the Covid-19 pandemic." The researchers argued from the perspective of teachers that, teachers' performance in online learning is low due to the working environment at home, not like a classroom, distracted by social network and other entertainment, and interruption of parents, siblings, friends and / or pets. They further argued that distraction during online teaching is liable to lose teachers the mood for work. When losing mood to work, the teachers need to rest for a while and not push themselves in order to regain the mood for work, which is a disadvantage for them.

Other problems related to the application of online learning during Covid-19 were identified by respondents. Teachers-students' relationship was described as average challenging noted among participants containing, interaction between teachers and students and build interpersonal relationships between teachers and students. Those challenges included negative influence from the online mode that weaken the relationship between teachers and students. About the challenging problem of interaction between teachers and students, approximately half of the participants 51.25% agreed and 48.75% of the participants disagreed. This challenge was identified

as a factor hindering the implementation of efficient online learning. Niemi and Koussa (2020) supported a similar finding in most schools in Finlands. In their study on the students' and teachers' perceptions in a Finnish High School during the COVID pandemic that going to online learning due to Covid-19 pandemic required from teachers a rapid transition to a new mode of teaching. This transition caused a main challenge which was the interaction with students, and teachers missed the spontaneity of interaction that face-to-face teaching provided. To teachers, an active interaction was a necessary requirement for learning and could not be replaced by online learning. The researcher continued as cited in Nambiar (2020), that this is because in a classroom management, a teacher can perceive student's body language and these non-verbal signs help the teacher to immediately make the suitable adjustment in their teaching approach to meet students' needs. Finally, the lack of building interpersonal relationships between teachers and students was identified by participants as medium challenging; 50% agreed and 50% disagreed as a barrier to proceeding online learning actively. Sepulveda-Escobar and Morrison (2020) reinforced a similar finding in most schools in Chile, South America. In her study on the online teaching placement during the covid-19 pandemic in Chile: challenges and opportunities, they suggested that teaching and learning occurs with the interaction between teachers and students inside the classroom. This interaction creates interpersonal relationships that are the core of successful teaching and learning.

Even though, there were divergent responses among participants, the results indicated that teachers faced three level of challenges: teachers' tools for application of online learning were considered very highly challenging, teachers' academic work was considered highly challenging, and teachers-students' relationship as average challenging in implementing of online learning. The challenges identified by participants agreed with the findings of other studies conducted by researchers that revealed similar problems faced by teachers in application of online learning. For

example, in a study conducted among secondary school Mathematics teachers in Indonesia, Almanthari et al. (2020) found online learning barriers related to teachers include technology and internet accessibility and lack of a suitable online learning curriculum and an effective assessment tools to evaluate student growth. Those barriers limit teachers' ability, what and how to teach, and how to know if students will learn. A study also carried out in schools in England revealed that a high workload is described by teachers that they were spending more time on administrative work and preparation of lessons than on normal teaching days. Preparation of lessons to be given online demands new design that includes sourcing for suitable teaching resources for online teaching and setting up appropriate platforms for delivery (See et al., 2020). Furthermore, in a research studied online teaching amidst covid-19 in India, Joshi et al. (2020) pointed that one of the issues encountered by teachers in offering online learning education is the continuous external distractions due to noise from the neighborhood or interruption by family members during the teaching period that negatively affected the continuity of sessions. This issue makes teachers feel exhausted and demotivated to deliver education through the online system. Finally, Aliyyah et al. (2020) in their research about the perceptions of primary school teachers of online learning during the covid-19 pandemic period in Indonesia. They underlined that online learning makes teachers less enthusiastic with School from Home (SFH) than face-to-face teaching. The fact that teachers cannot interact directly physically with students, so teachers cannot measure the level of students understanding when learning online.

Conclusion of Research Question Two

Research question two was intended to find out the challenges faced by teachers in implementing of online learning during Covid-19. It was revealed that a significant number of challenges faced

by teachers across the eight middle schools. According to the findings, it appeared that there were three level of challenges faced by teachers included very high challenging as effective assessment tools to evaluate students' learning, internet connection, and equipment for online learning; high challenging as digital competence to apply online learning, modify lesson plan, heavy workload for teachers, get credible data on students' performance, and external distractions, and average challenging as interaction between teachers and students, and build interpersonal relationships between teachers and students. These challenges negatively affected the effective implementation of online learning during Covid-19 by teachers. However, when statistics were compared about schools, there were divergent views from school to school. In the next section, Research Question Three the available opportunities regarding online learning for teachers are discussed.

The available opportunities for science teachers in implementing online learning

Research Question 3: What were the opportunities for science teachers at middle school in implementing online learning?

Research Question Three was to determine the available opportunities for teachers in implementing online learning. Based on the data generated from the questionnaires and interviews, the majority of the principal participants, coordinator participants, and teacher participants indicated that the application of online learning made availability of numerous opportunities for teachers in giving instruction, in doing academic work, and in daily working routine. Here, opportunities determined by the participants focused around novel teaching methods, recording teachers' class period, using various online resources, discovering educational technology tools, give teachers' instant feedback to students, development of teachers' technology skills, improvement of teachers' communication skills, presence of technology tools and programs in

online platforms save teachers' time in their academic work, save teachers' commute time from home to school or vice versa, and choosing any place at home where teachers feel comfortable to work.

Ten items were given to participants to get their experiences regarding available opportunities for sciences teachers in middle schools when implementing online learning. Their responses were assessed on a five-point Likert scale with the choices: Very low opportunity (VLO), Low opportunity (LO), Average opportunity (AO), High opportunity (HO), Very high opportunity (VHO).

Table 7: *Distribution of participants' response to available opportunities for sciences teachers in implementing online learning*

Statements	VHO (%)	HO (%)	AO (%)	LO (%)	VLO (%)
Novel teaching methods	97.5			2.5	
Recording teachers' class period	97.5			2.5	
Using various online resources to apply different learning styles	97.5			2.5	
Give teachers' instant feedback to students	97.5			2.5	
Development of teachers' technology skills		97.5		2.5	
Improvement of teachers' communication skills		95		5	
Discovering educational technology tools which teachers can integrate in normal classes	97.5			2.5	
Presence of technology tools and programs in online platforms save teachers' time in their academic work		93.75		6.25	
Save teachers' commute time from home to school or vice versa			51.25	48.75	
Choosing any place at home where teachers feel comfortable to work			45	55	

As for the distribution of participants' response to available opportunities for sciences teachers in implementing online learning (see table 7), a considerable number of coordinator participants and teacher participants 78 (97.5%) considered the professional development of the teachers as very high opportunity which include novel teaching methods, recording teachers' class period, using various online resources to apply different learning styles, discovering educational

technology tools which teachers can integrate in normal classes, and give teachers' instant feedback to students.

Also, from the interviews that were conducted with the principal and teacher coordinator participants, it was ascertained that application of online learning opened different opportunities for principals and teachers that could each one of them benefit from those opportunities depend on their daily work duties. One teacher coordinator's participant in an interview commented positively on the application of online learning as follows: "Despite the challenges faced by our teachers in implementing online learning, there were different opportunities that teachers benefit from them such as using videos to explain a concept related to the lessons, using features in Microsoft Teams to complete their academic works or to prepare their teaching work in less time, and using technologies that support them in students' learning and help them to communicate and collaborate with coordinators and others teachers. They try a different mode of teaching during Covid-19 and then after Covid-19 they return to conventional learning with adding spices of online learning. One can strongly tell that online learning made a positive change in school curriculum". She strongly believed that the "job of a teacher is important and such jobs need an individual with patience, willingness to learn new skills and to benefit from each opportunity put in their hand to improve students' learning". She further concluded that opportunities offered to teachers, principals and administrators as a consequence of application of online learning play the role of catalyst that accelerate the modifying of school curriculum that is surely be different after Covid-19. From those opportunities, we can choose the best to integrate in school curriculum to increase students' performance and outcome.

In schools during Covid-19 where application of online mode is new and sudden for teachers, implementation of online learning come up with opportunities which as a result gives

chance to teachers to apply different teaching strategies that meets students' needs. Conversely, while the majority of the teacher participants articulated that application of online learning made opportunities available, few school principals who were interviewed were consistent in their views that application of online learning did not make available opportunities. Table 7 above indicated participants' responses on available opportunities in implementing online learning.

The data in Table 7 showed the responses of sciences coordinators and teachers across the eight schools. The data revealed that a significant number of respondents, 78 (97.5%) indicated that the most very high opportunity that application of online learning made available to teachers was teachers' professional development including novel teaching methods, recording teachers' class period, using various online resources to apply different learning styles, discovering educational technology tools, which teachers can integrate in normal classes, give teachers' instant feedback to students.

Likewise online learning acquires teachers an opportunity to integrate more media such as video, images, graphs, audio, in their teaching methods but teachers should produce good teaching materials and be able to leverage on them to help students actually learn. Teachers should think carefully about what students should do to learn effectively and what novel instructional methods can include listening to a podcast, reading a text or watching a video to maintain student-centered design, which is a requirement for successful online learning (Rapanta et al., 2020). This was the second opportunity found available for instructors in Chinese schools where sciences teachers explained why recording teachers' explanation become an opportunity to many educators. It was in view of this that Guo and Li (2020) science teachers find that using recorded explanation videos and simulated experimental teaching through online learning is advantageous for them to improve students' understanding of the material lesson and students' familiarity and proficiency in the

experiment in an autonomous learning way. This is beneficial for teachers to ensure that students cover all aspects of the lesson from theory explanation to experiment observation. An additional opportunity from application of online learning leading to increased teachers' professional development became popular among Italian teachers. For example, according to Ferri et al. (2020), in her study conducted on "Online learning and emergency remote teaching: opportunities and challenges in emergency situations: An Italian case study", there are reports of the most advantages of online learning are continuity and flexibility of the teaching process through overcoming of space-time barriers and increasing flexibility in the ways and styles of learning. This opens possibility to use various online resources that permits teachers to apply different teaching methods focusing on certain skills and lesson objectives needed to be achieved by each student.

Not limited to China's and Italy's school experience, there was one more opportunity found from application of online learning leading to teachers' given instant feedback in schools in Australia, Canada, Spain, and Switzerland. Rapanta et al. (2020) who are experts in education investigated into the online teaching during and after the Covid-19 crisis in schools in Australia, Canada, Spain, and Switzerland and emphasized that the use of online learning authorizes teachers to monitor students' learning process based on formal and informal feedbacks as the outcomes of different instruments and strategies of assessment available in online learning platform applied by them to assess their students. Suitable feedback on questions and as evaluations helps students progress in their learning every time and support teachers to evaluate their teaching strategies.

The majority of sciences coordinator participants and science teacher participants concurred that there was a high opportunity in the development of teachers' skills and awareness through application of online learning. This high opportunity called teachers' skills and awareness development including development of teachers' technology skills, improvement of teachers'

communication skills, and presence of technology tools and programs in online platforms save teachers' time in their academic work. Obtained from Table 7 are the responses of sciences coordinator participants and sciences teacher participants. On whether development of teachers' technology skills was an opportunity in application of online learning for educators, 97.5% of the all the participants confirmed it was high opportunity while 2.5% indicated that it was a low opportunity. At the same time, 95% of the participants observed that improvement of teachers' communication skills was a high opportunity while 5% indicated that it was a low opportunity. On the level of presence of technology tools and programs in online platforms save teachers' time in their academic work, 93.75% of the participants showed that it was a high opportunity, while 6.25% agreed it was a very low opportunity.

Even though the participants' views were unified, the overall impression from the findings is that there existed a multiple opportunities available for educators in implementing online learning that positively affected to develop school curriculum. Jena (2020a) was also consistent with similar findings when he conducted a study on the impact of pandemic Covid-19 on education in India, and found out that Covid-19 pandemic induced educators and learners to adopt digital technologies to ensure transmission of teaching and learning through online learning. This results in increasing technology knowledge of teachers and students. Using online learning provides teachers a chance to acquire new skills and improve their professional experience in technology to become more effective and productive in teaching. Applying new ways of teaching delivery and assessments of learning through online learning produce a positive change in the area of curriculum development and pedagogy.

Lagandesa (2021) was also consistent with the same opinion when she found out in her study on the training and implementation of google applications for online learning in the

pandemic Covid-19 in Indonesia, that Indonesian elementary school teachers used Google applications for online learning because it maintains interactive online learning and contains material that develop two-way of communication in synchronous and asynchronous online learning. This study revealed that using google application enable teachers to boost their communication skills through expanding communication in different direction and to direct students to the material related to the lesson objectives through giving them appropriate links in class assignments. Ability of using applications and communication skills are requirement from teachers to carry out online learning efficiently.

This was also supported by Singh and Phirriyalatha (2020), in their study about the impact of Covid-19 on education and new opportunities in online teaching in India. Their study revealed that online learning provides teachers with tools and system that save their time spending on academic work. These technology tools and programs allow teachers to use a new process to correct and grade students' assignment, to monitor and check students' learning progress, to apply teaching methods to meet students' needs, with less time.

Furthermore, the principals and sciences coordinators of middle school during the interview expressed that "available opportunities for principals, educators, and administrators in implementing of online learning was a crucial factor in helping to update a school curriculum" in their schools. One of the principal participants summed up the idea of available opportunities in implementing online learning as: "necessity of integration of technologies in education sector appropriately to serve the school stakeholders in their working field efficiently". He emphasized that certain opportunities were features, such as ability to use technologies, capability to choose the suitable technologies to communicate among principals, coordinators, teachers, administrators, students, and parents, and having awareness of technology tools and applications that facilitate the

work of principals, teachers, and administrators. Based on their answers of what the available opportunities in implementation of online learning are, all the principals and teacher coordinators admitted to varying opportunities available with implementing of online learning at their respective schools. One of the principal participants was quite explicit and viewed opportunities provided from application of online learning as a power given to teachers, principals, and administrators to accomplish tasks easily and to implement the school curriculum skillfully. He went on to say that:

> *"Application of online learning is very powerful for educators and administrators. Both, experience new mode of teaching or administrative working consequent of available opportunities that they serve and develop each one of us in our working field. In fact, many of the teachers are giving positive feedback on the available opportunities of implementation of online learning and explain how their usage facilitate and improve their teaching duties. Likewise, many of the administrators are commented positively how the available opportunities of application of online learning make their work rum smoothly and done in less time when they know about applications and how to use technologies. Those opportunities are supported by educators and administrators leading to make an advancement in the school curriculum to meet their needs during and after Covid-19.".*

During the interview with another principal of middle school participant, he explained that available and useful opportunities classified as being: "utilize technology tools in class activities, presence of technologies and applications employed in administrative work, applying different teaching methods, complete tasks in short period of time, save files and documents on computer, and meeting students' needs, etc". He reported his opinions as follow:

"The available opportunities for educators and administrators as technology tools were present before Covid-19 but there was a light use of those opportunities. The application of online learning during Covid-19 pushed educators and administrators to modify school curriculum in order to use and benefit from those opportunities to achieve their work effectively. Teachers and administrators have been involved in all sorts of opportunities given by application of online learning to accomplish tasks and to maximize students' achievement of lesson objectives. These include using videos, pictures, graphs, save soft copies of documents and files, giving oral or written feedback to students, utilize technologies, communicate with staff and educators through applications, administrative work of schools done quickly and effectively by emails, and teachers meet students' needs through technologies."

The results in table 7 showed that there was an average opportunity in implementing online learning labeled teachers' reduced stress in everyday school across the sampled schools including save teachers' commute time from home to school or vice versa, and choosing any place at home where teachers feel comfortable to work that made teachers benefit from the available opportunities of application of online mode. When participants were asked on the extent of saving teachers' commute time from home to school or vice versa, the average of the participants (51.25%) articulated that it was an average opportunity, while 48.75% voiced that it was a low opportunity. This implied that consequences for the available opportunities for teachers to save teachers' commute time from home to school or vice versa was observed as an average opportunity for teachers despite decreased the level of teachers' stress in everyday school but teachers strongly prefer face to face learning. Similarly, when participants were asked about choosing any place at home where teachers feel comfortable to work, 45 % indicated that it was an average opportunity,

and 55% said it was a low opportunity. This hinted that consequences for the available opportunities for teachers to choose any place at home where they feel comfortable to work more or less noted as an average opportunity means that going to schools is a need for teachers where classrooms are good working environment to engage students' learning.

Although there were divergent views among participants, the results shown in Table 7 disclosed that there was an average opportunity for teachers' reduced stress in everyday school in implementing online learning. During the interview with the coordinator teacher participants, they all confirmed that saving teachers' commute time from home to school or vice versa, and choosing any place at home where teachers feel comfortable to work were an average opportunity for teachers for a specific duration of time that teachers will be required to work from home. This lead to save teachers' time in order to use this time according to the need of teachers and feel teachers less stress from waking up early and from traffic jams to go to school and to return to home. Besides, they said that changing teachers' working environment from time to time is beneficial that increase teachers' performance and boost teachers' innovation in doing class activities. The findings were supported by researchers such as Verma and Priyamvada (2020) who found out that most of the teachers in Haryana schools in India found that one of the positive outcome of online learning is saving commute time. Teaching online benefits teachers to save on travel time to and from school which allows them to use that time according to their need and convenience, and feel relax from their mandatory presence in class. This was also confirmed by Purwanto et al. (2020), in their study about the impact of work from home on Indonesian elementary school teachers' performance during the Covid-19 pandemic. Their study revealed that online learning offers them a flexibility to choose any place at home where they feel more comfortable to work. This increases teachers' ability to complete their teaching activities specified for that day. In regular classes

teachers have a desk and a chair as their workplace, but at a certain time they feel bored and need a new teaching environment. Changing working atmosphere is a necessity to boost teacher performance.

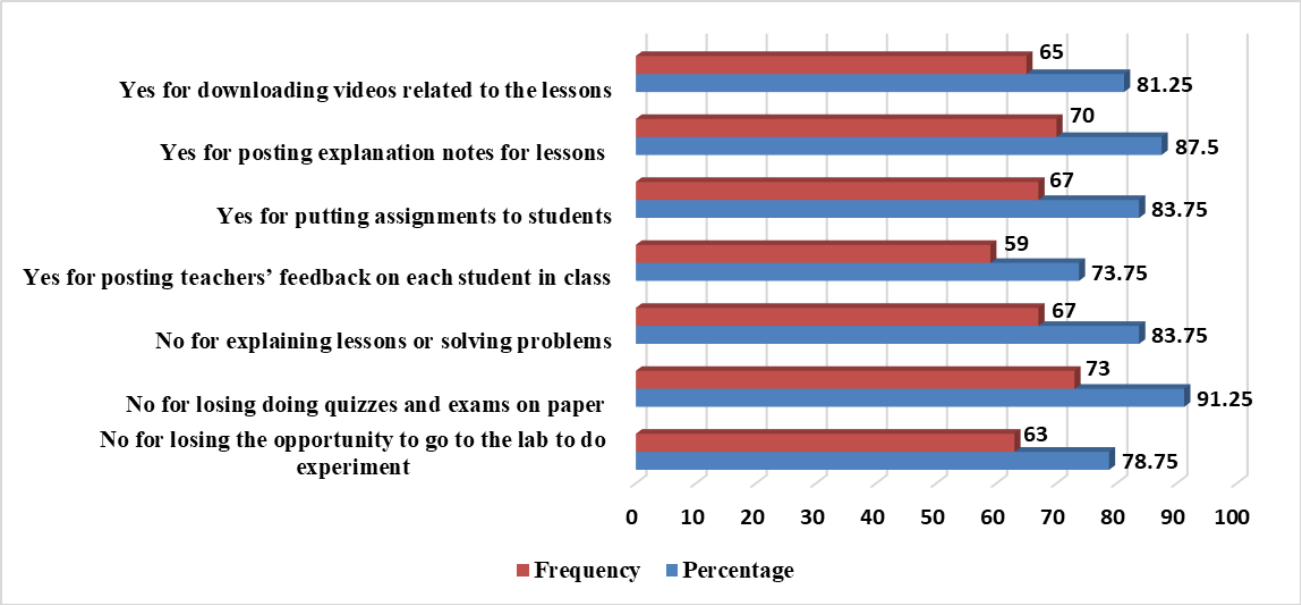
Sciences coordinators and teachers' opinion from their personal experience, if online learning can be integrated in the school curriculum in middle schools when the Covid-19 pandemic ends.

Participants were asked to provide opinions from their personal experience if online learning can be integrated in the school curriculum in middle schools when the Covid-19 pandemic ends. The findings of this section were based on the questionnaires and interviews.

Several reasons of agreement and disagreement identified by sciences coordinators and teachers (see Figure 3) included agreement restricted to downloading videos related to the lessons, posting explanation notes for lessons, putting assignment to students, and posting teachers' feedback about each student after each 6 weeks done in schools. As well, it included disagreement restricted to not explaining lessons and not solving problems, not losing to do quizzes and exams on paper, and not losing the opportunity to go to the lab to do experiment.

The responses of participants on reasons of agreement and disagreement of integration of online learning in the school curriculum in conventional learning when the Covid-19 pandemic ends are tabulated to show frequency and percentages. Out of the 100 participants, Figure 2 presented the responses from 80 who responded to the open-ended question.

Figure 2: *Reasons of agreement and disagreement identified by participants*



Agreement restricted to downloading videos related to the lessons

From figure 2, it is seen that restriction to download videos related to the lessons was an agreement to integrate online learning in school curriculum in conventional learning mentioned by the majority (81.25%). The participants indicated, this is because using YouTube videos related to the lessons help students to assimilate easily the keywords and to achieve quickly the objectives of the lesson and create an engagement learning environment for students. For instance, YouTube videos played a vital role in helping teachers to provide students flexible teaching during online learning. The use of YouTube is a good teaching material that facilitates for teachers to ensure students' understanding of the lesson explanation and to keep their students motivated to learn online (Lestiyanawati, 2020).

Agreement restricted to posting explanation notes for lessons

Another major reason agreement mentioned by 87.5% of the participants was posting explanation notes for lessons. Posting explanation notes for lessons was perceived by participants as items advantageous to be integrated in the school curriculum when Covid-19 ends leading to

update school curriculum that allow teachers to meet students' needs. This component noted by participants was agreed to be integrated in the school curriculum in normal learning in the written explanation given by sciences coordinators and teachers in the opened ended question in the questionnaire and the literature review.

Inside the questionnaire, a large number of the sciences coordinators and teachers agreed that although the idea of integration of online learning in conventional learning was important to make improvement in the school curriculum, the integration was limited only to post explanation notes for lessons or for problems solved or corrected in class that permit both students present and absent to review at home the material done in class during a school day. Moreover, reviewing the lesson materials support students to increase their understanding and performance in the lesson learned. Different teaching methods and techniques are used by Biology teachers in online learning as direct instruction, sharing of explanation lesson notes, demonstration method, and audio and visual materials through a specified online platform observed in a study conducted in schools in Turkey by Karakaya et al. (2020). Results of their study indicated that those teaching methods enable teachers to establish a positive relationship with their students and to increase their effectiveness in online learning by using audio and visual teaching materials. The use of technology tools to apply those teaching methods helps students to boost their understanding and skills in the lesson learned.

Agreement restricted to putting assignments to students

Putting assignments to students was also identified as an agreement item to the integration of online learning in school curriculum when returning to normal learning. Of the total participants, 83.75% noted that integration of putting teachers' assignments to students in conventional learning made a positive change in school curriculum. This assertion was understood from two dimensions

First, teachers explained that they were satisfied by the experience of putting assignment to students in application of online learning during pandemic where they felt that integration of putting assignment to students in normal class based on different forms of assignment as chart table, games, creating PowerPoint presentations, resolve problems, and answering questions improve school curriculum for better students' learning, save teachers' time in correcting assignment, and motivate students to do assignment in using technology tools. This way they ensure students' achieving of lesson's objectives and facilitate students' retrieving of lesson key words when needed. Similarly, one coordinator participant stated during an interview that teachers' feedback on implementation of online learning was positive about integration of technologies to upgrade the school curriculum such as download videos, pictures, and animation, post explanation notes, put assignment to students, and post teachers' comment on the work of each student in class. This is because of having awareness of using technologies improve teachers' performance in teaching and create an engagement learning environment for students. She said; "most of the teachers has positive feedback about using technologies in implementation of online learning during pandemic and they highly encourage integration of technologies to boost school curriculum. They approved to limit integration of online learning in their normal classes through downloading videos, pictures, and animation, posting explanation notes, putting assignment to students, and posting teachers' comment on the work of each student in class. Since those technologies support teachers to allow students to reach the objectives of the lesson easily and in funny way and increase students' motivation and critical thinking."

Agreement restricted to posting teachers' feedback on each student in class

Another item agreement, raised by participants was integration of posting teachers' feedback on each student in class in the school curriculum when return to conventional learning.

Participants, 73.75% noted that integration of posting teachers' feedback on each student enrolled in class made development in the school curriculum and enabled parent to monitor their children. Their view was consistent with the interview with one of the principals of middle school that was carried out. The principal mentioned that integration of posting teachers' feedback on each student in class has a significant impact in improving school curriculum and in involving student parents in school work of their children. Presence of parents plays a vital role in supporting students academically and morally that lead to increased performance and strengthening the personality of students. He proclaimed; "integration of posting teachers' feedback on each student after each 6 weeks done in schools in the school curriculum highly recommended by teachers to allow parents to follow up and monitor their children. This integration boosts school curriculum to raise students' benefit to achieve a high academic level and to build a strong personality. Therefore if students faced an academic or a psychologic problem that allows school and parent to collaborate and work together to resolve problems in order to increase students' performance, outcome, and self-confidence."

Disagreement restricted to explaining lessons or solving problems

Majority of the participants, 83.75% indicated that explanation of lessons or solving problems was not agreed to be integrated in the school curriculum after Covid-19. However, they felt that it was one of the major challenges faced in application of online learning during Covid-19 in middle schools. All sciences teacher and coordinator participants who were given written reason about their disagreement of integration of this item in the school curriculum confirmed that online learning can not replace face to face learning in the case of given teachers instruction to students in class but in other cases online learning can be completed of in-person learning. For instance, one of the teacher participants went on to say:

"Face to face learning is a need in giving explanation of lessons and in solving or correcting problems since it allows teachers to observe students' interaction and their faces' reaction to know if they understand the explanation and reach the lesson objectives. Although in case of YouTube videos, they can be integrated in conventional learning to support teachers to apply different teaching methods to maximize students' understanding of the lesson learned."

The majority of the participants disclosed that no integration of explaining lessons or solving problems in the school curriculum has resulted in a making benefit to students through attending classes where interaction with teachers and engaged learning environment are available. Niemi and Kousa (2020) conducted a study titled "Students' and Teachers' Perceptions in a Finnish High School during the COVID Pandemic". In his findings, going to online learning due to Covid-19 pandemic required from teachers a rapid transition to a new mode of teaching. This transition caused a main challenge was interaction with students, and teachers missed the spontaneity of interaction that face-to-face teaching provided. To teachers, an active interaction was a necessary requirement for learning and could not be replaced by online learning. This is because in a classroom management a teacher can perceive student's body language and these non-verbal signs helps the teacher to immediately make the suitable adjustment in their teaching approach to meet students' needs (Nambiar, 2020).

Disagreement restricted to losing doing quizzes and exams on paper

A considerable number of participants, 91.25% identified losing doing quizzes and exams on paper at schools as a disagreement item to be integrated in the school curriculum when come back to ordinary classes. This study also sought to understand the challenges facing and opportunities offering for application of online learning during Covid-19 across the eight middle

schools that were studied. From the data generated from questionnaire and interview, it was evident that losing doing quizzes and exams on paper at schools were not accepted, supported, and trusted. This disagreement item presented by the participants is supported with the view of Niemi and Kousa (2020) when they also found in their study on secondary school teachers' perceptions during the Covid-19 pandemic in Finland, the most of teachers expressed two aspects of worries or issues related to assessing learning and learning outcomes. The first worry was reliability of students' performances when they are doing examinations and tests at home. The lack of supervision makes impossible for teachers to control if students do not use the book or dictionary as an aid during their exams. The second worry was about formative assessment during learning process. Online learning impedes teachers to follow the learning process in the same way as in an ordinary classroom. Thus, teachers commented that there is no certainty about student learning which it became very difficult to assess students' real learning. During the interview, when one of the coordinator participants was asked about what was the main difficulties in terms of administration in applying online learning, she clearly stated as follow:

> "*Unfortunately, there is no practical program for online quizzes or exams to test, evaluate, or assess our students during application of online learning as expected because it is the right procedure to get credible data. Application of online learning is new mode of teaching for schools where no program specified for doing quizzes or exams are tested, experienced, and evaluated by educators. Application and evaluation of those programs by teachers are necessity to know the strength and weakness in order to make the appropriate adjustment to those programs to get reliable data on students' performance in the lessons learned".*

As a consequence of the absence of a practical program for online quizzes and exams according to the interviewed teacher; principals, coordinators, and teachers took a firm decision that all

quizzes and exams are mandatory to be done in schools taking into account all the needed precaution for Covid-19, which allows teachers to supervise their students, to reduce the risk of cheating and get credible result.

Disagreement restricted to losing the opportunity to go to the lab to do experiment

Yates et al. (2021) argued that during the application of online learning due to Covid-19, Chemistry and Physics teachers give their students assignments as practical experiments to do in a safe way by asking them to use available and simple household products or objects. This type of assignment is authentic learning activities that allow students to put theory into practice which maximize their learning. The majority of the participants, 78.75% singled out that students not going to the lab to do experiment was a disagreement item not supporting integration of online learning in the school curriculum while revert to ordinary learning. Despite that the fact that application of online learning hindered students to practice in school lab the theory learned during online class that made lesson objectives strongly assimilated by them, teachers also struggled to not allowing students to lose this opportunity by downloading videos showing an experiment or asking them to try an experiment at home with simple product existing at home. During the interviews, one coordinator participant linked teachers' disagreement for the integration of this item to the following: several teachers are giving the same feedback in the filled evaluation form about application of online learning during pandemic that one of the disadvantage of online learning losing students the opportunity to go to the lab to do experiment that increase students learning effectiveness through putting theory into practice leading to integrate students in the real life.

Conclusion of Research Question Three

Different aspects of online learning application by sciences coordinators and teachers in middle schools during Covid-19 pandemic that were assessed revealed that some opportunities offered to educators in implementing online learning. There were a variety of responses on specified levels of opportunities, as very high, high, average, low, and very low, offered to teachers in implementing online learning in the eight sampled schools. Moreover, there were a range of teachers' disagreement and agreement restricted to certain reason items that teachers identified to give verification about their disapproval or approval to integration of online learning in the school curriculum when return to conventional learning at the end of Covid-19. According to the statistics provided, it was confirmed that online learning opportunities offering were arranged in groups of three level of opportunity such as teachers' professional development (very high opportunity), teachers' skills and awareness development (high opportunity), and teachers' reduced stress in everyday school (average opportunity). Furthermore, it was asserted that integration of online learning in the school curriculum when going back to normal learning was refusable or acceptable based on valid reasons determined by educators that relied on their teaching experience in online mode. Several opportunities available from application of online learning which offered to sciences educators in middle schools and added benefit to them were identified by participants. The principal participants, sciences coordinator participants, and sciences teacher participants cited novel teaching methods, recording teachers' class period, using various online resources, discovering educational technology tools, give teachers' instant feedback to students, development of teachers' technology skills, improvement of teachers' communication skills, presence of technology tools and programs in online platforms save teachers' time in their academic work, save teachers' commute time from home to school or vice versa, and choosing any place at home

where teachers feel comfortable to work. In the next section, the instructional approaches used by teachers in implementing online learning during Covid-19 were discussed.

The instructional approaches used by science teachers in implementing online learning

Research Question 4: By using the instructional approaches in implementing online learning could science teachers at middle school achieve their learning objectives more easily?

Research Question Four was set to solicit information about the instructional approaches (teaching, assignment, and assessment methods) that were used by sciences coordinators and teachers in the implementation of online learning in schools during Covid-19. Questionnaires and Interview schedule were used to solicit information from the principal participants, coordinator participants, and teacher participants.

Teaching methods approaches used by teachers to implement online learning

The findings derived from this section were based on the survey questionnaires and interviews with the sciences coordinator participants and sciences teacher participants. The Information gathered showed that educators used different teaching strategies to ensure the achievement of learning objectives in implementation of online learning that drive to boost school curriculum. This section presents data collected on the teaching strategies and how they were implemented by teachers during online learning.

It was revealed from the survey questionnaire that a number of teaching methods approaches were used by teachers to continue the learning process of students in implementation of online learning. Even though various teaching methods approaches were used, it was found that some of the teaching methods approaches varied from school teacher to school teacher as each teacher had different ways of application of lessons plan through online mode. The results in Table

8 revealed that 81.25% of the participants strongly agreed and 5% disagreed with the statement that using of direct instruction to teach students was one of the teaching strategies used by educators in schools while implementation of online learning. 3.75% of the participants across the eight schools were neutral and 10% agreed. No participant strongly disagreed.

Regarding all teachers share explanation lessons notes to allow students to review the material of the lessons after classes, the data revealed that 60% strongly agreed, 37.5% agreed and 2.5% of the participants were neutral. Followed by using teachers power point slides, 62.5% of the participants strongly agreed, 32.5 agreed and 5% was neutral. Also, using teachers of YouTube videos, 83.75% of the respondents agreed and 16.25% strongly agreed. Similarly, the use of pictures by teachers was identified as one of the teaching strategies, 12.5% strongly agreed, 85% agree and 2.5% were neutral. The use of word or pdf documents by teachers was also one of the teaching strategies, 82.5% agreed while 17.5% were neutral. Half of the participants, 50% agreed that doing class discussions was used in their teaching methods while 50% disagreed.

Furthermore, a significant number of participants, 80% agreed that using games in their teaching methods was a means of facilitating explanation of the lesson in implementing online learning while 20% were neutral. Relatively, 71.25% of the participants strongly agreed that they use audio visual media as a teaching strategy to explain a lesson, while 16.25% disagreed and 12.5% of the participants were neutral. Finally, the participation of students in explanation of the lessons through clarification, interpretation, demonstration as a way in getting students involve in lessons explanation in dealing with interaction and motivation problems was strongly agreed upon by 25%, while 72.5% agreed and 2.5% were neutral.

Table 8: *Participants' responses to teaching methods approaches used by teachers in implementing online learning*

Items	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
Using direct instruction	0	5	3.75	10	81.25
Sharing explanation lessons notes	0	0	2.5	37.5	60
Using Power Point slides	0	0	5	32.5	62.5
Using Youtube videos	0	0	0	83.75	16.25
Using pictures	0	0	2.5	85	12.5
Using Word or PDF documents	0	0	17.5	82.5	0
Doing class discussions	0	50	0	50	0
Using gamification	0	0	20	80	0
Using audio visual media	0	16.25	12.5	0	71.25
Students participation in explaining parts of the lessons	0	0	2.5	72.5	25

Even though there were different responses among participants, the data in Table 8 revealed that there was a multiple number of teaching methods approaches used by teachers during implementation of online learning. According to the interview with the sciences coordinator participants, it was revealed that the sciences coordinators of Biology, Chemistry, and Physics provided them with a number of teaching strategies based on the usage of technology which can be applied in class activities through online learning. Also, one of the principal of middle school participants highlighted the fact that when sciences teachers started applying online learning, they attended seminars given by experts in education to know how to teach online and how to use technology tools to apply different teaching methods to maximize students' understanding and performance in the subject learned through application of online learning. Considering the teaching methods approaches proposed by sciences coordinators, sciences teachers modify or apply different teaching strategies when managing their class activities to suit their students' needs. However, for teaching methods application through online mode to be effective, an integration of technologies must be needed. Karakaya et al. (2020) argued that different teaching methods and

techniques are used by Biology teachers in online learning as direct instruction, sharing of explanation lesson notes, demonstration method, and audio and visual materials through a specified online platform. Those teaching methods enable teachers to establish a positive relationship with their students and to increase their effectiveness in online learning by using audio and visual teaching materials. The use of technology tools to apply those teaching methods helps students to boost their understanding and skills in the lesson learned.

On the other hand, it was confirmed from the data gathered through the questionnaire that some teaching strategies were found to be helpful for sciences educators if not completely a power for them to implement online learning across the eight schools. They included: audio visual media, sharing explanation notes with students, and participation of students in lessons explanation. Others like fostering students' engagement and interest in the learning process. For example, using videos, pictures, animation, graphs, games and diagram, gave students opportunity to participate in the class session by explaining an idea, answering a question, and interpreting a result obtained, using power point in class activities, and doing class discussions like sharing views between teachers and students or testing students' assimilation of lesson objectives were utilized. Those teaching strategies increase students' benefit from online learning concurred with the views of Fauzi and Khusuma (2020) who observed in their studies that creating different types of audio visual media are teaching methods used by the most of the teachers in implementing online learning because it enables them to design a very effective and engaging teaching strategy to explain lessons to students. Using Audio visual media creates positive change and acquires experience in the learning process where teachers can employ animated images and graphic items as diagram, chart, and graph in their teaching procedure that make learning more interesting for students.

Assignment approaches used by teachers to implement online learning

The study also sought to establish the assignment approaches adopted by sciences coordinators and teachers in maintaining achievement of learning objectives among students in implementation of online learning leading to make certain positive modification in the school curriculum by integration technologies. Participants were asked to identify some of the assignment approaches from their own experience that they believed their school principals of academic affairs adopted in implementing the online learning among middle school students.

According to participants' responses to assignment approaches used by teachers in implementing online learning (see Table 9), it was clear that different assignment approaches supporting assimilation of learning objectives were employed by sciences educators at different levels. However, there were no convergent responses towards each of the assignment approaches. This could mean that each school principal had specific assignment approaches at a given time that fit their school's curriculum to achieve better learning objectives. From the data presented in Table 9, it can clearly be seen that most of the sciences educators in the sample schools encouraged a basic type of assignment to assist students to reach the objectives of the lessons learned through online mode. For example, it was indicated that giving problem sets including a group of basic level questions and another group of difficult level questions were given to students to allow them to assimilate the objectives of the subject learned. Also, analyzing the result of an experiment that promotes achieving the lesson objectives that increases students' critical thinking and understanding of the material of the lessons.

Relating to the importance of incentive assignment for reaching objectives of the subject learned in online mode, sciences educators are given to do practice of the theory learned such as doing safe experiment at home, project assignment related to the lesson, videotaping a practical

task to illustrate a theory explained in class, and this will encourage students to see that online learning allows them to practice what they learned through using technologies and integration in real life. Of most important was the achievement of learning objectives in online learning similarly to conventional learning through which sciences educators provide their students with practical assignment to integrate student in authentic learning by using suitable technologies. When teachers give an appropriate assignment, it becomes powerful for them to make students achieve the objectives of the lessons and retrieve them when cues are present. Other researchers such as Tang et al. (2021) supported the assertion that online learning environment consists of two learning contexts related to teachers: the lessons setting and assignments setting. The lesson setting is a platform used by teachers to deliver information and the lesson materials to the students. The assignment setting includes exercises, solving problems, or tasks given by teachers to assess the level of students' understanding required to be achieved in the lesson learned. In addition, Yates et al. (2021) affirmed that Chemistry and Physics teachers give their students assignments as practical experiments to do in a safe way by asking them to use available and simple household products or objects. This type of assignment is authentic learning activities that allow students to put theory into practice which maximize their learning.

However, there were mixed answers on the assignment approaches used to achieve learning objectives from participants as some of them said the assignment approaches put in place were not achievable even and other felt they were achievable. Coordinator participants and teacher participants' responses are summarized in Table 9 below.

Table 9: *Participants' responses to assignment approaches used by teachers in implementing online learning*

Items	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
Giving problem solving.	0	26.25	17.5	56.25	0
Giving practical experiments to do at home.	0	0	11.25	88.75	0
Giving problem sets including a group of basic level questions and another group of difficult level questions.	0	0	0	100	0
Giving project assignment.	0	13.75	13.75	72.5	0
Giving exercises.	0	30	20	50	0
Giving to answer questions as written tests.	0	65	10	25	0
Participation in online discussion.	0	63.75	6.25	30	0
Giving to write the lesson objectives.	70	15	0	15	0
Giving to analyze experiment results	0	22.5	10	67.5	0
Giving to make a videotape for a practical work.	0	27.5	10	62.5	0

According to the eight schools presented in Table 9, the top five assignments adopted by their sciences educators were giving problem sets including a group of basic level questions and another group of difficult level questions, where 100% of the participants agreed that they gave to students frequently problem sets assignment to allow them little by little to reach all the objectives of the lesson, followed by giving practical experiments to do at home to put theory learned into practice 88.75% agreed and 11.25% were neutral. Next was the project assignment to encourage exchanging information among students to help them achieve better learning objectives, 72.5% of the participants agreed and 13.75% disagreed while 13.75% were neutral, followed by giving to analyze experiment results to ensure attaining students learning objectives through critical thinking, 67.5% of the participants agreed and 22.5% disagreed while 10% were neutral. Altogether 62.5% of the participants agreed, 27.5% disagreed and 10% were neutral on the assignment given to students about making a videotape for a practical work, this was a motivation

assignment to boost students' achieving of learning objectives. In such type of assignments, a sciences teacher produces an upgrade in the school curriculum by integration of technologies in appropriate way to increase students' innovation and understanding of the concept learned during a class session. The fourth ranking assignment was problem solving, 56.25% of the participants agreed, 26.25% disagreed and 17.5% were neutral. The last of the fifth ranking strategies was giving exercises, 50% agreed, 30% disagreed and 20% were neutral.

On the statement about students were provided with an assignment to write lesson objectives, the responses showed that 15% agreed, 15% disagreed while 70% strongly disagreed. Regarding the assignment of participation of students in online discussion, 30% agreed while 63.75% disagree and 6.25% were neutral. Finally, 25% agreed while 65% disagreed and 10% were neutral with the statement that students were given to answer questions as written tests as a type of assignment.

Assessment approaches used by teachers to implement online learning

Further, the study examined the assessment approaches applied by sciences coordinators and teachers during online learning in getting credible data on students' achievement of learning objectives. Despite the difficulty of teachers to evaluate their students through online mode, an advantage change is done in the school curriculum concerning assessment of students through creating a rubric that includes an explicit set of criteria used for assessing any type of students' work or performance. Participants were requested to determine some of the assessment approaches based on their personnel experience that they convinced their school principals of academic affairs accepted to use those types of assessments in continuing regular teaching among middle school students during pandemic.

It was detected from the survey questionnaire that several assessment approaches were used by teachers to evaluate the students' assimilation of learning objectives through implementing of online learning. Regardless, different assessment approaches were practiced, it was revealed that some of the assessment approaches differentiated among sciences instructors from school to school as each teacher was oriented by the coordinator of the subject teaching toward what and how to choose an assessment method to be effective in online mode to get reliable data on students' outcomes and achievement. The results in Table 10 showed that 80% of the participants strongly agreed and 3.75% disagreed with the statement that using multiple choice questions to assess students was one of the assessment methods used by teachers in schools during conducting of online learning. 6.25% of the participants across the eight schools were neutral and 10% agreed. No participant strongly disagreed.

Concerning all teachers using extended matching to allow students through analyzing what they learned to choose the reasonable answer, the data disclosed that 65% strongly agreed, 30% agreed and 5% of the participants were neutral. Pursued by applying online quizzes to assess students, 62.5% of the participants strongly agreed, 32.5% agreed and 5% were neutral. Half of the participants, 50% agreed that submission of students' assignment is an assessment strategy to evaluate students' comprehension while 50% disagreed. Moreover, an important number of participants, 80% agreed that true-false tests were used in their assessment methods as a means of identifying the weakness and strengthen areas of students' assimilation of the materials lesson explained during online classes while 20% were neutral. Similarly, 75% of the participants strongly agreed that they use project presentation as an assessment strategy to evaluate the level of creativity and achievement of students in the lesson learned, while 15% disagreed and 10% of the participants were neutral.

On the other hand, as to whether sciences educators did online exams as a summative assessment to evaluate students learning objectives and academic achievement, 20% agreed while 70% disagreed and 10% was neutral. With the statement of submission of students' portfolio to assess students' academic work, only 22.5% of the participants agreed while 61.25% strongly disagreed and 16.25% were neutral. Of the responses given regarding problem sets as an individual assignment that promotes evaluating students' understanding by solving problems, 35% agreed, 35% disagreed while 30% were neutral. Finally, when participants were asked about application of the assessment strategy discussion forums, 15% agreed while 77.5% disagreed and 7.5 of the respondents were neutral. Table 10 represents the distribution of participants' responses.

Table 10: *Participants' responses to assessment approaches used by teachers in implementing online learning*

Items	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
Multiple choice questions	0	3.75	6.25	10	80
Extended matching	0	0	5	30	65
Online quizzes	0	0	5	32.5	62.5
Submission students' assignment	0	50	0	50	0
Submission students' portfolio	61.25	0	16.25	22.5	0
True-False tests	0	0	20	80	0
Project presentation	0	15	10	0	75
Online exams	0	70	10	20	0
Problem sets as an individual assignment	0	35	30	35	0
Discussion forums	0	77.5	7.5	15	0

Even though there were different responses among participants, the data in Table 10 revealed that there was a large number of assessment approaches used by sciences educator in implementing online learning. According to the interview with the principal participants of intermediate school, it was found that online mode demands from teachers to think carefully what to adopt as assessment methods to evaluate students to get credible data and how to apply the assessment

chosen with the minimum risk of students cheating. Also, one of the sciences coordinator participants expressed concern over the fact that teachers create an exam plan based on assessment strategy adopted including a limited duration of exams, specific questions with different level, and the question was distributed randomly to students. Considering the exam plan created aims to assess students' understanding, achievement, and competencies in order to have a valid data with less possibility of cheating. Khan and Jawaid (2020) discussed that multiple choice questions as single best answer, one correct response, extended matching is an assessment method used in online learning to maintain equivalent assessment of traditional methods. Multiple choice questions applied by teachers online on a prearranged date and for a specific duration of time to assess students' knowledge. This method helps teachers assess the level of cognitive thinking skills of students depending on how they construct their multiple-choice items. Furthermore, Guangul et al. (2020) stated that application online quizzes can easy randomize the questions by using various educational software platform that decrease the risk of cheating among students. Finally, Lapitan Jr et al. (2021) argued that teachers in Chemistry subject used problem sets as an individual assignment given to the students that contains a certain number of questions to solve in a fixed time then send to teacher to evaluate their students during online learning. This kind of self-assessment allow students to understand theory, practice problem solving and develop knowledge in Chemistry field. Those assessment questions are aligned with lesson objectives that enable teachers from each student outcome to know the level of assimilation of the material lessons.

On the other hand, it was confirmed from the data gathered through the questionnaire that the following assessment methods were found to be useful if not completely beneficial across the eight schools. They included: online quizzes, online exams, project presentation, and submission of students' assignment. Other methods like continuous students' assessment for example,

multiple choice questions, extend matching, true or false, doing presentation, problem sets, and discussion forums were applied. These assessment strategies to get trusty data about students learning outcomes concurred with the views of Karakaya et al. (2020) who observed in their studies that Biology teachers applied in online learning several measurement techniques and assessment methods as multiple-choice tests, true-false tests and matching for summative evaluation, and project presentation and online exams for formative evaluation, to assess the level of students' learning and their competencies. However, it has to be noted that despite the implementation of many assessment strategies during online learning to keep students learning, the level of students' achievement of learning objectives may not be higher.

Improvement in achieving learning objectives by application of instructional approaches above during online learning.

To know if online learning improves students' achievement of learning objectives by using instructional approaches which rely on using technologies comparing to conventional learning, participants were asked about the extent of instructional approaches (Teaching, Assignments, and Assessments methods) used for online learning in improving the achievement of learning objectives by comparing to conventional learning method. The sciences coordinator participants and teacher participants were asked to provide their answers using the scale ranging from 1 to 4 in which 1 for 'Very highly improved', 2 for 'Highly improved', 3 for 'Medium improvement' and 4 for 'No improvement'.

The results shown in Table 11 were the responses of sciences coordinator participants and teacher participants on improve students' achievement of learning objectives. Seventy-two (90%) of the participants indicated that instructional approaches used for online learning make medium

improvement. From this percentage, one can deduce that application of online learning was complemented to face-to-face learning and this proves that integration of technologies in the school curriculum needed to support teachers to put students on the right track toward achieving of learning objectives.

Table 11: *Distribution of Participants' response to what extent is the instructional approaches (teaching, assignments, and assessments methods) used for online learning improve the achievement of learning objectives by comparing to conventional learning method.*

	Frequency	Percent	Valid Percent	Cumulative Percent
Very highly improved	0	0		
Highly improved	0	0		
Medium improvement	72	90	90	90
No improvement	8	10	10	100
Total	80	100		

Moreover, 8 (10%) of the participants indicated that instructional approaches used for online learning make no improvement. From the available statistics, one can infer that ordinary learning was the favorable teaching platform for teachers supporting educative technologies to increase teachers' effectiveness in the classroom.

Medium improvement was confirmed by the sciences coordinators during the interview who expressed concern that application of online learning during pandemic was not completely achieved learning objectives as normal learning. Also, according to the coordinators, often in faculty meeting, teachers commented that one of the problems of online learning was absence of interaction, interpersonal relationship, and eye contact that decrease the level of students' achievement. In other words, there was no live communication between teachers and students to enhance students' abilities to reach the objectives of the lessons. It was further elaborated that face-to-face learning remained the number one for teachers to allow students to achieve better learning objectives by integration of effective technologies experienced during online learning in the school

curriculum such as videos, pictures, games, power points, graphs, and animation. Accordingly, this evidence that online learning cannot replace face to face but it can be combined with conventional learning to improve the achievement of students' learning objectives.

Conclusion of Research Question Four

Research Question Four discussed the various instructional approaches (teaching, assignment, and assessment methods) adopted by sciences instructors in implementing online learning in middle schools in Lebanon. It was revealed from the questionnaire that different instructional approaches were used by sciences educators during application of online learning to provide students with continuous and effective achievement of learning objectives in the subject learned. However, it was also confirmed that the instructional approaches used by the sampled schools varied among sciences teachers from school to school, given that academic guidance of sciences coordinators was never the same as each school sciences coordinator had specific characteristics, point of views, and techniques on how to apply learning through online mode that made it different from others. As mentioned by a sciences coordinator in the interview, all types of instructional approaches used during online learning have the same pedagogic purpose to empower teachers to boost students' engagement to reach the objectives of the lessons learned through online platform. However, each sciences coordinator has his/her own academic point of views, styles, and strategies on what to choose and how to apply those instructional approaches. As well, each sciences coordinator takes into consideration the teachers' feedback in applying those instructional approaches to identify the weakness and strength. Based on the criteria identified and the personal academic perspective of coordinators, sciences educators were oriented

toward adopting an appropriate type of instructional approaches that motivate students and improve their achieving of lesson objectives, so, instructional approaches were not the same.

Even though there were instructional approaches adopted in all the sample schools to enhance students' achievement objectives of the lesson learned in online learning, the problem remained that the instructional approaches were not effective to improve achievement of learning objectives among students in online mode. In the next section, the Research Question Five, recommendations for effective application of online learning are discussed.

Recommendations of an effective implementation of online learning

Research Question 5: What recommendations should be made to implement effective online learning?

The researcher asked the participants to give their views in the previous question about the challenges they encountered to suggest ways in which the problems could be overcome. Research question five was to find out some recommendations to resolve the challenges faced by sciences educators of middle schools in the implementation of effective online learning.

Out of the 100 participants, a total of 80 responded to this section. Figure 3 presented the different recommendations of the participants on how to enhance the implementation of online learning based on the different challenges that they encountered to make the online learning successful.

Dealing with problems being encountered is one of the best methods to be done in order to solve a particular problem. Given the problems that are frequently associated with the management of application of online learning in middle schools in the Lebanese setting, it was of greater significance to investigate how these problems were being manifested and addressed in the real world of teaching and learning, and to establish the extent to which they appeared amenable to

resolution. Hence, giving the appropriate solutions to a problem would lead to a successful program and could give a positive outlook towards quality and effective integration of online learning in the school. Thus, recommendations to encourage the integration of the effective online learning in school curriculum was very relevant to this study. This was the key to achieve the objectives that were stated in chapter one. Figure 3 presents the different recommendations from the participants on how to achieve effective integration of online learning in school curriculum.

The data generated revealed that an overwhelming majority of participants, 77 (96.25%) opted the implementation of a more comprehensive and advanced pedagogic design to re-arrange lessons, assignments, assessments through online mode, would be the best option to integrate online learning in conventional learning by making positive rearrangement in the school curriculum. This supports teachers' productivity in their class activities that improve students' achievement of learning objectives. Seventy-six (95%) participants believed that training programs for teachers to develop their digital competence should be planned, increasing teachers' technologies skills in education would be one of the contributing factors to the effective integration of online learning in conventional learning. This implied that when school curriculum was strongly upgraded, this would improve teachers' professional development which empowers them to apply different teaching strategies ensuring students' assimilation of the lessons objectives.

Training programs for teachers about methods of conducting online classes should be planned as one of the corrective measures was rated at 75 (93.75%). This is in line with the fact that teachers' preparedness to conduct online learning plays a greater role in making significant improvement in the school curriculum by integration of online learning in face to face learning as such teachers possessing the requirement skills of using technologies in teaching must assist students to attain lessons objectives and engage them in the learning process. The views of the

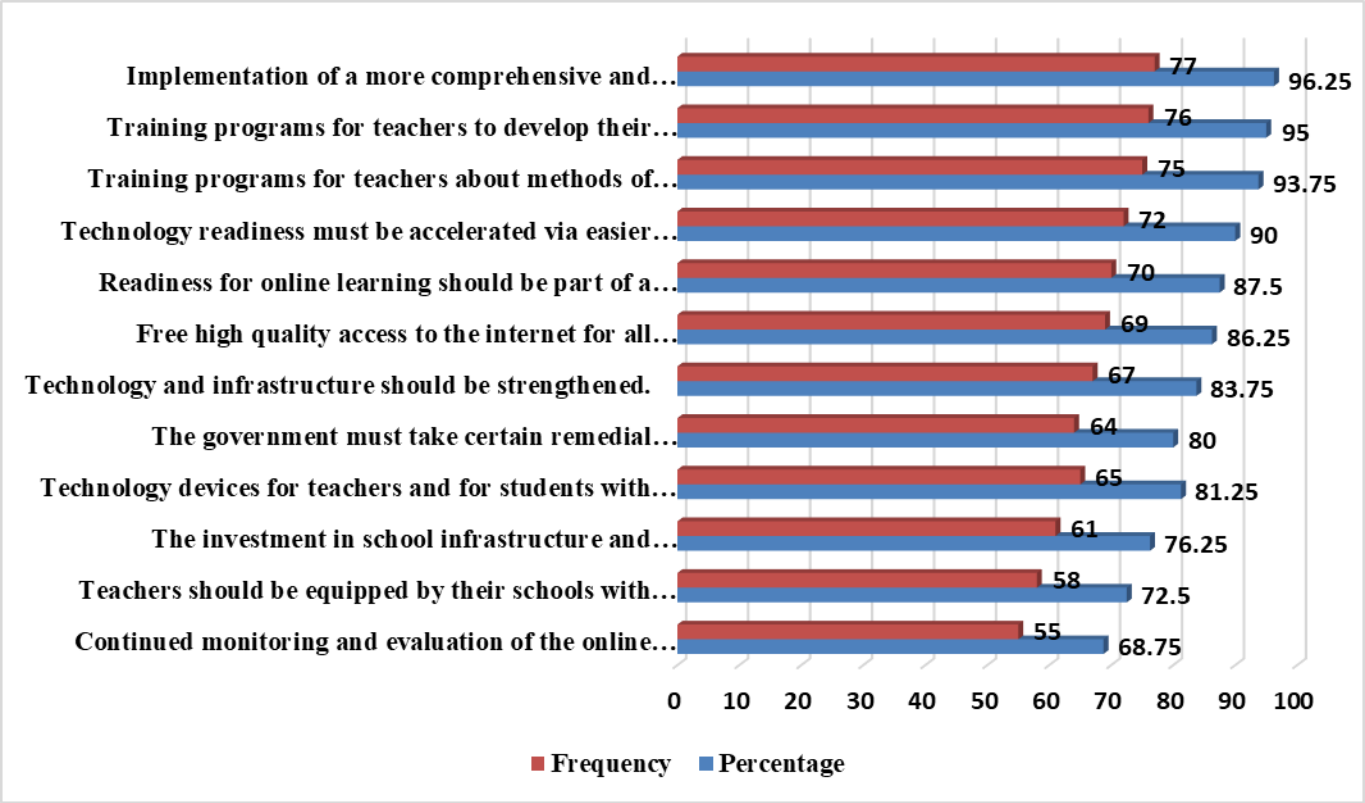
participants are thus consistent with Rouadi and Anouti (2020) who argued that online learning supports and facilitates learning and teaching activities for both teachers and students, but there is a dire teachers' need for pedagogical competency, technical capability, preparedness to online teaching, and the presence and the usage of technology tools more efficiently. Online learning was completely new for Lebanese teachers who did their best to teach online in efficient possible way but various difficulties faced them in implementing it.

Other recommendations identified by participants to avoid ineffective integration of online learning in the school curriculum to improve students' learning in ordinary classes included technology readiness must be accelerated via easier and more widespread access to the Internet and the provision of Internet networks, 72 (90%), and readiness for online learning should be part of a school's strategy, 70 (87.50%). Most of the participants also felt that problems in having good internet connection and cost for internet services for teacher and students are valuable to be supported by schools because of the efficacy of integration of online learning in school curriculum. This integration creates development in school curriculum that acquires teachers several features can be applied in their class activities to create an engagement learning environment to raise students' performance and outcomes. Several, 69 (86.25%) of the participants, suggested that free high quality access to the internet for all teachers and students should be the main criteria in the minds of school institutions. Another portion, 67 (83.75%) of the participants also felt that the successful integration of online learning in the school curriculum is by strengthening technology and infrastructure. Technology and infrastructure are the main components of any use of online learning. Without technology and infrastructure, there is no online mode. From this point of view, having them readily available will support teachers to implement different teaching strategies to reinforce students' achievement of learning objectives.

Furthermore, 64 (80%) of the participants suggested that the government must take certain remedial measures to overcome the challenges faced in online learning. The government's support for integration of online learning in the school curriculum is needed based on an official strategic planning distributed to schools with the ability to be modified depending on the needs of each school community. This can lead to a formal integration of online learning in normal learning with using its appropriate characteristics in teaching to maximize students' benefit from learning process. 65 (81.25%) of the participants were of the view that technology devices for teachers and for students with economic disadvantages are put in place in order to stimulate equity. Technology tools with affordable prices for all teachers and students in service would promote effective integration of online learning in conventional learning. 61 (76.25%) considered that the investment in school infrastructure and technological equipment should be increased, especially in LMS, communication systems and digital content as another way of achieving effective integration of online learning in face to face classes through producing modification in the school curriculum. Given that the integration of online learning in the school curriculum allowed teachers to specify in their lesson plans the materials and facilities needs to apply suitable features offered by online learning to foster the benefit of students in the learning process. This requires from schools to put at disposition of teachers all the usage tools related to computer hard- and software. Thus, another number 58 (72.5%) suggested teachers should be equipped by their schools with computer hard- and software that are necessary for online teaching. Finally, continued monitoring and evaluation of the online learning education program would be a great help to enhance the system of delivering education by teachers, were rated 55 (68.75%). The constant evaluation of integration of online learning in conventional learning was to assess and to tackle the problems being encountered in the process of integration of online learning in the school curriculum. All suggestions made by the

respondents if integrated, would go a long way in succeeding integration online learning features that are making evolution in the school curriculum to increase investment in students' learning.

Figure 3: *Participants' responses on recommendations to achieve effective integration of online learning in conventional learning.*



The findings discussed in Figure 3 were in agreement with the view of Lewis et al. (2015) who found that developing the strategies needed to teach and learn online successfully demands to have an understanding of learning styles and how they can be applied effectively in the online environment. In fact a teacher must overcome all the barriers that occur in online learning responsively in order to keep the learning process on the right track towards to achieve the targets set (Aliyyah et al., 2020).

Similarly, the suggestions corresponded with those of See et al. (2020) whose study acknowledged that preparation of lessons to be given online demands new design that includes sourcing for suitable teaching resources for online teaching and setting up appropriate platforms

for delivery. According to Portillo et al. (2020) and Al Kodri (2021), the need for proper Digital Competence for Educators is a major requirement to avoid the disruption in teaching-learning processes via online learning during the pandemic. The findings of the study showed that sciences educators in the sample schools hardly conduct online learning to continue delivering knowledge to students, and that was why the majority of the principals and coordinators who were interviewed mentioned that the online teaching made a medium improvement in the achievement of students' learning objectives comparing to ordinary learning.

Ali (2020) was of the view that it is necessary to indicate that to deliver effective online and blended learning there must be available of adequate ICT support in way of infrastructure and learning tools as well as hardware and software support system. The findings of the current study, however, contradict that of Ali (2020) where in the sample schools, availability and accessibility of hardware and software technologies, and good internet connection were not provided to sciences teachers to conduct online learning in appropriate way. It was also revealed that the investigated schools did not support teachers' readiness for online teaching mode through processing a strategical plan in the school curriculum for implementation of online learning including the process and the tools required to run smoothly in order to facilitate its application if there was a need. This has also contradicted the view of Alea et al. (2020), who proposed in their study on teachers' Covid-19 awareness in Philippines schools that the presence of facilities, equipment, and capacity building to online learning education, such as having stable internet access, presence of phones, laptops, and tablets or any devices, existence of Learning Management System, and attending a training or workshop on online learning education management, boost teachers' readiness to online learning education. Teachers should be well-equipped and ready for online learning, this results in raising their ability to offer online learning education successfully.

From the interview, when the principals and coordinators were asked about their suggestions to integrate online learning in conventional learning, the majority of them opted for an online learning pedagogical design combined with face to face learning school curriculum and teachers' training programs, but they also complained about the lack of school funding to finance online learning integration in normal learning. When responses were compared from the interview, most of the principals and coordinators confirmed that for online learning integration to become effective, it must always be emphasized, which entails the following: first, equipping teachers with appropriate technologies. Second, educators should attend seminars or workshops to know about online learning features to be merged in face to face learning to increase educators' effectiveness in their classroom management. Third, principals should create awareness within the school community regarding renewal teaching strategies through integration of online learning leading to new ways to deliver learning to students.

The interview between the principals and sciences coordinators of middle schools and the researcher had the following in as far as integration of online learning in ordinary classes was concerned. When further asked to explain the possible ways of achieving effective integration of online learning in conventional learning school curriculum, one principal reiterated that the administration gave teachers a room to form governing councils which represented their approved items experienced from application of online learning during pandemic needed involvement in school curriculum of normal learning, there uploaded suggestion form about integration of online learning in face to face learning in the school website page where students, teachers and parents' suggestions were submitted and taken into consideration when selected features from online learning to be integrated in the school curriculum of normal learning, and also the school authority gave teachers an opportunity to engage in open forums and debate to voice their opinions based

on their personal experience during application of online learning some of which were incorporated in the acceptance adoption and integration of certain items from online learning in conventional learning.

Proposed strategic plan to integrate online learning in conventional learning

On the whole, the principal participants, sciences coordinator participants, and sciences teachers overwhelmingly agreed to the effectiveness of measures like updating school curriculum, training teachers, teachers' preparedness, availability of technology, online learning integration continuous evaluation, etc., to improve the integration of online learning in conventional learning and their implementation. Based on the objectives of the study and the proposed recommendations from the participants, the researcher was convinced of the need for schools to draw up a new strategic plan for integration of online learning in conventional learning in middle schools that would be implemented in the way they supposed to be implemented. The objective of integration of online learning in conventional learning is to ensure that teaching and learning is made updated to meet the needs of 21st century educators and to give each one an opportunity to achieve professional development in the teaching field. In so doing, schools where teachers play a significant role in building a future generation well educated to become an active citizen participate in developing country must take responsibility to eliminate any difficulty that is capable of withholding such a vision. In the case of Lebanon, however, the online learning during Covid-19 applied by sciences teachers in middle schools had not being realized.

Furthermore, developing a strategic plan should not be only the principal's responsibility. It is important that it is not just one member of faculty who writes the strategic plan. The strategic plan would be more meaningful if developed in consultation with coordinators, teachers, students,

parents, and Education specialists. The proposed strategic plan on integration of online learning in conventional learning was described as follows:

	Proposed goals	**Accomplishments**
Curricular Development	Introducing new teaching strategies …. e.g. YouTube videos, animations, graphs. Reviewing sciences program curricula.	- Placement of active boards in the classrooms that permit teachers to use novel teaching methods as follows: 1) Videos 2) Animated videos or pictures 3) Graphs 4) Diagrams - Reviewing sciences program curricula: Biology subject, Chemistry subject and Physics subject. Based on reviewers' comments, the coordinator of each subject will propose curricular changes (including games by using students technology related to the lessons learned and asking from students to make a video tape as a lab report to submit to the teachers that explain the results will be obtained in doing the experiment in Lab.) to improve students' assimilation of the learning objectives. - Accreditation of schools requires revision of the sciences subjects (updating of the lesson plans will be a demand where technologies will be integrated.)
	Developing the existing sciences program curricula (involves revision of program curricula by integration of educational technology); improving teaching methodologies (render more interactive with using technologies	Existing Sciences program curricula will be revised by asking from sciences teachers to fill an evaluation form about integration of online learning in conventional learning. A school committee including principals, coordinators, and teachers will make

	to meet students' needs of 21st century.)	decisions about what and how integrate technologies in the teaching and learning process based on the results and feedbacks will be obtained from the evaluation form.
Enhancement school facilities	Providing a good internet connection during the school days.	- This is by setting up a solar power system in school to provide teachers with electricity and high speed internet connection during all the school day with low cost.
	Establishment of a business agreement between school and computer company.	- Signing a contract with a company that imports technology tools to buy school, teachers, and students technology equipment with affordable prices.
	Building a good IT department in school	- Processing an IT department in school is necessity to support teachers and students in resolving technical problems, downloading educational app, renewal software.
	Allocate budgets or bring funds for school to support integration of technologies in the school curriculum.	Part of the school annual budget or part of school funds will be allocated to plan for integration technologies in teaching strategies.
Teachers' professional development	Inviting experts in educational technology to train teachers what and how to use technologies in the class activities.	- Doing training for sciences teachers on what and how features from online learning can be applied in normal learning to increase students' engagement in the learning process. - Receiving invitation from schools abroad that invite sciences Lebanese teachers to spend a week in a school abroad to make supervision to learn and observe how foreign teachers use technologies in their teaching strategies. - Technology training for teachers to acquire them with skills and competencies needed to use

		technology smoothly in their class activities.
Students' awareness about the appropriate use of technologies	Organize a debate discussion with students where students are involved to create knowledge about the proper use of technologies.	The principal of middle school will arrange a debate discussion with students twice per academic year to encourage students to use technology in their learning properly.
Extracurricular	Establishment of student clubs of using technologies in education.	Applying the process of establishing a Biology, Chemistry, or Physics club among student that use games, educational app, online quizzes competition among students, etc.

Conclusion of Research Question Five

Application of online learning during Covid-19 pandemic in middle schools in Lebanon had not been effectively dealt with, which necessitated the current study. Eight middle schools were investigated and their challenged were found. Recommendations were made by participants to promote the integration of online learning in conventional learning leading to make a significant improvement in the school curriculum. It is hoped that this proposed strategic plan outline and its strategies for integration and implementation of online learning in conventional learning would be embraced, adopted and put into practice.

Summary of Chapter Four

This chapter presented the qualitative findings for the study, arranged using broad themes such as the extent of teachers' preparedness for application of online learning, difficulties teachers' facing the implementation, available opportunities for teachers from the implementation, instructional approaches used by teachers to implement the online learning, and some recommendations from teachers' perspective to achieve effective integration of online learning in conventional learning in middle schools in Lebanon.

The next chapter summarized the study and drawn conclusions pertaining to the research questions, based on data collected. The chapter also concluded by making recommendations based on the findings of the study. Areas for further researched were also discussed.

CHAPTER FIVE

Conclusion

Introduction

The preceding four chapters dealt with several aspects pertaining to the research problem. This chapter presented a summary of the findings of the study, conclusions made from the findings, implications, limitations, recommendations of the study and suggestions for further studies.

Summary of the study

The study aimed to assess the application of online learning during Covid-19 pandemic from sciences teachers' perspective in middle schools in Lebanon. Eight middle schools were used for the study. This study used the descriptive survey design because the researcher could not investigate every member of the population. The sample consisted of eighty participants which included fourteen sciences teacher and coordinator participants and sixty-six sciences teacher participants. Questionnaires and structured interview guide were used to collect data. The questionnaires were administered to the sciences coordinators and sciences teachers, and the interview was conducted with the principals and sciences coordinators of middle schools. All the information collected from each of these was organized and analyzed using tables and figures. The researcher used both descriptive statistics and content analysis of data. The analysis of the data enabled the researcher to come up with the following findings based on the five research objectives.

Objective one

Teachers' preparedness for application of online learning

This objective was to assess teachers' preparedness for application of online learning in the sampled schools. Since the implementation of online learning was due to the Covid-19 pandemic which created an emergency situation in education sector by putting the teaching and learning process at risk of discontinuity. The finding of the study revealed that each sciences coordinator and teachers of the eight schools investigated admitted that application of online learning was the first experience as a response to the EiE inducing online mode which it was highly effective to be implemented to safeguard the continuity of students' learning during this crisis time.

However, despite the effort made by the schools to support teachers in academic work and usage of technologies in conducting online learning through sciences teacher committee and IT department were placed on standby for solving problems and answering questions, there had still been difficulties facing sciences teachers which imply that the implementation of online learning decrease teachers' effectiveness to allow students to achieve lesson objectives as in conventional learning. To fully understand the extent to which the implementation of online learning by sciences teachers were prepared, the study investigated the participants' level of use of the online learning mode before Covid-19. According to the findings, a low level of use of online learning before Covid-19 was found among participants which, in the view of the researcher, was very worrisome since it would be difficult for sciences teachers to fulfill the aims and objectives of the application of online learning without having full experience in using it. In relation to the teachers' preparedness of application of online learning needed the availability technology tools, the study also sought to establish if the online learning tools were very highly available, it was revealed that the application of online learning had been delayed by 2-3 weeks of school closure and the tools for online learning were moderately available. This implies that even though application of online learning was highly effective to ensure delivering learning to students during pandemic, schools

and teachers were not equipped with the required tools to conduct online learning. It also meant that the use of technologies in education in ordinary learning was very limited, which lead to make the school curriculum was outdated to meet the needs of the 21st century educators and learners.

Objective two

The challenges encountered by sciences teachers in implementation of online learning

The objective had to explore the challenges that sciences coordinators and teachers encountered during the implementation of online learning process and established the factors that contribute to the problems that sciences educators are faced with. The findings revealed that there were a number of challenges faced by sciences educators which were classified into three levels. Teachers' tools for application of online learning very high challenging level identified by participants included effective assessment tools to evaluate students' learning, internet connection, and equipment for online learning. Teachers' academic work high challenging level including digital competence to apply online learning, modify lesson plan, heavy workload for teachers, get credible data on students' performance, and external distractions was mentioned by the participants. Teachers-students' relationship average challenging level containing interaction between teachers and students, and build interpersonal relationships between teachers and students was determined by the participants.

Objective three

The available opportunities for sciences teachers in implementation of online learning

Objective two was meant to highlight on the available opportunities for sciences teachers in implementing online learning. The finding revealed that the available opportunities were

arranged in a series of three groups as follow: first, teachers' professional development as very high opportunity including novel teaching methods, recording teachers' class period, using various online resources to apply different learning styles, discovering educational technology tools, which teachers can integrate in normal classes, and give teachers' instant feedback to students. Second, teachers' skills and awareness development as high opportunity covering development of teachers' technology skills, improvement of teachers' communication skills, and presence of technology tools and programs in online platforms save teachers' time in their academic work. Third, teachers' reduced stress in everyday school as average opportunity containing save teachers' commute time from home to school or vice versa and choosing any place at home where teachers feel comfortable to work. In addition, opinions of sciences teachers based on their personal experience if online learning can be integrated in the school curriculum to be used in conventional learning when Covid-19 ends were specified that included agreement and disagreement items. Teachers agreed that they can integrate the following items: downloading videos related to the lessons, posting explanation notes for lessons, putting assignments to students, and posting teachers' feedback on each student in class. They also suggested that some items can not be integrated in normal learning and those including; explaining lessons or solving problems, losing doing quizzes and exams on paper, and losing the opportunity to go to the lab to do experiment.

Objective four

Instructional approaches used by sciences teachers in implementation of online learning

Objective four was to determine the instructional approaches (teaching methods, assignment, and assessment approaches) used by sciences teachers in implementing of online learning. The results showed that sciences teachers applied various instructional approaches in

teaching to deal implementation of online learning. Some of the instructional approaches used by sciences teachers in schools included sharing explanation lessons notes, using videos, using games, giving problem solving, giving practical experiments to do at home, online quizzes, and project presentation. Even though these instructional approaches were utilized by sciences teachers in online mode, they proved not to have increased the level of achievement of learning objectives among students regarding normal learning. This indicates that the instructional approaches used in online learning limited teachers' effectiveness in engaging students' learning to improve the achievement of lesson objectives by students in regard to conventional learning. However, face to face learning remained the fundamental mode of teaching and online learning was complemented to it where several features from online learning were given approval by sciences teachers to be integrated in the school curriculum. This definitely leads to make development in the school curriculum and to provide support to teachers in given instruction during their normal classes that accomplished one of the teachers' pedagogical goals was boosting students' achievement of the learning objectives.

Objective Five

Recommendations to achieve effective integration of online learning in conventional learning

The fifth object aimed at explaining ways in which the integration of online learning in conventional learning could be effective to improve school curriculum and achievement of students' learning objectives. The participants gave their suggestions on what they felt should be done. From the findings, the need for a well-developed strategical plan to integrate certain advantageous items used during online learning in normal learning emerged strongly among participants. Other suggestions included high level of supporting teachers with appropriate

technologies needed, training programs for teachers to know what and how features in online learning to integrate in conventional learning to be beneficial for students, involvement of students and parents in giving suggestions about items could be integrated. Also, teachers participation in decision making, spreading awareness about new learning methodologies combined between traditional learning and online learning among students and parents were suggested by participants.

Conclusions of the study

Based on the findings, the following conclusions were drawn:

1. All the sampled schools had implemented online learning during Covid-19 pandemic to ensure continuity of the learning process for students but the application of online learning was challenging for sciences educators.
2. Absence of strategical plan in the school curriculum for application of online learning was perceived by participants as a drawback to it.
3. Application of online learning in all the schools was new mode of teaching. Sciences educators suffered from the availability and accessibility to the essential components needed in conducting online learning. The elements that were strongly required included: hardware, devices, software, online platform, internet connection, and technologies.
4. Application of online learning relied on technologies that not officially integrated in the school curriculum to increase the familiarity with technology by implementers and competency of use technology by implementers.
5. Participants lacked the awareness and experience of conducting online learning, thereby limiting their knowledge about the online learning mode and ways of implementing the online learning.

6. The application of online learning mode in the eight schools was poor with the most common forms of inadequate running of online learning absence of interaction between teachers and students, low teachers' competence in using technologies, lack of effective assessment tools to evaluate students, bad internet connection, limited availability of technology tools, teachers unawareness of conducting online learning, and interruption of teachers during giving online classes.
7. The available opportunities for sciences educators in implementing online learning were: novel teaching methods based on audio visual media, using educational technology tools, giving teachers' instant feedback to students, development of teachers' technology and communication skills, and saving teachers' time in their academic work when needed to enter data or retrieve data.
8. The most common instructional approaches used by sciences teachers in implementing online learning were: using videos, audio visual media, and games, sharing explanation notes, participation of students in the explanation of the lessons, giving problem solving, giving practical experiment, giving project assignment, online quizzes, and project presentation.
9. The integration of online learning in conventional learning was given a restricted approval by sciences teachers on specific features experienced in online learning. They highly agreed to integrate certain items used in online learning to normal learning because based on their own experience integration of those items produce an upgrade in the school curriculum and improvement in students' achievement of learning objectives.

The implications of the study

The purpose of the study was to assess the application of online learning during Covid-19 pandemic in private middle school in Lebanon. In doing so, the researcher explored the readiness of sciences teachers for application of online learning, challenges encountered by sciences teachers, opportunities provided to sciences teachers, instructional approaches used by sciences teachers, and recommendations to achieving effective integration of online learning in conventional learning. The study revealed that all the sample schools applied online learning to ensure continuity of students' learning but this application lack of a strategical plan in the school curriculum to be implemented effectively. Several challenges were identified by participants which included equipment for online learning, digital competence to apply online learning, interaction between teachers and students, etc. According to the findings, some actions such as using rotation mode to make sure that there is always an IT expert available in the school to support teachers and resolve any emergency, providing all the necessary infrastructure (rooms, power, internet connection…) that can be used anytime by teachers to give any online session, provide trainings etc. have been applied to provide support for teachers and minimize the challenges faced by teachers during conducting online learning. However, from what was discovered from this study, few implications were made from the problem of application of online learning among middle school sciences teachers.

First, the study found out that awareness of the online learning features to be integrated in conventional learning was very low among school principals, sciences coordinators, and sciences teachers. This study implies creating awareness to coordinators, teachers, students, parents and other stakeholders. As far as the researcher is aware, no study has been carried out on a similar topic of application of online learning during Covid-19 with a focus on some online learning

features chosen to be integrated in normal learning based on sciences teachers experience of middle schools in Lebanon. If this result is utilized, coordinators, teachers, students, parents and other stakeholders will become aware of the importance of integration of online learning in conventional learning that is capable of improving school curriculum and students' achievement of learning objectives.

The second implication of the study was other Lebanese researchers. Only a few studies related to application of online learning during Covid-19 have been carried out in Lebanon. This study, then, contributes to this growing body of research. The main implication of the current study is that it is the first local study that provides findings from well-designed research on school principals', coordinators and sciences teachers' perceptions towards taking advantage from implementation of online learning during Covid-19 through integration of educational technology in the school curriculum to increase teachers' effectiveness in the classroom leading to raise the level of achievement of lesson objectives by students. As well as their views on the recommendations for future Lebanese sciences educators. This result can be used to inform local researchers to derive other areas of studies about the benefit of application of online learning during Covid-19 on curriculum in schools. The study has also yielded up-to-date information on school principals', sciences coordinators' and sciences teachers' difficulties and instructional approaches used in implementing online learning, which all add to the limited literature on beneficial online learning implementation in Lebanese middle schools. This study will be significant to the local and international researchers to explore more on the beneficial application of online learning as far as school curriculum and students' achievement of lesson objectives are concerned.

Third, the results imply to provide middle school principals with an understanding of the challenges other principals deal with and that the application of online learning problems that one school encounters are not limited to that school, but is a general phenomenon within the education system. Also, conducting this study has provided coordinators and teachers with the necessary knowledge on what application of online learning problems they face, how to deal with these challenges and how to benefit from this experience to develop the current school curriculum to make a great improvement in achieving learning objectives by learners.

The fourth implication of the study was the MOE and school curriculum planners. It was discovered through the study that the MOE does not make any update in its national school curriculum to integrate educational technology in primary, middle, and secondary schools. If this result is read, it will provide the Ministry and its school curriculum planners with an opportunity to understand the challenges middle school principals and educators faced on the field due to their inability to provide specific educational technology instructional materials and competency needed to use technologies that will support school principals and educators on how to deal with application of online learning during Covid-19. This result will be an avenue to school curriculum makers to consider the issues of application of online learning during Covid-19 as relevant when they are updating national education school curriculum for schools.

Limitations of the study

The research was conducted on the application of online learning during Covid-19 in eight middle schools. The study was confronted with few limitations. First, an obvious limitation of the study is the small size of the sample that not represent the entire education population and schools. The study was geographically limited to private Lebanese schools and the sample was limited to only eight Catholic private middle schools in one community. Therefore, the results cannot be

generalized to the population at large. Second, there was a limitation during the administration of the questionnaire and interview. It was noticed that some of the participants did not submit their survey and some filled but did not answer up to 50% of the questionnaire. For the interview, instead of 11 principals and 22 coordinators, only 4 principals and 2 coordinators were able to show up. Third, Coronavirus pandemic and the economics and financial crisis in Lebanon affected strongly the education sector where all school leaders were busy in solving their problems faced in the process of data collection. Due to the hard situation during the data collection, the researcher had to run after participants to encourage them to fill and submit the questionnaires and conduct interviews on WhatsApp call.

Finally, the study could have been usefully expanded to include students' views about implementing online learning during Covid-19 since they are the ones affected by the application of online learning. The different views between teachers and students could have been investigated. Moreover, a comparison between teachers' and students' views might have assisted in creating the preferable future needs of students which school curriculum makers and principals should consider when updating school curriculum in order to achieve effective integration of educational technology in teaching and learning process to enhance students' achievement of learning objectives.

Despite these limitations, the data gathered from this study yielded relevant areas that contributed to a better understanding of the integration in the school curriculum of effective online learning features on teachers' lesson plan in middle schools in Lebanon.

Recommendations for practical action

The purpose of this study was to assess the application of online learning during Covid-19 pandemic in private middle schools in Lebanon. Based on the conclusions of the findings, the following recommendations were made:

1. This study identified a need for schools to update and develop the school curriculum on integration of online learning in conventional learning. It is recommended that school principals set up a strategic plan educational technology integration that serve the school and the larger community.
2. School curriculum should be redesigned with combination of technologies and roles of different educators modified well to be facilitators of learning to avert role of teacher centered learning which could be counterproductive in online learning integration in ordinary learning management.
3. An integration of online learning in normal learning is relevant for the effective and efficient teachers classroom management. When the school's curriculum is being updated, all major stakeholders' perspective including principals, coordinators, teachers, students, parents must be involved to ensure that changes in the school curriculum are being done in democracy way to maximize students' benefit in the learning process.
4. At the beginning of every school year, the principals of each cycle in school should orient teachers about school curriculum modifications that include teaching strategies in technology and rules of appropriate use of technologies. Teaching techniques with technology and the way of applying them in class activities must be clearly explained to teachers during monthly meeting and other assembly with coordinators, a team of teachers, or experts in education.

5. Teachers were the main agent of effective integration of online learning in conventional learning in the school setting. It was revealed that teachers were low equipped with technology tools by school principals to integrate online learning features in normal classes. Therefore, it is recommended that principals spend a part of the school fund to support teachers in technology materials needed to teach students in the classroom when it comes to improve students' achievement of learning objectives.
6. Principals are also advised to involve students to assist in selecting items from online learning to be integrated in ordinary learning. When students are involved in such activities, they will become more engaged in the learning process and this might raise students' performance in achieving lesson goals.
7. According to the findings, the causes of not making improvement in achieving lesson objectives in online learning regarding conventional learning were attributed to lack of teachers awareness and competency on what and how to use technologies to be effective in teaching process. A low level of awareness and competency in using technologies was found among all the sampled schools as a problem. Hence, it is recommended that principals should create a training program for educational technology awareness and competency among educators.
8. Finally, the government through the Ministry of Education has a major role to play in integrating online learning features in the school curriculum of ordinary learning. Therefore, it is recommended that the MOE should draw up a clear strategic plan that specifies instructional approaches and rules about integration of effective and appropriate educational technology in the school curriculum to foster education and meet the needs of the 21st century learning community.

Suggestions for further studies

The study endeavored to throw light on the concept of application of online learning in schools during Covid-19 pandemic. The challenges, opportunities, and instructional approaches during the implementation of online learning process were discussed in order to bring to the awareness of how school principals and sciences teachers need to see online learning experience from different angles. Participants of the study suggested their views and some findings were revealed about online learning application. At the end of the study, recommendations were made as a way forward to making an effective integration of online learning in conventional learning for the benefit of students. However, there is a need to conduct other studies in areas related to the current topic.

1. This study was conducted only in eight private middle schools in the Keserwan community. So, the data obtained does not give a whole picture of the situation. It is suggested that a similar study should be conducted to the whole country at the middle private school level. This could help to give the whole picture from sciences teachers' perspective concerning the implementation of online learning during Covid-19 in private middle school country wise.
2. Since the study was conducted in private middle school level, the same should be conducted at private secondary school level to get the general picture of the implementation of online learning during Covid-19 to compare the instructional approaches and difficulties between middle schools and secondary schools.
3. Moreover, the study examined sciences teachers' perspectives in private middle schools, the same should be managed to show all teachers' opinion among private and public primary, middle, and secondary schools on the implementation of online learning during

Covid-19 to update and strengthen the school curriculum with educational technologies. This could lead to create readiness for school stakeholders for any emergency situation in education sector and meet the needs of teachers and students who lived in the 21 century where technologies are surrounded them everywhere.

4. Furthermore, studies would be necessary on the experience of parents in the implementation of online learning during pandemic in private middle schools. This may allow parents to be involved in the learning process of their children through e-school as a communication platform between parent and school. This online platform confers parent an opportunity to monitor their children through feedback posted by teachers at the end of a certain period of time, and to send concerns or comments to school concerning their children attitude or performance in academic work. The parents' involvement could have a significant effect on students' performance, behavior, and achievement at school.
5. Due to the lack of research on the perception of the students in the management of application of online learning in private middle schools, many aspects still require further more detailed research. Thus, strategies to improve students' involvement in selecting items from online learning to integrate in conventional learning needs to be investigated in Lebanon.

Summary of Chapter Five

The chapter provided the summary of the study, conclusions based on the findings, implications, limitations, recommendations and suggestions for further research. The suggestions for further research were also outlined in this chapter. The study was carried out to provide an answer to the specific research questions that guided the study. The study aimed to assess the application of online learning during Covid-19 pandemic in private middle schools in Lebanon.

From the researcher's expectation, the aim of the study was achieved by examining the extent of teachers' readiness for application of online learning, challenges that come with effective online learning implementation, opportunities in implementing the online learning, instructional approaches in implementing the online learning and providing recommendations to assist school principals in their effort to integrating online learning in conventional learning to upgrade school curriculum toward improving students' achievement of learning objectives.

Concluding statement

The overall objective of this study was to assess the application of online learning in private middle schools during the Covid-19 pandemic context of Lebanon. On the whole, the study disclosed that application of online learning played significant role in enhancing school curriculum by integration of educational technologies to support students' achievement of subject learning outcomes. The adoption further revealed that when online learning is applied, it prescribes in the long run the standard of knowledge and competency of using technology in education expected of teachers. School teachers are the most important person in the practice curriculum to help students develop an engaged relationship with the content. For this reason, their professional development in educational technology are important for achieving the goal of school to reach school vision and mission. Hence, giving consideration to the issues in implementing online learning that challenge education either by absence of skills or tools in technologies among sciences teachers can contribute to development of school curriculum and engagement learning environment. Education in Lebanon is faced with many challenges in updating programs and integrating technologies in the school curriculum in primary, middle, and secondary school due to many factors including accessibility and availability of educational technology which are the main issues of application of online learning, as well as features in the school community such as lack of awareness and

competencies in using technologies, and limited education funding. Given the lessons learned from this study, it might be safe to conclude that the Government of Lebanon and school principals need to join hands and make renovation to the school curriculum through effective integration of educational technology to benefit from the sciences teachers experience of application of online learning during Covid-19 that spotlighted on challenges, opportunities, and instructional approaches in private middle schools. To end, I used the words of Jena (2020a) of India as follow:

> *"COVID-19 pandemic induced educators and learners to adopt digital technologies to ensure transmission of teaching and learning through online learning. This results in increasing technology knowledge of teachers and students. Using online learning provides teachers a chance to acquire new skills and improve their professional experience in technology to become more effective and productive in teaching. Applying new ways of teaching delivery and assessments of learning through online learning produce a positive change in the area of curriculum development and pedagogy."*

Application of online learning during Covid-19 pandemic from Lebanese sciences teachers' perspective was a power stone that broke the routine of face-to-face learning and added a tasty flavor to teaching and learning through using technologies. It pushed teachers out from their comfort zone and trying new teaching method by integrating technology in the lesson plans that suit the online education. This led to create innovative class activities, develop communication and technology skills, and apply different learning styles, which increase teachers' professional development in the education field. To conclude, the online learning experience in Lebanon under emergency management actually represents an advantageous turning point in promoting the development of online learning. Thus, the effects of blending the online mode with the traditional

mode can be a strengthening factor of the overall education system, improve teacher teaching attitudes, and enable curriculum content to be more in line with the student needs.

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APPENDICES

The appendices in the study were made up of two different parts which included the survey questionnaire for sciences coordinator participants and sciences teacher participants, and interview guide for principal participants and coordinator participants.

Appendix A: Consent form

Appendix B: Questionnaire for Sciences Coordinators and Sciences Teachers

Appendix C: Interview Questions for Principals and Sciences Coordinators

Appendix A: Consent Form

Consent Form

Study of Application of online learning by sciences teachers in private middle schools in Lebanon during covid-19 pandemic: challenges and lessons learned
Under the supervision of Dr. Christine Sabieh

Purpose: The study is interested in understanding what challenges faced and what available opportunities in Application of online learning during covid-19 pandemic from sciences teachers' perspective to propose an update school curriculum by integration of online learning in conventional learning.
Procedure: Consenting to participate in the study, you will fill a set of questions describing your teaching experience in online learning during Covid-19 pandemic. These questionnaires are self-reported, this means we really want your personal opinion and perspective. Also, the researcher will do interview through phone call with sciences coordinators and principals of middle school to ask them questions orally that we would like them to answer. No recording will be used during these calls. These questions are also about your online teaching experience during Covid-19 and we want you to express your opinion in your own words.
Duration: The study will require about 10 minutes of your time to answer the questionnaires. The interview with the researcher could last up to 10 minutes.
Benefits and risks on the participant:
We thank you for your time and contribution in helping us with my study. In addition to helping me understand the sciences teachers' perspective on application of online learning during Covid-19 pandemic at middle school, these are the personal benefits that you will gain from participating in our study:
- be more aware of the features in online learning can be integrated in conventional learning to increase teachers' effectiveness in the classroom.
- become more conscious of the importance of using technologies in education.
- understand that their teaching experience in online learning were be positive to update school curriculum.

Voluntary Nature of the Study/Confidentiality:

Your participation in this research project is completely voluntary. You may decline altogether, or leave blank any questions you don't wish to answer. There are no known risks to participation beyond those encountered while answering questions on personal experiences. Your responses will remain confidential and anonymous. Data from this research will be kept under lock and key and reported only as a collective combined total. No one other than the researcher will know your individual answers to this questionnaire.
If you have questions about the study, kindly contact:

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Please sign below if you agree to participate:

Participant's signature

Date

Thank you for your participation!

Appendix B: Survey Questionnaire for Administrators and Teachers

The main purpose of the questionnaire for sciences coordinators and sciences teachers was to solicit information related to application of online learning during Covid-19 in private middle schools in Lebanon. The sciences coordinators and teachers' contributions or views was significance since they are dealing with application of online learning issues in giving online classes from home. They were given the survey to fill starting from their biography, questions related to teachers' readiness to implementation of online learning, challenges, opportunities, instructional approaches and recommendations on how best to have an effective integration of online learning in conventional learning that will upgrade the school curriculum and maximize students' achievement of learning objectives in Lebanon.

There are six (6) sections in this online survey questionnaire. You are expected to answer ALL the questions listed. Your participation in this study is completely voluntary. Under no circumstances are you obliged to answer any of the questions; however, pay your all-out effort to assist me in completing my study and enhancing my understanding of this research focus. There is no potential risk or harm to you for participating in this research project. If you have any concerns or questions, please contact the researcher of this project (nantoun@ndu.edu.lb). The following survey questionnaire will take approximately 10 minutes to complete. Thank you in advance for taking your time to assist with this research. The data collected will remain confidential and used solely for this research paper.

Please click the "NEXT" button below to answer the questions if you agree to participate in this research.

Section A: Demographic information

Kindly put a tick [√] on the alternative that best represents you.

1.	Gender	Male [ ] Female [ ]
2.	Age Class	25-30 [ ] 31-35 [ ] 36-40 [ ] 41-45 [ ] 46-50 [ ] Above 50 [ ]
3.	Subject Teaching	Biology [ ] Chemistry [ ] Physics [ ]
4.	Years of experience as a teacher	1-5 [ ] 6-10 [ ] 11- 15 [ ] 16-20 [ ] Above 20 [ ]
5.	Level of education	Certificate [ ] Diploma [ ] Bachelors [ ] Masters [ ] PhD [ ]

Section B: Assessing teachers' preparedness for online learning

Kindly put a tick [√] on the area that best represents you.

6. How can you define education in emergencies (EiE)?
   a. EiE ensure the right to education for children during emergencies.
   b. EiE provide access to education for all ages in situations of crisis.
   c. EiE provide instant physical, psychosocial and cognitive protection for all ages in time of crisis.
   d. EiE support teachers to increase the education quality for better learning outcomes.

7. In your opinion Covid-19 can be considered as a crisis where education in emergencies needs to be applied to continue the learning process?
   a. Yes b. No

8. To what extent is online learning effective as a tool to mitigate the impact of Covid-19 on the education system?
   a. Very highly effective b. Highly effective
   c. Moderately effective d. Not effective

9. How often did you use online learning before the Covid-19?
   a. Always (Every week) b. Sometimes (Once or twice per month)
   c. Rarely (Once or twice per year) d. Never

10. When did you start applying online learning after school closure due to covid-19 pandemic?
    a. During first week b. After 2-3 weeks
    c. After 4-6 weeks d. Above 7 weeks

11. To what extent are the tools below for online learning available?

	Hardware	LMS*-Software	Internet Access	Technology Tools
Very highly available				
Highly available				
Moderately available				
Not available				

*Learning management system.

Section C: Challenges faced by science teachers during the application of online learning

Kindly put a Tick [√] under the number that best classifies the challenges faced in implementing online learning based on your personal experience, where 1 is very low challenging and 5 is very high challenging.

1 = Very Low challenging; 2 = Low challenging; 3 = Average challenging; 4 = High challenging; 5 = Very High challenging

No.	Items	1	2	3	4	5
12.	Modify lesson plan (Time period of class; Class activities).					
13.	Digital competence to apply online learning.					
14.	Interaction between teachers and students.					
15.	Build interpersonal relationships between teachers and students.					
16.	Heavy workload for teachers (Reorganization of lessons; Answer emails and calls; Work schedules; Family coexistence).					
17.	Effective assessment tools to evaluate students' learning.					
18.	Get credible data on students' performance.					
19.	Internet connection.					
20.	Equipment for online learning.					
21.	External distractions (Social network; Noise from the neighborhood; Interruption by family members or pets…)					

22. From your personal experience, what other challenges (if any) did you face in implementing online learning? Please specify the rank from 1 to 5.

	Items	**1**	**2**	**3**	**4**	**5**

Section D: Available opportunities regarding online learning for teachers

Kindly put a Tick [√] under the number that best classifies the opportunities acquired in implementing online learning based on your personal experience, where 1 is very low opportunity and 5 is very high opportunity.
1 = Very Low opportunity; 2 = Low opportunity; 3 = Average opportunity; 4 = High opportunity; 5 = Very High opportunity

No.	Items	1	2	3	4	5
23.	Novel teaching methods (YouTube videos, Power Point, charts, graphs, diagrams, images, audio).					
24.	Recording teachers' class period.					
25.	Using various online resources to apply different learning styles.					
26.	Choosing any place at home where teachers feel comfortable to work.					

27.	Development of teachers' technology skills.					
28.	Discovering educational technology tools, which teachers can integrate in normal classes.					
29.	Save teachers' commute time from home to school or vice versa.					
30.	Presence of technology tools and programs in online platforms save teachers' time in their academic work.					
31.	Improvement of teachers' communication skills.					
32.	Give teachers' instant feedback to students.					

33. From your personal experience, what other opportunities (if any) did you acquire in implementing online learning? Please specify the rank from 1 to 5.

	Items	**1**	**2**	**3**	**4**	**5**

34. From your personal experience, can online learning be integrated in the education system when the Covid-19 pandemic ends? Please explain?

Section E: Instructional approaches used by science teachers at Private Middle School for implementing the online learning

Tick [√] your opinion on the instructional approaches used to implement online learning.
SD = Strongly disagree; D = Disagree; N = Neutral; A = Agree; SA = Strongly Agree

No.	Statements	SD	D	N	A	SA
	Teaching Methods Approaches					
35.	Using direct instruction					
36.	Sharing explanation lessons notes					
37.	Using Power Point slides					
38.	Using YouTube videos					
39.	Using pictures					
40.	Using Word or PDF documents					
41.	Doing class discussions					
42.	Using gamification					
43.	Using audio visual media (Animated images, Diagrams, Graphs, Charts)					
44.	Students' participation in explaining parts of the lessons.					
	Assignment Approaches					
45.	Giving problem solving					
46.	Giving practical experiments to do at home					

47.	Giving problem sets including a group of basic level questions and another group of difficult level questions					
48.	Giving project assignment					
49.	Giving exercises					
50.	Giving to answer questions as written tests					
51.	Participation in online discussion					
52.	Giving to write the lesson objectives					
53.	Giving to analyze experiment results					
54.	Giving to make a videotape for a practical work					
	Assessment Approaches					
55.	Multiple choice questions					
56.	Extended matching					
57.	Online quizzes					
58.	Submission students' assignment					
59.	Submission students' portfolio					
60.	True-False tests					
61.	Project presentation					
62.	Online exams					
63.	Problem sets as an individual assignment					
64.	Discussion forums					

65. Specify other **teaching methods approaches** used by science teachers at Private Middle School for implementing the online learning.

_____

_____

66. Specify other **assignment approaches** used by science teachers at Private Middle School for implementing the online learning.

_____

_____

67. Specify other **assessment approaches** used by science teachers at Private Middle School for implementing the online learning.

_____

_____

68. To what extent is the instructional approaches (teaching methods, assignments, and assessments) used for online learning improve the achievement of learning objectives by comparing to conventional learning method?

a. Very highly improved b. Highly improved
c. Medium improvement d. No improvement

Section F: Possible solutions to implement effective online learning

Direction: Consider the following suggestions below and tick (√) your opinions

No.	Statements	Tick (√) the most appropriate
69.	Implementation of a more comprehensive and advanced pedagogic design to re-arrange lessons, assignments, assessments through online mode.	
70.	Training programs for teachers to develop their digital competence should be planned.	
71.	Training programs for teachers about methods of conducting online classes should be planned.	
72.	Technology readiness must be accelerated via easier and more widespread access to the Internet and the provision of Internet networks.	
73.	Readiness for online learning should be part of a school's strategy.	
74.	Free high quality access to the internet for all teachers and students should be the main criteria in the minds of school institutions.	
75.	Technology and infrastructure should be strengthened.	
76.	The government must take certain remedial measures to overcome the challenges faced in online learning.	
77.	Technology devices for teachers and for students with economic disadvantages are put in place in order to stimulate equity.	
78.	The investment in school infrastructure and technological equipment should be increased, especially in LMS, communication systems and digital content.	
79.	Teachers should be equipped by their schools with computer hard- and software that are necessary for online teaching.	
80.	Continued monitoring and evaluation of the online learning education program would be a great help to enhance the system of delivering education by teachers.	

81. Others (Please specify)

Thanks very much for answering this survey.

The survey was used to solicit information from the sciences coordinators and teachers about application of online learning during Covid-19 pandemic. After distributing the online questionnaire to the participants to fill out, the researcher collected the feedbacks by downloading the data on excel sheet and arranged them according to different sections as indicated in the survey in order to find out percentages of participants.

Appendix C: Interview Questions

The purpose of this interview guide was to get the principal participants and sciences coordinators participants' opinions on application of online learning during Covid-19, challenges, opportunities, instructional approaches, and recommendations on how effective integration of online learning in conventional learning could be achieved. The principals' and coordinators' opinions during the interview were relevant since they were directly involved in application of online learning during Covid-19 in the school decision making process. They had diverse knowledge about application of online learning problems faced by sciences teachers in their respective schools and they were also in the better position to come up with strategies that could solve the problem under study. The interview guide comprised of 10 different questions, the questions were designed for information about principals and coordinators and their opinions concerning application of online learning during Covid-19.

1. Gender: Male [ ] Female [ ]
2. How long have you been in this position in the present school?
3. Did you have a strategic plan in your school for Education in Emergencies before Covid-19 crisis?
    - If yes, what is this plan? and how did you implement it during Covid-19?
    - If no, what strategies do you use to implement online learning during school closure due to Covid-19?
4. On average, how would you rate effectiveness of online learning application during Covid-19 in your school?
    a) Excellent b) Good c) Average d) Poor e) Bad
5. Did you start to apply online learning directly after the Ministry of Education declared schools closure? If Yes or If No, why?
6. What was the main difficulties in terms of administration in applying online learning?
7. What are the available opportunities in terms of administration in applying online learning?
8. What administrative measures did you take in order to support teachers to exceed the challenges faced during online learning? Explain

9. How did you guide teachers to the best use of online learning for the benefit of students? Explain
10. What are the lessons learned from this experience at what are your recommendations for the future?

Thanks for your time.

The interview guide was used to gather information from principals and coordinators about application of online learning during Covid-19 pandemic in middle schools in the Keserwan community. The results from the interview was used to back up the information from the questionnaire on how to promote effective integration of online learning in conventional learning to improve the school curriculum and students' achievement of learning objectives.