AMERICAN UNIVERSITY OF BEIRUT

USE AND ACCEPTANCE OF THE INTERACTIVE WHITE BOARD BY BIOLOGY TEACHERS IN THE LEBANESE PUBLIC SCHOOLS

by

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ABSTRACT

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The trend of Interactive Whiteboard (IWB) adoption outstandingly boomed in Lebanon between 2011 and 2018 when two hundred twelve IWBs were distributed among public schools in Lebanon. Research provides evidence that IWB use in classrooms enhances student engagement, participation, motivation and retention as well as supports a variety of learning styles. Although several studies examined teachers' attitudes toward using the IWB in the western countries, very few were carried out in the Arab world. Based on the Unified Theory of Acceptance and Use of Technology (UTAUT), this study used an online survey with Biology teachers at Lebanese public schools to understand the factors that may affect their Behavioral Intention (BI) towards the use and acceptance of IWB in their teaching practices. Additionally, interviews were carried out with seven teachers to validate the survey findings and provide participants the opportunity to comment on their experience in their own words. Results reveal a significant correlation between UTAUT determinants and behavioral intention. However, only teaching performance expectancy (TPE) and voluntariness of use (VOU) were shown to positively impact BI, independent of other factors. Additionally, although demographics were not found to directly influence BI, age has an indirect impact on BI through UTAUT determinants (learning performance expectancy (LPE), social influence (SI), effort expectancy (EE), and VOU). Also, the number of IWBs in schools affects VOU and thus indirectly impacts BI. The average VOU score was shown to decrease as the number of IWB in schools increases. Qualitative results demonstrated teachers' belief in the effectiveness of IWB in teaching and learning and whether or not they intend to use it. Indeed, several factors were shown to hinder teachers' use of the IWB, like technical issues, need for time, effort, and training as well as scarcity of IWBs in the school.

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CHAPTER 1

INTRODUCTION

The effects of interaction between teachers and students and between students themselves on pedagogy have been extensively and widely studied through investigating students and teachers Initiate-Respond-Feedback moves in the classroom setting (Sinclair & Coulthard, 1975). These studies have increased the awareness of the multi-modal nature of teaching, which involves the integration and coordination of different communication activities from verbal, to visual, to interpersonal (Higgins, Beauchamp, & Millar, 2007). In the light of the studies, the incorporation of Interactive White Board (IWB) in classrooms seems to involve more than just acquiring the board and installing the software (Sutherland et al., 2004). It has been shown that the technical affordances of this relatively new technological device do not guarantee its interactive pedagogical affordances. On the contrary, its untrained use as a typical board might actually, on one hand, transform instruction into a more traditional one (Smith et al., 2006) and, on the other hand, present an obstacle towards achieving a student-centered classroom setting. Hence, it was shown that IWB usage needs to be tailored to specific learning goals in order to serve its purpose in enhancing interactivity rather than defeating it. Teachers are fully responsible for exploiting the IWB in their teaching practices. Thus, they are the critical agents in promoting the effective use of this so-called interactive tool (Sutherland et al., 2004).

Previous research examined the use of IWBs in both primary and secondary schools.

These include general studies done to detect the impact of IWB use on student learning and behavior as well as those involving teachers' beliefs, behavior, professional skills, and professional development.

Impact of IWB on Teaching and Learning

Several studies examined the impact of the use of IWBs on student learning, beliefs, behavior, engagement, and interest in the classroom. Research provides evidence that IWB use enhances student engagement, participation, motivation and retention (Hall & Higgins, 2005; Wall, Higgins & Smith, 2005) and supports a variety of learning styles essential for students with special needs. Moreover, the inclusion of IWB allows students to explicitly express ideas, share knowledge, and learn by making mistakes (Smith et al., 2005). Also, students showed positive beliefs toward the use of IWBs in the classroom (Mundy, 2011). However, other studies showed that both teachers and students have positive beliefs toward IWBs but liking it is linked to how frequently it is used (Aydinli & Elaziz, 2010; Kennewell & Beauchamp, 2007). The reason is because it enhances students' attention span and focus, engages the less able, allows better visual representation, and better retention of key lesson concepts. Students perform better when teachers use the IWB for more than 120 minutes per day compared to that when teachers use it for a shorter period (Mundy, 2011). However, continuous evaluation of the correlation existing between IWB use and students' achievement could not prove any significant positive association (Higgins et al., 2007; Moss et al., 2007; Swan, Schenker, & Kratcoski, 2008), except at the level of students' behavior where using IWB enhances students' behavior toward learning (Aydinli & Elaziz, 2010). This shows that there is a need to follow up the integration and usage of IWBs in the classrooms even after its inclusion for a few years.

Teachers play a crucial factor in the successful implementation of a lesson using the IWB and thus there is a need to provide them with proper professional development to acquire the technical skill in order to use this technological tool effectively. Several studies determined positive beliefs and behaviors towards using IWBs in the classrooms (Higgins, 2010; Mundy, 2011), but others showed that although some teachers learned the proper skills to master integrating IWB, they do not use it to produce novel teaching approaches (Van Laer et al, 2014; Wong, Teo, & Russo, 2013). In addition, their positive beliefs depend on how frequently they use the IWB (Aydinili & Elazizz, 2010). However, few studies focused on the factors needed for the successful implementation of IWB in classrooms and the factors that drive teachers' intention to use them.

Since teachers are an important factor that determines the success of the tool, several studies were conducted to study their role in integrating IWB. Yet, research indicated that although IWBs have been largely integrated in classrooms, the shift in teachers' instruction to integrate IWB effectively is not significant (Van Laer et al, 2014; Wong et al., 2013).

Similar results were obtained in studies done in Arab countries but these studies remain very few. Most studies were conducted in Saudi Arabia and Jordan. Very limited studies were conducted in Lebanese school contexts especially concerning the IWB technology. Some studies showed that teachers and students have positive attitudes toward using IWB in classrooms and perceive it as a beneficial tool to enhance teaching methods (Gashan & Alshumaimer, 2015; Isman, Albulaziz, Barakat, & Abdelrahman, 2012). However, teachers face technical problems and fail to use all the options provided by this tool during its implementation. Also, many teachers still use the IWB as a normal whiteboard which shows a limitation in using the full options provided by

this tool that plays an important role in enhancing learning. Moreover, although teachers' perceptions of IWB determine their proper usage, studies showed that many do not perceive IWB as a tool that facilitates their job (Abuhmaid, 2014; Jwaifell & Gasaymeh, 2013). In Lebanon, very few studies were conducted on using IWBs in classroom and those that were done focused only on the professional development of teachers when using IWB (Zein & Majdalani, 2011).

IWB in Science Education

Research on the IWB and its use in science education is rare (Ormanci, Cepni, Deveci, & Aydin, 2015). Several studies have shown that using IWB has the potential to enhance students' motivation, scientific understanding, and curiosity (Hennessy, Deaney, Ruthven & Winterbottom, 2007). Also, IWB helped teachers overcome difficulties faced during the structuring of lessons and better implement and teach a lesson especially with abstract scientific concepts. However, other studies showed that improved learning is difficult to attain (Gregorcic et al., 2018; Jang, 2010; Murcia & Sheffield, 2010). Moreover, science teachers do not include IWBs fully in their teaching practices even when they have acquired the technical and pedagogical skills to do so. Moreover, despite learning the technical skill of using the IWB, no significant changes are observed in teachers' practices (Gregorcic, Etkina, & Plaaninsic, 2018).

Theoretical Framework: UTAUT Model

Several studies adopt the Unified Theory of Acceptance and Usage of Technology (UTAUT) in order to examine or predict the factors that influence the adoption and acceptance of a technological tool. The major advantage of using this model suggested by Venkatesh et al. (2003) is that it includes experience, age, performance and effort expectancy, facilitating conditions, social and behavioral

influences as factors to help understand how they influence teachers' use of the model. There is a lot of evidence about the reliability and validity of UTAUT to predict the factors that influence the adoption of a new technology from a teacher's perspective. For instance, Wong et al. (2013) showed that this framework is confirmed and validated by the data collected in their study by a test for good-of-fit. Thus, in this study, the model was used as a framework to investigate the behavioral intention of Biology teachers toward using the IWB in their classrooms. Thus, the purpose of this study is to investigate the behavioral intention of Biology teachers toward IWBs using the UTAUT model as a framework.

Research Questions

Based on the UTAUT framework, and within the context of Lebanese public schools, this study attempts to investigate the following questions:

1- What are the factors (teaching performance expectancy, learning performing expectancy, effort expectancy, social influence, and facilitating conditions as well as voluntariness of use) that affect Biology teachers' behavioral intention to use IWB in their teaching practices?

2- How do demographics (age, gender, teaching experience, length of IWB use, and number of IWBs in the school) moderate the behavioral intention of Biology teachers to use IWB in their teaching practices?

Rationale

In the past few decades, technology has invaded our world rapidly. From smart phone applications to computers, video games, and play stations, there is no more doubt that the current generation is raised strongly depending on these tools. As a result, the

inclusion of technological tools in classrooms can no longer be ignored. Not only because they have become a need in our societies, but also because they have the potential to enhance teaching and learning; the ultimate goal of any educational system.

In Lebanon, the educational system did not witness a major change for over a century. Even though the curriculum has changed in the late nineties, one cannot ignore the technological advancements that occurred in the last 20 years. The integration of technological tools in the classroom is essential and has the potential to enhance students' learning and thus since 2014 till mid-2018, IWBs were distributed in Lebanon. However, nothing is known about how teachers are behaving with them and whether they are positively enhancing students' leaning. Unfortunately, Lebanese students do not perform well on international tests that require critical thinking and high thinking abilities. In fact, TIMSS (Trends in International Mathematics and Science Study), an international study that measures the achievement trends in math and science among students of grade 8 of Basic Cycles, showed that in 2019 Lebanon ranked at the bottom of the Arab countries, with only Egypt and Morocco performing less, and the score is still below average (Mullis et al., 2020). No significant improvement has been shown in Lebanese students' TIMSS results since 2007. Since Lebanese students scored at the low benchmark, this means that they show limited understanding of science principles and concepts and show limited knowledge of scientific facts. Knowing that TIMSS is not based on memorization and passive learning but on active and critical thinking, there is a need to improve students' higher-order thinking skills especially their understanding of abstract concepts. Thus, incorporating technological tools such as the IWB that provides simulations to better understand these concepts may help in the teaching learning process. Nevertheless, the obstacle in incorporating these tools is no

longer restricted to their availability in the Lebanese schools but the way they are used. Since teachers are the main factor that influences the successful use of the tools, they need to adapt to the new technologies and enhance their skills to meet the needs of the digital generation.

Capitalizing on the previously described, this study aims to investigate the use and acceptance of IWBs by Biology teachers in Lebanese public schools. This is important in order to identify their behavioral intention or willingness to use IWBs in teaching and learning and determine the factors that affect their use and acceptance of this tool.

Significance

Examining the use and acceptance of IWBs by teachers has implications on both theory and practice. This study enlightens the literature about the way teachers in Lebanese public schools are using IWBs and the factors that affect their usage and acceptance which could be generalized to other similar contexts. It encourages school administrators to assist and help teachers into acquiring the needed skills in their teaching practices. In addition, this study fills the gap about the use of IWB in science classrooms, in particular. Since few studies were done about the usage of IWBs in science education, this study adds to previous results on this matter. Science, as a discipline, and the Lebanese public school setting are two components that make the proposed study of high value. This is because science, in particular, is one of the disciplines where the use of IWB is becoming more widespread. Additionally, the environment of these schools, being public in nature, makes them poor in technology and deficient in the expertise of its use. Students of public schools belong to a medium-low socio-economic level and live in a relatively poor technological environment where

laptops might not exist. These characteristics, which are peculiar and presumably unique to Lebanese public school settings, call for an urgent need to explore teachers' points of view regarding the potential barriers and the enhancing factors that impinge on their decisions to use IWB in their classrooms. Moreover, this study takes into consideration teachers from different grade levels who use the IWB and this usage is not restricted to one grade level. This might shed light on common barriers in the use and acceptance of IWBs among teachers across levels.

Investigating teachers' behavioral intention, the proposed research findings might add to the other studies having as purpose "potential usage of IWB" extra guidelines for planning effective professional development programs aiming at training Lebanese practitioners (teachers and even students), technically and pedagogically, to improve their IWB skills (Zein & Majdalani , 2014). Therefore, the results of study will identify the factors which create potential problems for Lebanese teachers and hinder the smooth progression of teachers' skills using IWB. Finally, this study would contribute to the existing research and would promote educators', researchers' and policy makers' awareness on the current use and the factors that affect their potential use of IWB.

CHAPTER 2

LITERATURE REVIEW

Twenty first century learners require the incorporation of 21st century methods into their classrooms. From smart phones, computers, video games, and play stations, the spread of use and dependency of this generation on technological tools can no longer be ignored. However, the educational system in Lebanon did not witness a major change over more than century. Even though the curriculum has changed in the late nineties, one cannot ignore the technological advancements that occurred in the last 20 years. It is notable to mention that the integration of technological tools in the classroom is essential since it has the potential to enhance students' learning.

Competent teachers nowadays should be aware of the features of the technology adoption to be able to link it to interactive pedagogy. However, technology infusion into the teaching and learning process is not an easy task. Its abuse can easily drive adopters away from learning and teaching objectives: providing high quality instruction and building responsible digital citizens, knowledge constructors, innovative designers, computational thinkers, creative communicators, and global collaborators.

Schools seek to integrate information and communication technology (ICT) into instruction in hopes that it has a positive impact on the teaching and learning process and on the school community as a whole. Based on this optimistic expectation, many educational organizations across the world have installed the most prevalent classroom tool: interactive white boards (IWBs).

In this section, an overview of the history and features of IWBs is presented. Moreover, previous findings about the use of IWB in teaching and learning are

mentioned with a focus on research done on this matter in the Arab world and in science education.

Overview of IWBs

IWBs are advanced educational technology tools which are designed to improve learning based on promoting interactive teaching. The effective use of IWB has been hypothesized to foster the development of students' 21st century skills. It ought to enhance students' engagement in higher critical thinking practices, thus facilitating students' ability to grasp the taught knowledge (Somekh et al., 2006; Walker, 2003). This development of autonomous learning is supposed to be pre-planned by teachers through creating knowledge, together with students, in a dynamic process during IWB lessons (Hennessy, Deaney, Ruthven, & Winterbottom, 2007). Learning via the IWB is supposed to aid teachers to bring various perspectives from the outside world into the classroom, through the formation of an authentic and more relevant connection to their students (Somekh et al., 2006). Although findings of the above-mentioned studies have demonstrated that purposeful and skillful usage of IWB can contribute to the advancement of the 21st century skills, results from another body of research have shown that those promises are not always held true with IWB adoption.

The, so-called, smart classrooms consist of an electronic white board, which enables interaction, writing, and surfing the internet. The latter is made up of a computer connected to both a projector and touch-sensitive screen, which presents the pictures projected from the computer. This connection allows a range of activities, including those that can be used without the use of the IWB (e.g., projecting presentations and short films, writing, and erasing the board) as well as activities unique to this technology (Turel & Demirli, 2010). The IWB software has features that are

manufactured to enhance interactivity between teacher, material and students. They include drag and drop, hide and reveal, color, shade and highlight, matching equivalent terms, movement or animation, and immediate feedback (Miller, Glover, & Averis, 2004).

The idea of an IWB originated in 1987 by Martin and Knowlton who co-founded the SMART Technology Company. Together they introduced the first smart board to the world in 1991 with the purpose of creating a tool that can function as both a whiteboard and computer. When this tool was marketed, a touch sensitive application was embedded in it (SMART technology, 2012). This tool continued to develop to include features that allowed users to play videos or record lessons and presentations in 2001. In 2002, the wireless feature of the board was available. A year later, SMART established the first online community for educators and in 2004 a learner response system was available that allowed the active engagement of learners in the classroom. In 2009, IWB became more affordable with the Promethean design: Active inspire software. As a result of the increasing popularity, the IWB sales tripled from 2005 to 2009 (Lee, 2010). In 2011, the IWB could operate on solar power and in 2012 a four-touch IWB designed by SMART technology was introduced.

Therefore, in the past few decades, especially in Western schools, the IWB has become a common educational technology (Gregorcic, Etkina, & Planinsic, 2017). In 2016, 93% of classrooms in the United Kingdom incorporated IWBs, 80% in Turkey, and 70% in Denmark and the Netherlands, and about 50% in Australia and USA (Hennessy & London, 2013). Indeed, many classrooms worldwide are now equipped with interactive whiteboards. In addition to the aforementioned countries, Lebanon,

Japan, Taiwan, Saudi Arabia, Jordan, Belgium, and many other developed and developing countries, are adopting interactive whiteboards.

The leading projects that expanded the use of IWB were launched in the UK and Turkey. In 2003, the government in London commenced the London Challenge: Transforming London Secondary Schools in an attempt to improve creativity and learning. This five-year project depended on the inclusion of IWB in order to achieve its objective. As a result, currently, London's secondary schools include IWB in all classrooms and teach using them in at least one core subject (English, Math, or Science). The government spent about 25 million pounds to enhance the standards of teaching and learning (Somekh et al., 2007). Moreover, in Turkey, a large-scale project called FATIH was launched to enhance the quality of education, provide equal opportunities for learners, offer services such as the incorporation of technological tools such as IWB, enhance productivity, and eliminate the digital gap among classrooms.

Unfortunately, the availability and integration of IWBs in the classroom does not ensure the transfer of lessons from teacher-centered to student centered. Moreover, many teachers are not adopting them in their teaching despite their availability due to lack of technical skills or knowledge on how to integrate them into teaching. Yet, despite teachers' training and mastering of the technical skills of applying teaching material within the IWB, there is no significant change in their teaching practices (Gregorcic et al, 2018). This necessitated the conduction of several research studies to understand the factors that affect the successful implementation of IWBs that enhance learning.

Previous research examined the use of IWBs in both primary and secondary schools. In general, and as reviewed by Glover et al (2005) and Smith et al. (2005),

there is a number of existing research studies about the use of IWB; however, each possesses a different purpose. Steve Higgins et al. (2007) categorized the studies on IWB into three themes: (1) the initial adoption of the technology in schools, (2) the pedagogical impact of IWBs on both teachers and students in classrooms, and (3) the empirical evidence concerning learning and achievement. Yet, and more recently, Ummuhan et al. (2015) had reviewed publications about educational research involving IWB and highlight many other studies of different focused purposes. Some highlighted the impact of interactive whiteboards on teachers' classroom practices, while others targeted mapping the progress of teachers in developing their IWB skills in many countries at different educational levels. Still other studies were targeted at acknowledging teachers' use, acceptance, and perceptions of IWB in their classroom (Gashan & Alshumaimeri, 2015).

After examining the history of IWBs, the results of previous studies conducted on IWB use in teaching and learning are discussed in the following section. These include general studies done to detect the impact of IWB use on student learning and behavior as well as those involving teachers' beliefs, behavior, professional skills, and professional development (PD).

Impact of IWB on Students' Learning in the Classroom

The multiple and easy usage of IWB in classroom has been associated with several positive effects on the teaching classroom environment, teachers, and students. It enhances student engagement, participation, motivation and retention (Hall & Higgins, 2005; Wall, Higgins & Smith, 2005),s upports a variety of learning styles, and is essential for students with special needs. Similar positive effects of IWB have been derived out of many research findings such as studies conducted by the Georgia

Institute of Technology in the U.S. (Jonassen, Spector, Driscoll, Merrill, van Merrienboer, & Driscoll, 2008) and Simon Fraser University in Canada (McKenzie & University, 2003). The researchers in these studies have pinpointed the learning social dimension added by IWB where students can share knowledge publicly and learn by making mistakes together (Smith et al., 2005). They also referred to the information accessibility provided by IWB within a joyful and interactive atmosphere and the animation which offers a guided sequence of the events. Indeed, it is worth mentioning at this stage that, those potential benefits of adopting IWB are outlined from research conducted by the manufacturers of this instructional tool themselves rather than by professional researchers in the field of education (Smith et al., 2005).

One study that manifests the positive impact of IWBs on learning was conducted by Kennewell and Beauchamp (2007) in Wales who investigated the ways teachers used features of IWB to enhance learning. In this study, activities were designed to test the effect of IWB on teaching and learning. The lesson activity was comprised of four phases. During the first phase, the class activity was focused on the IWB to recall prior known information and required full class participation. During the second phase, the IWB was used to scaffold learning of concepts and skills. Also, students were engaged by being questioned or involved in animations. In the third phase, students worked in groups or individually but without the IWB in order to engage in further in-depth learning. The teacher's role in this phase was a facilitator of the collaborative work. In the fourth phase, the IWB was used again to revisit key concepts of the activity which is mostly teacher-centered. Since learning takes place when students' actions are directed to a specific task and influenced by features such as students' prior knowledge, skills, beliefs, classroom setting, use of IWB, and teachers' role, a teaching model supported

by these features was used to analyze student learning. Results showed that teachers believe that the IWB has a positive impact on learning because it enhances students' attention span and focus, engages the less able, allows better visual representation, and better retention of key lesson concepts.

Mundy (2011) investigated the impact of IWB on elementary students' achievement. The study involved 7 local schools, 700 teachers, and about 16 thousand students. The study also examined the factors (such as time spent using IWBs actively, teachers' skills, and student use of response devices) that affect students' achievement and beliefs about IWBs. The data used were students' term grades in Math and English and analyzed quantitatively using SPSS. Results showed that students perform better when teachers use the IWB for more than 120 minutes per day more than when other teachers use it for a shorter period. Moreover, students showed positive beliefs toward the use of IWBs in the classroom. Yet, at a larger scale, continuous evaluation of the correlation existing between IWB use and students' achievement could not ascertain any significant positive association (Higgins et al., 2007; Moss et al., 2007), except at the level of students' behavior (Aydinli & Elaziz, 2010).

Mathews-Aydinli and Elaziz (2010), studied the possible reasons affecting teachers' and students' beliefs toward using IWB. The study was conducted across Turkey with teachers from primary to university levels. Results showed that both have positive beliefs toward the use of IWB is linked to how frequently it is used.

Another study showed the insignificant relation between using the IWB and students' learning. Swan, Schenker, and Kratcoski (2008) examined the impact of IWB on student learning in English and math lessons based on the results of the state achievement scores. Students from grades 3 to 8 were divided into two groups where

one experimental group was taught by teachers who used IWB for instruction and another control group where the teachers did not. They found that students in an interactive whiteboard group demonstrated slightly higher performance than the control group with a short-lived motivation.

Higgins (2010) examined the impact of IWBs on student interaction and learning in the classroom. Knowing that the UK has largely invested in the integration of IWBs in its schools, it was important to test for the success of this inclusion. Data was collected from 80 primary schools from different regions in the UK with a sample of students aged between 9 and 11. Data from national tests and classroom observations were analyzed. Results showed that although students have positive beliefs toward using IWB and there was classroom interaction, the impact on students' achievement was insignificant. Moreover, it was noted that the improvement was more in the early stages of integration but the pace of progress decreased with time. This shows that there is a need to follow up the integration and usage of IWBs in the classrooms even after its inclusion for a few years.

The Impact of IWB on Teaching Practices in Classrooms

In addition to its impact on students in the classroom, IWB improves teacher productivity, simplifies teacher preparation (Higgins et al., 2005; Higgins, 2006) and allows for the visualization of presentations (Brecka & Oleksakova, 2013). Several studies examined teachers' beliefs, usage, and acceptance of IWBs. Results of such studies showed positive beliefs and behaviors towards using IWBs in the classrooms (Higgins, 2010; Mundy, 2011). However, the successful implementation of IWB necessitates understanding the factors that drive teachers' intention to use them and a limited number of studies focused on this matter. Also, researchers stressed the need to

provide training for teachers in order to use technological tools effectively since many still face obstacles that hinder their successful implementation.

Few studies examined the distribution and number of IWB in their country or evaluated the level of teachers' usage. However, this step is fundamental and basic in order to analyze any result or conduct any study that deals with IWB. For example, one cannot train teachers to better use this tool and enhance their skills without understanding their current level and skills. Moreover, studying the impact of integrating IWB on learning necessitates acquiring knowledge about the distribution of IWBs in schools and the way teachers use them. Van Laer, Beauchamp, and Colpaert (2014) mapped the distribution of IWBs in Flemish secondary schools and assessed the usage of IWBs by secondary school teachers. In this qualitative study, a survey was conducted to collect the data. They used Beauchamp's framework to evaluate teachers' usage level of the IWB. This framework classifies usage levels into 5 phases: 1) Blackboard substitute, 2) Apprentice user, 3) Initiate user, 4) Advanced user, and 5) Synergistic user. The Blackboard substitute is the phase where the teacher uses the IWB as the common whiteboard and thus presents the lowest usage level of the IWB. An apprentice user shows some technical skills allowing students to use it but the IWB is similar to a regular computer tool. An initiate user uses the IWB to improve his/her teaching practices. Thus, they realize at this level the importance of using the IWB to change and improve teaching and learning. The advanced user not only realizes the importance of using the IWB as an active learning tool, but also implements it throughout teaching. Finally, a synergic user is able to create, along with the students, new pedagogical strategies. Results showed that teachers are at a level where they are

beginning to initiate a wider usage of IWBs. They are confident in the technical use of the board but not as much in producing new teaching approaches with the IWB.

In a more recent study, Kearney, Schuck, Aubusson, and Burke (2017), examined teachers' use of IWBs in Australia. The researchers conducted an online survey to record teachers' rationales and practices for using IWBs. They conducted the surveys on both primary and secondary teachers. Although previous studies showed that teachers in Australia have overcome the obstacles facing their usage of the IWB (Ertmer et al., 2012), they pointed out that problems such as lack of professional support and limited access to use IWB persist especially among secondary teachers. Their results showed that primary teachers use the IWB in a more diverse way than secondary teachers do. Also, primary teachers classify themselves to be more likely at the intermediate level in using the IWB and less likely to be at the introductory level compared with secondary teachers.

Several studies examined teachers' beliefs toward using IWBs. The reason is that understanding teachers' beliefs could help reveal the factors that determine the level of usage of IWB by the teachers. For example, Mathews-Aydinli and Elaziz (2010), studied the possible reasons affecting teachers' behavior toward using IWB by examining their beliefs through a questionnaire. The study was conducted across Turkey with teachers from primary to university levels. Results showed that they have positive attitudes toward using IWBs but their level of interest in using it is linked to how frequently it is used.

Another study examined teachers' behavior and actual usage of IWB in practical lessons. In this study, Turel and Johnson (2012) administered questionnaires to 174 teachers who teach grades 6 to 12. Results showed that teachers believe that IWBs can

facilitate teaching and improve learning and that they can be used across different subjects if there is cooperation with fellow teachers and coordinators, effective training, and frequent use of the tool.

Wong et al. (2013) used a questionnaire to investigate the factors that affect Australian teachers' acceptance for using the IWB. These factors include Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Facilitating Factor (FC), and Behavioral Influence (BI). Since limited studies investigated the engagement of teachers with IWBs and since they are the main determinants the success of this tool, it was important to understand the factors that drive their intention to use it. In this study, teachers were grouped as either with limited experience or with some experience to evaluate the impact of their prior experience in using the IWB. Thus, they adapted UTAUT framework to fit their purpose. Results showed that PE and EE have a positive influence on teachers' use of IWBs so, teachers use this tool when they perceive it as beneficial and valuable. Also, the results showed no significant relation between FC and BI. Teachers' experience in using the IWB has a medium effect on the relationship between EE and BI. This stressed the need to facilitate the use of IWB by inexperienced novice teachers. However, contrary to previous studies that showed that SI has a significant influence on teachers' usage and acceptance (Chan et al., 2010; Chang et al., 2011; Loo et al., 2009; Yang, 2010; & Zhou et al., 2010), this study showed the opposite. The researchers claimed that this is due to the young sample of females aged between 18 and 21 who are not influenced by others. This was also suggested by Rhodes (1983), Oz (2014), and Venkatesh et al. (2003) who showed that the impact of social influence on teachers' behavioral intention has less influence among the younger generation. Thus, social influence is a stronger determinant of behavioral intention

among older IWBs users than younger ones. Moreover, based on the results from the Center for Research and Education on Aging and Technology Enhancement (CREATE), a study showed that older adults use technology, computer, and the World Wide Web less than younger adults (Czaja, Charness, Fisk, Hertzog, Nair, Rogers, & Sharit, 2006). In a sample of 1204 individuals between the ages of 18 and 91 years, a survey was conducted to determine the factors that predict the use of technology. Results showed that the relation between technology use and age is affected by people's cognitive abilities, computer self-efficacy, and computer anxiety. Results also showed that older adults have more computer anxiety, less interest in computers, and less computer self-efficacy than younger adults. Concerning gender, women showed higher computer anxiety, less interest in computers, lower computer self-efficacy, and lower computer attitudes than men (Czja et al., 2006).

In general, there are conflicting results about the impact of age and gender of teachers and their perceptions toward using technology. Several studies examined the impact of age and gender on teachers' perceptions when using technology. Research showed that in-service teachers had a stronger negative correlation between age and knowledge of technology than pre-service teachers (Kazu & Erten, 2014; Lee & Tsai, 2010; Lin et al., 2013). According to Luik et al. (2017), there is a negative correlation between age and technology among pre-service teachers that is independent from teachers' pedagogical knowledge. Some studies showed that there is a positive correlation between age and technological knowledge (Lin et al., 2013) but others showed no significant relation (Koh et al., 2010).

Concerning gender, several researchers suggested that male in-service teachers tend to have more technological knowledge or perceptions of technology than females

(Koh et al., 2010; Luik et al., 2017) while others showed no gender differences at the level of pre-service teachers (Lin et al., 2013). Also, Dincer & Zeki (2014) showed that teachers have a positive attitude toward using IWB that is not influenced by age or gender, although the attitudes were more positive when teachers used the IWB for a longer time.

Thus, many studies done on the impact of IWB on students and teachers showed positive teachers' and students beliefs and behaviors. Also, teachers believed that this tool has the potential to enhance students' learning. However, many studies showed that the improvement in student learning is not significant. Also, since teachers are an important factor that determines the successful implementation of the tool, several studies were conducted to investigate their role in integrating IWB. Yet, research indicated that although IWB have been largely integrated in classrooms, the shift in teachers' instruction to integrate IWB effectively is not significantly observed. In the following section, further gaps in literature are identified as research done about IWBs in science education is highlighted.

IWB in Science Education

Research on the use of IWB in education has increased in the past decade. Research showed that IWB can enhance students' motivation and engagement in science classrooms (Murcia & Sheffield, 2010) as well as their understanding of difficult or abstract science concepts (Jang, 2010). However, studies that address science education or science learning are rare (Ormanci, Cepni, Deveci, & Aydin, 2015). Moreover, despite learning the technical skill of using the IWB, no significant changes in teachers' practices are observed (Gregorcic, Etkina, & Plaaninsic, 2018).

Gregorcic et al. (2018) claim that the use of the unique features of the IWB is rarely linked to improving education beyond the primary school level. Thus, these researchers described how high school physics teachers learn to use the IWB in a novel way and plan a lesson on orbital motion of planets. They used an ethnographic approach to investigate teachers' and students' ideas during the process of lesson planning, learning, and teaching. Data was collected from video and voice recorded interviews as well as field observations. They used the activity theory framework where an individual (student or teacher) acts to achieve a goal (student engagement or effort) using a tool (IWB). This is a case study involving two teachers who were trained to teach new active instruction methods using the IWB. Fifty four students were involved and were divided into two sections (and two students were selected from each section for the interview): an experimental one where two students who actively used the IWB were interviewed and a control one from which two students who did not use it were interviewed. Results showed that the IWB has significant potential to be a tool for engaging students in a physics student-centered lesson. Also, teachers' confidence in having efficient technical skills using the IWB enhanced their intention to transfer learning. However, the training of teachers to shift their traditional lesson into a student-centered IWB-based lesson was not optimal. In order to achieve that, more time and resources need to be dedicated for teachers' PD. Similarly, Gregorcic et al. (2014) examined the use of IWB in Slovenian high school physics classrooms. However, the classes were taught by experienced teachers. Results showed that although teachers have efficient technical skill in using this tool, their teaching practices in the classroom did not significantly change.

Another study aimed to examine how experienced science teachers use the IWB to support learning by utilizing factors that enhance students' interactivity. In this study,

Hennessy, Deaney, Ruthven, and Winterbottom (2007) focused on the teaching methods that favor students' cognitive, social, and physical participation in the classroom. Experienced teachers using the IWB from 10 science departments were selected and interviewed. Data from the interviews as well as from lesson plans and classroom observations were analyzed. Results showed that this tool with the strategies adopted by the teachers enhanced students' independence rendering them more responsible. Also, students' thinking was challenged and their curiosity increased. However, students were unable to apply what they have learned in new examples.

Jang (2010) claimed that the relation between the use of IWB and science teachers' pedagogical content knowledge is not fully understood. Thus, in his study, a model was developed to train teachers using peer coaching in order to allow for collaboration and criticism which enhances teachers' understanding of ideas. Participants were only four teachers and data were collected from written assignments, journals, and interviews. Results showed that science teachers realized that IWB can be used to apply science learning to everyday life, share knowledge, and convey students' understanding. Moreover, IWB helped teachers overcome difficulties faced during the structuring of lessons using traditional methods. Integrating the IWB helped them better implement and teach a lesson. Also, IWB can enhance the TPACK (Technology Pedagogical and Content Knowledge) of teachers. This is because the IWB simplifies difficult and abstract scientific concepts such as heat and temperature. Enhancing the TPACK of teachers who are the key determinants for the successful implementation of the lesson enhances students' learning.

In brief, research on IWB and its inclusion in science education is rare. Studies showed that IWBs have the potential to enhance students' motivation and scientific

understanding, others proved that improved learning is difficult to attain. Also, research showed that science teachers do not include IWBs fully in their teaching practices even when they have acquired the technical and pedagogical skills to do so. In addition to the scarcity of research on IWB in science education, research done on this tool in the Arab World has been limited as well. In the next section, the studies that examined the use of IWB in Arab countries are discussed.

IWBs in Arab Countries

Few studies examined the use of IWB in Arab countries. Most studies were done in Saudi Arabia and Jordan while a few studies were conducted in Lebanese school contexts especially concerning the IWB technology.

Gashan and Alshumaimer (2015) examined female teachers' attitudes concerning the use of IWB when teaching English as a foreign language (EFL) in Saudi Arabia. They administered questionnaires to 43 teachers. Their results showed positive attitudes toward using IWB in EFL classrooms. Another objective was to reveal any obstacles that teachers face when using this technology. Their results showed that although teachers perceive IWBs as useful tools to improve teaching and learning, they face technical problems and fail to use all the options provided by this tool during its implementation. The researchers recommend more teacher training to resolve this issue.

Isman, Albulaziz, Barakat, and Abdelrahman (2012) examined the attitudes of secondary school teachers in Saudi Arabia toward using IWB in classrooms. Data was collected using a survey. Similar to the previous study, results revealed a positive attitude of teachers toward using IWB. An online questionnaire was conducted on secondary school teachers in Riyadh city, Saudi Arabia. A total of 100 teachers from different subjects but excluding science (Math, Arabic, English, Computer, and Islamic)

participated. Results shows that teachers have positive attitudes toward the use of IWB in classrooms but more professional development is needed since most do not use it in the right way (90%). Most of them use IWBs as a normal whiteboard or for the purpose of PowerPoint presentations.

Abuhmaid (2014) examined 200 teachers' perspectives regarding IWB in four private schools in Jordan. The researcher examined teachers' perceptions on using IWB as a teaching technology tool and identified the factors indispensable for its successful implementation. Results showed that although extensive effort and funding are offered to integrate IWB, this tool does facilitate teachers' job which requires the need for other factors, such as teacher training to better implement the use of IWBs. In another Jordanian study, Jwaifell and Gasaymeh (2013) investigated the use of IWB by Female English teachers and the factors that influence their adoption of this tool. Results showed that using IWB depends on teachers' perceptions regarding its relative advantages, simplicity, compatibility, and observability. They stressed the need to provide workshops to train teachers to use IWBs.

In Lebanon, very few studies were conducted on using IWBs in classrooms. In fact, those that were done focused on the professional development of teachers when using IWB (Zein & Majdalani, 2011) or the use of technology in general (Baytiyeh, 2014). Results of these studies showed that, Information and Communication Technology (ICT) levels do not influence student learning (Nasser, 2008). Moreover, several factors hinder the integration of technology in the teaching and learning process such as the limited number of technological tools in Lebanese schools (public ones in particular), dependency on the textbook as a unique source of instruction, lack of teacher training, absence of technological instruction beyond teaching some computer

skills (Baytiyeh, 2014). However, results showed that PD has the potential to enhance the usage of IWBs and encouraging cooperation among teachers and administrators reduces the stress and difficulty when using this tool (Zein & Majdalani, 2011).

UTAUT Framework Background and Development

Being a technological device, the use of the IWB is subject to several factors that may influence the readiness and propensity of a user to adopt such a tool and behave in a manner that guarantees its effective use; a use that brings about the desired outcome.

Theories of technology adoption attributed behavioral tendencies to factors inherent to the user and the technique, and created different links between them (Lai, 2017). They were established to describe the differential impacts these have on "behavioral intentions". These models define different methodologies governing the assessment and justification of the way a user approaches the implementation of a new technological advancement. It is worth noting that such frameworks differentiate between settings, implying the importance of tailoring the choice of the most suitable and appropriate model to the characteristics of the environment to which prospective and/or potential users belong (Lai, 2017). Moreover, technology adoption theories shed light on the nature of adoption, being voluntary or mandatory, which influences teachers' behavioral intention when using IWB. In other words, the ability of social influence to affect behavioral intentions was thought to be more pronounced in the settings where technological adoptions were rather mandatory and less personal (Venkatesh, Morris, Davis, & Davis, 2003). The inclusion of this aspect, i.e. social impact, in the equation that predicts users' behavior has been the subject of debate.

However, many models still believed in social impact being a player in shaping behavior.

Technology adoption models have also described the different stages to which users can belong based on their acceptance of the technological device and the responsibility assumed in willfully adopting it. Two of these theories are the "diffusion of innovation" (Rogers, 1995) and the "technology readiness" (Parasuraman & Colby, 2001). The first fitted users into an S-shaped adoption curve starting from innovators to early adopters, early majority, late majority, and finally laggards (Rogers, 1995). Rogers assumed that the different stages consumers pass through in the gradual process of adopting a technique are: understanding, persuasion, decision, implementation, and confirmation. As for the "technology readiness" theory, it categorized users into five segments: explorers, pioneers, skeptics, paranoids, and, again, laggards (Parasuraman & Colby, 2001).

The Theory of Reasoned Action (Fishbien & Ajzen, 1975) differentiates between three terms, which were later used by subsequent models of technology adoption, attempting to explain the "reason" behind a specific action, illustrating the intentional use or the abandonment of a certain technological system. These are "attitude", "belief", and "behavior" (Fishbien & Ajzen, 1975). The former theory defined a behavior as being the result of a certain evaluation of an object or an "attitude" held by an individual based on a certain "belief". In other words, it is an individual's intention to carry out a certain action according to his or her perceived value of an object, formed when linked to a certain attribute. The Theory of Reasoned Action attributes the intention to behave in a certain manner not only to the individual's attitude but also to that of their community or the so-called "subjective norm". Another

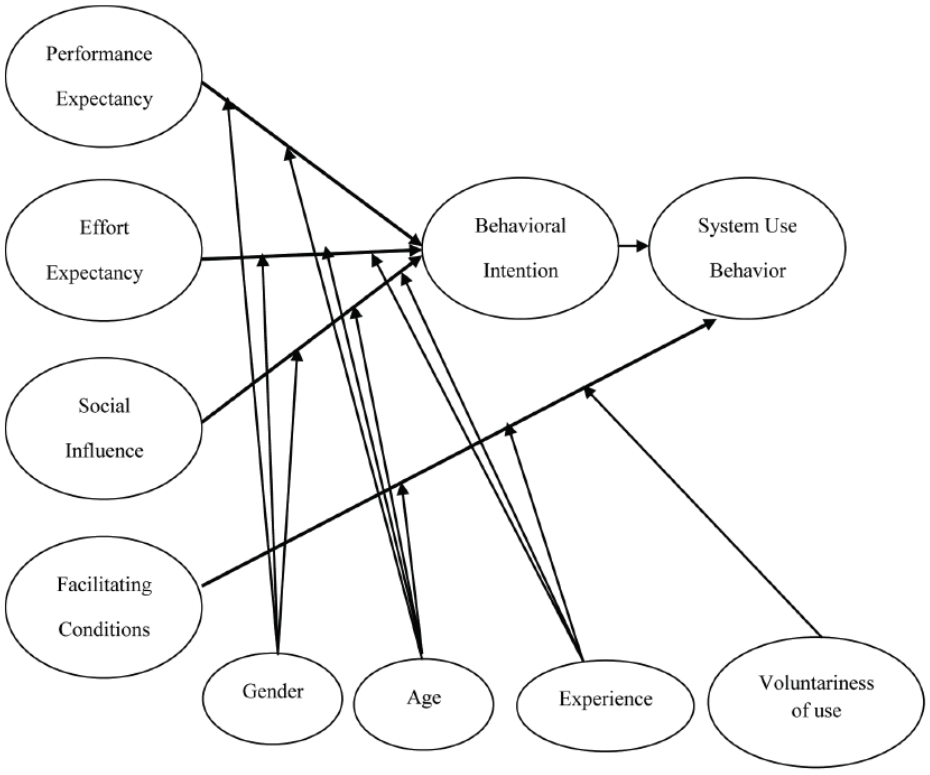
model kept the same associations, however, added a third factor that they suspected to affect behavioral intention. The Theory of Planned Behavior (Ajzen, 1991) introduced the concept of "perceived behavioral control" or the barriers that might hinder an individual from carrying out a certain behavior, thus affecting the intention to perform it. Hence, when examining teachers' behaviors towards IWB adoption, it is necessary not to overlook the role of social impact and the setting- and individual-specific and resource-related limitations.

The Technology Acceptance Model (TAM) (Davis, 1989) stands out as the most popular, most refined model of technology adoption theories as it has been modified four times, and new factors were added to it. TAM, basically, addresses user motivation based on two beliefs, perceived usefulness and perceived ease of use, affecting attitude. The latter is a reiteration of the "perceived behavioral control" presented by the Theory of Planned Behavior as a factor indirectly affecting behavior (Ajzen, 1991). Other variables were then added to this model and were thought to play a role in dictating perceptions of usefulness and ease of use (Davis, Bogozzi & Warshaw, 1989). TAM2, an elaboration of the original model, further specified the factors affecting perceived usefulness. TAM2 again proposed the contribution of subjective norms to behavior suggesting that it has an impact on perceived usefulness (Venkatesh & Davis, 2000). It also suggested that the relationship between subjective norms and perceived usefulness was mediated by voluntariness and experience. According to TAM2, three other factors affected perceived usefulness and those are rather task-related: job relevance, output quality, and result demonstrability. TAM3, another development of the original TAM model, identified aspects of perceived ease of use. According to TAM3, individual differences, system characteristics, social influence, and facilitating conditions

determine the perceived usefulness and ease of use. Finally, the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) was based on four constructs that are: performance expectancy including perceived usefulness, effort expectancy covering perceived ease of use, social influence, and facilitating conditions. According to the UTAUT, these were considered predictors of behavioral intention (Figure 1).

Figure 1

The UTAUT Model



In Lebanon, in a work similar to the proposed, Baytiyeh (2014) has employed the UTAUT and TAM models to investigate Lebanese public-school teachers' behavioral intention towards the use technology in their lessons and attempt to explain

them. For this purpose, she used a questionnaire based on the constructs of the previously mentioned frameworks. Her study provides evidence on the fact that teachers in Lebanese public schools

are left behind in terms of the incorporation technology and use of computers in their teaching. This was explained by the results which showed that, although they perceived technology adoption as useful, they still feel reluctant to interact with computers due to effort expectancy (Baytiyeh, 2014). This was attributed to absence of facilitating conditions like training sessions, equipment, and administration support. However, they all reflected a readiness to learn. Researching into teacher's current perception of IWB incorporation into classroom activities allowed in-depth knowledge about the factors hindering teachers from implementing constructive teaching methods.

CHAPTER 3

METHODOLOGY

This study uses a mixed method design, based on UTAUT framework, to examine the use and acceptance of IWBs by Biology teachers in Lebanese public schools focusing on the factors that favor or limit this use and acceptance. In particular, the following research questions were examined:

1. What are the factors (teaching performance expectancy (TPE), learning performing expectancy (LPE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC) as well as voluntariness of use (VOU)) that affect Biology teachers' behavioral intention to use IWB in their teaching practices?

2. How do demographics (age, gender, teaching experience, length of IWB use, and number of IWBs in the school) moderate the behavioral intention (BI) of Biology teachers to use IWB in their teaching practices?

Context of the Study

The study was conducted in public schools across Lebanon where IWBs are distributed. Despite the high literacy levels (~ 93%), Lebanese public schools face several obstacles (Blominvest, 2016). Although the curriculum followed by both private and public schools is the same, the tuition fees in private schools are very much higher than that in public ones. Yet, the number of private schools is slightly higher than that of public schools (54% of the total number of schools in Lebanon). Students who attend the public schools commonly belong to low-medium socioeconomic status in the country.

The implementation of the IWB in public schools was intended to assist in students' learning process. In fact, all students in grade 9 and grade 12 have to go through official exams to be able them to pursue their university studies. Since these official examinations are decisive in students' life, teachers follow passive learning methods to cover the needed condensed material required by the curriculum. Many teachers mainly depend on textbooks as the sole teaching resource. As a result, student learning is based on rote memorization of facts or skills to perform well on the official examinations. Also, public schools suffer from scarcity of computers or other technological tools and the lack of teacher training to use any available tool. Even though curriculum objectives stress the need to teach information technology instruction, the instruction is not applied in most classroom subjects and is often restricted to ineffective computer sessions since it is not included in official exams' assessments (Baytiyeh, 2014). Another obstacle to incorporating technology is the expensive and unavailable internet connection by most schools (Blominvest, 2016).

Thus, the new government decision to incorporate several IWB in public schools has been a significant step towards enhancing teaching and learning practices. It has launched a high-tech initiative to equip classrooms in public schools across the country with a suite of technology tools, which includes 212 of interactive whiteboards, from late 2004 until mid-2018.

IWB Distribution

To date, the total number of public high schools in Lebanon is 274. The 212 IWB were distributed to 126 schools across Lebanon as shown in Table 1. This step targets improving student learning in schools and developing skills that are vitally important for a 21st-century global workforce (Slay, Sieborger, & Hodgkinson-

Williams, 2008). IWBs are unequally distributed among schools and in different regions (Table 1 & Appendix III). In order to use the IWB, teachers book beforehand the room where the tool is found since not every classroom is equipped with an IWB. In fact, many Lebanese public schools have only one IWB that is shared by all teachers.

Table 1

Distribution of IWBs among public schools in Lebanon

Number of all Lebanese public high schools	274
Number of Lebanese public high schools that received IWBs	126
Number of IWBs distributed to 126 schools	212
Number of schools with 0 IWBs	148
Number of schools with 1 IWB	87
Number of schools with 2-5 IWBs	29
Number of schools with 12-24 IWBs	3
Regions with most IWBs (20-30 IWBs)	Baabda & Metn

Instrumentation and Data Collection

This study uses a mixed method approach in order to answer the research questions. Therefore, the tools for data collection include a survey (Appendix I) and interviews (Appendix II).

Survey

The survey consists of thirty questions addressed to Lebanese Biology teachers using IWB in their teaching practices in the public schools. The questions investigate

the reasons behind the intentional use or the abandonment of IWB as a classroom technological system. The questions aim to examine teachers' behavior as defined by UTAUT framework. According to this framework, four main determinants influence the behavioral intention of teachers when using IWB: which includes Teaching Performance Expectancy (TPE), LPE (Learning Performance Expectancy (LPE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC).

The first two series of questions explore the performance expectancies for teachers and students (as seen by teachers) of IWB usefulness. The survey consists of five questions related to TPE variable that inquire about the quality of teaching science in classrooms. However, three questions related to LPE inquire about the students' learning process in science-related materials. The next UTAUT determinant is EE reflected by the ease of use. It investigates the effort required from teachers to learn and use IWB. Teachers' intentional use of IWB is also influenced by FC, SI, and VOU. The FC variable investigates the availability of any help for teachers to use IWB. The related questions assess the weight of the SI in shaping BI of teachers toward adopting the IWB in their teaching practices. According to UTAUT framework, in addition to the four main determinants, another element is related to the voluntariness of use (VOU).VOU determines whether using IWB is a personal decision (voluntarily) or an obligatory task (mandatory). A mandatory task is set by the government or principals and obliges teachers to use the IWB in their classroom. Usually a large number of IWBs are installed in schools and teacher training is offered to ensure the proper usage of these boards. However, if the usage of IWBs is voluntary, the teacher has the freedom to either to use the board in their classroom or not. Other factors (not the mandatory system) influence whether teachers use the board such as internal motivation. The

demographics section of the survey includes questions about general information, such as age, gender, major, years of teaching experience, length of IWB use, and the number of IWB in their school. The aim of these questions is to determine any relation between them and teachers' BI when using IWBs and how they could influence their perceptions on using this tool.

The Ministry of Education and Higher Education (MEHE) provided the co-researcher with teachers' email addresses. These email addresses were entered via the lime survey platform by the lime survey team given that the names remain anonymous. The co-researcher sent the invitation to the teachers. Upon, the teachers' approval to participate, an online electronic survey was used to collect data as an effective and feasible research instrument. A survey with two sections was used in this study:

- One section was used to collect demographic information about age, gender, school, teaching experience years, length of IWB use, and number of IWB in the school in an attempt to trace the effect of the personal characteristics on teachers' developmental stage using IWB (Appendix I).
- A four option Likert scale section (1- Strongly Disagree, 2- Disagree, 3- Agree, 4-Strongly Agree) that includes 24 questions about the four Unified Theory of Acceptance and Use of Technology (UTAUT) determinants: TPE & LPE, EE, SI, and FC as well as VOU. The 25th question is about the BI of teachers to use and accept the IWB in their teaching practices (Appendix I).

It is worth highlighting that UTAUT questionnaire is designed in such a way that questions are affirmative of the positive impact of the IWB. Teachers who "strongly agree" with the statement reflecting the positive aspect of the IWB are assigned the highest score on a 4-likert level (4) while those who "strongly disagree"

are assigned the lowest score (1). Thus, higher scores on TPE indicate that the teacher expects the use of the IWB to improve his/her teaching performance. Similarly for LPE, a higher score indicates that teachers expect its use to improve students learning performance. For EE, teachers scoring high expect that the use of the IWB is associated with little effort. As for FC, the higher the score the more likely teachers are to believe that their use of the IWB is supported by facilitating conditions. Teachers with high SI scores are not influenced by their peers, colleagues, and principal to use the IWB. Finally, higher VOU scores indicate that the teacher's use of the IWB is voluntary.

Interviews

Interviews were conducted with seven teachers. These interviews provided teachers with the opportunity to express, without limitation, their opinions about the reasons that affected their behavior to use IWB as well as to share their experience when using the IWB. The interview questions were adapted from a study conducted by Bakadam and Asin (2012) who interviewed teachers in order to identify their BI to use IWBs (Appendix II). The interview questions were open-ended and asked teachers to explain their perceptions about using the IWBs and whether or not they believe it positively enhances teaching and learning. The interview also investigated the obstacles teachers' face when using the IWB and the factors that encourage or demotivate them toward using this tool taking into consideration their school context. Teachers' responses collected qualitative data to further understand teachers' views regarding the use of IWB and explain how certain factors impact their use of IWB in their teaching (Appendix II).

Participants

In this study, Biology teachers from Lebanese public schools that have IWBs, who teach different grade levels, were asked to voluntarily fill a survey about their use of IWBs in their schools. The study population consists of 293 Biology teachers from 126 Lebanese public schools where IWBs are available. The research used lime survey as a platform for data collection where anonymous data can be collected. Prior to the study, the researcher received the approval of MEHE to conduct the interviews and survey as well as that of the Institutional Review board (IRB) at the American University of Beirut (AUB).

Out of the 293 public school Biology teachers from the 126 schools who have IWBs, 96 teachers completed the survey. Thus, 96 (about 33% response rate) Biology teachers from Lebanese public schools completed the survey and then seven of them were interviewed to further understand teachers' experiences and perceptions when using the IWB. The majority of participants (N=82) were female teachers, with greater than 11 years of teaching experience (N=68) and 0-2 IWBs in the schools they teach in (N=83). Only 12 teachers have used IWBs for more than 5 years.

Only 20 teachers out of the 96 Biology teachers who completed the survey were interested in an interview and filled their email and contact information after they filled out the survey. Their contact information was not linked to their answers. However, only seven of them accepted to share their views and responded to the interview request. Teachers who were interested in the interview, were virtually interviewed, for about 35 minutes, and asked to freely voice their opinions about the use and acceptance of IWB. This helps in examining the perceptions of teachers through their own words to

construct a robust view of their intentional behavior regarding the use of IWBs. Table 3 includes an outline of the demographics of the seven interviewees.

Table 2

Participants' General Demographic Information

Demographic information (N=96)		Frequency	Percent (%)
Age	20-40	55	57.3
	>40	41	42.7
Gender	Females	82	85.4
	Males	14	14.5
Years of teaching experience	1-10	28	29.2
	>11	68	70.8
Number of IWBs in school	0-2	83	86.5
	>2	13	13.5
How long have you been using IWB?	Never	43	44.8
	1-5 years	41	42.7
	>5years	12	12.5

Table 3

Information of Participants Interviewed

Name	Specialization	Grade	Gender	Years of teaching experience	Years of experience using IWB	Education	Teaching simultaneously in private and public school
Ms. A	Biology	7,8,9, 10,11	F	13	4	Master's	X

Ms. B	Biology	Secondary	F	26	4	Bachelor	Only Public
Ms. C	Biology	7,8,9,10,11	F	11	0	Master's	Only public
Ms. D	Biology	All levels	F	30	7	Master's	X
Mr. E	Biology	10,11,12	M	20	10	Master's	X
Mr. F	Biology	7,8,9,10,11,12	M	14	5	Master's	X
Ms. G	Biology +TD	6,9,10,11,12	F	20	1	Bachelor	X

Data Analysis

The objective of this research study was to explore Biology teachers' use and acceptance of IWB and understand the factors that may impact their intentional behavior to use IWB in their classroom.

Quantitative Data Analysis Related to the First Research Question

In order to answer the first research question "What are the factors (specifically, Teaching Performance Expectancy, Learning Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions and Voluntariness of Use) that affect Biology teachers' Behavioral Intention to use IWB in their teaching practices?" a composite score was calculated for every determinant corresponding to the average of the scores of all the items belonging to it. Pearson correlation test was carried out to determine whether or not a relationship exists between each independent variable (TPE,

LPE, EE, SI, FC and VOU) and the dependent variable (BI of teachers to using IWBs). Where a significant correlation exists, multi-variate linear regression was performed in order to determine the impact of every construct on behavioral intention. Prior to the analysis, the reliability was assessed for each of the determinants as well as the internal consistency between the questions forming it, Cronbach's alpha for each of the four determinants: PE (TPE and LPE), EE, SI, and FC) as well as for VOU was calculated.

Quantitative Data Analysis Related to the Second Research Question

To answer the second research question, "How do demographics (age, gender, years of teaching experience, number of IWB in school, and length of IWB use) moderate the behavioral intention (BI) of Biology teachers to use IWB in their teaching practices", independent sample, 2-tailed t-test was used. Demographics were categorized such as: age (20-40 and >40 years), gender (male/female), years of teaching experience (1-10 and >11 years), and number of IWBs in the school (0-2 and >2) to test their impact on behavioral intention (BI) of teachers to use the IWB. One-way ANOVA was used to investigate the effect of years of IWB use (0, 1-5, and >5 years) on BI. Similarly, independent sample, 2-tailed t-test was used to study the effect of age, gender, years of teaching experience, and number of IWBs in the school on UTAUT determinants (TPE, LPE, EE, FC, SI, and VOU). For t-tests, Levene's test for equality of variance was used. P-values were selected based on the assumption of equal or not equal variances according to Levene's test. Particularly, a p-value>0.05 for Levene's test indicates that we should choose the p-value of t-test assuming equal variances. Alternatively, a p-value<0.05 for Levene's test indicates that we should choose the p-value of t-test with equal variances not assumed.

Qualitative Data Analysis

Teachers' responses on interview questions were used to collect qualitative data to explain the reasons why certain factors influence their use of IWB in their teaching. As a result, we can draw out conclusions that should justify how certain factors impact teachers' use of IWBs. The analysis that produces understandable data requires finding patterns or relationships and linking them to establish a logical explanation (Gibbs & Flick, 2018). There are two different methods: inductive and deductive explanation. In order to generate an explanation or theory based on the collected data, the inductive method is used. This method consists of analyzing the qualitative data collected through the interviews. It is based on specific or similar pattern from which a general explanation is generated (Gibbs & Flick, 2018). This method requires reading the data, looking for repetitive key words, finding patterns among them, and creating general themes from these connections. Hence, the interviews help validate the findings of the closed-ended survey questions to better understand the real context that is affecting teachers' use of IWBs. Data and audio recordings were stored by the primary researcher on password-protected computer. The consent forms and the interviews were conducted in English. Moreover, the reliability during the analysis of the interview was tested where another colleague, who was not involved in the data collection, coded for the interview responses along with the researcher. The interviews were shared with this colleague as well as with a professor at the university to check for agreement during the coding process and to ensure a high level of inter-reliability (about 90%).

After acquiring the results from the quantitative analysis and the coding results of qualitative data analysis, there was an aim to relate the presence or absence of a relation between the factors (UTAUT factors and demographic factors) and the

dependent variable (teachers' behavioral intention) and to connect to previous research findings. Moreover, a discussion of how the factors influence behavioral intention was related to previous literature in order to compare the results in the Lebanese context to findings performed in other contexts and draw out whether the same factors or not affect teachers' behavioral intentions to using IWBs in their teaching. In the discussion, understanding which factors mostly impact behavioral intention and explaining the reasons with respect to literature is essential to understand the use and acceptance of IWBs by Biology teachers in Lebanese public schools.

CHAPTER 4

RESULTS

Reliability Analysis

Considering the goals for the study, a descriptive analysis was performed to understand the teachers' intentional behavior to use IWBs. To provide a clear picture of the results, percentages of teachers' agreement levels are presented in two groups: agreeing (agree and strongly agree options), and disagreeing (disagree and strongly disagree options). For internal consistency and reliability, Cronbach's Alpha coefficients were calculated and interpreted for each theme based on the rules (0.9 = high level, 0.8 = moderate, 0.7 = low level, 0.6 = acceptable level, and <0.6 = unacceptable level) (Murphy & Davidshofer, 1991). The composite reliability of each of the determinants was measured using Cronbach's alpha (Table 4).

Table 4

Cronbach's Alpha for Internal Consistency with Variance, Mean and Standard Deviation

	Cronbach's Alpha	Standardized Cronbach's Alpha	Variance	Mean	Standard deviation
TPE	0.935	0.935	0.431	2.7375	0.65683
LPE	0.917	0.918	0.377	2.7479	0.61370
EE	0.881	0.882	0.393	2.4521	0.62727
FC	0.905	0.906	0.509	2.1424	0.71368
SI	0.827	0.828	0.397	2.4826	0.63036
VOU	0.755	0.754	0.323	2.5104	0.56806
All (UTAUT Model)	0.951	0.951			

Note. The total score of each determinant is 4. Strongly disagree=1, disagree=2, agree=3, strongly agree=4. All corresponds to the 24 questions of the UTAUT Model, excluding question number 25 related to behavioral intention. Only 1 question corresponds to behavioral intention.
TPE: teaching performance expectancy, LPE: learning performing expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, VOU: voluntariness of use

The values of Crombach Alpha ranged between 0.755 for voluntariness of use (VOU) and 0.935 for Teaching Performance expectancy (TPE), which are considered good values according to De Vellis (2003). This indicates that the significant positive impacts of TPE and VOU on Behavioral Intention (BI) is based on consistent responses to the 4-likert questions, which reflects a consistent perspective of the factors which affect the BI to use the IWB. Each participant responded similarly to the different questions forming each determinant. Additionally, the total Cronbach's alpha for all the questions was significantly high (α=0.951) indicating reliability between questions of the different determinants, reflective of the validity of the study framework in assessment of behavioral intention to use the IWB.

Quantitative Results

Effect of UTAUT Determinants and VOU on BI of Teachers to Use IWB

To answer the first research question: determining the UTAUT determinants (teaching performance expectancy (TPE), learning performance expectancy (LPE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC)) that affect Biology teachers' behavioral intention to use IWB in their teaching practices, a two-tailed Pearson correlation was conducted to study the association between UTAUT determinant scores and BI (Table 5). In an attempt to discover the cumulative effect of the determinants categories, UTAUT determinant scores were calculated. These were used to assess the global effect of TPE, LPE, EE, FC, SI, and VOU on BI. Similarly, significant positive correlations ($p<0.01$ in all) were obtained for all scores with TPE, LPE, and VOU showing the highest beta values of Pearson correlation (0.686, 0.679, and 0.630, respectively). In other words, teachers are more likely to intend to use IWB in their classrooms when: they expect it to (1) improve their teaching and (2) their

students' learning performance, (3) to be easy to use and deliver their objectives, (4) their use of the IWB is supported with facilitating conditions, (5) their use of the IWB is perceived highly by their social circle, and (6) they perceive their use as voluntary.

To explore independent relationships between UTAUT determinant scores and BI, multivariate regression was then conducted. The latter revealed independent relationships and positive relationships only between TPE score and BI (β=0.334, $p<0.01$) as well as between VOU score and BI (β=0.409, $p<0.05$) (Table 7). Importantly, these were strong linear associations as indicated by an R^2-value=0.640 of multi-variate regression (Table 6).

Table 5

Two-Tailed Pearson Correlation between UTAUT Determinant Scores and Behavioral Intention

Behavioral Intention	Beta (Pearson)	P-value
TPE	0.686**	0.000
LPE	0.679**	0.000
EE	0.516**	0.000
FC	0.318**	0.002
SI	0.543**	0.000
VOU	0.630**	0.000

**p<0.01
TPE: teaching performance expectancy, LPE: learning performing expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, VOU: voluntariness of use

Table 6

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.800[a]	0.640	0.616	0.437

[a] Predictors (constant): VOU, FC, TPE, SI, EE, LPE

Table 7

Multivariate Linear Regression between UTAUT Determinant Scores and BI

	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	t	Sig.
Constant	-0.140	0.250		-0.559	0.578
TPE	0.359	0.142	0.334**	2.531	0.013
LPE	0.200	0.168	0.174	1.193	0.236
EE	-0.001	0.119	-0.001	-0.009	0.993
FC	0.037	0.089	0.038	0.419	0.677
SI	0.048	0.109	0.043	0.436	0.664
VOU	0.508	0.090	0.409**	5.671	0.000

**p<0.05

TPE: teaching performance expectancy, LPE: learning performing expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, VOU: voluntariness of use

Effect of Demographics on BI of Teachers to Use IWB

To answer the research question number 2: How do demographics (age, gender, years of teaching experience, number of IWB in school, and length of IWB use) moderate the behavioral intention (BI) of Biology teachers to use IWB in their teaching practices, independent sample, 2-tailed t-test was determined (for the variables age, gender, number of IWBs, and years of teaching experience) and a one-way ANOVA was determined to study the effect of years of IWB use on BI. There was no significant difference in mean BI score between groups of age, gender, teaching experience,

number of IWBs in schools, or years of IWB use (Tables 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, and 18). Mean BI score did not differ among groups of age, gender, years of teaching experience, number of IWBs, and years of IWB use.

Table 8

Statistical Test and p-Value for the Effect of Demographics on Behavioral Intention

Demographic, BI	Statistical test	P-value
Age, BI	t-test	0.137
Gender, BI	t-test	0.966
Years of teaching experience, BI	t-test	0.485
Number of IWBs, BI	t-test	0.920
Years of IWB use, BI	One-way ANOVA	0.686

Table 9

Mean, Standard Deviation, and Standard Error of Mean of Behavioral Intention Across Age Groups

	Age	Mean	Std. Deviation	Std. Error Mean
Behavioral intention	20-40	2.96	0.543	0.073
	>40	2.73	0.867	0.135

Table 10

Independent, 2-Tailed t-Test for the Effect of Age on Behavioral Intention

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Behavioral intention	Equal variances assumed	12.793	0.001	1.607	94	0.111	0.232
	Equal variances not assumed			1.507	62.853	**0.137**	0.232

P=0.137 for the effect of age on behavioral intention (equal variances not assumed, p<0.001 for Levene's test).

Table 11

Mean, Standard Deviation, and Standard Error of Mean of Behavioral Intention across Gender Groups

	Gender	Mean	Std. Deviation	Std. Error Mean
Behavioral intention	Male	2.86	0.535	0.143
	Female	2.87	0.733	0.081

Table 12

Independent, 2-Tailed t-Test for the Effect of Gender on Behavioral Intention

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Behavioral intention	Equal variances assumed	0.827	0.366	-0.042	94	**0.966**	-0.009
	Equal variances not assumed			-0.053	22.319	0.958	-0.009

P=0.966 for the effect of gender on behavioral intention (equal variances assumed, p=0.366 for Levene's test)

Table 13

Mean, Standard Deviation, and Standard Error of Mean of Behavioral Intention across Years of Teaching Experience Groups

	Years of teaching experience	Mean	Std. Deviation	Std. Error Mean
Behavioral intention	1-10	2.79	0.499	0.094

	>11	2.90	0.775	0.094

Table 14

Independent, 2-Tailed t-Test for the Effect of Gender on Behavioral Intention

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Behavioral intention	Equal variances assumed	1.160	0.284	-0.701	94	**0.485**	-0.111
	Equal variances not assumed			-0.836	76.829	0.406	-0.111

P=0.485 for the effect of teaching experience on behavioral intention (equal variances assumed, p=0.284 for Levene's test)

Table15

Mean, Standard Deviation, and Standard Error of Mean of Behavioral Intention across Number of IWBs in School Groups

	Number of IWB in your school	Mean	Std. Deviation	Std. Error Mean
Behavioral intention	0-2	2.87	0.677	0.074
	>2	2.85	0.899	0.249

Table 16

Independent, 2-Tailed t-Test for the Effect of Gender on Behavioral Intention

	Levene's Test for Equality of Variances		t-test for Equality of Means			
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference

Behavioral intention	Equal variances assumed	2.151	0.146	0.101	94	**0.920**	0.021
	Equal variances not assumed			0.082	14.209	0.936	0.021

P=0.920 for the effect of number of IWBs in school on behavioral intention (equal variances assumed, p=0.146 for Levene's test)

Table 17

Mean, Standard Deviation, and Standard Error of Mean of Behavioral Intention across Years of IWB Use Groups

				95% Confidence Interval for Mean			
	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
0	2.88	0.731	0.111	2.66	3.11	1	4
1-5	2.80	0.641	0.100	2.60	3.01	1	4
>5	3.00	0.853	0.246	2.46	3.54	1	4
Total	2.86	0.705	0.072	2.72	3.01	1	4

Table 18

One-Way ANOVA for the Effect of Years of IWB Use on Behavioral Intention

Behavioral Intention	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.382	2	0.191	0.379	0.686
Within Groups	46.858	93	0.504		
Total	47.240	95			

Effect of Demographics on TPE, LPE, EE, FC, SI, and VOU

Effect of Age groups on TPE, LPE, EE, FC, SI, and VOU. Significant effects for age on LPE ($p<0.05$), EE ($p<0.05$), SI ($p<0.05$), and VOU ($p<0.05$) were found (Tables 20 and 22). Particularly, LPE, EE, SI, and VOU scores were higher in younger participants (20-40 years of age) compared to their older counterparts.

Table 19

P-Values for T-Tests for the Effect of Age on UTAUT Determinants

Age, UTAUT Determinant	P-value
Age, TPE	0.165
Age, LPE	0.020*
Age, EE	0.022*
Age, FC	0.666
Age, SI	0.045*
Age, VOU	0.022*

Note. TPE: teaching performance expectancy, LPE: learning performing expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, VOU: voluntariness of use

*$p<0.05$

Table 20

Mean, Standard Deviation, and Standard Error of Mean for UTAUT Determinant Composite Scores (TPE, LPE, EE, FC, SI, and VOU) across Age Groups

	Age	Mean	Std. Deviation	Std. Error Mean
TPE	20-40	2.8182	0.58787	0.07927
	>40	2.6293	0.73289	0.11446
LPE	20-40	2.8727*	0.51978	0.07009
	>40	2.5805	0.69254	0.10816
EE	20-40	2.5782*	0.61183	0.08250

	>40	2.2829	0.61478	0.09601
FC	20-40	2.1697	0.71972	0.09705
	>40	2.1057	0.71274	0.11131
SI	20-40	2.5939*	0.62093	0.08373
	>40	2.3333	0.61914	0.09669
VOU	20-40	2.6242*	0.51741	0.06977
	>40	2.3577	0.60273	0.09413

Note. TPE: teaching performance expectancy, LPE: learning performing expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, VOU: voluntariness of use

*p<0.05

Table 21

Independent, 2-Tailed t-Tests for the Effect of Age on UTAUT Determinants

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
TPE	Equal variances assumed	2.679	0.105	1.401	94	0.165	0.18891
	Equal variances not assumed			1.357	74.822	0.179	0.18891
LPE	Equal variances assumed	2.341	0.129	2.363	94	0.020*	0.29224
	Equal variances not assumed			2.268	71.330	0.026	0.29224
EE	Equal variances assumed	0.211	0.647	2.334	94	0.022*	0.29525
	Equal variances not assumed			2.332	86.103	0.022	0.29525
FC	Equal variances assumed	0.039	0.844	0.433	94	0.666	0.06401

	Equal variances not assumed			0.433	86.780	0.666	0.06401
SI	Equal variances assumed	0.275	0.601	2.037	94	0.045*	0.26061
	Equal variances not assumed			2.037	86.464	0.045	0.26061
VOU	Equal variances assumed	0.181	0.672	2.326	94	0.022*	0.26652
	Equal variances not assumed			2.275	78.477	0.026	0.26652

Note. TPE: teaching performance expectancy, LPE: learning performing expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, VOU: voluntariness of use

*p<0.05

Effect of Gender on TPE, LPE, EE, FC, SI, and VOU. Gender appears to have no significant effect on UTAUT determinants. No significant differences were observed in mean UTAUT composite scores among gender groups (Tables 22, 23, and 24).

Table 22

P-Values for t-Tests for the Effect of Gender on UTAUT Determinants

Gender, UTAUT Determinant	P-value
Gender, TPE	0.702
Gender, LPE	0.664
Gender, EE	0.561
Gender, FC	0.998
Gender, SI	0.571
Gender, VOU	0.147

Note. TPE: teaching performance expectancy, LPE: learning performing expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, VOU: voluntariness of use

Table 23

Mean, Standard Deviation, and Standard Error of Mean for UTAUT Determinant Composite Scores (TPE, LPE, EE, FC, SI, and VOU) Across Gender Groups

	Gender	Mean	Std. Deviation	Std. Error Mean
TPE	Male	2.8000	0.64689	0.17289
	Female	2.7268	0.66184	0.07309
LPE	Male	2.8143	0.55727	0.14894
	Female	2.7366	0.62529	0.06905
EE	Male	2.5429	0.71222	0.19035
	Female	2.4366	0.61514	0.06793
FC	Male	2.1429	0.89361	0.23883
	Female	2.1423	0.68500	0.07565
SI	Male	2.5714	0.57629	0.15402
	Female	2.4675	0.64120	0.07081
VOU	Male	2.7143	0.48670	0.13008
	Female	2.4756	0.57623	0.06363

Note. TPE: teaching performance expectancy, LPE: learning performing expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, VOU: voluntariness of use

Table 24

Independent, 2-Tailed t-Tests for the Effect of Gender on UTAUT Determinants

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
TPE	Equal variances assumed	0.032	0.858	0.383	94	0.702	0.07317
	Equal variances not assumed			0.390	17.970	0.701	0.07317

LPE	Equal variances assumed	0.143	0.707	0.436	94	0.664	0.07770
	Equal variances not assumed			0.473	19.048	0.641	0.07770
EE	Equal variances assumed	0.386	0.536	0.584	94	0.561	0.10627
	Equal variances not assumed			0.526	16.479	0.606	0.10627
FC	Equal variances assumed	1.641	0.203	0.003	94	0.998	0.00058
	Equal variances not assumed			0.002	15.714	0.998	0.00058
SI	Equal variances assumed	1.223	0.272	0.568	94	0.571	0.10395
	Equal variances not assumed			0.613	18.940	0.547	0.10395
VOU	Equal variances assumed	0.315	0.576	1.462	94	0.147	0.23868
	Equal variances not assumed			1.648	19.785	0.115	0.23868

Note. TPE: teaching performance expectancy, LPE: learning performing expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, VOU: voluntariness of use

Effect of Years of Teaching Experience on TPE, LPE, EE, FC, SI, and VOU. No significant effect for years of teaching experience on UTAUT determinants ($p>0.05$ for all composite scores) (Tables 25, 26, and 27).

Table 25

P-Values for t-Tests for the Effect of Years of Teaching Experience on UTAUT Determinants

Years of Teaching Experience, UTAUT Determinant	P-value
Years of Teaching Experience, TPE	0.129
Years of Teaching Experience, LPE	0.901
Years of Teaching Experience, EE	0.584
Years of Teaching Experience, FC	0.249
Years of Teaching Experience, SI	0.856
Years of Teaching Experience, VOU	0.423

Note. TPE: teaching performance expectancy, LPE: learning performing expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, VOU: voluntariness of use

Table 26

Mean, Standard Deviation, and Standard Error of Mean for UTAUT Determinant Composite Scores (TPE, LPE, EE, FC, SI, and VOU) Across Years of Teaching Experience Groups

	Years of teaching experience	Mean	Std. Deviation	Std. Error Mean
TPE	1-10	2.5786	0.57694	0.10903
	>11	2.8029	0.68020	0.08249
LPE	1-10	2.7357	0.48703	0.09204
	>11	2.7529	0.66208	0.08029
EE	1-10	2.5071	0.58748	0.11102
	>11	2.4294	0.64578	0.07831
FC	1-10	2.2738	0.63540	0.12008
	>11	2.0882	0.74116	0.08988
SI	1-10	2.4643	0.51591	0.09750

	>11	2.4902	0.67524	0.08189
VOU	1-10	2.5833	0.61279	0.11581
	>11	2.4804	0.55054	0.06676

Note. TPE: teaching performance expectancy, LPE: learning performing expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, VOU: voluntariness of use

Table 27

Independent, 2-Tailed T-Tests for the Effect of Years of Teaching Experience on UTAUT Determinants

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
TPE	Equal variances assumed	0.000	0.999	-1.532	94	0.129	-0.22437
	Equal variances not assumed			-1.641	58.968	0.106	-0.22437
LPE	Equal variances assumed	0.612	0.436	-0.124	94	0.901	-0.01723
	Equal variances not assumed			-0.141	67.885	0.888	-0.01723
EE	Equal variances assumed	0.423	0.517	0.550	94	0.584	0.07773
	Equal variances not assumed			0.572	55.059	0.570	0.07773

FC	Equal variances assumed	0.054	0.818	1.160	94	0.249	0.18557
	Equal variances not assumed			1.237	58.347	0.221	0.18557
SI	Equal variances assumed	1.327	0.252	-0.182	94	0.856	-0.02591
	Equal variances not assumed			-0.204	65.409	0.839	-0.02591
VOU	Equal variances assumed	0.228	0.634	0.806	94	0.423	0.10294
	Equal variances not assumed			0.770	45.887	0.445	0.10294

Note. TPE: teaching performance expectancy, LPE: learning performing expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, VOU: voluntariness of use

Effect of Number of IWBs in the School on TPE, LPE, EE, FC, SI, VOU. No significant effect for number of IWBs in schools on TPE, LPE, EE, FC, and SI ($p>0.05$ for composite scores) (Tables 28, 29, and 30). However, mean VOU score was shown to be significantly higher among teachers who have less IWBs in their schools (0-2 IWBs) (Tables 28, 29), indicating that as the number of IWBs increases, teacher's perception that the use of IWB is voluntary decreases. As number of IWBs in schools increases, teachers feel that its use becomes mandatory rather than voluntary.

Table 28

P-Values for T-Tests for the Effect of Number of IWBs in Schools on UTAUT Determinants

Number of IWB in school, UTAUT Determinant	P-value
Number of IWB in school, TPE	0.491
Number of IWB in school, LPE	0.617
Number of IWB in school, EE	0.967
Number of IWB in school, FC	0.735
Number of IWB in school, SI	0.149
Number of IWB in school, VOU	0.014*

Note. TPE: teaching performance expectancy, LPE: learning performing expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, VOU: voluntariness of use

*p<0.05

Table 29

Mean, Standard Deviation, and Standard Error of Mean for UTAUT Determinant Composite Scores (TPE, LPE, EE, FC, SI, and VOU) Across Number of IWB Groups

	Number of IWB in your school	Mean	Std. Deviation	Std. Error Mean
TPE	0-2	2.7108	0.59613	0.06543
	>2	2.9077	0.97507	0.27044
LPE	0-2	2.7301	0.56173	0.06166
	>2	2.8615	0.89957	0.24950
EE	0-2	2.4506	0.57750	0.06339
	>2	2.4615	0.91427	0.25357
FC	0-2	2.1325	0.67863	0.07449
	>2	2.2051	0.93827	0.26023
SI	0-2	2.4458	0.58499	0.06421
	>2	2.7179	0.85901	0.23825
VOU	0-2	2.5663*	0.54034	0.05931

>2	2.1538	0.63268	0.17547

Note. TPE: teaching performance expectancy, LPE: learning performing expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, VOU: voluntariness of use

*p<0.05

Table 30

Independent, 2-Tailed T-Tests for the Effect Number of IWBs in Schools on UTAUT Determinants

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
TPE	Equal variances assumed	6.864	0.010	-1.005	94	0.318	-0.19685
	Equal variances not assumed			-0.707	13.439	0.491	-0.19685
LPE	Equal variances assumed	6.567	0.012	-0.716	94	0.476	-0.13142
	Equal variances not assumed			-0.511	13.503	0.617	-0.13142
EE	Equal variances assumed	8.009	0.006	-0.058	94	0.954	-0.01094
	Equal variances not assumed			-0.042	13.539	0.967	-0.01094
FC	Equal variances assumed	3.915	0.051	-0.339	94	0.735	-0.07260

	Equal variances not assumed			-0.268	14.033	0.792	-0.07260
SI	Equal variances assumed	2.843	0.095	-1.456	94	0.149	-0.27217
	Equal variances not assumed			-1.103	13.796	0.289	-0.27217
VOU	Equal variances assumed	1.796	0.183	2.500	94	0.014	0.41242
	Equal variances not assumed			2.227	14.870	0.042	0.41242

Note. TPE: teaching performance expectancy, LPE: learning performing expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, VOU: voluntariness of use

Effect of Years of IWB Use on TPE, LPE, EE, FC, SI, VOU. There was no significant effect for the years of IWB use on UTAUT determinants ($p>0.05$ for all UTAUT determinant scores) (Tables 31, 32, and 33).

Table 31

P-Values for One-Way ANOVA for the Effects Number of IWBs in Schools on UTAUT Determinants

Years of IWB use, UTAUT Determinant	P-value
Years of IWB use, TPE	0.112
Years of IWB use, LPE	0.768
Years of IWB use, EE	0.066
Years of IWB use, FC	0.903

Years of IWB use, SI	0.334
Years of IWB use, VOU	0.385

Note. TPE: teaching performance expectancy, LPE: learning performing expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, VOU: voluntariness of use

Table 32

Mean, Standard Deviation, and Standard Error of Mean of UTAUT Determinant Scores across Years of IWB Use Groups

					95% Confidence Interval for Mean			
		Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
TPE	0	2.6233	0.56266	0.08581	2.4501	2.7964	1.00	4.00
	1-5	2.7610	0.69888	0.10915	2.5404	2.9816	1.00	4.00
	>5	3.0667	0.75478	0.21789	2.5871	3.5462	1.00	4.00
	Total	2.7375	0.65683	0.06704	2.6044	2.8706	1.00	4.00
LPE	0	2.7209	0.54009	0.08236	2.5547	2.8871	1.00	4.00
	1-5	2.7415	0.66670	0.10412	2.5310	2.9519	1.00	4.00
	>5	2.8667	0.71010	0.20499	2.4155	3.3178	1.00	3.80
	Total	2.7479	0.61370	0.06264	2.6236	2.8723	1.00	4.00
EE	0	2.3302	0.55871	0.08520	2.1583	2.5022	1.20	3.20
	1-5	2.4780	0.65250	0.10190	2.2721	2.6840	1.00	3.60
	>5	2.8000	0.68224	0.19695	2.3665	3.2335	1.00	4.00

	Total	2.4521	0.62727	0.06402	2.3250	2.5792	1.00	4.00
FC	0	2.1628	0.66814	0.10189	1.9572	2.3684	1.00	3.33
	1-5	2.1057	0.74699	0.11666	1.8699	2.3415	1.00	4.00
	>5	2.1944	0.80977	0.23376	1.6799	2.7089	1.00	3.00
	Total	2.1424	0.71368	0.07284	1.9978	2.2870	1.00	4.00
SI	0	2.3876	0.56311	0.08587	2.2143	2.5609	1.33	4.00
	1-5	2.5285	0.64968	0.10146	2.3234	2.7335	1.00	4.00
	>5	2.6667	0.77850	0.22473	2.1720	3.1613	1.00	3.67
	Total	2.4826	0.63036	0.06434	2.3549	2.6104	1.00	4.00
VOU	0	2.5969	0.58896	0.08981	2.4156	2.7782	1.00	4.00
	1-5	2.4553	0.57133	0.08923	2.2749	2.6356	1.00	3.67
	>5	2.3889	0.46782	0.13505	2.0917	2.6861	1.33	3.00
	Total	2.5104	0.56806	0.05798	2.3953	2.6255	1.00	4.00

Note. TPE: teaching performance expectancy, LPE: learning performing expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, VOU: voluntariness of use

Table 33

One-Way ANOVA for the Effect of Years of IWB Use on UTAUT Determinants

		Sum of Squares	df	Mean Square	F	Sig.
TPE	Between Groups	1.884	2	0.942	2.241	0.112
	Within Groups	39.101	93	0.420		

	Total	40.985	95			
LPE	Between Groups	0.202	2	0.101	0.264	0.768
	Within Groups	35.577	93	0.383		
	Total	35.780	95			
EE	Between Groups	2.119	2	1.059	2.794	0.066
	Within Groups	35.261	93	0.379		
	Total	37.380	95			
FC	Between Groups	0.106	2	0.053	0.102	0.903
	Within Groups	48.282	93	0.519		
	Total	48.388	95			
SI	Between Groups	0.881	2	0.440	1.111	0.334
	Within Groups	36.868	93	0.396		
	Total	37.749	95			
VOU	Between Groups	0.623	2	0.312	0.965	0.385
	Within Groups	30.033	93	0.323		
	Total	30.656	95			

Note. TPE: teaching performance expectancy, LPE: learning performing expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, VOU: voluntariness of use

Qualitative Results

The purpose of the study was to examine teachers' use and acceptance of IWBs. Interviews with seven teachers were conducted to understand their experiences with IWBs and their views about implementing it in the classrooms. Although 20 participants, out of the 96 participants who responded to the survey, shared their email addresses and willingness to participate in an interview, only seven ended up agreeing on an interview date.

Overall, the results showed that teachers perceived and used IWBs as a useful instructional tool, which confirmed the literature review findings and extended knowledge about the school technology integration process as shown in Tables 49 and 50 below. Analysis of data showed that all the participants saw IWBs as a good tool for planning and creating lessons by incorporating videos, interactive lessons, graphics, images, and mechanisms to explain abstract concepts into the lesson content. Four teachers gained their experiences at their schools that encouraged workshops and training or were personally motivated to use the IWB. Five teachers also cited that they consider it similar to an LCD projector and do not believe it provides additional advantages. Moreover, all the interviewees perceived the IWB as a tool that fosters lessons interactivity, learning differentiation, student motivation, engagement, and problem-solving skills. Also, all interviewees recognized difficulties in using IWB for teaching. They suggested that administrators need to provide teachers with additional technical support and extra time for planning lessons with IWBs. They pointed out internet connection problems, lack of IWB availability, and the need for extra time and effort to use it as a part of their lesson. According to the interviewees, the IWB is not mandatory for use in the schools of the interviewees. Teachers have the freedom to use

it or not and three of the teachers recommend that its use becomes mandatory while two of them considered its use a personal decision and should be voluntary. Four teachers mentioned the importance of peer support to encourage them to use IWBs while one considered peers have no influence on IWB use. All interview participants recommended technological and curriculum training, purchasing more IWBs, teacher collaboration, and more school-based technical support.

Table 34

Responses of Interviewees Regarding their Experiences in Integrating IWBs in their Classrooms

	Develop lessons using IWB			Teaching with IWB		Assessing With IWB
Teacher	Resources	Collaboration	Subjects	Projector	Group work/ presentation	
Ms. A	X e.g images, videos	X Minor peer support	X -Use in different subjects like Geography -use in science -helps in understanding abstract concepts	X used the LCD projector	Not mentioned	More student engagement
Ms. B	X e.g videos, drawings, mechanism, problem solving	X Peer support and motivation in private school	X	-	X Preparing projects using the software in science fairs	-
Ms. C	videos	-Peer support -Internal motivation	Productive especially in Biology		Not mentioned	More student interaction
Ms. D	Abstract concepts	-graduate new teachers encourage using	Abstract concepts	-used as projector for videos only	-not mentioned	Not mentioned

		it more/not recommended by teachers				
Mr. E	Interactive lessons	-administration support IWB use -few teachers use it	-effective in science but not enough for learning experience	-same as projector/projector is sufficient	IWB not feasible for 2 students to use pen at same time	Not mentioned
Ms. F	Interactive	administration supports using it -no peer support	-effective better than ppt -useful in Biology because it is a concrete subject	-same as ppt but more interactivity	More interactivity between teachers and students	Not mentioned
Mr. G	videos, images, flash, abstract concepts, animation, action, students more focused	-obligatory to use at first by principle -internal motivation	- effective in all subjects: math, science, Arabic	- IWB used as LCD projector -LCD projectors can be used instead of IWBs in economic crisis but not sufficient in future		

Table 35

Responses of Interviewees Regarding their Experiences in Integrating IWBs in their Classrooms

Teacher	Productive integration	Pedagogical practices	Issues With IWB	School Support
Ms.A	Yes, but not in the long run, students get bored	-S-centered approach - Science is a very related to real life. -student interest	- technical: lack of teacher technical skills - demotivated because of preparation time and effort is not equivalent to rights received	-more in private than public school -IWB not activated in public school -need for training and laptops -voluntary use of IWB preferred
Ms. B	Yes, makes teaching easier, but 1st needs time -It is very effective. It saves time. It makes you use varied techniques in order to deliver your lesson.	-creativity -Student interest -Student abilities	-technical: at 1st, IT helped -Time: technical problems take time to solve	-Not much -using IWB personal decision, peer motivation
Ms. C	Yes especially in biology and online teaching	-student interaction	-technical problems -no internet connection	-IWBs should be mandatory to get along advances in technology -internal motivation is important

				-peer influence to use IWB especially teachers involved in using IWB -availability in schools is a must (this school lacks IWBs) -training is needed
Ms. D	Only when explaining abstract concepts	-explain mechanisms of abstract concepts	-no internet connection -lack of resources: digital copies of national textbooks -number of IWBs in school is lacking -needs effort	-no training -other teachers did not recommend it -new graduate teachers recommend it but mention that it doesn't make an impact -would use it if mandatory to not be left behind/would not approach IWB if not mandatory
Mr. E	Yes captures interest/interactive/improves student achievement and engagement but not enough for learning experience	Student engagement/interaction/interest	-lack of IWB availability in all classes -problems with screen -expensive/not feasible to use majorly	-not mandatory to use IWB -hard to use at first then becomes easier but depends on teacher using it -no peer influence to use IWB
Ms. F	-yes provides audio-visuals for interactions	-student engagement/interaction	-IWB training Needs time and effort (depends on the teacher) -No internet connection	-administration supports using IWB -Teachers scared and intimidated by new tool -teachers need support or to ask for help or a model for teachers to use -need peer support

			-IWB room is on fourth floor and 10 min wasted to go to class -Not feasible to include IWB in G12 where curriculum is overwhelming -no peer support	-internal motivation and changing teachers' perspectives are needed
Mr. G	IWB should be primarily used for teaching, beneficial for students -effective for all subjects -IWB achieve student outcome if teacher is trained - more students understand the lesson	-learning abstract concepts in science	-internet connection only in private school -took one training session then trained on my own -no pre-prepared resources/no national textbook -electrical and technical problems -IWBs freeze/stop functioning -needs time	-Used IWB in private school more than in public school -obliged to use at first, although I do not like change but it was fast and easy to use -if not obligatory to use, I would avoid it at first but then initiate using it after positive feedback -difficult for older people to use -must use IWB not to lag behind -there is school support

Figure 2 shows the coding structures that resulted from the analysis related to the experiences of biology teachers integrating interactive whiteboards in their classrooms while Figure 3 represents the coding structures that relate to teachers' IB about IWBs when integrating them in their classrooms.

Figure 2

Coding Concept map about Teachers' Experiences Using IWBs

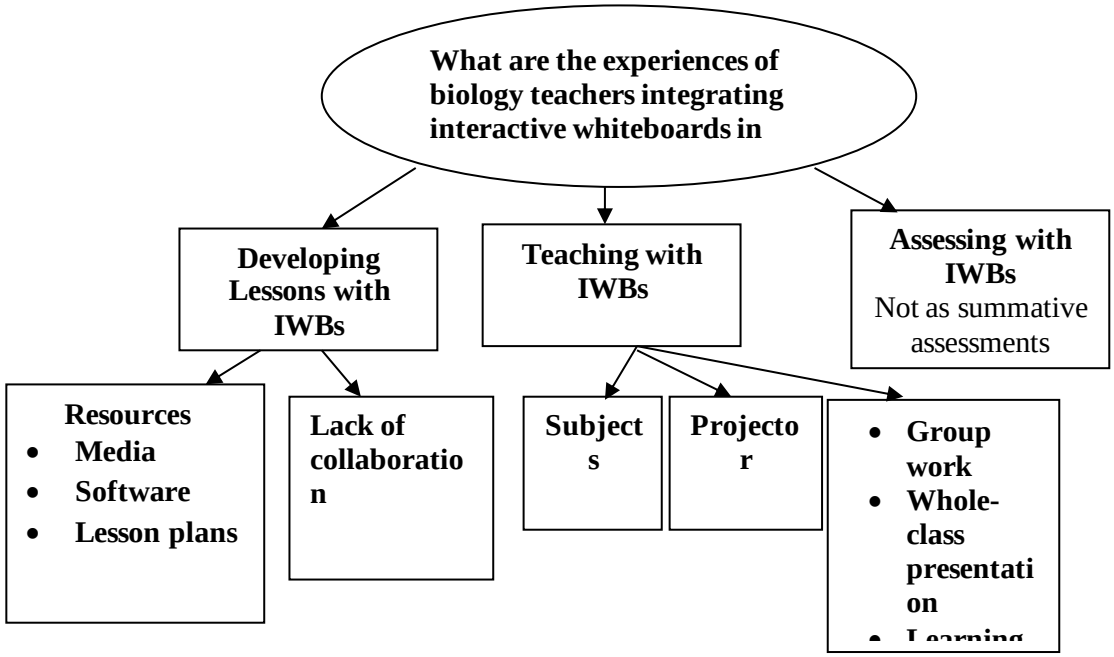
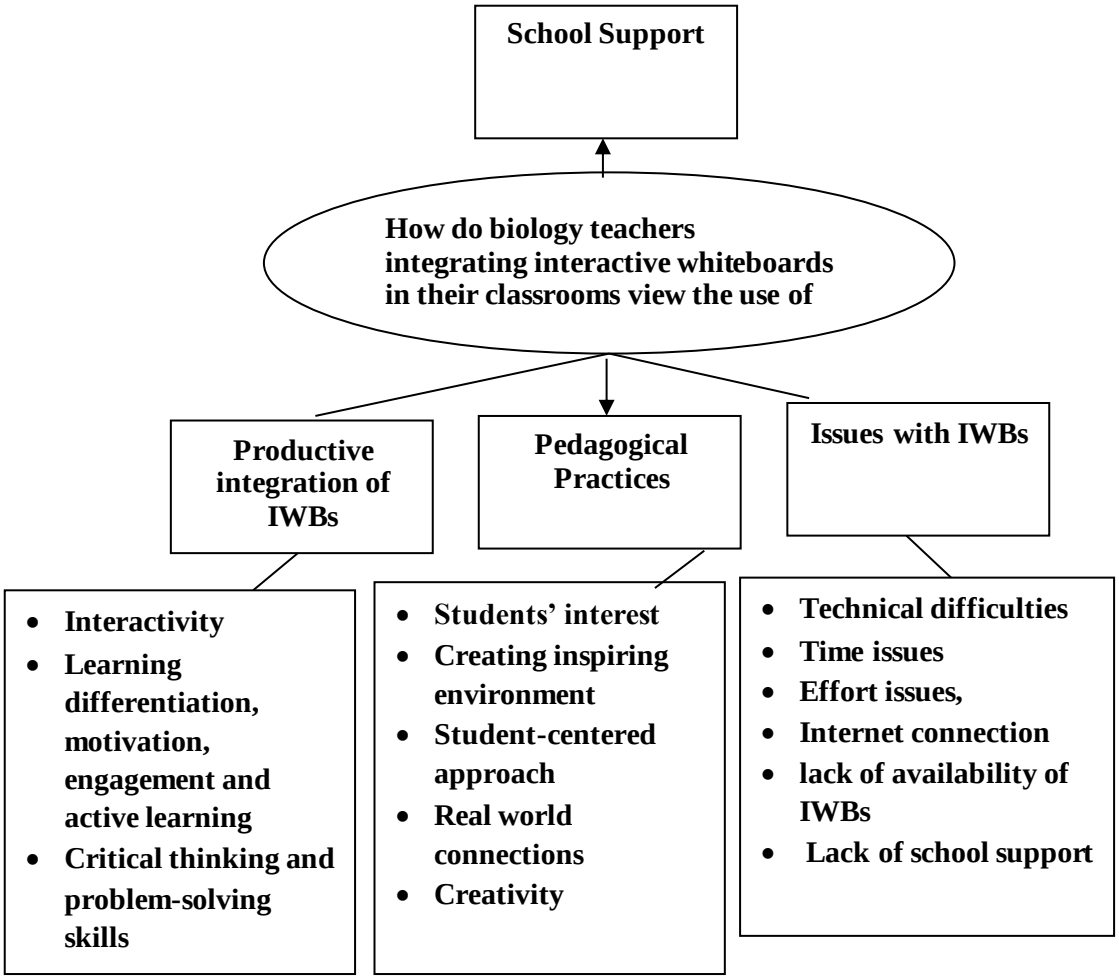


Figure 3

Coding Concept Map about Teachers' BI using IWBs



CHAPTER 5

DISCUSSION

The purpose of this study was to examine the behavioral intention of Biology teachers toward IWBs using the UTAUT model as a framework and within the context of Lebanese public schools. Specifically, the aim was to: 1) determine the factors (teaching performance expectancy (TPE), learning performing expectancy (LPE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC) as well as voluntariness of use (VOU)) that affect Biology teachers' behavioral intention to use IWB in their teaching practices, and 2) investigate how demographics (age, gender, teaching experience, and number of IWB in schools) moderate the BI of Biology teachers to use IWB in their teaching practices.

Discussion of Results Addressing 1st Research Question

Teaching Performance Expectancy (TPE)

TPE is the teachers' perceptions of the usefulness of using technology in activities related to teaching and lesson preparation. The results indicate that teaching performance expectancy (TPE) is significantly and positively correlated with teachers' behavioral intention (BI) ($p<0.01$). In other words, TPE had statistically positive effects in regard to the intention to use IWBs. These results reflect that teachers find IWBs necessary to improve their job performance, quality of work, productivity, and teaching. Teachers also believe that the IWB is clear, easy to use, does not require a lot of mental effort, and easy to become skilled in using it. Teachers' use of technology for teaching can be seen when teachers evaluate the advantages and obstacles of the tool (Howard, 2013). Howard (2013) found out that the decisions could originate from teachers'

evaluation of the risk of the technology integrated. The findings of this study support the earlier studies by Wong et al. (2012), Venkatesh et al. (2003), Venkatesh and Zhang (2010) and Wang and Shih (2009). It should also be noted that the results align with theorized in the original UTAUT model. Since PE significantly influences behavioral intention, teachers will engage with IWBs when they see value and benefit in doing so (Wong et al., 2012). Thus, policymakers and curriculum designers should reveal the benefits of IWBs to teachers and students and provide training in its use. Cronbach's alpha coefficient for this part of the questionnaire is 0.935 (high internal consistency and reliability of question items related to TPE) (Table 4).

Learning Performance Expectancy (LPE)

LPE is the teachers' perception of the usefulness of technology in their students' learning process (Venkatesh et al., 2003). The results indicate that LPE is significantly and positively correlated with teachers' BI ($p<0.01$). Thus, teachers believe that IWBs assist students in learning, enhances their collaboration, helps them develop research and presentation skills, and makes topic areas more interesting. These results conform to other studies that showed that the increased BI of the usefulness of a learning tool leads to greater intention to use it (Pynoo et al., 2011; Radovan & Kristl, 2017; Wang & Wang, 2009). Pynoo et al. (2011) stated that PE was (along with SI) the main reason for digital learning environment acceptance. Cronbach's alpha coefficient for this part of the questionnaire is 0.917 (high internal consistency and reliability of question items related to LPE) (Table 4).

Effort Expectancy (EE)

Results showed that ease of use (EE) is also a major determinant of intention to use an IWB learning environment (BI). This result aligns with findings of Wong et al.

(2012), Gupta et al. (2008), Im et al. (2008), Schaik (2009) or Venkatesh et al. (2003), who found positive impact of EE on BI. However, they contradict with those of Radovan and Kristl (2017), Gruzd, Staves, and Wilk (2012) and Pynoo et al. (2011), who reported no positive impact of EE on BI. The significant relation between EE and BI means that higher levels of EE will result in a greater BI by teachers to use IWBs. This result can be explained by the fact that teachers perceive interacting with IWB as easy and as something that does not need a considerable amount of time and mental effort. This result is supported by Sime and Priestley (2005) who found that the ease of the use of a technological tool affects the attitude of pre-service teachers. Cronbach's alpha coefficient for this part of the questionnaire is 0.881 (good internal consistency and reliability/between moderate and high) (Table 4).

Social Influence (SI)

Results showed a significant relation between SI and BI. This demonstrates that it plays a significant role in teachers accepting the IWB as a tool for learning. The social environment influences the BI of IWB use. These results conform to previous studies that showed that social environment increased perceived usefulness of web-based learning system (Chan et al. 2010; Cheng et al. 2011; Loo et al. 2009; Radovan & Kristl, 2017; Wang & Wang, 2009; Yang 2010; Zhou et al. 2010). The findings are also consistent with other studies that revealed that more social support presence determines teacher's use of technology tools as they recognize it a useful tool for teaching (Pynoo et al., 2011). However, the results contradict with another study that showed that social influence did not have a significant influence on teachers' BI to use IWBs (Wong et al., 2012). The results of this study indicate that social influence has a great influence on Biology teachers in Lebanese public schools. Nowadays, teachers feel pressured to use

technology, especially as it has become a necessity in students' life. Probably teachers perceive that although IWB could be complex to learn and use, they are influenced by the need to belong to the digital world. Cronbach's alpha coefficient for this part of the questionnaire is 0.827 (good internal consistency and reliability/between moderate and high) (Table 4).

Facilitating Conditions (FC)

Facilitating conditions turn out to be another influential factor in accepting the IWB (BI), although the original theoretical model (UTAUT) does not anticipate them as such (Venkatesh et al., 2003). This result aligns with other studies (Chan et al., 2010; Cheng et al., 2011; Loo et al., 2009; Yang 2010; Zhou et al., 2010). The higher the individual's belief that he or she has the knowledge and equipment to use the IWB (or another technological tool) or the more an individual favors its use, the higher its acceptance will be (Lee et al., 2010; Radovan & Kristl, 2017; Venkatesh et al., 2012). This means that SI is an important determinant in the intentions of teachers to use IWBs. However, it contradicts with the results of Wong et al. (2012) who explained that their result could be due to the limitations of the UTAUT's applicability in different user populations or age range and its levels of voluntariness. It is important to note that SI is a stronger determinant of behavioral intention among older IWBs users than younger ones (Wong et al., 2013). Cronbach's alpha coefficient for this part of the questionnaire is 0.905 (high internal consistency and reliability) (Table 4).

Voluntariness of Use of IWB (VOU)

According to Venkatesh et al. (2003), who developed UTAUT, gender, age, experience, and voluntariness of use are moderators in this model, and have no direct influence on the BI or the use of technology. However, they have indirect effects on

cognitive behavioral factors. Venkatesh et al. (2003) claim that PE is the most significant indicator of BI, regardless of whether or not technology use is voluntary. However, in this study and contrary to Venkatesh et al. (2003), results showed that voluntariness of use of IWBs have a significant impact on teachers' BI to use it. According to Wong et al. (2012), the SI is affected by the applicability of UTAUT in different levels of VOU. This explains the results under hand since, in this case, when teachers have a high level of voluntariness to use IWBs, with minor social pressure imposed by the principal to integrate it in teaching, the level of VOU as well as the SI significantly correlate with teachers' BI. Thus, social behavior, such as principal's support and positive peer encouragement, might have greater influence on the BI of teachers who can voluntarily use the IWB. Cronbach's alpha coefficient for this part of the survey is 0.755; showing an acceptable (between low and moderate) internal consistency and reliability of question items related to voluntariness (Table 4). This could indicate the need for further question items related to VOU for a more accurate measurement.

Analysis of the quantitative results showed that TPE and VOU have the most positive impact on BI. This result conforms to Venkatesh et al. (2003) who argue that PE is the most significant indicator of BI. However, our results contradict with Venkatesh et al. (2003) concerning their finding that voluntariness of use of IWBs doesn't have a significant impact on teachers' BI to use it.

Discussion of Results Addressing 2nd Research Question

Demographics

The second research question examined how demographics (age, gender, years of teaching experience, number of IWB in school, and length of IWB use) moderate the

Behavioral Intention (BI) of Biology teachers to use IWB in their teaching practices. One survey section was used to collect demographic information about age, gender, school, teaching experience years, using IWB experience, and number of IWB in the school in an attempt to trace the effect of the personal characteristics on teachers' developmental stage using IWB (Appendix I).

Results showed that none of the demographics significantly correlated with behavioral intention ($p>0.05$, Table 8). However, when testing the effect of age on UTAUT determinants, significant effects for age on learning performing expectancy (LPE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC) as well as voluntariness of use (VOU) were found (Table 19). Particularly, LPE, EE, SI, and VOU scores were higher in younger participants (20-40 years of age) compared to their older counterparts. This result is similar to what was suggested by the UTAUT model such that age does not directly affect the behavioral intention of teachers to use IWBs but they moderate the relation between UTAUT determinants and BI (Venkatesh et al., 2003). Thus, age indirectly impacts BI of teachers to use IWBs through LPE, SI, FC, and VOU. This result conforms to studies that showed that in-service teachers had a stronger relation (negative correlation) between age and technology (Baytiyeh, 2014; Kazu & Erten, 2014; Lee & Tsai, 2010; Lin et al., 2013; Luik et al., 2017) and Lin et al. (2013) who showed a positive correlation between age and technological knowledge. However, the results contradict with Koh et al., (2010) who showed no significant relation. The indirect impact of age on teachers' BI and that the scores of UTAUT determinants were higher in younger teachers indicate that younger teachers possess a more positive belief towards the use of technology compared with the older teachers. This outcome can be explained by one of the rules Douglas Adams suggested regarding

responses of people to technology: “Anything invented after you’re thirty-five is against the natural order of things” (Adams, 2003, p.95). In fact, 41% of the participants are above 40 years old and adopting technology which renders this implementation more challenging for them.

Concerning gender, the results contradict with some researchers who suggested that male in-service teachers tend to have more technological knowledge than females (Koh et al., 2010; Luik et al., 2017) while it aligns with others who showed no gender differences at the level of pre-service teachers (Lin et al., 2013). Also, the results regarding the relation between age and BI align with Dincer & Zeki (2014) who showed that teachers have a positive belief toward using IWB that is not influenced by age or gender, although the attitudes were more positive when teachers used the IWB for a longer time.

The length of IWB use and the years of teaching experience did not have significant effect neither on BI nor on any of the UTAUT determinants. Almost 71% of the teachers have more than 11 years of teaching experience. The findings showed that 44.7% of the participants have no experience in using IWB, which implies that possessing IWB-related skills is not obligatory in Lebanese public schools (Table 2). Also, this shows that the majority of these teachers have not learned how to use IWBs which explains the insignificant relation. This also shows that integrating IWB in teaching and learning appears to be optional. According to the Center for Educational Research and Development, selected teachers receive about five days of professional development per year that is provided mainly by the center. However, this professional development is not limited to technology. Thus, the lack of integration of IWBs by teachers stems mainly from the limited support offered to public schools’ teachers.

However, this result could be different if they are provided with the adequate training and support. This result contradicts with other studies that showed a significant positive relation between length of technology use and BI (Baytiyeh, 2014; Venkatesh et al., 2003). Earlier studies showed that computer experience influenced teachers' belief regarding the importance of using computers in classrooms (Hermans, Tondeur, van Braak, & Valcke, 2008; Mueller, Wood, Willoughby, Ross, & Specht, 2008). Interestingly, voluntariness was shown to be significantly higher among teachers who have less IWBs in their schools (0-2 IWBs), indicating that as the number of IWBs increases, teacher's perception that the use of IWB is voluntary decreases. As number of IWBs in schools increases, teachers feel that its use becomes mandatory rather than voluntary. Thus, the number of IWBs in school indirectly impacts teachers' BI through voluntariness of use. This result conforms to other studies that showed that voluntariness of use had the strongest significant positive effect on behavior in terms of whether teachers use technology in teaching tasks even though it is not mandatory in the Lebanese public schools (Baytiyeh, 2014). It seems that teachers could decide to use technology to keep up with the predominant digital environment not to feel left behind.

Discussion of Qualitative Results

Interviews results showed that although all interviewees consider IWBs as a good teaching tool that provided resources for lesson planning and improved the quality of their interactions with students, five of them do not use it (Figures 2 &3). These results correlated with some researched-based practices and provided new insights into IWB use.

Developing lessons with IWBs

The results showed that IWBs can enhance the overall teaching experience. Teachers indicated that there is lack of availability of IWBs in their schools which hinders their use. The scarcity of IWBs affects teachers understanding of technology and that they comfortably use IWBs as an instructional tool (Samsonova, 2018). Indeed, all seven teachers indicated that using the IWB requires time and effort which demotivates them to use it. For example, one participant elaborated

"You need time to train yourself and time to prepare the lesson using the IWB." Only 3 teachers are expert in using the whiteboard software which allows participants to create resources that students would find motivating. The teachers' inexperience with IWBs affects their usage which can be interpreted through Davis's (1989) TAM definition of perceived ease of use. Only one interviewee stated that the use of IWBs enhanced the lesson preparation because they were easy to use. As found through this study, the interviewees stated that they do not have access to a variety of resources for different topics which might be explored on the IWB such as digital copies of the national textbooks. According to one interviewee

> "Regarding the disadvantages of the use of the IWB, we do not have pre-prepared resources in our official textbook, nothing is ready to use…the textbooks are not equipped with resources that are compatible with the IWB."

Some teachers also said that they waste time creating their resources and to take students to the IWB room. Six of the interviewees view the IWB as an LCD projector. Teachers said they were concerned that they spent too much time developing lesson plans using IWBs to deliver this material. This result is similar to Daki and Mobasheri's (2013) finding that it is complicated for educators to select useful information from the

Internet. Media resources, such as videos, games, educational websites and graphics, and educational software were cited as tools that provided diverse teaching methods for learning. According to the participants, schools lack educational software such as high-quality curriculum resources for teachers. Erbas, Ince, and Kaya (2015) emphasized that better IWB integration with proper software would support whole-class demonstrations, discussions, and students' investigations. Three participants mentioned that by using a moderately short-term investment of time at the start to create these presentations; they received long-term benefits in both the quality of the lessons and the ease of updating and maintaining these lessons for their teaching. Interviews showed that teachers only received some training sessions to use the IWBs however; they are not familiar with how this tool could be adapted according to the students' needs, and shared with colleagues at the same or different schools through saving the lessons as web pages. This collaboration could happen over the Internet, the local school network, or email. The Karsenti's (2016) study found that planning lessons with the IWB took too much time and suggested teacher collaboration as support. All interviewees mentioned that using the IWB was not a mandatory school policy. Nevertheless, five participants indicated the need for peer support and collaboration in their schools and cited that teacher collaboration in the development and usage of IWB lessons would be beneficial for them. There are always difficulties, predominantly among the older and less technology-orientated teachers, to adopt new technologies (Bakadam & Asiri, 2012; Korkmaz & Cakil, 2013). They often need extra support from colleagues, IT, and school administration.

Teaching with IWBs

Five interviewees mentioned that they do not used IWBs for teaching and 5 of them only used the projector functions of the IWB, if they use it. In their responses, they believe that the use IWBs can increase students' performance. According to one interviewee

> "The use of IWB transforms the learning process from a passive experience to a movie-like one…with the use of IWB, grasping the knowledge becomes easier and even more durable."

Most of the participants mentioned that the interaction, motivation and interest of students increased with the IWBs and they also became involved with one another. Only one participant mentioned that IWBs are needed for problem solving while most of them believed that IWBs are important for learning abstract scientific concepts.

Assessing with IWBs

The results indicated that the participants did not mainly use the IWB as an assessing tool but only to engage students in the lesson. One interviewee explained

> "When using IWB, many questions are raised in the students' minds and the interaction between us is increased."

Teachers consider the IWBs encouraged interest questions, besides with evaluative responses as part "of the general flow of the lesson" (Teck, 2013, p.6). According to the participants' responses, teachers used the dynamic demonstration of videos, mechanisms, and images to clarify students' thinking. Confirming the study results, Kyriakou and Higgins (2016) stated IWBs affected classroom talk and suggested enhancing the theoretical framework. The De Vita, Verschaffel, and Elen's (2014) literacy review noticed that using IWBs; teachers could prompt discussions and

explanations in the lessons by getting students to illustrate, direct, and explain from IWBs. However, teachers did not mention using the IWB for summative assessments which offer considerable insights into students' learning.

Productive Integration of IWB

Teachers agreed there are benefits to using IWBs in the classroom. One interviewee stated

> "The IWB is effective in providing images, animation, and action. When I introduce action, it makes the student more focused on what to focus his attention to."

According to the data found, the IWBs promoted increased interaction involving the students and the teacher (Daki & Mobasheri, 2013). Most of the participants felt that IWBs enhanced better practices in teaching. However, two interviewees believed that the IWB is not productive in the long run as students get bored and is not enough for the learning experience. The interviewees mentioned that IWBs offered interactive learning experiences during discussions and motivated students to learn. Higher motivation led to greater participation (Begolli & Richland, 2015). An engaged and active learning style matched the needs of a current generation of students who are comfortable as active participants, which supported Fraser and Garofalo (2015) and their findings. In Fraser and Garofalo's (2015) research, the teachers used IWB programs, PowerPoint files, powerful software packages, and student response systems because they felt that IWBs' features offered students valuable activities. The study interviewees agreed that IWBs could be the incentive to get them involved (Begolli & Richland, 2015; Fraser & Garofalo, 2015). They believed that students were more engaged in learning when the IWB technology was integrated into instructional activities. Student engagement was

recognized as the most substantial aspect of the learning process (Tertemiz et al., 2015). However, in this study, some interviewees do not feel that the IWB is valuable in the long run and is not enough for the learning experience. Some interviewees believe that it adds nothing to an LCD projector.

Pedagogical practices

The interviewees agreed that the IWB technology use with effective teaching techniques could increase student productivity. One interviewee commented

> "…the idea is smoothly conveyed when the student feels that he/she has generated it rather than it being simply transmitted by the teacher."

Katwibun (2014) specified that it is crucial for the educators to assimilate the IWBs with the learning theory and pedagogy that cater to learners' individual needs. Teachers must take the time to know the students individually by asking about their interests and using this knowledge in creating lessons on IWBs. According to the study interviewees, educators have to become advocates of new educational standards and techniques. Many of them suggested that if the IWB was mandatory in schools, they would have to use it to not be left behind others. For example one participant elaborated

> "If the IWB was not mandatory, I would have tried to avoid using it for a month, or two, three, or four, but when I am going to find that its use is spreading and is beneficial, and when I get positive feedback about it, I'll reconsider using it as I would not want to be left behind."

Interviewees also cited creating real-world connections as a technique that encourages students to engage more deeply in lesson materials that are related to real life. The participants mentioned that through IWBs students are shown concrete examples - the real world in the classroom.

Issues with IWBs

The interviewees identified problems with the integration of IWBs into their classrooms. The research participants mentioned technical issues when working with IWBs and considered technical support as a substantial factor for IWB integration into the teaching and learning process. For example, one participant elaborated

> We have to deal with electrical and technical problems upon the use of the IWB, i.e. electrical cutoffs and the time it requires to restart the tool especially in the absence of UPS, and when the IWB stops functioning.

They also named time and effort issues, internet connection, lack of availability of IWBs in schools, and a lack of school support as additional problems that appeared through the technology implementation process. The results are consistent with Samsonova (2018) who stated that participants were more concerned that they did not have enough time for IWB lesson development and collaboration with the colleagues, or that there is no teacher collaboration at school at all. One interviewee mentioned that it is difficult to integrate IWBs in grade 12 where the curriculum is condensed. The Ministry of Education and Higher Education requires all Lebanese schools to follow a prescribed curriculum that focuses on preparing students for the two following major official examinations: the 'Brevet' at the end of grade 9 and the 'Baccalaureate' at the end of grade 12. The curriculum is very condensed and teachers' focus is to prepare their students for the official exams. Due to the extensive use of textbooks and notes, students favor memorization for the purpose of passing the official exams.

Two interviewees, who teach in both private and public schools, pointed that they used the IWB in private schools and were encouraged to do so by the school and colleagues but were not as motivated to do so in a public school. The learning process in

Lebanese public schools is passive and methods are mostly traditional where textbooks are the main source of instruction. Moreover, public schools lack technological equipment and trained teachers. As a result, technology is rarely integrated in lesson plans. It is important to note that the curriculum includes information technology instruction at the secondary level (grades 9–12 with one class period per week), but this instruction is not applied to school subjects except to one period of learning computer skills (LAES, 2007). Moreover, official exams exclude technology information and thus it is not of major importance for the school who prepare students to succeed in the official exams.

Another obstacle to the use of technology in public schools, which was mentioned by all interviewees, is the lack of internet connection due to the unaffordability of this technology. The cost of good-quality Internet is relatively high in Lebanon compared to other countries in the United Nations Economic and Social Commission for Western Asia (ESCWA) Region (ESCWA, 2006). On the other hand, private schools are equipped with the latest technological tools for and to enhance students' engagement in the learning process. Moreover, Lebanese teachers are not paid modestly which is demotivating to invest in the time and effort needed to learn and integrate a new technological tool.

School support

Participants revealed that schools do not require teachers to integrate IWBs in the lessons although the administration encourages its use. Most teachers went to training workshops to learn how to use IWBs but the majority does not integrate it in their lessons. Also, schools do not plan teacher collaboration time for IWB lesson preparation as school policy. The interviewees named professional development; the

purchase of IWBs, technical support of existing smartboards; and supporting teacher collaboration as needed support. One interviewee indicated

> "With respect to teachers, they should be provided with training workshops in order for them to be more involved in their use."

Once educators have established professional development and an education technology installation, it is operational that the IWBs integration would mesh effortlessly with the curriculum and assist the lesson preparation and, in that way, grow teacher productivity (Yang & Teng, 2014). Confirming these findings, Karsenti (2016) stated that IWBs had better not be mounted in classrooms until teachers are fully ready for it. The researcher stressed that teachers need special days so they could take group or individual preparation sessions for learning how the IWB functions, particularly in the fostering student engagement interactive aspects.

In this study, the UTAUT model was used to help understand why Biology teachers in Lebanese public schools do not use the IWB while research suggests that the use of technology in the classroom enhances the understanding of subject matter especially science. The purpose of this study was to determine the factors that affect teachers' behavioral intention to use the IWB. Concerning the first research question: identifying the UTAUT determinants (TPE, LPE, EE, SI, and FC) that affect Biology teachers' behavioral intention to use IWB in their teaching practices, the quantitative results showed significant positive relation between TPE, LPE, EE, FC, SI, VOU and BI of teachers, with TPE and VOU showing an independent positive impact on BI. Concerning the second research question: How do demographics (age, gender, years of teaching experience, number of IWB in school, and length of IWB use) moderate the behavioral intention (BI) of Biology teachers to use IWB in their teaching practices,

there was no significant effect of groups of age, gender, teaching experience, number of IWBs in schools, or years of IWB use on the BI. However, only the number of IWBs in schools show an inverse relation with, when comparing the average VOU score across categories of number of IWBs in schools. The qualitative results showed that although all interviewees consider IWBs as a productive teaching tool that provided resources for pedagogy practices and improved the quality of their interactions with students, there are many issues that hinder its integration and usage such as technical issues, need for time, effort, and training as well as scarcity of IWBs in the school. Both qualitative and quantitative results suggest that Biology teachers' BI in Lebanese public schools is correlated with UTUAT determinants, but demographics have no effect on BI or UTAUT determinants except for VOU specifically concerning the number of IWBs available in schools. Moreover, teachers tend to accept and use the IWB in their own classroom if they believe it enhances their performance in teaching as well as students' learning and in the presence of FC that affect their BI. Also, the voluntariness of use of IWB by teachers and the number of IWBs are negatively related such that the more IWBs present, fewer teachers use them.

CHAPTER 6

CONCLUSION

This paper presents IWBs acceptance and usage by Lebanese public school teachers. The study was informed by data collected from public schools having IWBs. The collected data was analyzed quantitatively and qualitatively and findings indicate that (1) teachers' incapability to realize the positive effect of using IWBs on their teaching performance: teaching quality and productivity (2) teachers' tendency to believe that the use of IWB is not mandatory but rather voluntary and (3) the scarcity of number of IWBs in public schools play a significant role in the productive integration of IWBs in schools. This study contributes to practice and management by identifying those areas that needs attention by public school administrators and managers to encourage the potential acceptance and use of IWBs in their schools. It also contributes to maintaining the validity of UTAUT model in the adoption and use of different technologies.

CHAPTER 7

LIMITATIONS OF THE STUDY

One limitation of the study is that the same teacher could be teaching in different schools that have IWBs. If this teacher teaches in both public and private schools, he/she might confuse the factors affecting the use and acceptance of IWB between these schools since the teacher is most probably forced to use the IWB in the private school and this use could benefit the public school where this same teacher works. This might influence the results of the study concerning the factors which impact the use of IWBs in public schools. Another limitation is the percentage of survey participants (response rate) that was about 33% and % of interviewees that is about 35%. This rate is acceptable but if there was a chance to gather data from a larger number of participants, the response rate would be higher and these findings would be more generalized. However, I was hindered by the multiple crisis Lebanon was going through during the time I was collecting data including the political unrest and frequent strikes along with the pandemic and its associated lockdowns. All this created restlessness among teachers and the educational system which made less willing to be enrolled in research.

CHAPTER 8

RECOMMENDATIONS

We believe that the findings obtained from the research will provide a useful framework for policy makers to ensure the successful implementation of IWBs in Lebanese public classrooms. As for researchers, this study will reinforce the validity of UTAUT model in the adoption and use of different technologies.

Firstly, an important strategy to increase the success of IWB implementation in classrooms is to help teachers develop the belief that the use of IWBs improves their teaching performance. This is because teachers with higher performance expectation aim to use IWB more compared to the ones with low expectation. Policy makers should work on helping teachers realize the necessity of using IWBs to improve their job performance, quality of work, productivity, and teaching. This can be achieved by facilitating the quick access of teachers to the resources necessary for IWB use, organizing regular training workshops, and providing teachers with continuous consultancy offered by experts capable of offering instant solution to the encountered problems. Those educational initiatives increase teachers' aim to use the IWBs (BI). When the number of teachers who adopt and use interactive whiteboard becomes considerable, the participation of others will quickly increase by social influence.

Another important strategy to increase the success of IWB implementation in classrooms is to strive to develop teacher's belief that the use of IWBs is highly appreciated, if not to say mandatory. They should encourage teachers to develop active lessons using IWB features and enhance teachers' collaboration and tasks delegation. Moreover, it is indispensable to make them feel that their efforts pay off.

A third important way to support the successful implementation of IWB in classrooms is increasing its number in the same school. When IWB availability increases, teachers will tend to believe that using it requires less effort. In other words, it is not time consuming to book for its use. Consequently, teachers' belief about the use of IWB will change from believing a personal decision to being obligatory. As such, teachers' will voluntarily accept and use IWBs in the teaching process.

APPENDIX 1

Survey Questions about Participants' Demographic Information and UTAUT Determinants

Question	Demographics of IWB adopter
1	What is your age? between 20-40 ☐ >40 ☐
2	What is your gender? Female ☐ Male ☐
3	How many years of teaching experience do you have? 1-10 ☐ >11 ☐
4	How many IWBs do you have in your school? 0-2 ☐ >2 ☐
5	How long have you been using IWB? never used it ☐ 1-5 years ☐ >5 years ☐

UTAUT Determinants	Questions	Strongly Disagree	Disagree	Agree	Strongly Agree
TPE: Teaching Performance Expectancy (usefulness for teachers)	TPE1:Using IWB will improve my job performance				
	TPE2:Using IWB will enhance my effectiveness on the job				
	TPE3:Using IWB will increase my productivity				
	TPE4:Using IWB will improve the quality of my work				
	TPE5:I find IWB a useful tool for my teaching job				
LPE: Learning Performance Expectancy (usefulness for students)	LPE1:Using IWB will help and assist students in their learning process				
	LPE2:Using IWB will promote collaboration between students				
	LPE3:Using IWB will help students to develop research and presentation skills				
	LPE4:Using IWB will make topic areas more interesting for students to learn				
	LPE5:Using IWB will help stude additional learning resources co the traditional books and diction				
EE: Effort Expectancy	EE1:My interaction with IWB is clear and understandable				
	EE2:I find it easy to get IWB to do what I want to do				
	EE3:Interacting with IWB does not require a lot of mental effort				
	EE4:It is easy for me to become skillful in using IWB				
	EE5:I find IWB easy to use				
FC: Facilitating conditions	FC1:When I need help to use the IWB, guidance is available to me				
	FC2:When I need help to learn some IWB applications, someone is there to provide assistance				

	FC3:When I need help to use IWB, instructions are available to me
SI: Social influence	SI1:People who are important to me encourage me to use IWB SI2:My principal/director think that I should use IWB SI3:My colleagues/friends think that I should use IWB in my teaching
VOU: Voluntariness of use	VOU1: Although it might be helpful, using IWB is not mandatory in my teaching tasks VOU2: The school principal/director doesn't expect me to use IWB VOU3: My use of IWB technologies is voluntary
BI: Behavioral intention	BI1:Whenever possible, I intend to use IWB in my future teaching tasks

APPENDIX 2

INTERVIEW QUESTIONS

Number	Questions
1.	What do you think of the IWB as an instructional tool for your subject?
2.	In your opinion, how effective is the IWB in delivering your subject contents?
3.	In your opinion, do students achieve the desired learning outcomes when you use the IWB?
4.	What are the advantages of using the IWB in teaching your subject?
5.	Would you support continuing the current practice of using the IWB in teaching and learning?
6.	What are your suggestions to improve the current use of IWB?
7.	How did you start using IWB and why?
8.	How did you know you were in need to use it? Were you influenced by anyone?
9.	Is the benefit acquired from the use of IWB greater when it comes to science?
10.	How were you capable of assessing the effectiveness of IWB?
11.	Do you feel there is enough support to learn and practice the use of the IWB from the administrator, from you colleagues?

APPENDIX 3

Distribution of IWBs across Lebanese Public Schools

وزارة التربية والتعليم العالي
المديرية العامة للتربية
مديرية التعليم الثانوي

الالواح التفاعلية الموجودة في الثانويات الرسمية

#	Cerd	اسم الثانوية	قضاء	عدد الالواح التفاعلية الموجودة في الثانوية
١	٥	جبران غسان التويني الاولى الرسمية	بيروت	0
٢	٦	جبران غسان التويني الثانية الرسمية	بيروت	1
٣	٨	لور مغيزل الرسمية للبنات	بيروت	3
٤	١٩	المفتي الشهيد حسن خالد الرسمية للبنين - حوض الولاية	بيروت	2
٥	٢٢	زهية سلمان الرسمية - وطى المصيطبة	بيروت	0
٦	٢٤	فخر الدين المعني الرسمية للبنات	بيروت	1
٧	٣٠	دولة الرئيس رياض الصلح الرسمية للبنين	بيروت	1
٨	٣١	راس بيروت الرسمية المختلطة	بيروت	1
٩	٣٨	جميل رواس الرسمية للبنين	بيروت	1
١٠	٤٠	عمر فروخ الرسمية للبنات	بيروت	1
١١	٥٢	زاهية قدورة الرسمية للبنات	بيروت	0
١٢	٥٦	الرئيس رينيه معوض الرسمية المختلطة	بيروت	1
١٣	٥٧	الدكتور حسن صعب الرسمية المختلطة	بيروت	0
١٤	٦٠	الدكتورة أمان كبارة شحراني الرسمية للبنات	بيروت	0
١٥	###	العلامة عبد الله العلايلي الرسمية للبنات	بيروت	2
١٦	###	الامير شكيب ارسلان الرسمية المختلطة	بيروت	0
١٧	###	العلامة صبحي المحمصاني الرسمية المختلطة	بيروت	0
١٨	###	جبران اندراوس التويني الرسمية المختلطة	بيروت	0
١٩	٧٤	المربية ناديا عون الرسمية للبنات	بعبدا	2
٢٠	٧٦	المربي شفيق سعيد - الشياح	بعبدا	1
٢١	٧٨	الغبيري الاولى للبنات	بعبدا	24
٢٢	١٠٦	الحدث	بعبدا	0
٢٣	١١٠	كفرشيما	بعبدا	2
٢٤	١١٢	برج البراجنة للبنات	بعبدا	1
٢٥	١٢٢	حسين علي ناصر	بعبدا	2
٢٦	١٢٤	حارة حريك الرسمية مختلطة	بعبدا	1

٢٧	٢٣٦	قرنايل	بعبدا	1
٢٨	٢٤٢	ثانوية عبد الله الخوري الرسمية	بعبدا	12
٢٩	###	نجيب بك صالحة الرسمية راس المتن	بعبدا	0
٣٠	###	الغبيري الثانية للبنات	بعبدا	1
٣١	###	الغبيري الثالثة للبنات	بعبدا	1
٣٢	###	حسين مكتبي - المريجة الليلكي المختلطة	بعبدا	0
٣٣	###	العبادية	بعبدا	5
٣٤	###	حارة حريك الرسمية للبنات	بعبدا	0
٣٥	١٥٢	عرمون	عاليه	1
٣٦	١٥٥	الشويفات المختلطة	عاليه	1
٣٧	٢٥٥	مارون عبود عاليه	عاليه	1
٣٨	٢٦٢	بيصور	عاليه	0
٣٩	٢٦٧	حسين مسعود - بشامون	عاليه	1
٤٠	٢٧٣	مجدل بعنا	عاليه	1
٤١	٢٧٧	عين داره	عاليه	0
٤٢	###	مارون عبود عاليه فرع القماطية	عاليه	0
٤٣	###	الرئيس الشهيد رفيق الحريري - دوحة الشويفات الرسمية	عاليه	0
٤٤	###	صوفر	عاليه	0
٤٥	###	مارون عبود عاليه فرع رشميا	عاليه	0
٤٦	١٦٤	الشهيد رفيق الحريري - حارة الناعمة الرسمية	الشوف	0
٤٧	٢٩٠	برجا	الشوف	0
٤٨	٢٩٩	كفرحيم	الشوف	0
٤٩	٣٠٥	المؤرخ جوزف نعمه-دير القمر	الشوف	1
٥٠	٣١٠	بعقلين	الشوف	1
٥١	٣١٣	المختارة	الشوف	1
٥٢	٣٢٥	عين زحلتا	الشوف	0
٥٣	٣٣٢	شحيم	الشوف	2
٥٤	٣٤١	عانوت	الشوف	1
٥٥	٣٤٩	منيرة ابو مرعي البليل كترمايا	الشوف	0
٥٦	###	نيحا	الشوف	1
٥٧	###	الدامور	الشوف	0
٥٨	###	بتلون الرسمة المختلطة	الشوف	0
٥٩	###	برجا فرع جون	الشوف	0

٩٣	###	كفرذبيان	كسروان	1
٩٤	٧١٠	ددة	الكورة	0
٩٥	٧١١	اميون	الكورة	0
٩٦	٧١٧	خليل سالم بطرام	الكورة	0
٩٧	٧٣٠	كفرحاتا	الكورة	0
٩٨	###	كفرعقا	الكورة	2
٩٩	٤٣٤	المنية	المنية الضنية	2
١٠٠	٤٦١	بخعون	المنية الضنية	0
١٠١	٤٧١	سير الضنية فرع كفرحبو	المنية الضنية	0
١٠٢	٤٧٧	بيت الفقس	المنية الضنية	1
١٠٣	٤٩٠	سير الضنية	المنية الضنية	1
١٠٤	###	السفيرة	المنية الضنية	0
١٠٥	###	بيت الفقس فرع قرصيتا	المنية الضنية	1
١٠٦	###	مراح السراج	المنية الضنية	1
١٠٧	###	مركبتا	المنية الضنية	0
١٠٨	###	طاران	المنية الضنية	0
١٠٩	###	الشهيد الرائد وسام عيد الرسمية	المنية الضنية	0
١١٠	###	سير الضنية فرع ايزال	المنية الضنية	0
١١١	###	منية فرع انكليزي	المنية الضنية	0
١١٢	٧٣٩	جبران خليل جبران الرسمية	بشري	0
١١٣	٦٦٥	مرياطة	زغرتا	1
١١٤	٦٧٤	زغرتا	زغرتا	1
١١٥	٦٩٠	ثانوية اسعد السبعلي الرسمية	زغرتا	0
١١٦	###	رشعين	زغرتا	0
١١٧	٧٤٦	شكا	البترون	0
١١٨	٧٥٧	البترون	البترون	1
١١٩	٧٦٤	عبرين	البترون	1
١٢٠	٧٨٠	البترون فرع دوما	البترون	4
١٢١	٧٨٦	تلورين	البترون	1
١٢٢	٣٧١	طرابلس للبنات	طرابلس	1
١٢٣	٣٧٢	المربي حسن الحجة (سابقا الملعب)	طرابلس	0
١٢٤	٣٨١	المربي فضل المقدم (سابقا زاهرية)	طرابلس	0
١٢٥	٣٨٣	اندريه نحاس للبنات ـ الميناء	طرابلس	2

٦٠	###	شحيم فرع الزعرورية	الشوف	0
٦١	٦٥	سن الفيل	المتن	1
٦٢	٩٢	جديدة المتن للبنات	المتن	1
٦٣	٩٣	الاخطل الصغير	المتن	1
٦٤	٩٩	الدكوانة	المتن	0
٦٥	١٠١	بيت مري	المتن	0
٦٦	١٤٠	الضبيه	المتن	4
٦٧	١٤٢	انطلياس	المتن	1
٦٨	١٤٤	مزرعة يشوع	المتن	0
٦٩	١٤٦	جل الديب	المتن	1
٧٠	١٤٨	الزلقا	المتن	0
٧١	٢١٩	بكفيا	المتن	1
٧٢	٢٢٣	بتغرين	المتن	1
٧٣	٢٢٥	بسكنتا	المتن	1
٧٤	٢٢٧	ضهور الشوير	المتن	21
٧٥	٢٣٥	اللواء جميل لحود الرسمية - بعبدات	المتن	0
٧٦	###	بيت شباب الرسمية	المتن	0
٧٧	١٦٥	جبيل	جبيل	1
٧٨	١٧٩	عمشيت	جبيل	1
٧٩	١٨٦	ميفوق	جبيل	0
٨٠	١٩٥	قرطبا	جبيل	0
٨١	###	اهمج الرسمية	جبيل	0
٨٢	###	جبيل الرسمية فرع حصارات	جبيل	0
٨٣	١٣٠	الصفرا	كسروان	0
٨٤	١٣٢	جونيه	كسروان	0
٨٥	١٣٦	الياس ابو شبكة - زوق مكايل	كسروان	0
٨٦	١٩٩	عجلتون	كسروان	0
٨٧	٢٠٦	المؤرخ انطوان الخويري الرسمية (غوسطا سابقاً)	كسروان	0
٨٨	٢٠٩	غزير	كسروان	1
٨٩	٢١١	الكفور	كسروان	1
٩٠	###	د.يوسف عمرو الرسمية - المعيصرة	كسروان	0
٩١	###	جورج افرام النموذجية (كسروان النموذجية)	كسروان	3
٩٢	###	خليل الجر الرسمية - يحشوش	كسروان	0

١٢٦	٣٨٤	المربي سابا زريق (سابقا ميناء بنين)	طرابلس	2
١٢٧	٣٩٩	المربي مواهب اسطى	طرابلس	0
١٢٨	٤١٣	طرابلس الحدادين للبنات	طرابلس	0
١٢٩	٤٣٣	طرابلس القبة المختلطة (الاولى)	طرابلس	1
١٣٠	٤٤٤	القلمون	طرابلس	0
١٣١	٤٤٨	المربي جورج صراف (سابقا بحصاص)	طرابلس	0
١٣٢	###	طرابلس القبة المختلطة الثانية	طرابلس	0
١٣٣	###	البداوي	طرابلس	1
١٣٤	###	طرابلس القبة المختلطة (الاولى) فرع القبة المختلطة الثالثة	طرابلس	0
١٣٥	###	ثانوية عدنان الجسر الرسمية المختلطة	طرابلس	0
١٣٦	٥٣٠	حلبا	عكار	1
١٣٧	٥٤٣	منيارة	عكار	1
١٣٨	٥٥٤	الشهيد رفيق الحريري ببنين	عكار	1
١٣٩	٥٦٥	برقايل	عكار	0
١٤٠	٥٩٠	البيرة	عكار	0
١٤١	٥٩٦	رحبة	عكار	0
١٤٢	٦٠٣	العبون	عكار	0
١٤٣	٦١٦	عكار العتيقة	عكار	0
١٤٤	٦٢٣	فنيدق	عكار	0
١٤٥	٦٣٥	القبيات المختلطة	عكار	0
١٤٦	٦٤٩	مشتى حسن	عكار	0
١٤٧	٦٦٣	الهيشة	عكار	0
١٤٨	###	حرار	عكار	0
١٤٩	###	الحيصة	عكار	0
١٥٠	###	بقرزلا	عكار	0
١٥١	###	عيدمون	عكار	
١٥٢	###	القبيات للبنات	عكار	0
١٥٣	###	كفرتون	عكار	
١٥٤	###	وادي خالد	عكار	0
١٥٥	###	مشحا الرسمية المختلطة	عكار	1
١٥٦	###	الشهيد وليد عيدو البقيعة المختلطة	عكار	
١٥٧	###	الشيخ عياش الرسمية	عكار	1
١٥٨	###	قنية	عكار	0

١٥٩	###	مشمش	عكار	0
١٦٠	###	الكواشره	عكار	1
١٦١	###	ثانوية بهية الحريري الرسمية للبنات	عكار	0
١٦٢	###	حرار فرع قبعيت	عكار	0
١٦٣	###	برقايل الرسمية للبنات	عكار	1
١٦٤	###	بزبينا	عكار	
١٦٥	###	وادي خالد فرع الوعر	عكار	0
١٦٦	###	فنيدق فرع القرنة	عكار	0
١٦٧	###	برقايل فرع القرقف	عكار	0
١٦٨	###	جباع	النبطية	0
١٦٩	###	حسن كامل الصباح	النبطية	1
١٧٠	###	النبطية للبنات	النبطية	1
١٧١	###	جبشيت	النبطية	1
١٧٢	###	رمال رمال - الدوير	النبطية	1
١٧٣	###	القصيبة	النبطية	1
١٧٤	###	ميفدون	النبطية	0
١٧٥	###	رومين	النبطية	0
١٧٦	###	انصار الرسمية	النبطية	0
١٧٧	###	المربي عبد الرضا نور الدين الرسمية -عربصاليم	النبطية	0
١٧٨	###	تبنين	بنت جبيل	1
١٧٩	###	موسى واسماعيل عباس - بنت جبيل	بنت جبيل	1
١٨٠	###	رميش	بنت جبيل	2
١٨١	###	عيتا الشعب	بنت جبيل	0
١٨٢	###	السيد محسن الامين - شقرا	بنت جبيل	0
١٨٣	###	كفرا	بنت جبيل	0
١٨٤	###	عيترون	بنت جبيل	0
١٨٥	###	حاصبيا	حاصبيا	0
١٨٦	###	شبعا	حاصبيا	1
١٨٧	###	الكفير	حاصبيا	0
١٨٨	###	كفرشوبا	حاصبيا	0
١٨٩	###	مرجعيون	مرجعيون	1
١٩٠	###	الخيام	مرجعيون	1
١٩١	###	المربي محمد فلحة - ميس الجبل	مرجعيون	1

١٩٢	###	مجدل سلم	مرجعيون	1
١٩٣	###	الطيبة	مرجعيون	1
١٩٤	###	لبعا	جزين	0
١٩٥	###	جزين	جزين	1
١٩٦	###	صور المختلطة	صور	2
١٩٧	###	الامام الصدر الرسمية للبنات – صور	صور	2
١٩٨	###	العباسية	صور	1
١٩٩	###	دير كيفا	صور	0
٢٠٠	###	مبرة علي الجمال النموذجية الشاملة	صور	0
٢٠١	###	الشهيد خليل جرادي ـ معركة	صور	0
٢٠٢	###	قانا	صور	0
٢٠٣	###	كمال سلهب الرسمية ـ عين بعال	صور	2
٢٠٤	###	علما الشعب	صور	1
٢٠٥	###	البازورية	صور	4
٢٠٦	###	ثانوية المربي عباس ايوب الرسمية	صور	0
٢٠٧	###	شحور	صور	0
٢٠٨	###	صور المختلطة فرع مروحين	صور	0
٢٠٩	###	رحمن يونس ـ قليلة	صور	0
٢١٠	###	د.حكمت صباغ "يمنى العيد" الرسمية	صيدا	1
٢١١	###	ثريا فارس ابو علفا الرسمية	صيدا	0
٢١٢	###	مصطفى الزعتري الرسمية	صيدا	2
٢١٣	###	الغازية	صيدا	1
٢١٤	###	كفرحتى	صيدا	0
٢١٥	###	مغدوشة	صيدا	0
٢١٦	###	عنقون	صيدا	0
٢١٧	###	عدلون	صيدا	0
٢١٨	###	البابلية	صيدا	1
٢١٩	###	الشهيد نعمة هاشم ـ الزرارية	صيدا	2
٢٢٠	###	الصرفند	صيدا	0
٢٢١	###	الدكتورنزيه البزري	صيدا	2
٢٢٢	###	حارة صيدا	صيدا	1
٢٢٣	###	المروانية	صيدا	0
٢٢٤	###	الشهيد نعمة مروى الرسمية سكسكية سابقاً	صيدا	0

٢٢٥	٩٨٥	جب جنين	البقاع الغربي	1
٢٢٦	٩٩١	كامد اللوز	البقاع الغربي	0
٢٢٧	٩٩٥	غزة	البقاع الغربي	1
٢٢٨	٩٩٩	المنارة	البقاع الغربي	1
٢٢٩	###	مشغرة	البقاع الغربي	0
٢٣٠	###	صغبين	البقاع الغربي	0
٢٣١	###	القرعون	البقاع الغربي	0
٢٣٢	###	سحمر	البقاع الغربي	1
٢٣٣	###	المرج	البقاع الغربي	0
٢٣٤	###	الصويري	البقاع الغربي	1
٢٣٥	###	لالا الرسمية المختلطة	البقاع الغربي	0
٢٣٦	###	لبايا	البقاع الغربي	0
٢٣٧	###	مرج الرسمية فرع حوش الحريمة	البقاع الغربي	0
٢٣٨	###	راشيا	راشيا	2
٢٣٩	###	الرفيد	راشيا	0
٢٤٠	###	كوكبا	راشيا	2
٢٤١	###	حرمون الرسمية - راشيا	راشيا	0
٢٤٢	٧٩١	زحلة الرسمية	زحلة	2
٢٤٣	٧٩٣	زحلة المختلطة	زحلة	0
٢٤٤	٨٠٠	حوش الامراء	زحلة	1
٢٤٥	٨١٠	تعلبايا	زحلة	0
٢٤٦	٨١٣	رياق	زحلة	0
٢٤٧	٨٣١	بر الياس	زحلة	1
٢٤٨	٨٣٣	مجدل عنجر	زحلة	١ معطل
٢٤٩	٨٣٦	قب الياس	زحلة	1
٢٥٠	###	علي النهري	زحلة	0
٢٥١	###	سعدنايل	زحلة	0
٢٥٢	###	بر الياس الرسمية فرع كفرزبد	زحلة	0
٢٥٣	٨٥٩	الهرمل	الهرمل	1
٢٥٤	###	القصر - سهلات الماء	الهرمل	0
٢٥٥	###	الهرمل النموذجية	الهرمل	3
٢٥٦	###	المربي مفلح محمد سعيد علوة	الهرمل	0
٢٥٧	٨٧٠	اللبوة الرسمية	بعلبك	0

٢٥٨	٨٧٧	عرسال	بعلبك	2
٢٥٩	٨٨١	العين الرسمية	بعلبك	0
٢٦٠	٨٨٥	الفاكهة الرسمية	بعلبك	1
٢٦١	٨٨٧	راس بعلبك	بعلبك	1
٢٦٢	٩٠٨	دير الاحمر	بعلبك	2
٢٦٣	٩٢٤	عبدو مرتضى الحسيني الرسمية المختلطة	بعلبك	0
٢٦٤	٩٣٣	جودت رستم حيدر الرسمية	بعلبك	1
٢٦٥	٩٣٨	شمسطار	بعلبك	2
٢٦٦	٩٥٥	النبي شيت	بعلبك	0
٢٦٧	٩٦٢	بريتال	بعلبك	0
٢٦٨	٩٦٧	نبيل اديب سليمان - بدنايل	بعلبك	1
٢٦٩	###	القاع	بعلبك	0
٢٧٠	###	بعلبك الثانية للبنات - دورس	بعلبك	2
٢٧١	###	شعث الرسمية	بعلبك	0
٢٧٢	###	تمنين التحتا	بعلبك	0
٢٧٣	###	طاريا	بعلبك	1
٢٧٤	###	دير الاحمر فرع بوداي	بعلبك	0

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