



SMART Interactive White Board Utilization in Al-Shifaa Bint Ouf School

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1. Introduction:

This case study is coordinated and conducted by the Jordan Education Initiative to further understand how SMART Interactive White Boards have been utilized in the teaching of certain subjects in a school where the board has been installed for two years. In particular, this study examines methods through which SMART board has been integrated in the teaching strategies and learning experiences of teachers and students, respectively, in the 8th and 9th grades focusing on the subjects of Math and Science. It explores the changes that the SMART board brought to professional teaching practices and students' attitudes toward Math and Science and their acquisition of concepts. It also lays out the conditions that set the grounds for the participating school, AlShifaa Bint Ouf, to lead in integrating the board in the educational process, compared with other Discovery Schools. In particular, this case study will focus on the following aspects:

- Attitudes towards SMART-aided lessons.
- Teaching and instructional practices in SMART-aided classrooms.
- Students interests, enthusiasm and motivation towards Math and Science
- Classroom Management of a SMART-aided Lesson
- Role of Students in an SMART-aided Lesson

2. Overview of the Study:

Integrating and testing the latest technologies in the classroom is a long time endeavor for the Jordan Education Initiative (JEI). In Spring 2007 the JEI started a pilot project to install 18 SMART Interactive White Boards (IWBs), donated by SMART Technologies, to examine the potential of these boards in Jordan's teaching and learning environments. In 2009, the JEI carried out a preliminary study aiming to explore the extent to which the implementation of SMART boards in five Discovery Schools changed the learning environment in the year of 2008/2009, one year after the boards had been installed in the classrooms. General findings from the study demonstrated wide acceptance of the board and recognition of its benefits in the classroom, from both teachers and students. Despite this progress in one year, teachers' adoption was still largely focusing on developing their technical competences rather than on the possible applications of the board to create a more interactive and student-centered classroom. Across the five schools, students reported that science and math subjects were the subjects where the board is mostly needed.

These general findings elicited the need to conduct an in-depth study on the stages that teachers reached after using the interactive white board in a school that had the board installed for the longest period comparing to other schools. There are three stages through which teachers undergo while using the Interactive White Board: the "supported didactic", the "interactive" and the "enhanced interactive" (BECTA ICT Research Bursaries¹). Findings of the first study conveyed that teachers across schools were using the board as a visual support tool in the lesson and continued with the teacher's centered instruction, in other words the board "supported [the teachers'] didactic."

In this case study, the JEI sought to discover the function stage that the board serves within teachers' pedagogical practices after overcoming the

¹ BECTA 2005, 'How can the use of an interactive whiteboard enhance the nature of teaching and learning in secondary mathematics and modern foreign languages?', report prepared for BECTA ICT Research Bursaries

functionalities of the board; and the the choice of a school rested on one with earliest board's integration amongst all other schools; al Shifaa Bint Aouf. The case study goes further to narrow the lens on the Math and Science subjects of the 8th and the 9th grades as their teachers were the most experienced with using the board within the school.

3. Research Questions:

This case study focuses on the overall learning environment of the Math and Science SMART-aided lessons. It explores professional practices of teachers in a SMART-aided lesson, the in-class tools and activities, overall students' roles and interaction, and the conditions affecting the boards' application and utilization frequencies, after two years of exposure. This case study aims at answering the following questions:

- How did Smart Interactive board improve teaching Math and Science? And what stage teachers reach in using the board?
- What changes did the board inflect on students' interest, enthusiasm and motivation, especially the lower achieving ones?
- How did the board improve teachers' ability to manage the classroom?
- What were the supporting conditions that helped placing the board as an integral tool in the Al-Shifaa School's learning environment

4. Instruments Utilized in this Study:

To capture answers of the case study's questions, the Monitoring and Evaluation Department of the JEI developed an evaluation framework using the following instruments:

- **Classroom Observations:** for evidence based research, three Math and two Science lessons were observed over the period of two months for 8th and the 9th grade. The Math and Science teachers taught the subjects for both grades. Teaching and instructional strategies, student's interactivity, and classroom management were the main areas to observe in these lessons.
- **Students Focus Groups:** two focus groups, from the 8th and 9th grades, took place to get an in-depth understanding of students' learning experiences in Math and Science SMART-aided lessons. Each comprised of 6 randomly selected students, the focus groups explored the differences in students' learning experiences in a regular and an SMART-aided lesson mentioning wide range of examples in the Math and Science subjects.
- **Teachers Interviews:** Math and Science teachers were interviewed to investigate ways the utilization of the IWB board changed preparing and conducting the lessons, lessons activities, and their perceptions on the changing roles of students in the SMART-aided lesson comparing to the regular one.
- **Principal's Interview:** the principal interview investigated the existing conditions and the administration measures that encouraged teachers to utilize the SMART board and institutionalize it.
- **Students Final Survey:** a survey measuring the attitudes of students towards SMART-aided lessons in general was distributed to all students in both the 8th and the 9th grades.

5. Participating School:

Located in one of Amman's underprivileged and populated neighborhoods, Al-Shifaa Bint Ouf Secondary School for Girls has 32 teachers serving 760 students from the 7th to the 12th grades. When it comes to its technical infrastructure, the school has 4 computer labs hosting 80 computers and 4 Interactive White Boards of which 2 are SMART boards. Installed in 2007, the first SMART board is located in a dedicated room shared by different grades and subjects according to a schedule. The other board was installed in 2008 in the Science Lab where it is mostly used for science lessons across different grades, in addition to minimum number of Religion and Math lessons scheduled to use the board.

In 2008, seven teachers from different subjects received technical and pedagogical training on integration of the SMART board in the classroom. But there has been a noticeable increase in the number of teachers, (15 out of 32) who are using the board, as of 2009 according to the principal. This was due to internal training sessions that the school organized of which are run by experienced teachers to introduce the board to new ones or those who developed an interest using it.

To ensure the utilization of the board, the principal developed a schedule for each hosting room which is shared among different grades and subjects.

.Not only the frequency but also application methods of the board in-class are also monitored. In addition to the frequency report that each lab technician has to give in to the administration, the lab technicians have to report on the tools and applications that were used throughout the lesson. A random visit by the principal to SMART-aided lessons is another feedback method on how the board is used.

"All teachers are entitled to use the board through a schedule that would cover all grades and subjects. We organize classes so that different labs won't conflict together, and when a conflict in timing appears, we have a laptop aside to take to the classroom. Even when you set a schedule there is a fluctuation in applications as some teachers use it as a white board and others don't so the administration has to monitor the in-class applications to maximize the benefits as well." (Principal)

6. Key Findings:

For teachers, students and the principal of Al-Shifaa school, the SMART board has transformed the classroom environment and emerged as an integral component of teaching in the school. The school has set a system to maximize sharing the benefit of the SMART board among the largest number of students through organizing schedules and setting a monitoring process. All students in the focus groups expressed their preference of a SMART-aided lesson over a regular one, and said that they were more motivated to learn Math and Science in the former. And finally the Math and Science teachers became more oriented with the utilization of the board and recognized methods where the SMART board facilitated their work and students' acquisition of concepts.

The following sections demonstrate details of the findings that were consolidated from the baseline and final evaluation surveys, and classrooms observations conducted by the JEI.

6.1 General Attitudes towards SMART-aided Lessons:

"Using internet sources and the different tools on SMART instill the information better in our minds. When I want to retrieve information, I go back to the tools I used in the SMART board." (9th grader)

Prevalent in the findings of the survey were the 8th and the 9th grade students' enthusiasm and the positive attitudes towards attending a SMART-aided lesson. Of the students, 91% were more interested in learning when the SMART board is used in class, 86% agreed that using a SMART board motivates them to participate, and 71% of the students expressed that they wait impatiently for the SMART-board class

"We are bored with the "dictation" style of teachers in the regular classroom. In the SMART board classroom we are more interactive and we get to have a bigger role in the classroom." (8th grader)

As for the tools and activities that teachers, in general, apply in a SMART-aided lesson, over 80% of the students reported that the 'interactive whiteboards' encourage teachers to use a variety of medias and visuals to illustrate complex concepts, to divide students

"Smart Board develops a motivational atmosphere into the classroom away from boredom; we learn things in a modern way where the material is more attractive through utilizing different mediums of videos and pictures." (9th grader)

into groups in the classroom, and to integrate E-content in the lesson." Working in teams, presenting to classmates and participation is generally encouraged in a SMART-aided lesson according to more than 70 percent of the students. Also, 55% thought that their teachers use more interesting teaching methods/activities in an IWB classroom than in the regular classrooms.

While students reported that using the interactive whiteboard requires a strong technical background, only 16 percent of students do not feel nervous or afraid when using the board, and they do not think the board is difficult to use which reflects the high level of comfort for most students using the board.

SMART-aided Lessons for Math:

After two years of practice, the teacher displayed high technical competency and confidence in using the board in front of the classroom. She was able to use different exclusive board features to stimulate classroom interactivity and increase the attentively of students. The Math teacher said that integrating IWB in the classroom was hard and complicated in the beginning but, for her, practicing and attending SMART-aided lessons for other teachers of longer experiences abbreviated the learning time.

Despite that at the beginning of each school year a schedule is put together to divide time slots of the SMART room among different subjects and grades, the frequency of SMART-aided Math lessons fluctuated throughout the semester. Eighth grade students mentioned that at the beginning of the semester, the SMART-aided math lessons were very few, but the last unit in the Math book was wholly carried out in the SMART-aided room. On the other hand, the math teacher stressed that *"the main factor to decide when an IWB should be used is the curriculum and not necessarily the schedule"*. For the math teacher, some lessons in the curriculum can only be carried out in the *"lecturing style"* which urges her to either stay in the regular classroom, or take students to the SMART

board room to solve problems and show Medias related to previous lessons. In the last month of the semester, the teacher conducted all the 8th and 9th grades Math lessons in the SMART room in order *"to make up for all the missed scheduled IWB classes,"* and because *"geometry, the unit's theme, was flexible in its nature."*

Math lessons for both 8th and 9th grade took place in the SMART-dedicated room according to a schedule that assigns 2 classes every week for each grade. The three observed classes covered lessons of "Geometry", "Fractions" and "Real Numbers", and each class period was around 50 minutes.

6.1.1 Teaching and Instructional Practices:

For 8th and 9th grades students, the differences in instruction between a regular and smart-aided lesson revolved mainly around the increased interactivity. Using combinations of tools on the SMART board enforces their understanding of Math concepts.

For students and teachers, certain tools on the SMART board facilitated working on some textbook exercises as it saved time and achieved better accuracy:

"We were able to measure the length and angle of shapes accurately using different tools like the protractor and the ruler; we can never achieve this level of accuracy on the chalk board. We were also able to see if shapes are compatible or identical through rotating them and placing them on top of each other."

"The "measurements and angles" lesson is very complex. In one of its book's exercises that asks students to measure different angles using a "real" protractor. I asked them not to bring their tools and use the protractor tools on the board instead."

Teachers' preparedness for SMART board lessons was high as she planned different tools and presentations using smart board applications to demonstrate the lesson. Instruction practices in the observed lessons mainly took the form of questions and answers directed to the whole class and supported by a presentation on the board using different features. In some classes, the math teacher will divide students into groups like in one

observed lesson on "real numbers". The teacher gave groups similar problem to solve and then chose one group leader to demonstrate the solution.

Whether in the form of Power Point or SMART Notebook, prepared presentations were the most common application used on the board, according to the account of teachers and students, and classroom observations. External websites or media from the Math E-content are not within the main resources of the Math SMART-aided lessons in general; *"media from the Math E-content was used few times to introduce a new concept,"* as the teacher mentioned

Using tools:

"Using the SMART board tools depends on the rigidity of the curriculum," as the teacher elaborates. In the Geometry lesson, the teacher used a presentation for the whole lesson time to explain the lesson concepts, and used the SMART Board toolbox and gallery to display different shapes of triangles, the ruler and the digital protractor to calculate the length of lines and the angles. In the "real numbers" class, on the other hand, the teacher prepared a presentation to introduce concepts and had students demonstrate the solution of a few problems using the lens and the timer tool.

While at times the teacher use different tools and features of the SMART tool box in her presentations to make them more interactive, at other times the board functions more as a white board where the pen is the only tool used. This was prevalent in the "addition and subtraction of fractions" lesson, where the first 20 minutes of class was for teacher to present the steps of solving a problem on white sheet on the board, and in the rest of the time, students demonstrated their homework from the previous lesson.

The Math teacher mentioned that using the tools on SMART board does not necessarily substitute hands on experiences,

"Selecting tools depends on the importance of the tool itself. The protractor has no use in other lessons, while the ruler is always present which makes me want them to have hands on experiences with it."

"but it saves more time". She explains that if it wasn't for the tools, she would have had to divide students into groups and walk through the groups to help them with their measurements using the protractor.

6.1.2 Preparation of a SMART-aided Math Lesson:

In the second year of utilization, preparing a lesson for the teacher became less *"tiresome"* as the teacher would use the same prepared lessons from last year with *"few tweaks."* Practice and peer collaboration together gradually reduced the time the Math teacher needs to prepare a SMART-aided lesson.

In General, preparing for a SMART-aided lesson is different from preparing for a normal class, for the Math teacher. It takes more time to prepare a SMART-aided lesson especially if she is integrating different Medias, E-content and tools from the board, but the complexity of the lesson is the main decider. Some lessons cannot be demonstrated except in the *"traditional lecturing style"* according to the teacher, in this case, the board is only used as a digital chalk board and only needs 10 minutes to prepare for. But if the concepts were malleable enough, the teacher prepare for a lesson using the Boards tools and presentation application.

Watching different teachers giving a Smart board lesson speeded our learning skills and helped us identify the tools that will cater to the lesson needs," (Math teacher)

6.1.3 Students Motivation and Attitudes Towards Math

Highly pleased with the Math SMART-aided lessons, the difference between regular and SMART-aided Math classrooms for students is the move from *"lecture-style"* teaching in regular classrooms to "a more interactive one in SMART-aided classes". The fact they were able to use SMART tools and shapes "to test triangles symmetry", for example, breaks the routine and adds a sense of entertainment to the regular classroom. It is the increased participation and the better concepts acquisition what makes students more motivated in a SMART-aided lesson.

"Having to use the tools of the board enforced our understanding of concepts, especially in Math where it needs a lot of work." (9th grader)

In the three observed Math lessons, teacher-students interaction was high as students were eager to respond to teacher's questions. Students would occasionally discuss with each other answers of problems and help out other students on the board. When asked to identify some participation trends among students in an SMART-aided lesson, the teacher answered that students interact differently without trends depending on the lesson, the method of instruction, and the instruction styles they are most comfortable with, *"some are traditional learners, others like more interactive methods."* She mentioned that some students are used to be recipients of the information rather than participants in the lesson, which does not necessarily make the SMART-aided environment a motivating one for them.

"I remember using a trivia tool from the e-content in the "probabilities" unit with 7th grade students last year, and I will not be exaggerating if I say the whole class wanted to participate. At the same time, I can open another media and not get the same interests from students."

As for the skills of the students, having used the board for at least one year, math teacher noticed that students are more motivated to come to the front of the class to present their work in a SMART-aided lesson. Some students take the initiative to bring in Medias and materials that are relevant to the lesson. In both focus groups, students pointed out that lower achieving and shy students had more courage to walk to the board and learn how to use it even though that they make mistakes. However, the teacher noticed that students who have access to home computers are more accepting and motivated to work on the SMART board than those who don't.

When talking about the impact of the SMART-aided lesson on relating math concepts to real life experiences, the math teacher commented that

"A good lesson should also relate the introduction and the conclusion to reality especially in math; I have to start by associating the title of the lesson to real life to make them see the benefits out of it."

While the teacher attempts to use the board to simplify abstract concepts to students, they, on the other hand, could not find a relationship between

using the SMART board and bringing Math concepts closer to real life since *"the curriculum itself is not relevant to real life, and some lessons can only be taught through lecturing style."*

6.1.4 Role of Students

Most students from the 8th and 9th grades agreed with what one student said about their roles in a SMART-aided lesson: *"In the smart board room the class is more interactive and we get to have a bigger role."*

Lessons' interactive nature and level of complexity are the main deciders of the role of students. According to the teachers, there has to be a pure integration between the roles of students and the teacher so as each is not totally dependent on the other. While 12 students walked up to the board in one class, only 2 students got to use the board in the other two observed classes and the rest of the class worked in groups to solve similar problems. *"In general, if it is a smart board lesson, the role of the student can never be ignored,"* according to the teacher. On the other hand, to the math teacher, the increased role of students' in the lesson *"consumes time because regardless of their knowledge on using the board, they will still make mistakes and you will have to correct them."*

One student in the 9th grade pointed out that in a Math IWB-lesson; teacher is encouraged to divide students in groups:

"I think it's because the tasks are bigger in an IWB class and doing through groups is easier. It's also to increase the participation of the girls, as through a group, one get to solve the problem, the other takes notes, the third walks to the board to write the solution to a problem and so on. Everybody gets to do something."

6.1.5 Classroom Management:

In general, in all observed classes students were attentive to the teacher and eager to participate and there were no significant incidents of disruption. Misbehavior is not an issue in a SMART-aided room, for the Math teacher. Students commented that their classmates are actually

more attentive to the teacher than in a regular class where more reasons for distraction exist. In the 9th grade some students complained about some of their peers making noise in the beginning of the lesson, especially those setting back in the classroom.

It takes time to get students moved into the SMART room as pointed out in the interview with the teacher, and observed in the classrooms, 45 out of 50 minutes were used for instruction time for 8th grade. It is different in the 9th grade as the class size is bigger and students are harder to manage, so it takes over 5 minutes for students to settle in an IWB-room.

As for keeping the discipline throughout a regular or an SMART-aided lesson, dividing students into groups is one method to how teachers manage bigger classroom size of the 9th grade (49 students). Students from the 9th grade mentioned that class groups are more disciplined during a SMART-aided lesson as assigned tasks are bigger, while in a regular lesson, students find an opportunity in groups for side talks.

6.2 SMART-aided Lessons for Science:

Known to be one of the best teachers to embrace the SMART board, the science teacher has been utilizing the board in her classes for over 2 years in the same school. Ever since its introduction to the school, the science teacher was able to foresee what the board can offer to the classroom, *"but it was harder then because I was not that competent using it."* After two years of experience, the teacher demonstrated high competency and self-confidence using the board in front of the classroom. She was able to utilize different features and Medias on the board that accommodated the lesson activities and concepts. Students in the two observed lessons were highly engaged in the class as the teacher was able to attract their attention in delivering the lesson.

Science SMART-aided lessons took place in the science lab where the second SMART board in school was located. Initially, a schedule is developed at the beginning of each year to share time periods among

science classes across all grades. Based on the schedule, the 8th and the 9th grades were assigned to use the room at least 2 times a week.

But the frequency of the science SMART-aided classes did not necessarily depend on the assigned schedule when it comes to the Science teacher. At the beginning of the current year, the teacher reported using the board at least once a week for the 9th grade Chemistry classes and fewer times for the 8th grade. However, the frequency of the SMART-aided lesson increased for both grades, as the last unit in each of their curricula was completely carried out in the Science lab. Throughout the semester, the frequency of the SMART-aided classes fluctuated according to the curriculum and not necessarily the schedule.

"We do not necessarily go by the schedule. If I feel that a lesson can be facilitated in the Smart room, I would exchange classes with the scheduled teacher for that period. We all coordinate among each other to be able to use the board whenever it's suitable for the curriculum. So the schedule is not necessarily the main decider of the frequency and the timing of the SMART-aided classes but it's mainly the needs of the curriculum."

6.2.1 Teaching and Instructional Practices:

The science teacher described a *"good and effective lesson"* with *"a lesson that covers all the points listed in the text book..."* and lessons bringing concepts closer to reality;

"You have to make sure that what they [students] imagine in class is identical to reality through practical experiments, worksheets, and brainstorming."

The SMART-aided lesson facilitates achieving this vision of good and affective classroom, as for her, she can *"cover the points in the lesson, have students work hands-on on the board, and use E-content Medias that connect concepts to daily life experiences."*

The class time was carefully planned in both observed classes as the teacher was able to juggle between presenting on the board, carrying out real experiments in the lab, and assigning different book questions to groups. The adoption of blended learning methods was reflected in

student's accounts when they listed reasons behind favoring the SMART-aided Science lessons:

In general, in both of the observed classes, students had high interactivity

"The teacher would integrate different sources of e-learning, different websites, power point presentations, and incorporate videos and pictures in addition to the experiments."

and were able to clearly demonstrate their understanding of concepts.

This high interaction did not necessarily mean a more student centered approach in delivering the lesson, as it was mainly led by the teacher and students were only responsive when they were asked to.

"The whole Space Unit in science was entirely carried out in the IWB room. The teacher used interactive presentation on the SMART board using a video on "the taking off" of the space shuttle, and its movement around the moon and earth. Demonstrating information through visuals better instilled the information of that unit in us." (9th Grader)

Using Tools:

For the science teacher the choice of tools and features on the board merely depends on the curriculum. The curriculum is harder for the 9th grade, more theoretical and formula-based than practical, according to the science teacher; this limits the utilization of the board to demonstrating experiments rather than introducing concepts. *"In the 9th grade, the IWB is useful for demonstrating practical experiments where they cannot see in their bare eyes even if I perform it in the lab."* On the other hand, the curriculum of the 8th grade is more flexible and relevant to student's daily lives which make the board useful to introduce lessons through different Medias and visuals.

6.2.2 Preparation of a SMART-aided Science Lesson:

Comparing to last year, this year, *"the SMART-aided lessons made my work easier as I started using different features like "the lens" and different colors, different sources like the "Sunflower" software."* In her second year

of using the board, the teacher does not spend the same time preparing for classes as she *"have whole units in the 8th grade science curriculum ready to be demonstrated using the board: "Lenses" and "Earth and Space" units."*

The complexity of the lesson factors in the lesson preparation for the science teacher, as she that mentions preparing for 9th grade lessons is

"For the "chain of chemical reaction" lesson in the 9th grade, I was pleased to find demonstrations about water and metal interaction as students were able to see what will happen to metal bridges if they were exposed to rivers, things they cannot see in their daily lives. I couldn't go further to use the board beyond these concepts for this lesson in particular because the rest is just symbols and formulas that have to be written by hand."
(Science Teacher)

harder than for the 8th grade as concepts are more developed. The SMART gallery provides media for basic and general concepts in the curriculum, but for special and detailed concepts, according to the science teacher, "one needs to look for other sources beyond what the gallery provides which takes more time."

Technical competency was another aspect facilitating the lesson preparation. Science teacher found it difficult at the beginning to embrace the utilization of the board, but with practice she was able to map out the demonstration and delivery of the SMART-aided lessons easily. Peer review and access to foreign lesson samples were other factors that the science teacher mentioned to have helped her reduce lesson preparation time: *"We all studied how we can apply the lens feature in our lessons and it worked for me and another colleague."*

6.2.3 Students Motivation and Attitudes towards Science

"We got more interested in Science" is what one student said, and the rest agreed upon when asked about their attitudes towards the subject with the

SMART-aided lessons. Students thought that they were able to relate science concepts to real life experience.

"There are experiments that [they] cannot carryout in real life like the interaction of Potassium or Sodium with water that causes an explosion, an experiment that we can only see on the board"

"Sometimes we will line up thinking that we will go to the SMART room but the teacher will announce that the room is not available and get very disappointed." (9th graders)

During two of the observed classes, students were very engaged and eager to get a turn to work on the board. Their attention was focused on the teacher walking through the lesson and asking questions in between experiments and demonstrations on the board.

Student-student interaction was low, on the other hand, as students got very few chances to work together although they were divided in groups.

"Girls are usually sleepy and low on energy, but in a Smart class, the teacher divides the class into groups, assign tasks and worksheets and the participation is higher which keeps all of us alert." (9th grade student)

They would occasionally discuss among each other the

answers to problems, but the main interaction was a teacher-student one

"I make sure groups are diverse in terms of their academic accomplishments ...groups choose the student that will solve the problem on the board and they among themselves give bigger turns to lower achieving or shier students."

through the whole class questions and answers instruction method. As for students with lower academic records, they were more motivated to participate in the class, according to the teacher. For the teacher, dividing students in groups was the main method that she used to encourage lower achieving students.

When it comes to skills that students developed using the board for about a year now, teacher and students mentioned the computer skills especially for those who do not own a computer and do not how to use it. Those who don't have computer at home became interested in learning how to run the board and experiment with its features.

6.2.4 Role of Students

In the observed 9th grades' classes, an average of 5 students out of 49, got the chance to use the board to solve problems. The science teacher mentioned that it is hard to have more students come to the board as it takes some time from that to cover concepts of the lesson. While dividing students in groups was a strategy to increase interaction and participation

in the classroom for the science teacher in general, the delivery of the two observed lessons was mainly through a whole class interaction and individual answers from students to the questions of the teacher.

6.2.5 Classroom Management:

There is more discipline in the regular classroom according to the teacher. The teacher complained that it takes time to get girls settled in the Science lab; *"in the same class period, you have to get the girls down to the computer lab, have them settled, then take them up again by the end of the classroom which sometimes make me unable to cover the material I prepared."*

This was reflected in the account of the 9th graders as they reported incidents where students would take advantage of moving to the classroom; create chaos to waste some of the class time. However, the teacher mentions that Smart board encouraged her to conduct more group based lessons, as it brings better classroom discipline with the increased in-class assignments of the students.

"I always start teaching 10 minutes out of 50 after the period start in the 9th grade. The 8th graders are more disciplined as they arrive to the room earlier, are more organized, as they are new to the board and more motivated and enthused to use it."

6.3 Limitations of Pedagogy for SMART-Aided lessons:

In a SMART-aided lesson, instruction style and activities are influenced by the following limitations as was pointed out by both of the teachers and the principal.

6.3.1 Technical Challenges:

Preparing for class is one thing, and implementing is another for both teachers. If the board's "touch-screen" feature suddenly stops working, the class will shift towards lecturing style of a regular classroom as the mouse cursor on the supporting computer will not be visible enough. Both teachers mentioned facing sudden technical problems while using the board during the lesson which disrupts the course of the lesson and consumes time.

The role of the students in the classroom can be affected with technical issues, as the Science teacher does not allow her students to present their work on the board for the fear of injecting the supporting computer with viruses. The science teacher is concerned *"about all the viruses that students might transfer when plugging their flash memory devices, where they save their work."* She adds that she herself does not prepare her lessons on her home computer fearing for the files to catch viruses; instead, she does it directly on the supporting computer.

6.3.2 Large Class Size

Giving a lesson to 45 students of the 9th grade is not the same as giving it to a 32 students of the 8th grade according to the Science teacher. Percentage of students who get to use the board in one class drops in larger classes as, for both teachers, *"it takes time for a student to walk to the board and back to her chair."*

Dividing the 9th grade students into groups is how the Math teacher deals with the big size of the classroom whether in the regular or SMART-aided lesson. For both teachers; however, it takes longer time to start

instruction with the 9th grade as 10 minutes are used to move students and have them seated.

6.3.3 Time and Curriculum Limitation

The intensity of the curriculum makes every minute of the lesson matters for both teachers. The requirement of the Ministry of Education to finish the textbook has an impact on both the activities and the roles of students in SMART-aided lessons compared to the regular classrooms. A girl walking in to the board means that the allocated time for covering the material is reduced for the Science teacher and to a lesser extent the Math teacher. The math teacher was concerned about students' learning time on the board; *"regardless of their knowledge on using the board, they will still make mistakes and you will have to correct them."*

"Moving the girls into the SMART board room and having them come to the board to solve problems takes from the time I need to cover the material."

She also adds that in an SMART-aided lesson *"when students miss a point they ask me to repeat the slides which take time."*

6.3.4 The Hosting Room:

Students sitting in the back row of the dedicated SMART board room, are not very much likely to be picked by the teacher to come to the front of the board; *"since it takes time for them to go around the tables and reach the board,"* as the Math teacher informs us. For the Math teacher, those closer to the board have easier mobility and are more likely to get a turn.

"In the first two years, the SmartBoard room had seats organized in rows which were a bit disturbing as the board was not accessible to all students. This year the seating changed to have students set around a U-shape tables through which the board was visible to the whole class."

The visibility of the board was another problem for students sitting in the back and teachers wanting to keep a discipline. Students who were seated at the back of the dedicated room or the science lab complained about not

being able to see the board and having more distractions. For the science teacher the visibility of the students is a problem. It is harder to manage the discipline in the SMART-aided classroom comparing to the regular one, as

"In the regular classroom, the whole class will be within my sight as the organization and lighting are better. But in the science lab where the board is located, the seating of the girls are not at a proportionate distance from where I stand and the lighting is lower which makes it hard to pay attention to all the girls."

Rotating students' locations in the same lesson was not a feasible solution as it will waste more class time for the science teacher.



6.4 Leading the Adoption of SMART Board in Schools:

This was a general overview of the pedagogical practices through which the board was utilized in the Math and Science practices. Comparing to the regular classroom, the board has positively shifted the learning and teaching environment for both subjects. It was prevalent in the students and principal account that the Math and Science teachers are leading in the adoption of the SMART board in classrooms. They both are assigned for any technical or instructional support needed by other teachers in the school. Over two years of adoption, certain circumstances helped both teachers to be ahead in embracing the board.

6.4.1 Self Motivation and Practice:

Strongly present in both accounts of the teachers was teacher's intrinsic motivation to try new teaching techniques. *"It really comes down to the personality of the teachers themselves and their vision to improve their skills and style"* as the Math teacher said. At their free time, both teachers practiced on the board to explore its different features and develop their lessons; *"if you didn't get the chance to experience using the board first hand, you will not get the concepts easily,"* as the science teacher pointed out. The principal in return described those with higher adoption of the board with teachers who are highly motivated and do not look at their work as just a job but a profession.

6.4.2 Collaboration:

Both teachers stressed on the importance of teachers' collaboration in the school to encourage the adoption of the SMART board by other teachers. *"We used to exchange visits to each other's classes to explore different purposes that the board can serve,"* as the Math teacher stated. Organizing internal training sessions for the board to novice teachers conducted by practicing ones helped expediting adoption of the board according to the Science teacher. This was aligned with what the principal mentioned in terms of assigning two teachers as a reference for their colleagues in the school..

6.4.3 Schedule:

"The schedule pushed me towards utilizing the board in the classrooms" the Math teacher said. The follow up from the school leadership on the frequency of use and attendance reports encouraged both teachers at the beginning to discover ways the board can facilitate their work.

While these conditions prepared a proper environment for the Math and Science adoption, teacher not only encouraged trained teachers but also brought in those who were resistant to undertake the experience of SMART-aided lessons. Getting new teachers on board was also the outcome of the following activities, according to the principal.

6.4.4 Recognition:

Appreciation and support by the school leadership and visits to the school by local and international guests to observe SMART-aided classes changed the attitudes of the teachers who were resistant in the beginning; "they started to follow up the steps of their peers." When the school organized an open day to show the scientific and academic achievements and tools developed on site, the SMART board sample lessons was the corner that got the most attention from visitors and teachers.

6.4.5 Orientation:

At the beginning of each semester, the new coming teachers are to be trained and exposed to the board by other experienced teachers in the school.

"Tools in the lab do not accommodate the whole size of the classroom. So I divide the class space into stations one for experiments, another for demonstrations and have the girls rotate between these stations until each gets a turn." (8th grader)

7. Conclusions:

After two years of exposure and practice of a group of teachers at Al-Shifaa Bint Ouf School, the functional expertise of the board is no longer an obstacle in its adoption as a tool to develop teaching skills. This case study shed the light on math and science teachers teaching 8th and 9th grades because they were known to have strongly embraced the board which puts the technical incompetency aside. The case study also investigated the mechanisms that the school put in place to maintain a high board adoption and attract new teachers to the SMART board.

From the key findings of the case study, the following can be concluded:

Teachers and students believe that SMART board had high impact on revitalizing the classroom

Teachers and students were able to realize the higher interaction in the dynamics of a SMART- aided lesson in comparison to the regular classroom. The move from a dictation-style instruction to a more participatory one was the most highlighted point in students' accounts when it comes to the impact of the board. As for the teachers they were able to recognize the higher attention of students and their eagerness to participate. They mentioned that it was easier to bring the concepts of the lessons closer to real life experiences through the different Medias that can be displayed on the board. The fact that the students get the chance, sometimes, to use the board makes them more attentive and disciplined in the classroom.

Using the board for two years, both teachers moved to higher stages of board usage in the classroom compared to other teachers at schools in their first year of using the board

Giving a SMART aided science or math lesson is not an option to teachers anymore. The SMART board lessons are heavily integrated in the teaching process of science and math as both teachers depend on their ready

prepared SMART lessons. Both teachers moved away from using the board mainly as a "data show" for their PowerPoint presentations just like in other schools' first year of adoption. After improving the technical competency of the board and getting well oriented with its different features, the capacity of both of the Science and Math teachers to employ different tools to create interactive activities increased, aiming for higher students' participation and less time to explain concepts. The math teacher relied heavily on the local library of the board for digital tools like the digital protractor and ruler for the geometry unit. In the real numbers lesson, a "rigid lesson" according to the teacher, she prepared presentation using the board tools of lens and timer to stimulate the interest of students in solving presented problems. The science teacher, on the other hand, integrates different external Medias to get concepts closer to students and digitally demonstrate experiments that are not viable on the real grounds for the lack of tools or their hazardous nature. In other words, teachers are moving away from the "supported didactic" stage in using the board to the more "interactive" one, using different interactive activities. While students acknowledged the higher use of interactive content in the lesson, comparing to lessons of teachers who have been only practicing for a year on the board, teachers were still leading a teacher-centered lessons of which provide support for concepts, but does not necessarily transform the role of students from receivers to acquirers of the information

Students were more active in SMART-aided lessons compared to regular lessons, but their in class role fluctuated depending on different variables

The following are the factors influencing the role of students in the classroom:

Intensity of the textbook: The textbook is intense and more complex for the 9th grade which reduces students' roles in the lesson according to science teacher. The teacher believes that an ultimate class is one

that covers the objectives in the book, and having to increase the students' role in the classroom may affect this goal.

Time Constraints: The Math teacher gives more space for students to participate on the board and sometimes present their own work, but at the same time, she acknowledges that students' movement in the room takes some time as the mobility between tables is difficult. As techniques of blended learning existed in science smart-aided lessons, the teacher was more concerned with covering the whole objectives and content of the lesson in an interactive manner more than increasing the participation of students on the board, as for the teacher, "it took more time, especially in a class with a big size.

Technical issues: While the math teacher encourages her students to develop their own presentations to demonstrate certain concepts of lessons, the science teacher does not encourage it to protect the main computer from viruses and save time. In some cases where the math teacher is tied with the class time, she presents students work herself to be more efficient.

Administration support and collaborative learning facilitated progressing teachers' experiences in adopting the board over the years of implementation.

Setting a schedule for the SMART-board rooms and monitoring its application by the school leadership was one reason that gave teachers a jump start to using the board. The leadership set a monitoring mechanism in the school to follow up with the utilization of the board and its application inside the classrooms. This was through monthly reports from the technicians and random lesson visits carried out by the principal.

Teachers also attributed their progress on the board to developing an internal community of practice where trainings on the SMART board is held at the beginning of each semester and teachers are asked to attend other teachers SMART-aided classes.