Integrating Information and Communication Technology in Schools: Existing Conditions and Challenges Through the Lenses of Teachers and Students in A Private School Network in Lebanon

Iman G. Freij[1] (iD)

[1]University of Sciences and Arts, Lebanon (USAL), Lebanon
Correspondence: Iman Freij, University of Sciences and Arts, Lebanon (USAL), Lebanon
Email: i.freij@usal.edu.lb

Abstract: This study aimed at exploring how Mabarrat, a private school network, integrates information and communication technology (ICT) within its schools. The current study has investigated a number of variables to explore the level of ICT integration and the encountered challenges from the teachers' and students' perspectives. Being a mixed-approach study, 632 students and 135 teachers were surveyed through two different questionnaires, and then from the surveyed participants only 15 teachers and 47 students were interviewed upon their willingness and approval. Data were analyzed using SPSS 26.0 for windows and a thematic analysis for the interviews. Results indicated that Mabarrat school network (MSN) has reached the entry level with few aspects of the adoption level of integrating ICT in which teachers sporadically use technology tools to deliver curriculum content while the students are actively engaged in using technology tools to collaborate with others and connect new knowledge to their prior one. Few discrepancies in ICT integration level are revealed with respect to different taught school subjects, grade levels and school location. On the other hand, examined challenges include crumbling schools' technology infrastructure, unavailability of adequate training and support, and the teachers' dismissive attitudes and beliefs toward ICT. The study recommended policy makers to rethink the available facilities, the students' social skills and the teachers' professional development program that neglects technological skills.

Keywords: Mabarrat School Network (MSN), ICT Integration, Mixed-Approach Method, School Subjects

1. Introduction

Globally in the last few decades, the use of technology has significantly progressed in various greatly developed educational settings where essentially required amenities are available for efficient information and communication technology (ICT) integration within k-12 school curricula. However, in Lebanon, the educational system had begun quite steady steps to integrate ICT in the last 15 years (Jabbour, 2011), yet unfortunately was abruptly interrupted upon the dramatic collapse of the Lebanese monetary system that has destructed all industries and particularly the electrical power system and the internet sector that have been gradually drained since October 2019 (Kaufman, 2021). Synchronizing with Covid-19 outbreak, the Lebanese widespread aggravating economic crisis has afflicted the education industry drastically.

To clarify more, this crisis represented by a dearth of electric power and internet accessibility, has obstructed the schools' capabilities to excel in integrating ICT with the teaching and learning process.

This completely desolate condition has undoubtedly affected all schools in Lebanon (Human Rights Watch, 2021) including Mabarrat school network (MSN) whose teachers were required to integrate ICT against all odds. Fortunately, with the beginning of the passing academic year 2022-2023, schools have adjusted their operating capacities to align with the unprecedented conditions that have been consuming Lebanon since late 2019 (World Bank, 2021). Schools of the private sector have accordingly become equipped with a plan that provides needed funding to cover the annual expenses that include an adequate budget for the diesel cost to run the school generator and for strong-signaled internet access.

2. The Problem

On its website, it is clearly stated that MSN has adopted information technology in its schools; thus, becoming part of the learning and teaching process. Besides, the platform mentions that it pays great tribute to the significance of practically developing the teachers' skills that fall within the context of integrating ICT in their teaching methods aiming at empowering active learning in the school environment. However, what's spotlighted digitally is poorly evidence-supported; therefore, there is no solid data about either rating the level of integrating ICT in its schools, the students' and teachers' perspectives on this topic, or even the challenges that stakeholders encounter in this aspect.

1.2 Purpose of the Study

The purpose of this study is to develop and validate an instrument that can be used to rate the level of ICT integration in Lebanese K-12 education and whether the degree of integration differs according to a set of independent variables such as the school location, the taught subject, and the taught grade-level. In addition, it aims at perceiving the barriers and challenges that teachers and students encounter in the process of integrating ICT within the applied curriculum. On a subordinate level, it is worthy to mention that this study will provide evidence-based data that will undoubtedly support MSN to better plan and apply a reliable policy for ICT integration.

1.3 Research Questions

The study is guided by the following exploratory questions:

- What is the level of ICT integration in MSN in Lebanon?
- How do variables as the school location, the taught subject and the students' grade-level affect the ICT integration?
- How does ICT integration affect teaching and learning at MSN?
- What challenges do MSN teachers encounter once integrating ICT within the curricula? How can they be tackled?

1.4 Significance of the Study

Since integrating ICT has been one of the major concerns that redirects the work of MSN, this study is considered to be one of the links that will make up the whole chain of how it is really integrating ICT within its schools' frames across the country. Additionally, this study will shed lights on what still needed to fill in the gaps in terms of the infrastructure, amenities, and stakeholders. Consequently, the study aims at bridging a research gap that will undoubtedly and worthily explore the level at which MSN processes ICT integration within its adopted curricula that resonate with the Lebanese national curricula.

2. Review of Relevant Literature

ICT integration in education involves incorporating computer-based communication into the daily instructional process in classrooms. ICT essentially encompasses the concepts of 'computers' and 'digital technology', which also includes digital mobile technology. Initially, the emphasis was primarily on computers, but this has evolved to include interactive whiteboards and tablets as well. It has transformed the teaching environment into learner-centered (Castro Sánchez & Alemán, 2011); thus, giving way to a pivotal role of the teacher that will influence the extent and efficiency of integrating ICT in the teaching and learning process.

2.1 Integrating ICT in K-12 Education: Impact on Teaching & Learning

ICT is a powerful tool that can greatly support teachers in enhancing students' skills in English as a foreign language (EFL) (Jack & Higgins, 2018); this tool offers a range of opportunities for children to practice and develop various literacy and language skills, including letter sound correspondence, speaking and listening, vocabulary, and preparation for reading and writing (Al-Awidi & Ismail, 2014). Extensive research demonstrates that utilizing computer software, social networking websites, online videos, audio tools (such as YouTube, Skype, and MP3 players), as well as smartphone and tablet apps, have a highly beneficial effect on the process of learning English as a foreign language (Alsulami, 2016).

Comparing EFL teachers' ICT pre-knowledge in the 2nd decade of the 20th century to their knowledge a decade ago, reveals dramatical differences; in which teachers have acquired more advanced knowledge in ICT integration; thus, leading to an indispensable need to find ways for practically applying their knowledge with a positive attitude (Sabiri, 2020). With the evolution of the teaching process, a teacher reports to have come up with solutions to the conflicts encountered; and thus, repositioning teaching practices through three varied stages. In these stages, ICT is initially integrated as visual aids and information resources, then as reflective practices including a series of campus-wide projects for extra-curricular learning enhancement, and consequently as expansive learning tools crossing the regional, ethical, cultural and language boundaries of EFL learning and thus empowering students through the Internet as a platform to generate knowledge collaboratively (Chen, 2011).

ICT impact is corroborated in math, science and English learning. Digital storytelling has enhanced EFL learners' reading and writing skills (Rahimi &Yadollahi, 2017) their motivation, autonomy, collaboration, and problem-solving skills (Alcantud-Díaz et al., 2014); their oral comprehension skills (Heidari Soureshjani and Etemadi 2012); their speaking skills (Hwang et al., 2016), and their collaborative writing skills (Elola & Oskoz, 2010). However, extending children's vocabulary and their motivation to read and

to like reading, is efficiently done by engaging appropriate software via computer (Nikolopoulou et al., 2019). Students' concentration and active learning in math and science have been promoted as ICT tools were used on a regular basis (Butler et al., 2014) to cater the needs of all students guiding and supporting them, promoting relevance and simulating learning, and consequently establishing connections with the teacher (Steiner & Mendelovitch, 2016). Upon using the Curriculum Customization Service (CCS), as a digital tool, science teachers have reported developing significant awareness and frequency of using interactive resources in their instruction. The tool has provided them with proper opportunities to surf and operate educational content from a variety of resources, and to adapt this content to their students' needs and interests who have remarkably revealed academic improvement; and eventually, teachers shared the personalized content with other educators for their perusal and exploitation (Ye et. al., 2015). Also, ICT tools have been incorporated in physics classes, in which physics teachers have reported the efficiency of integrating laptops, interactive digital textbook, internet-based simulations, digital drop-box, graphic calculators and other physics related software and video cameras (Zucker & Hug, 2008). In a comparative approach, findings revealed a noticeably higher frequency of ICT use in English classes compared to mathematics lessons; where the English teachers facilitated students' learning, from and with technology, promoting collaboration and production that; accordingly, emphasizes the pivotal role of the teacher in considering the pedagogical implications when integrating ICT in the teaching and learning process (Tay et al., 2012).

Teachers, recognized as the primary drivers, play a crucial role in utilizing ICT to prepare students for the modern digital age giving way to a dynamic and proactive teaching-learning environment (Arnseth & Hatlevik, 2010). Findings among primary and high school students, revealed that ICT integration prepares learners for real-life situations (Lowther et al., 2008, Weert & Tatnall, 2005) and these learners showed amplified interest, increased motivation, and higher levels of satisfaction when their classroom learning experiences were basically impacted by technology (Rafool et al., 2012). As a result, several pre-service and in-service training programs have been conducted recently to enhance teachers' proficiency in using ICT for teaching purposes since teachers' beliefs and attitudes as well as knowledge and skills are the vital factor in employing ICT in teaching (Sabiri, 2020). The success of their technology-based teaching and learning depends greatly on the engagement with ICT tools and facilities (Ghavifekr & Rosdy, 2015) that had consequently influenced their confidence and comfort level of the teachers (Liu et al., 2017). Teachers' positive perceptions of ICT impact on teaching and learning; such as the innovation and the development of the higher thinking skills ICT can bring about, will undoubtedly motivate teachers to integrate ICT (Silviyanti & Yusuf, 2015). On the other hand, teachers' negative perceptions, resulting from insufficient number of computers in the school, lack of access, and recurring technical operational problems, will all limit the use of ICT (Samuel & Bakar, 2006).

2.2 Challenges of Integrating ICT in K-12 Education

As cited by Shadreck (2015), there are two types of obstacles, external and internal, which educators may encounter in the process of integrating technology into their classroom practices. As for the external hindrances, they relate to resource availability (Nikolopoulou et al., 2019), accessibility, insufficient training, and limited technical support (Hew & Brush, 2007; Silviyanti &Yusuf, 2015). On the other hand, the internal barriers that teachers encounter include their attitudes and beliefs towards technology, their

reluctance to incorporate it in the classroom, and their proficiency in its usage (Ertmer & Ottenbreit-Leftwich, 2010; Frank et al., 2011; Johnson et al., 2016).

A variety of reactions has been revealed in the use of ICT worldwide. In Ireland, teachers lacking confidence in using ICT tended to avoid its usage. A similar scenario occurred in Canada, where some teachers admitted being hesitant ICT users due to concerns of potential embarrassment if their students had better knowledge of the technology (Hennessy et al., 2005). In Cameroon, which educational system-as Lebanon- is a legacy of British and French colonial administration, has undertaken several governmental and non-governmental initiatives for integrating ICT within the curricula of basic, secondary, vocational and higher education since 2001. Pertinent efforts were doomed to failure since there was a bunch of barriers that includes the chronic lack of infrastructure and equipment, the inadequate number of qualified trained teachers, lack of support from school administrators and dismissive attitudes and beliefs of teachers and parents toward ICT integration (Ngajie & Ngo Mback, 2016).

The aforementioned challenges can be smoothly addressed by conducting a set of measures that will undoubtedly bridge the gaps resulting in the evident impact of integrating ICT in K-12 schools. To begin with, students' ratio to computers should unequivocally become 1:1(Warschauer et al., 2014) while teachers should have at least one computer in their classroom every day with internet access (Gray et al., 2010). Definitely, this will require an essential upsurge in the school's budget which might accordingly create additional fiscal burdens on the school itself, and urge its leaders to pursue unconventional funding or move toward a cost-cutting strategy of asking students to bring their own device after providing appropriately- secured digital infrastructure within the school premises (Afreen, 2014). Moreover, since technology is dynamically changing, teachers' technological expertise should be constantly updated through continuously adequate training (Johnson et al., 2016) that will familiarize them with the abundant educational software and application pertinent to the school subjects they teach; and also, will foster their self-efficacy represented by two key components: perceived ease of use and perceived usefulness. This development may result in positively influencing the teachers' motivational beliefs in their continuance intentions to use ICT in their teaching practices (Bai et al., 2021). Synchronously, to endure proper update, it would be beneficial to provide training programs for educational game designers on the composition tools used in computerized educational game building (Al Sarhan et al., 2013)

In light of the above-mentioned internal barriers, educational administration can boost teachers' confidence in their digital skills and knowledge by optimizing their digital environment and incrementally promoting the achievement of their instructional goals through integrating ICT. Although, teachers play a critical role in students' success, their beliefs may impede students' progress; therefore, teachers, with the educational administration support, should promote student-centered class wherein active learning supported by ICT integration is delivered replacing traditional learning. Furthermore, educational administration can promote professional learning communities within the school to support teachers technically. In similar communities, peer support can be provided; wherein teachers can discuss innovative applications of the technology that are specific to their field of interest and the school subject they teach (Agbatogun, 2012 & Johnson et. Al, 2016) within the ambit of reform of teaching practices of varied school subjects (Pringle et al., 2015). In addition, other facilitating conditions such as availability of resources and necessary technical support can be provided to foster teachers' positive perceptions towards

ICT adoption and use (Bai et. Al, 2021). Nonetheless, harmonizing nationwide integration requires the development of clear policies and implementation strategies with the engagement of active participation of both administrators and teachers while educational technology experts will address any concerns or uncertainties, and provide guidance and support (Zhao & Xu, 2010).

Although teaching is a personal experience in which teachers have the freedom of technology choice, school administration should increase the teachers' acceptance of ICT integration. In addition, it should decrease the teachers' resistance by providing relevant training that pertains to a blend of technological, pedagogical and content knowledge in addition to empirically validated educational technologies that are rigorously tested and easily found and accessible (Johnson et al., 2016).

3. Methodology

This study adopted a mixed- method approach; in which quantitative and qualitative data were collected. The study utilized quantitative surveying and semi-structured interviews to arrive at the findings, and corroborate conclusions and recommendations. One of the questionnaires is directed to the students while the other one has targeted the teachers. Semi-structured interviews had targeted receptive participants from the teachers and the students.

3.1 Instrument

To answer the research questions, fifteen virtual and face-to-face semi-structured interviews were conducted to investigate the teachers' perspectives of the significance of technology on teaching, the challenges teachers might encounter and how to alleviate their negative impacts. In addition, forty-seven virtual and face-to-face semi-structured interviews were conducted to investigate the students' perspectives of the significance of technology on their learning and how frequently and efficiently technology is being integrated across different school subjects. On the other hand and prior to the interviews, two surveys were developed by the researcher on Google Forms. Both surveys were conducted online via Google Forms, and their links were sent to the teachers and students respectively. The researcher developed these surveys making use of The Technology Integration Matrix (TIM), developed by the Florida Center for Instructional Technology (FCIT, 2019), which incorporates active, collaborative, constructive, authentic, and goal-directed learning environments associated with the following five levels of technology integration: entry, adoption, adaptation, infusion, and transformation. The teachers' survey consisted of six sections featuring demographic data with a 4-point Likert scale (1= lowest frequency & 4= highest frequency) teachers' rating of their familiarity with technology and how frequently and effectively technology is used in their classes, and the challenges associated with integrating technology. The students' survey included seven sections requesting demographic data with a 4-point Likert scale (1= lowest frequency & 4= highest frequency) students' rating of their familiarity with technology and how frequently and effectively teachers of different school subjects have used technology. The first version of both surveys was initially subjected to a critical expert review, and then it was piloted on 108 (grade 4-12) students and 51 teachers. Reliability checks using the Cronbach alpha statistics were conducted for the internal consistency and were determined to be α=.943 for the students' survey and α=.967 for the teachers' survey which is considered to be a very good indicator of internal reliability (Creswell, 2014).

3.2 Participants

This study was conducted at MSN, founded in 1978 and made of academic chain that comprises 14 schools; nine (k-12) and five (k-9) schools hosting bilingual educational programs (with English or French as a foreign language) across three main governorates in Lebanon with a total enrollment of 2200 students. All teachers and students enrolled were invited to fill in the questionnaires. Only 135 teachers and 632 students participated in the quantitative part of the study; wherein 15 teachers and 47 students from the participants accepted to be interviewed.

3.3 Data Analysis

Quantitative data were analyzed using SPSS 26.0 for windows. Descriptive statistics were used to describe and summarize the properties of the mass of data collected from the respondents. Means scores, standard deviations and percentages were calculated in addition to Pearson Correlation and ANOVA. On the other hand, theme-based analysis was utilized in order to synthesize teachers' views on how integrating technology opportunities may be enhanced.

4. Results

4.1 Quantitative Results

Table 1 clarifies that the majority are female teachers between 25 and 44 years old with 6 to 20 years of experience teaching in MSN whereas Science & English teachers have participated the most (Appendix).

Table 2: Demographic characteristics of students

Students' Survey				
Variables		Frequency	Percentage	Total
Gender	Male	298	47.2%	
	Female	334	52.8%	
Grade Level	Cycle 2	208	32.9%	
	Cycle 3	227	35.9%	632
	Cycle 4	197	31.2%	
School Location	Beirut	284	44.9%	
	Bekaa	151	23.9%	
	South Lebanon	197	31.2%	

Table 2 displays almost equal representation of both genders and of the three learning cycles; however, students of Beirut schools have participated the most in this study.

Table 3: Results per dimension addressed in the teachers' survey

Dimension in Teachers' Survey	Mean	Standard Deviation
Familiarity with Varied Technologies	2.668	.627
Technologies Existing in Class	2.198	.644
ICT Integration in Assessments	1.982	.673
ICT-integrated Class Practices	2.287	.728
Effectiveness of ICT integration on Teachers' Performance	3.189	.537
Challenges of ICT integration	2.870	.653

Table 3 shows that MSN teachers reveal that ICT integration occurs occasionally and has not become a culture. To explain more the mean of the six different dimensions ranges between 3 and 2 which meet the scale of sometimes and rarely respectively. However, the lowest mean was for the extent to which technology integrates with assessment. On the other hand, the highest mean was for the teachers' perspective on the effectiveness of ICT integration on their performance.

Table 4: Pearson Correlation between the variables of the teachers' survey

Variables in Teachers' Survey		Pearson Correlation	Sig. (2-tailed)	N
Challenges of ICT integration	Years of Experience	-.208	.016	
	Taught Grade Level	-.176	.041	
	Age	-.178	.039	135
Familiarity with Varied Technologies	Taught Grade Level	-.187	.030	
	School Location	-.174	.043	
	Age	-.209	.015	
Correlation is significant at the 0.05 and 0.01 levels.				

To examine whether there is a correlation between the independent and dependent variables in the teachers' survey, Pearson correlation was calculated and displayed in table 4. The table demonstrates that there is a statistically significant negative correlation between challenges of ICT integration and the independent variables of years of experience (r= -.208, α= .016), taught grade level (r=-.176, α=.041) and age (r=-.178, α=.039). Apparently, according to the veteran senior teachers with many years of experience and have been teaching high grade levels, challenges of ICT integration occur less than those who are still young, have little experience and teach low grade levels.

Similarly, there is a statistically significant negative correlation between familiarity with varied technologies and the independent variables of taught grade level (r=-.187, α=.030), school location (r= -.174, α= .043) and age (r=-.209, α=.015). Obviously, elderly teachers who teach high grade- levels in rural branches of MSN are less familiar with varied technologies used for education purposes.

Table 5: Comparison of Means- ANOVA

Variables in Teachers' Survey		Sum of Squares	df	Mean Square	F	Sig.
Age and Familiarity with Varied Technologies		5.181	5	1.036	2.807	.019
School Location and ICT-integrated Class Practices		4.320	2	2.160	4.265	.016
Taught subject	Familiarity with Varied Technologies	11.506	11	1.046	3.116	.001
	Technologies Existing in Class	8.853	11	.805	2.115	.024

For further examination of the differences between the age groups, school location groups, and taught subject groups, ANOVA (analysis of variance) is conducted to find out whether the differences between these groups of data are statistically significant.

Table 5 reveals that there is a significant effect of the age on the teachers' familiarity with varied technologies (p-value= .019 < .05) with M = 2.79, 2.73, 2.67, 2.57 & 1.6 for the age groups (25-34), (< 25), (45-54), (35-44) & (>55) respectively. This means that the younger teachers are the more familiar with varied technologies they stand.

Additionally, there is a significant effect of the school location on ICT-integrated class practices (p-value= .016 < .05) with M = 3, 2.7 & 2.4 for schools in Beirut, South Lebanon & Bekaa respectively. In clear terms, teachers who teach in Beirut branches have reported ICT-integrated class practices more frequently than others who teach in rural branches in South Lebanon and Bekaa.

Furthermore, there is a significant effect of the taught subject on the teachers' familiarity with varied technologies (p-value= .001 < .05) with M = 3.03, 2.91, 2.61, 2.51, 2.49, 2.30, 2.21 & 2.16 for sciences, English, Physical Education, Arts, Arabic, Islamics, Math & Social Studies/ Economics respectively. Explicitly, these differences among groups show that teachers of sciences & English are the most familiar with varied technologies compared to other teachers.

Similarly, there is a statistically significant effect of the taught subject on technologies existing in class (p-value= .024 < .05) with M = 2.47, 2.35, 2.27, 2.15, 1.89, 1.55 for sciences, English, Arabic, Social Studies/ Economics/Physical Education, Arts/ Islamics, & Math respectively. Explicitly, these differences among groups show that varied technologies exist more frequently in the classes of teachers of sciences & English compared to other school subjects.

Table 6: Results per dimension addressed in the students' survey

Dimension in Students' Survey	Mean	Standard Deviation
Students' familiarity with varied technologies	2.450	.607
ICT integration in different school subjects	2.335	.707
Students' use of technologies at school	2.030	.579
Teachers' use of technology in class	2.008	.583
Students' ICT-integrated class practices	2.301	.729
ICT integration in assessments	1.661	.663
Effectiveness of ICT integration on students' learning	2.806	.849

Table 6 displays students' perspective on how frequently ICT is integrated in MSN. On a 4-point- Likert scale, students consider that ICT integration occurs on an average frequency with a mean ranging between 1.6 & 2.8. To delve into the survey's varied dimensions, findings show that ICT is rarely integrated in assessments, yet once ICT integration occurs; it often affects students' learning.

Table 7: Students' perspectives on ICT integration in different school subjects

	Arabic	English	Maths	Science	Social Studies	Physics	Biology	Chemistry	Economics	Islamics	Arts	Physical Education	Philosophy
Mean	2.73	2.87	2.74	2.91	2.13	2.35	2.38	2.40	1.58	1.57	1.42	1.93	1.36
Std. Deviation	.995	.967	1.009	.938	1.260	1.298	1.326	1.325	1.307	1.183	1.277	1.351	1.280
N	632												

In table 7, students express their perspectives on the extent at which each school subject integrates ICT. The table demonstrates that Sciences followed by English, Maths and Arabic incorporate an average level of ICT integration; i.e., the teachers of theses school subjects sometimes integrate ICT in their instructional process. On the other hand, teachers of minor school subjects as social studies, arts, physical education, economics, Islamics & philosophy rarely integrate ICT in their teaching.

To examine whether there is a statistical significance between the means of the variables' groups in the students' survey; accordingly, ANOVA test was conducted and table 8 reveals the results.

Table 8: Comparison of Means- ANOVA

Variables in students' survey		Sum of Squares	df	Mean Square	F	Sig.
Students' grade level	Students' familiarity with varied technologies	19.497	2	9.748	28.725	.000
	ICT integration in different school subjects	32.356	2	16.178	35.900	.000
	ICT integration in assessments	3.564	2	1.782	4.090	.017
School location	Students' use of technologies at school	2.115	2	1.058	3.171	.043
	ICT integration in assessments	2.964	2	1.482	3.395	.034

Table 8 reveals that there is a significant effect of the students' grade level on students' familiarity with varied technologies (p-value= .000 < .05) with M = 2.657, 2.481 & 2.221, for cycles 4, 3 & 2 respectively.

The highest students' grade level is, the more familiar with varied technologies they are, so cycle 4 students are more familiar with different technologies than students are in cycle 3 and 2.

Additionally, there is a significant effect of the students' grade level on ICT Integration in different school subjects (p-value= .000 < .05) with M = 2.599, 2.489 & 2.012 for cycles 4, 3 & 2 respectively.

This means that highest students' grade level is, the more ICT integration occurs in different school subjects, so cycle four students encounter ICT integration more than cycle 2.

Moreover, there is a significant effect of the students' grade level on ICT integration in assessments (p-value= .017 < .05) with M = 2.599, 2.489 & 2.012 for cycles 4, 3 & 2 respectively. This means that ICT is more integrated in assessment of cycle 4 than it occurs in other lower cycles, so cycle 4 students are assessed more frequently with ICT integration than other cycles.

With respect to school location, it demonstrates a significant effect on students' use of technologies at school (p-value= .043 < .05) with M = 2.134, 2.014 & 1.789 for Beirut, South Lebanon & Bekaa respectively.

Additionally, it reveals a significant effect on ICT integration in assessments (p-value= .034 < .05) with M = 2.631, 1.782 & 1.611 for Beirut, South Lebanon & Bekaa respectively. To interpret these findings, it can be clearly said that students at MSN Beirut schools use more technologies than those in branches in rural areas and accordingly, those in Beirut are more exposed to assessments that integrate ICT more frequently.

4.2 Qualitative Results

Teachers were interviewed to discuss three main topics: their perspective of the significance of technology on their teaching, the challenges they really face and how they overcome them.

Table 9: Qualitative data of the interviewed teachers

Teachers' interviewed aspects	Response themes
ICT integration and its effectiveness from teachers' perspectives	Little significance/No need for technology/Technology is a waste of time/ secondary role for technology Sporadic integration only Physical realia as teaching aids are more engaging &hands-on. Using selected variety of educational digital platforms to enhance teacher effectiveness Scientific experimentation digital simulations Problem-solving and critical thinking skills not exclusively developed through technology Absence of ICT in assessments
Encountered Challenges In-depth	Low achievers/academically and behaviorly struggling students Electricity & connectivity inconveniences/Poor digital infrastructure Students' lack of technological devices and their digital skill gap Stressing work environment Disrupted learning environment with students engaging in non-educational activities on their devices Time constraints Keep pace with rapidly evolving technology Addressing students' diverse learning needs Absence of clear vision or strategic planning
Challenges Overcome	Collaboration and cascading experience & best practices among teachers Proper training & technical support from the school administration Prioritizing robust technological infrastructure Recognition to the teachers

On the other hand, students were interviewed to extensively examine two issues: their perspective of the importance of ICT in their learning and how frequent and efficient ICT is incorporated in school subjects.

Table 10: Qualitative data of the interviewed students

Students' interviewed aspects	Response themes
ICT integration from the students' perspectives	Practically ICT has little significance Story recordings are shared in EFL class A link via Quizziz or Kahoot is shared for extra practice in learning math No tangible impact of ICT on school learning Links or videos shared are enjoyed by students Some teachers do not know how to turn on the desktop Technologically incompetent teachers will fall short of using technology to improve students' learning. ICT integration enhances our learning and clarifies abstract concepts.
Frequency & Efficiency of ICT integration in the school subjects	Gaps between the technologies students use at home and those teachers use in the classroom Rarely integrated ICT due to lack of proper infrastructure English, Math & Science incorporate more ICT integration Physics best explained through video tutorials Quizzes & summative tests are pen-and-paper conducted ICT is never used in social studies Digital tools are sporadically available for teachers only No direct access to technology Digital links to exercises in English are shared with students occasionally Projects conducted at home incorporate ICT integration are rarely inquired.

5. Discussion

In this study, ICT integration at MSN is examined from the perspectives of both teachers and students. Findings indicate that MSN across Lebanon has sometimes integrated ICT reaching the adoption level of integration and falling behind adaptation, infusion and transformation levels.

Firstly, Concerning the number of participants, English and science teachers are usually more numerous than teachers of other subjects since the Lebanese national educational system allots 8-6 teaching sessions for these school subjects per week compared to 3-5 teaching sessions for Arabic, math & social studies, and 1-2 teaching sessions for arts, Islamics & physical education (CRDP, 2022). On the other hand, the numerous number of cycle 2 participating teachers compared to the number of teachers from other cycles is simply explained by the fact that the higher the grade level is, the higher the drop-out rate is. Consequently, the number of teachers needed to teach high grade-levels is way much less than those needed for primary levels.

The findings demonstrated in tables 3 & 6 and in the qualitative data resonate appropriately and logically since both teachers and students think that ICT integration at MSN occurs at an average frequency of occurrence. To delve deeper into its implications; teachers have surpassed the entry level to the adoption level of ICT integration wherein they use technology tools to deliver the curriculum content in conventional ways (FCIT, 2019). Explicitly at this level of integration, only teachers have access to digital tools in the school and make the decision what tool and when to be used while students have limited exposure and access to digital tools and are remarkably guided by their teachers for any digital encounter.

Furthermore, MSN teachers expressed their beliefs toward how effective ICT is to their teaching performance, which apparently aligns with other reviewed studies in the same topic (Sabiri, 2020; Chen, 2011). Moreover, these teachers have also conveyed the need for a transformational role for technology in their classes wherein this integration is strategically planned for with a meticulous attention for the students' needs and for supplying the teachers with appropriate and efficient professional development (Nikolopoulou et al., 2019) to handle digital tools and get the best of them. Additionally, teachers have demonstrated the need to use ICT with and for learning in which digital tools are not only utilized for technological knowledge but also for pedagogical and content knowledge; thus supporting the teacher plan her daily lesson accordingly. These findings are also in association with previously reviewed studies (Arnseth & Hatlevik, 2010; Ghavifekr & Rosdy, 2015; Tay et al., 2012). However, what extends further in the current study is ICT integration in assessment. This aspect of the study has been highlighted in the teachers' and students' interviews in which the absence of ICT integration in assessment is being addressed as a gap that should be bridged by policy makers and on the macro level of planning for MSN.

On the other side, MSN Beirut schools, which belong to an urban community, are more accessible to technology; teachers and students have expressed their perspectives confirming how more familiar and more exposed to technology they are. This finding brings to surface the recurrent dilemma of uneven development between urban and rural communities in Lebanon, and how it should be tackled to ensure equality among all students and in particular those who belong to the same educational institution. This aligns with the results of a study conducted in rural areas in China; and thus, it recommends promoting strategic planning for better pedagogical use of technology to truly achieve educational equalization for rural students (Li et al., 2018).

The findings demonstrates that teachers' and students' perspectives are matching; both agreed that the highest frequency of ICT integration lies in Sciences, English, Math and then Arabic, while other subjects such as social studies, arts, Islamics and physical education have score the lowest frequency of ICT integration. Matching results ensure the surveys' reliability and the validity of collected data that affirm the value of the study's results.

The qualitative results demonstrated in tables 9 and 10, best resonate with findings from previously examined research that reveal that barriers, originated from the lack of training and support, should become the school's priority to overcome which will play a significant role in improving teachers' motivation toward integrating ICT in their teaching (Silviyanti & Yusuf, 2015).

Obviously, teachers and students agree that ICT integration does not really prevail in MSN; thus, conveying that it is essential for the betterment of the educational system in the association in which it promotes teachers' professional skills and students' critical and problem-solving skills as stated in several studies (Alcantud-Díaz et al., 2014; Rafool et al., 2012). However, quite a number of barriers is transparently communicated to mark the reasons for falling behind with adapting, infusing and transforming to technology.

In light of the qualitative results, teachers have clearly proclaimed a batch of barriers that impedes the efficiency of ICT integration within the delivered curriculum. Having a dull experience that lacks a number of major requirements has devalued the significance of incorporating ICT in the school syllabi resulting in teachers' resisting and dismissive attitudes toward technology in education although they have clearly expressed the effectiveness of ICT on their performance skills. Obviously, MSN policy makers have fallen behind to embrace ICT for facilitating the teachers' job and promoting students' higher-order thinking skills; ICT has been rather seen as a mere technological tool while its occurrence should comprehensively incorporate two more tiers of knowledge; the pedagogical and content (Johnson et al., 2016; Linn et al., 2016).

6. Conclusion

Undoubtedly, in order to cultivate competent individuals who are in high demand, it is crucial for students to have a thorough understanding and appropriate utilization of technology. According to Prensky (2001), the term "digital native" refers to children who are born and grow up in an era of advanced technologies; thus, more inclined to learning wherein they achieve goals and objectives of educational-instructional activities successfully (Bilgic et al., 2011). Additionally, teachers play a pivotal role in cultivating students; and thus their pre-service and in-service training should not target separate areas of knowledge such as understanding of pedagogy, ICT integration and teaching. Teachers' development should be directed towards extensively embracing their technological pedagogical content knowledge (Linn et al., 2016).

To conclude, it is evident that although ICT integration exists, its impact and prevalence is rather restricted due to many factors that revolve around the educational leadership role. In brief, K-12 schools should set the tone, expectations & timeline, plan comprehensively, share the plan with all involved teachers through ordinary channels, launch the process of ICT integration, keep up a close and meticulous follow-up, and eventually surmount encountered obstacles throughout the implementation journey.

Consequently, the foundations are well laid, yet they are a drop in the bucket. More advanced and innovative uses of technology in education are essential for the development of k-12 schools to keep pace with rapidly developing technology.

7. Recommendations

In this part of the article, the researcher will address a set of recommendations that could be instrumental for K-12 schools in Lebanon and abroad as long as they have similar conditions and facing parallel challenges.

ICT integration should shift away from being characterized as "all-or-nothing", yet more towards understanding integration as a process that can smoothly lead to different usage patterns of users diffusing it throughout the curricula and the yearly syllabi. There is an indispensable need to continuously investigate how ICT is being implemented with a constant evaluation to pinpoint what has boomed and what still needs to go the extra mile.

Since ICT integration can be double-edged and students can be influenced by technology in both positive and negative ways (Altan & Karalar, 2018); accordingly, policy makers and educators, hand-in-hand with parents, have to rethink the balance between using ICT appropriately and effectively (Albion et al., 2015). They should neither debar students from technology nor absolutely immerse them in it with diligent efforts to avoid affecting the students' social and academic skills or even worse causing deficits and regression in their basic skills of reading, writing and math, or leading to social interaction disorders.

This study recommends teachers to embrace technology and work towards bridging the gap between the devices and applications that students utilize at home, and the ones they encounter within the classroom. Developing Technological Pedagogical Content Knowledge is crucial for teachers to effectively integrate ICT into their teaching practices (Jiménez Sierra et al., 2023). However, these teachers are apparently in a dire need of well-equipped books that comprise of digital content to support them in planning for each individual lesson.

According to Chapelle (2011), schools equipped with ICT infrastructure receive support from either parental initiative or community empowerment; thus, this study recommends policy makers to demonstrate their technology acquisition, highlight to the community its positive impact on educating students, and then subsequently rely on the community in attaining further digital resources and maintaining the existing ones. This process will undoubtedly ensure integrating ICT and keeping up these efforts not only at MSN but also at all other private schools having the same structure, conditions and policy.

To wrap it up and away from so-called "Boutique Recommendations", ICT integration should be approached from three perspectives that incorporate ICT into learning as a school subject, as a resource or an educational tool and as a teaching method.

8. Contributions, Limitations & Further Studies

Numerous studies have investigated the integration of ICT in education; some focused on the basic tools as office and the internet use (Chiu & Wang, 2008); others focused on online educational platforms (Liaw & Huang, 2013); some examined ICT's role in lesson planning, providing relevant teaching resources, and promoting teacher-student interaction and discussion. Other research focused on ICT's significance to foster student-centered learning and efficient teaching practices (Sorebo et al., 2009). However, this study carries significant implications for the design of teacher professional development programs that target enhancing their teaching practices. In addition, it highlights the aspect of ICT integration in assessment giving way to a future call for action to extend ICT's incorporation to embrace the entire process of learning. Moreover, this study provides MSN with evidence-based and validated data, which can contribute to improving its educational policy and practices.

In order to establish causal claims, future studies should consider employing longitudinal or experimental designs to investigate ICT integration and validate the results globally. In addition, the present study did not assess teachers' ICT integration in each school subject or in each grade level; in future studies, classroom observations could be conducted to deeply examine teachers' actual frequency and quality of subsequent ICT integration in teaching and assessment. Additional studies can also investigate the school administration's significant role and the parents' part in fostering a smooth integration of ICT. Other future studies can explore other aspects of ICT integration, particularly from a macro-management perspective, such as strategic planning and policy-making considerations.

References

Agbatogun, A. O. (2012). Investigating Nigerian primary school teachers' preparedness to adopt personal response system in ESL classroom. *International Electronic Journal of Elementary Education, 4*(2), 377- 394. https://files.eric.ed.gov/fulltext/EJ1068617.pdf

Al-Awidi, H. M., & Ismail, S. A. (2014). Teachers' perceptions of the use of computer assisted language learning to develop children's reading skills in English as a second language in the United Arab Emirates. *Early Childhood Education Journal, 42*(1), 29–37. https://doi.org/10.1007/s10643-012-0552-7

Alcantud-Díaz, M., Ricart-Vayá, A., & Gregori-Signes, C. (2014). Share your experience. Digital storytelling in English for tourism. *Ibérica, 27*(3), 185–204. http://www.redalyc.org/articulo.oa?id=287030196005

Albion, P. R., Tondeur, J., Forkosh-Baruch, A., & Peeraer, J. (2015). Teachers' professional development for ICT integration: Towards a reciprocal relationship between research and Practice. *Education and Information Technologies*, *20*(4), 655–673. https://doi.org/10.1007/s10639-015-9401-9

Al Sarhan, K. A.; AlZboon, S. O.; Olimat, K. M.; Al-Zboon, M. S. (2013). Features of computerized educational games in sciences of the elementary phase in Jordan from the point of view of specialists in teaching science and computer subjects. *Education*, *133*(3), 247-260. https://eric.ed.gov/?id=EJ1022246

Alsulami, S. (2016). The effects of technology on learning English as a Foreign Language among female EFL students at Effatt College: An exploratory study. *Studies in Literature and Language, 12*(4), 1–16. http://dx.doi.org/10.3968/7926

Altan, B. A. & Karalar, H. (2018). How students digitally age: by gaining or losing? *Elementary Education Online, 17*(2), 738-749. http://dx.doi.org/10.17051/ilkonline.2018.419054

Arnseth, H. C., & Hatlevik, O. E. (2010). Challenges in aligning pedagogical practices and pupils' competencies with the Information Society's demands. *Cases on Interactive Technology Environments and Transnational Collaboration*, 266–280. https://doi.org/10.4018/978-1-61520-909-5.ch014

Bai, B., Wang, J. & Chai, C-S. (2021). Understanding Hong Kong primary school English teachers' continuance intention to teach with ICT. *Computer Assisted Language Learning, 34*(4), 528-551, http://dx.doi.org/10.1080/09588221.2019.1627459

Bilgiç, H. G., Duman, D., & Seferoğlu, S. S. (2011). The characteristics of digital natives' and their effects on the design of online environments. *Akademik Bilişim, 2*(4), 1-7. https://ab.org.tr/ab11/kitap/bilgic_duman_AB11.pdf

Butler, A.C.; Marsh, E.J.; Slavinsky, J.P & Baraniuk, R.G. (2014).Integrating Cognitive Science and Technology Improves Learning in a STEM Classroom. *Educational Psychology Review, 26*(3), 331–340. https://doi.org/10.1007/s10648-014-9256-4

Castro Sánchez, J. J., & Alemán, E. C., 2011. Teachers' opinion survey on the use of ICT tools to support attendance-based teaching. *Journal Computers and Education, 56*(3), 911-915. https://doi.org/10.1016/j.compedu.2010.11.005

Chapelle, C. (2011). *Computer applications in second language acquisition: Foundations for teaching, testing and research.* Cambridge: Cambridge University Press.

Chen, J.S. (2011). A critical reflection on integrating informational technology into EFL curriculum: An EFL teacher's inquiry. *US-China Education Review, A 4*, 464-470 https://files.eric.ed.gov/fulltext/ED526806.pdf

Chiu, C.M., & Wang, E. T. G. (2008). Understanding Web-based learning continuance intention: The role of subjective task value. *Information & Management, 45*(3), 194–201. http://dx.doi.org/10.1016/j.im.2008.02.003

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative and Mixed Methods Approaches (4th ed.).* Thousand Oaks, CA: Sage.

Center for Educational Research & Development (CRDP) in Lebanon. (2022). *Modified Curriculum for 2022-2023.* https://www.crdp.org/curriculum

Elola, I., & Oskoz, A. (2010). Collaborative writing: Fostering foreign language and writing conventions development. *Language Learning & Technology, 14*, 51–71. http://llt.msu.edu/vol14num3/elolaoskoz.pdf

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education, 42*(3), 255–284.http://dx.doi.org/10.1080/15391523.2010.10782551

Florida Center for Instructional Technology (2019). *Matrix.* https://fcit.usf.edu/matrix/matrix/

Frank, K. A., Zhao, Y., Penuel, W. R., Ellefson, N., & Porter, S. (2011). Focus, fiddle, and friends experiences that transform knowledge for the implementation of innovations. *Sociology of Education, 84*(2), 137–156. https://doi.org/10.1177/0038040711401812

Ghavifekr, S. & Rosdy, W.A.W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. *International Journal of Research in Education and Science (IJRES), 1*(2), 175-191. https://files.eric.ed.gov/fulltext/EJ1105224.pdf

Gray, L., Thomas, N., and Lewis, L. (2010). *Teachers' Use of Educational Technology in U.S. Public Schools: 2009* (NCES 2010-040). Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. https://nces.ed.gov/pubs2010/2010040.pdf

Heidari Soureshjani, K., & Etemadi, N. (2012). Listening comprehension success among EFL preschool children using internet-based materials. *Journal of Social Sciences and Humanities, 7*, 243–251. https://core.ac.uk/download/pdf/11493927.pdf

Hennessy, S., Ruthven, K. & Brindley, S. (2005). Teacher perspectives on integrating ICT into subject teaching: Commitment, constraints, caution, and change. *Journal of Curriculum Studies, 37*(2),155-192. https://doi.org/10.1080/0022027032000276961

Hew, K. F., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research. *Educational Technology Research and Development, 55*(3), 223–252. https://doi.org/10.1007/s11423-006-9022-5

Human Rights Watch. (2021). *Lebanon: Planning lapses endanger school year*. https://www.hrw.org/news/2021/10/11/lebanon-planning-lapses-endanger-school-year

Hwang, W. Y., Shadiev, R., Hsu, J. L., Huang, Y. M., Hsu, G. L., & Lin, Y. C. (2016). Effects of storytelling to facilitate EFL speaking using web-based multimedia system. *Computer Assisted Language Learning, 29*, 215–241. https://doi.org/10.1080/09588221.2014.927367

Jabbour, K. K. (2011). Web 2.0 Technology Tools for Global Education in Lebanon. *International Journal of Advanced Engineering Sciences and Technologies (IJAEST), 7*(1), 151 – 168. Retrieved from http://journals.indexcopernicus.com/issue.php?id=9938&id_issue=852200

Jack, C., & Higgins, S. (2018). What is educational technology and how is it being used to support teaching and learning in the early years? *International Journal of Early Years Education, 27*(3), 222-237. https://doi.org/10.1080/09669760.2018.1504754

Jiménez Sierra, Á. A., Ortega Iglesias, J. M., Cabero-Almenara, J., & Palacios-Rodríguez, A. (2023). Development of the teacher's technological pedagogical content knowledge (TPACK) from the Lesson Study: A Systematic Review. *Frontiers in Education*, *8*. https://doi.org/10.3389/feduc.2023.1078913

Johnson, A. M., Jacovina, M. E., Russell, D. E., & Soto, C. M. (2016). Challenges and solutions when using technologies in the classroom. In S. A. Crossley & D. S. McNamara (Eds.) *Adaptive educational technologies for literacy instruction* (pp. 13-29). New York: Taylor & Francis. Published with acknowledgment of federal support. https://doi.org/10.4324/9781315647500

Kaufman, A. (2021). *Lebanon's tragic path from economic miracle to collapse*. Kellogg Institute for International Studies. (n.d.). https://kellogg.nd.edu/news/lebanon%E2%80%99s-tragic-path-economic-miracle-collapse

Li, G., Jee, Y. & Sun, Z. (2018). Technology as an educational equalizer for EFL learning in rural China? Evidence from the impact of technology-assisted practices on teacher-student interaction in primary classrooms. *Language and Literacy, 20*(3), 159-184. http://dx.doi.org/10.20360/langandlit29415

Liaw, S.S., & Huang, H.M. (2013). Perceived satisfaction, perceived usefulness and interactive learning environments as predictors to self-regulation in e-learning environments. C*omputers & Education, 60*, 14–24. https://doi.org/10.1016/j.compedu.2012.07.015

Linn, M. C., Matuk, C., & Gerard, L., (2016). Technology as inquiry teaching partner. *Journal of Science Teacher Education, 27*(1), 1–9. https://doi.org/10.1007/s10972-016-9457-4

Liu, F., Ritzhaupt, A. D., Dawson, K., & Barron, A. E. (2017). Explaining technology integration in K-12 classrooms: A multilevel path analysis model. *Educational Technology, Research, and Development, 65*(4), 795-813. http://dx.doi.org/10.1007/s11423-016-9487-9

Lowther, D. L., Inan, F. A., Strahl, J. D., & Ross, S. M. (2008). Does technology integration work when key barriers are removed? *Educational Media International, 45*, 195-213.https://doi.org/10.1080/09523980802284317

Ngajie, B.N. & Ngo Mback, M. C. (2016). Integration of ICTs into the curriculum of Cameroon primary and secondary schools: A review of current status, barriers and proposed strategies for effective integration. *International Journal of Education and Development using Information and Communication Technology (IJEDICT), 12*(1), 89-106. http://ijedict.dec.uwi.edu/viewarticle.php?id=2069

Nikolopoulou, K., Akriotou, D. & Gialamas, V. (2019) Early reading skills in English as a foreign language via ICT in Greece: Early childhood student teachers' perceptions. *Early Childhood Education Journal, 47*(3), 597–606. https://doi.org/10.1007/s10643-019-00950-8

Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon- MCB University Press*, *9*(5). https://www.marcprensky.com/writing/Prensky%20%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf

Pringle, R.M.; Dawson, K. & Ritzhaupt, A.D. (2015). Integrating science and technology: Using technological pedagogical content knowledge as a framework to study the practices of science teachers. *Journal of Science Education and Technology 24*, 648–662. https://doi.org/10.1007/s10956-015-9553-9

Rahimi, M., & Yadollahi, S. (2017). Effects of offline vs. online digital storytelling on the development of EFL learners' literacy skills. *Cogent Education, 4*(1), 1-13. http://dx.doi.org/10.1080/2331186X.2017.1285531

Rafool,B.; Sullivan, E. & Al-Bataineh, A. (2012). Integrating technology into the classroom. *The International Journal of Technology Knowledge and Society, 8*(1):57-71. http://dx.doi.org/10.18848/1832-3669/CGP/v08i01/56265

Sabiri, K. A. (2020). ICT in EFL Teaching and Learning: A Systematic Literature Review. *Contemporary Educational Technology, 11*(2), 177-195. https://doi.org/10.30935/cet.665350

Samuel, R. J., & Bakar, Z. A. (2006). The utilization and integration of ICT tools in promoting English language teaching and learning: reflections from English option teachers in Kuala Langat district, Malaysia. *Journal of Education and Development, 2*(2). http://ijedict.dec.uwi.edu/viewarticle.php?id=161&layout=html

Shadreck, M. (2015). Integrating ICTs into the environmental science primary school classroom in Chegutu district, Zimbabwe: Problems and solutions. *European Journal of Science and Mathematics Education, 3(1)*, 90-96. https://files.eric.ed.gov/fulltext/EJ1107801.pdf

Silviyanti, T. M. & Yusuf, Y. Q. (2015). EFL teachers' perceptions on using ICT in their teaching: To use or to reject? *Teaching English with Technology*, *15*(4), 29-43. https://eric.ed.gov/?id=EJ1138430

Sorebo, O., Halvari, H., Gulli, V. F., & Kristiansen, R. (2009). The role of self-determination theory in explaining teachers' motivation to continue to use e-learning technology. *Computers & Education, 53*, 1177–1187. https://doi.org/10.1016/j.compedu.2009.06.001

Steiner, D., & Mendelovitch, M. (2017). "I'm the same teacher": The attitudes of science and computer literacy teachers regarding integrating ICT in instruction to advance meaningful learning.

Eurasia Journal of Mathematics, Science and Technology Education, 13(5), 1259- 1282. https://doi.org/10.12973/eurasia.2017.00670a

Tay, L. Y., Lim, S. K., Lim, C. P., & Koh, J. H.-L. (2012). Pedagogical approaches for ICT integration into primary school English and mathematics: A Singapore case study. *Australasian Journal of Educational Technology*, *28*(4). https://doi.org/10.14742/ajet.838

Warschauer, M., Zheng, B., Niiya, M, Cotton, S., & Farkas, G. (2014). Balancing the one-to-one equation: Equity and access in three laptop programs. *Equity & Excellence in Education, 47*(1), 46-62, https://doi.org/10.1080/10665684.2014.866871

Weert, T. V., & Tatnall, A. (2005). *Information and Communication Technologies and Real-Life Learning: New Education for the New Knowledge Society*. New York: Springer. https://doi.org/10.1007/b136546

World Bank. (2021). *Foundations for building forward better: An Education Reform Path for Lebanon*. Retrieved from https://documents1.worldbank.org/curated/en/627001624033308257/pdf/Foundations-for-Building-Forward-Better-An-Education-Reform-Path-for-Lebanon.pdf.

Ye, L., Recker, M., Walker, A., Lear, H. & Yuan, M. (2015). Expanding approaches for understanding impact: Integrating technology, curriculum, and open educational resources in science education. *Educational Technology Research and Development 63*, 355–380. https://doi.org/10.1007/s11423-015-9377-6

Zhao, J., Xu, F. The state of ICT education in China: A literature review. *Frontiers of Education in China* 5(1), 50–73. https://doi.org/10.1007/s11516-010-0006-1

Zucker, A., & Hug, S. (2008). Teaching and learning physics in a 1:1 laptop school. *Journal of Science Education and Technology, 17*(6), 586-594. Retrieved from http://www.jstor.org/stable/41219454

Appendix

Table 1: Demographic characteristics of teachers

Teachers' Survey				
Variables		Frequency	Percentage	Total
Gender	Male	16	12%	
	Female	119	88%	
Age (years)	< 25	26	19.3%	
	25-34	46	34.1%	
	35-44	45	33.3%	
	45-54	14	10.4%	
	55-64	2	1.5%	
	> 64	2	1.5%	
Highest Earned Degree	Lower than BA/BS	15	11%	
	BA/BS	42	31%	
	TD	28	21%	
	MA/MS	47	35%	
	Doctoral	3	2%	
Taught Grade Level	Cycle 2	63	46.7%	
	Cycle 3	36	26.7%	
	Cycle 4	36	26.7%	
Taught Subject	Arabic	15	11%	135
	English	33	24.4%	
	Math	19	14%	
	Sciences	37	27.4%	
	Social Studies & Economics	15	11%	
	Islamics	9	6.6%	
	Arts	4	2.9%	
	Physical Education	3	2%	
Experience Years	≤ 5 years	50	37	
	6-10	30	22.2	
	11-20	40	29.6	
	21-30	14	10.4	
	> 30	1	.7%	
School Location	Beirut	83	61.5%	
	Bekaa	17	12.6%	
	South Lebanon	35	25.9%	