

Implementation of E-Learning in New Taipei City During COVID-19

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Abstract

During the COVID-19 pandemic, educational institutions around the world have closed, affecting more than 60% of students and causing massive disruption to the education system. Taiwan is no exception. For this sudden and dramatic change, teachers, students, and parents all confront significant challenges. In order to make specific suggestions for improvement, the study aims to explore the current state of e-learning in Taiwan and to understand the difficulties faced by teachers, parents, and students. The study conducted in-depth interviews with 20 teachers, 12 parents, and 24 students. The research results show that in New Taipei City, there are barely any online courses for grades 1 and 2, blended learning is mainly for grades 3 and 4, and synchronous e-learning is designed for grades 5 and 6. The main challenges in adopting e-learning in primary schools include, as follows: (i) Teachers, parents, and students are unfamiliar with the user interface of the e-learning platform. (ii) Insufficient hardware and software equipment at home. (iii) Teachers cannot take care of special students. (iv) Communication between teachers and parents is not smooth. (v) Difficulty in assessing learning progress online. (vi) Students are easily distracted from their studies. Based on the above research results, the researchers put forward specific suggestions for future online teaching practices.

Keywords: COVID-19, science education, e-learning, teaching practice

INTRODUCTION

The COVID-19 pandemic has caused massive loss of life worldwide, affecting global industries, economies, healthcare, and learning, and Taiwan has not been spared. New Taipei City, Taiwan announced that schools needed to be closed from May 2021, students cannot go to school, and the face-to-face classrooms must be changed to online classrooms. It means that students should study from home. Faced with such a dramatic change suddenly, parents, teachers, parents, and students need to cope with the adaptation challenges.

For teachers, when face-to-face courses are transformed into online courses, teachers have to spend a lot of time and energy preparing all the online teaching materials in a short period. For parents, they need to take time off temporarily to accompany their kids to study online and help them operate the computers. For students, the lack of interaction with teachers and peers online can easily distract them from their studies. Science education aims to develop students' scientific

literacy to help them adapt to the environment and solve real-life problems. Therefore, for frontline teachers, how to provide suitable e-learning courses is an important issue. Besides, how to deal with and solve the challenges they face in the implementation process is also worth exploring in-depth.

Based on the above reasons, the study aims to conduct in-depth interviews with frontline teachers, parents, and students to understand their e-learning difficulties and put forward specific solutions, which can be referenced for educational institutions. The research objectives are, as follows:

1. To understand how primary schools in New Taipei City implement e-learning.
2. To explore the difficulties in adopting e-learning in primary schools in New Taipei City.
3. To figure out the feasible ways to implement e-learning in primary schools in New Taipei City.

Contribution to the literature

- This study aims to give feasible suggestions to teaching staff in the implementation of online courses.
- This study reveals possible challenges in the implementation of online courses.
- This study provides a specific direction of future research in E-learning for researchers.

LITERATURE REVIEW

Science Education

Scientific knowledge is used for explaining, predicting, and describing what, why, and how phenomena occur (Boon, 2006). Science education in a narrow sense generally includes mathematics and science (physics, chemistry, biology, and earth sciences), while science education in a broad sense includes environmental education, information education, technology education, engineering education, and even medical and health education. The intended audience of science education include preschoolers, primary and middle school students, college students, and even the general public (Maryanti et al., 2021; Permanasari, 2016).

Science education emphasizes cultivating people's scientific literacy, and science education can help people solve meaningful problems in real life (Feinstein, 2011). Science education should help develop students with inquiry ability, and the activities should be designed to suit their interests, skills, and relevant experience. Teaching should be carried out through observation, classification, measurement, experiment, etc. Students are encouraged to apply what they have learned to reason and think critically (National Research Council, 1996). Implementation should focus on satisfying students' curiosity. Once students' questions cannot be answered satisfactorily, they may become frustrated and gradually lose interest and willingness to learn.

The Implications of E-Learning for Education

E-learning is a new form of learning in the 21st century. Teachers play the role of subject experts and instructional designers, who facilitate the teacher-student and peer interaction and enhance learners' cognitive abilities and learning engagement (Seok, 2008). Bencheva (2010) pointed out that e-learning has advantages that traditional teaching models do not have. For example, peers can communicate quickly and with high quality, and knowledge can be transferred between peers and discussed in public. In this way of learning, the discussion between peers is equal. Learners can freely access information and discuss it at any time. Therefore, learners will have higher learning motivation and are more willing to participate in the whole learning process.

Besides, Classroom Response System (CRS) for e-learning can improve students' interest in learning and achieve effective learning through peer interaction

(Preszler et al., 2007). Students with personal mobile devices can study according to their individual needs. They can also interact with teachers and peers in real-time when accessing the internet. In this way, teachers can effectively track student progress, conduct assessments, and give appropriate feedback. Combining tablets with apps is helpful for teaching activities and enhancing students' interests in learning, creating a win-win situation for both teaching and learning (Chung & Chang, 2014).

Nevertheless, research by Abbasi et al. (2020) shows that 77% of students negatively view e-learning during COVID-19. Most students prefer face-to-face learning because they are not ready for e-learning. It coincides with the quantitative findings of Aboagye et al. (2021) that students are not prepared for a fully online experience.

For students studying online, the biggest challenge is accessibility. Computers, the Internet, and technology all affect students' e-learning efficiency, while social and lecturer Issues affect students' willingness to learn e-learning. To explore the implementation of e-learning during COVID-19, the researchers of this study conduct in-depth interviews to gain insights into the actual e-learning difficulties that teachers, parents, and students are experiencing.

The Implementation of Studying from Home in New Taipei City

According to the announcement of the Ministry of Education of Taiwan on May 18, 2011, when studying online from home, the curriculum and assessments can be designed to be flexible and diverse. Teachers can teach through familiar online teaching methods and asynchronous teaching resources. If students do not have digital learning equipment at home, teachers can encourage them to watch TV programs that help students learn.

In response to COVID-19, schools in New Taipei City implemented online classes with a 20-minute break every 30 minutes, referring to the online class guidelines. They offered e-learning resources for teachers and students. This way, learning is delivered to students' homes. Teachers can help students learn at home by teaching via videos, live streaming, customized learning packs, or textbook digital learning resources. The implementation of online classes in New Taipei City is shown in [Table 1](#).

Table 1. The implementation of online classes in New Taipei City

Teaching methods	Software/platform
Videos	Google Meet, Microsoft Teams
Live streaming	YouTube, Facebook
Customized learning packs	Google Classroom, Junyi Academy, LearnMode, Taipei City Cooc Cloud, PagamO e-learning platform
Textbook digital learning resources	Nani Bookstore, Han Lin Publishing Co., Ltd., Kst Education Corp., HESS International Educational Group, OneClass

Note. Source: <https://mis.ntpc.edu.tw/p/406-1001-4554,r2.php?Lang=zh-tw>

Table 2. Interviewee background

Interviewee	Number	Gender	Notes
Teacher	20	8 men 12 women	4 homeroom teachers, 2 special teachers, 2 science education teachers, 2 information education teachers, 3 English teachers, 2 social science teachers, 3 physical teachers, & 2 art teachers.
Parent	12	4 men 8 women	2 parents each for the lower, middle, & upper grades.
Student	24	13 men 11 women	6 students each for the lower, middle, & upper grades.

Note. Lower grades: Grades 1 & 2; Middle grades: Grades 3 & 4; Upper grades: Grades 5 & 6

RESEARCH METHODS

To understand issues related to the challenges of science education under COVID-19, the researchers conducted in-depth and semi-structured interviews in the study to gain insight into the uniqueness and complexity of individual cases. The interview method is face-to-face. The interviewees can speak freely and naturally express thorough opinions through such an interview method.

Instrument

The interviewer

In qualitative research, the interviewer is an important instrument, and his/her background can influence the findings. The interviewer for this study is an experienced front-line teacher. She is well aware of the problems that teachers may face and has empathy. Besides, she has two children in primary school. It means that she is the parent who experiences the challenges of e-learning under COVID-19. She is also a doctoral student in the field of science education. As a result, she is equipped with excellent observation and interview skills through research training in education. Based on the above background, she can make the interviewees willing to share their opinions freely and integrate into the interviewees' experience with a more open attitude.

Semi-structured interview outline

Researchers designed semi-structured interview outlines through literature analysis and mutual discussion. The interview outlines are different for teachers, parents, and students.

Interviewees

Due to time constraints, the researchers adopted purposive sampling (Etikan et al., 2016) and conducted interviews with teachers, parents, and students of a primary school in New Taipei City. A total of 24 students, 12 parents, and 20 teachers were interviewed, as shown in Table 2.

Interview Procedure

Preparation in advance

The researchers drafted the interview outlines through literature analysis and invited three experts to review them, including two experienced teachers and one science education scholar. According to the suggestions given by experts and scholars, the researchers then revise the interview outlines to suit the research objectives. Before the interview, the interviewer conducted self-training according to the two stages for interviewer training in Gall et al. (2007) to make the data collected credible and objective. The interviewer also memorized the interview outlines before the interview to make the interview process smooth and natural. The interviewer maintained an objective attitude towards the interviewees' responses and did not speculate or make excessive inferences. In addition, when conducting data analysis, the researchers present and report findings truthfully.

Interviewee invitation

After carefully selecting interviewees, the researchers contacted the interviewees by phone or e-mail and informed them of the research objectives. After the interviewee agreed and signed the consent form, the researchers scheduled the interview.

Interview process

Formal interviews were conducted one by one from mid-May 2021 to late May 2021. The interview date, time, location, and method (phone or face to face) were all specified by the interviewee. When the formal interview began, the interviewer reintroduced the purpose of the interview. The interviewer then asked about the background of the interviewee and informed him/her that the interview process would be recorded. During the interview, the interviewer took notes and recorded key points. When it is difficult to understand the interviewee's meaning, the interviewer would ask the interviewee to clarify or ask the question in another form later to increase the reliability of the interview. When the interview went off-topic, the interviewer would get back on track as quickly as possible to align the interview process with the research objectives. The interviewer must pay attention to her words and behaviors so as not to affect the direction of the interviewee's response.

Post interview

With the interviewees' consent, the researchers recorded the entire interview process and transcribed the recordings into transcripts. The results of each interview can be used as the basis for the next interview to draw comprehensive conclusions. After the interview, the data was analyzed immediately on the same day to avoid data interference or loss. The researcher then sent the transcripts to the interviewees to confirm the content and text and thank them again.

Data Analysis

To increase the credibility and quality of this study, the researchers employed a triangulation method between teachers, parents, and students (Patton, 2001). The data processing steps are, as follows:

1. **Step 1.** Listen to the recording files repeatedly, and convert the recorded interview data into transcripts.
2. **Step 2.** Ask another researcher to check the accuracy of the transcripts.
3. **Step 3.** Preliminarily analyze and sort the transcripts.
4. **Step 4.** Ask interviewees to confirm and correct transcript text.
5. **Step 5.** Read the data again, and conduct a comprehensive analysis of all the data.
6. **Step 6.** Discuss the results of the analysis and induction.

RESULTS AND DISCUSSION

Approaches of Implementing E-Learning in New Taipei City Primary Schools

There are few online courses in grades 1 & 2

Initially, there were no information technology courses in the first- and second-year curriculum. As a result, e-learning is more difficult for 1st and 2nd graders who have never taken an information technology course. That is, even if teachers use Google Meet for synchronous teaching, students do not know how to join the class. Few teachers record instructional videos and then pass them to parents through social media such as Line so that students can watch the videos and learn knowledge.

Grades 3 & 4 adopt blended learning

From the third grade onwards, students take courses in information technology. However, since they are still new to operating computers, they are still unfamiliar with the user interface. Thus, when teachers adopt synchronous online teaching, only about one-third of students are able to successfully take the online courses. Therefore, teachers finally decided to offer various learning paths, such as LearnMode, Junyi Academy, etc., so that parents can accompany their children to study online after getting off work.

Grades 5 & 6 adopt synchronous learning

Since 5th and 6th graders have been equipped with basic computer skills and are familiar with communication software, such as Facebook and Line. As a result, almost all teachers in grades 5 and 6 teach through Google Meet. Students have a very high attendance rate, and the instant online interaction makes the whole class as lively as in school.

Challenges of Implementing E-Learning in New Taipei City Primary Schools

Students are unfamiliar with the user interface & the hardware & software equipment are insufficient

It was the first time that schools were closed in Taiwan. Due to the sudden nature of the event, both teachers and students faced difficulties in operating online platforms. The front-line teachers were required to immediately develop a teaching plan and learn how to teach on the online platform. It is a daunting challenge for all teachers, particularly the older ones. It is not easy for teachers to know how to operate the user interface, let alone parents and students.

For example, when a teacher uses google meet with a common URL for online teaching, the first person to join the meeting becomes the moderator and can control the

audio and video of others. Thus, if the teacher joins the meeting too late, he/she will be a guest with no control over anything. All teachers and students take online courses at the same time. Without requiring students to turn off their microphones ahead of time, the entire class can become too noisy to hear the teacher's voice. Additionally, teachers cannot choose to share the entire screen when sharing screens; otherwise, they cannot see students when switching screens. Such problems can only be discovered after online teaching. Teachers, parents, and students all need to spend time learning how to operate an online platform, improving their operational skills through trial and error. The study by Abdedoyin and Soykan (2020) reported that students and teachers with low digital skills would easily not catch up with the progress during online learning.

The difficulty of e-learning is not only the unfamiliar user interface but also the lack of software and hardware equipment. For example, while learning synchronously online, you can only keep up with the pace of learning with microphones and video cameras. What's more, when a family has two kids attending different classes simultaneously, parents need to prepare two sets of e-learning devices. Although the mobile phone can access the internet, the screen is too small to read text. Therefore, having a desktop computer, laptop or tablet is still recommended. In addition, when both teachers and students access the online platform at the same time, problems such as slow bandwidth and unstable networks are prone to occur, resulting in screen and sound freezes. That is, network stability also affects the efficiency of e-learning. The study by Aboagye et al. (2021) also mentioned that the biggest challenge for online learning is insufficient e-learning equipment, such as computers, the internet, and information technology. Adedoyin and Soykan (2020) pointed out that since online learning highly depends on technology equipment and the internet, teachers and students with unstable internet would be unable to access online education.

Without individualizing instruction, it is difficult to take care of special students

The special need class adopted an asynchronous e-learning method during the home study period. Teachers created a parent-teacher group on Line for each student and listed lessons in its notebook. Besides, teachers provided parents with study sheets, videos, and recorded lesson videos, as well as designed simple surveys or games for special students to learn. However, the teachers in special need classes can only teach Mandarin and mathematics online, and the rest of the subjects must be studied in real classrooms. Online teaching can only follow a fixed schedule without additional guidance one by one. Taking care of each special student is challenging if the entire class learns online synchronously, so they cannot keep up with the

learning path. Previous studies also reported that online participants are more difficult to have one by one interaction with teachers, which makes them feel isolated from the classroom (Vonderwell, 2003; Woods, 2002).

Communicating with working parents is not easy

While studying at home, rely on various communication software to transmit information. Teachers usually use Line to communicate today's learning content and websites. However, very few pupils have mobile phones. Parents still have to go to work and cannot accompany their children. Even if they receive a message from the teacher, it cannot be immediately passed on to their children. That is, there is a time lag in communication. For example, a pupil forgets to learn online, and by the time parents get the message, it may be past school hours. The study by Zahrawati and Nurhayati (2021) also reported that working parents could not accompany students to learn online and suggested teachers find an approach to establish communication with parents.

Online assessments are not easy, & paper assignments are difficult to deliver

While studying at school, students typically hand in paperwork instead of online assignments, except for information technology courses. However, students' paperwork could not be delivered to their teacher smoothly during home study. It could only be handed over in the form of a photo, and the teacher would correct it and send it back to the student. Since e-learning is implemented, parents and students have complained that the amount of homework has increased significantly. Assignments that used to be done in real classrooms now have to take extra time after the online classes. Besides, almost every teacher assigns homework in every class, and students' eyes cannot get proper rest. For assessment, it is inconvenient to assess online. After all, there is no guarantee that students answer while reading textbooks during online quizzes. How to provide online assessment is a common problem for both teachers and students. Arkorful and Abaidoo (2015) reported that online assessment cannot avoid cheating behavior. Zahrawati and Nurhayati (2021) also studied the online learning challenges during the COVID-19 pandemic and found it difficult to assess students' learning processes and outcomes.

Students are easily distracted in class & even play games

Even when students study online, some cannot concentrate in class and even turn to another window to play games. Teachers cannot prohibit them from playing games unless parents can assist and supervise them. Inattention is one of the difficulties for students in

current e-learning. Also, it is easy to be interfered with by surrounding circumstances while learning online at home. For instance, students do not have an isolated room, so they are easily distracted by the noise made by family members. This was also reported by Aguilera-Hermida (2020) stating that students are easily disturbed by family members, noise, and household chores.

Feasible Approaches in Implementing E-Learning in New Taipei City Primary Schools

Flexible use of synchronous & asynchronous teaching

Teachers should flexibly use synchronous and asynchronous teaching methods for students with different grades and different frequencies of using internet devices. Teachers should not force students to be online at a specific time or even use attendance as a grading standard to avoid opposition from parents and students. For students who cannot be online in real-time, teachers should provide asynchronous learning resources, inform the progress, how to hand in assignments, and other information so as to achieve a win-win situation for teachers, parents, and students.

Use the instant feedback system for interaction

Although e-learning can stimulate students' interest in learning, the sustained attention of primary school children is limited. Classes are more fun if teachers can use the CRS for learning and interaction, such as Kahoot, Cloud Classroom, Quizizz, etc. Teachers can also grasp whether students are focused on learning. The results are consistent with the study by Preszler et al. (2007), which showed that CRS for e-learning improves students' learning motivation and effectiveness.

Use multiple assessments to evaluate student learning outcomes

While students cannot come to school for summative assessments, teachers can test students through online assessments and assignments rather than paper-based exams. Teachers can even allow students to self-assess or peer-review. Parents can also assist with assessment. For example, students can recite a text to their parents. Teachers can make grading scales more flexible and use different testing methods to increase parent-child interaction and interest.

CONCLUSIONS & RECOMMENDATIONS

Conclusions

Google Meet is the most popular online course communication software

Although the education department of the New Taipei City Government provides many e-learning websites, such as Junyi Academy, Taipei City CoC

Cloud, PagamO e-learning platform, etc., teachers prefer to use Google Meet to teach. It can help teachers and students communicate face-to-face and discuss online, adding a sense of reality.

Many difficulties in e-learning need to be actively improved

The first implementation of e-learning encountered many difficulties, such as insufficient software and hardware equipment, inconvenient online assessment, and inability to teach alone. It requires to be gradually optimized in teaching practices to achieve the goal of win-win and "learning never stops."

Recommendations

Purchase e-learning equipment for students

The education department of the New Taipei City Government provides tablet and network card services for low- and middle-income families. However, many households still lack software and hardware equipment. Besides, if a family has many children participating in online classes simultaneously, e-learning equipment may be insufficient, and the bandwidth may be unstable. Educational institutions should assist in adding online devices for students.

Remind students to take a rest to protect their eyes

E-learning must avoid the overuse of eyes. Although the education department of the New Taipei City Government recommends that students take a 20-minute break for every 30 minutes of online classes, students still need to complete their homework online after class. Some students linger on the Internet and enjoy the fun of fighting monsters online. Thus, it is necessary to remind students to rest and protect their eyes constantly.

Adjust the number of assignments & submission time

In addition to the original paper assignments, students are requested to complete extra online assignments assigned by teachers in every subject in the currently implemented online courses. It places a burden on parents and students. Teachers can adjust the amount of homework, extend due dates, or let students complete assignments during online classes to protect their eyes.

Continuously improve information technology skills

When changing a physical classroom to an online classroom, teachers, parents, or students are caught off guard. Not only were they unfamiliar with the user interface, but they also found a lot of problems using Google Meet in online classes. Thus, teachers, parents, and students need to improve their information technology skills.

Table 3. Recommendations for online learning in primary schools

Recommendations	Description
a. Purchase e-learning equipment	Many households still lack software and hardware equipment.
b. Remind students to take a rest	It is necessary to remind students to rest and protect their eyes constantly.
c. Adjust the number of assignments	Parents & students have complained that the amount of homework has increased significantly.
d. Improve information technology skills	Teachers, parents, & students need to improve their information technology skills.

The recommendations for implementing online learning in primary schools are listed in [Table 3](#).

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