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Teaching Metric Relations in a Triangle through WhatsApp, A Case Study of Students in Grade 12, Section General Sciences, in a Public School in Beirut

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Abstract: ***This research aims at examining the impact of teaching the lesson "metric relations in a triangle" in mathematics, through WhatsApp, to 23 students in grade 12, section general sciences, in a public school in Beirut. It also aims at determining students' opinions about the possibility of teaching other math lessons via WhatsApp to students in other classes and levels. Finally, it aims at estimating the percent of students who believe that the role of the teacher is important in delivering the information to the students through the WhatsApp and those who are willing to study a second lesson in mathematics through the same platform.The sample of the study was formed by 23 students in grade 12, section general sciences, through the purposive sampling technique. This research, through its quantitative approach, have explored the possible relations between Whatsapp and teaching a mathematical lesson. For statistics, the researchers have used the frequencies, the percent and the bar diagrams to represent the data of the study. Results of the study have revealed that the lesson "metric relations in a triangle" can be taught via the WhatsApp and through interaction with the teacher. Most of the participants were able to solve the assigned exercises after completing discussing the lesson through the WhatsApp and many of them have believed that it is possible teaching other math lessons via the same platform to students in other classes and levels. 95.6% of the participants have believed that the role of the teacher is important in delivering the information to the student through the WhatsApp, while 85.9% were willing to study a second lesson in mathematics via the same platform.The researchers recommend that math teachers use the deliberate practice through the WhatsApp and support their students with extra exercises to perform better in exams. They also recommend other researchers, through experiments, to examine the impact of teaching deeper mathematical lessons in different classes and levels through WhatsApp and other social media platforms and networking sites.***

Keywords: Mathematics, math teachers, WhatsApp, teaching, deliberate practice, social media platformsand networking sites

1. Introduction

1.1 Background of the Study

Social media platforms and networking sites have become one of the most interactive tools among people. Through social media, everyone can exchange, share, discuss, comment and inform others about the latest updates in almost any topic. This immerging rapid and massive expansion changed the ways of collaborations and communications among people; and because of that, students now have that ability to communicate and collaborate to learn in a more interactive way. Not only have that, but students and teachers have the opportunity to collaborate in tasks. Teachers can teach their students through social media and they can transfer some of their knowledge to them (Devi, Gouthami, & Lakshmi, 2019).

Some might ask why students and teachers should use social media in learning and teaching. The answer is simply because social media is defined by "the relationship that exists between networks of people". This alone has to influence both students and teachers to take advantage of the available features of the diversified social media platforms and networking sites, and use them to learn and teach in a better way (Devi, Gouthami, & Lakshmi, 2019).

Even-though many teachers are still reluctant or against using social media in teaching their own subject material, it has been able to influence some educators, just like the researchers in this study, to experiment its effect in education (Devi, Gouthami, & Lakshmi, 2019).

Unlike the other technical devices, social media presents the opportunity for people to collaborate and reinforce their thinking skills at any time and place. Its potential implications in teaching and learning in the 21st century are huge and it should be given a chance to prove its worthiness in education (Devi, Gouthami, & Lakshmi, 2019).

Based on what was mentioned above, we may ask about the effectiveness of WhatsAppin teaching mathematics to students. Can the "metric relations in a triangle", a lesson in mathematics in grade 12 General sciences, be completely taught through WhatsApp? If yes, can the students solve the exercises associated to the chapter after explaining it through the WhatsApp?

1.2 Theoretical Framework

The purpose of a theory, or a model, is to propose answers to basic questions related to a certain phenomenon. Based on this, the learning theory, model, is meant to help us understand how people learn and answer the questions associated to learning. The "community of inquiry" model, one of the most popular models for online learning, developed by Garrison, Anderson and Archer in 2000 (Picciano, 2017),describes how learning takes place for a group of learners, students in grade 12 in this case, through the educational experience that occurs at the intersection of the presence of three components: social, cognitive and teaching (Figure 1) (Center For Teaching Support and Innovation, 2016).

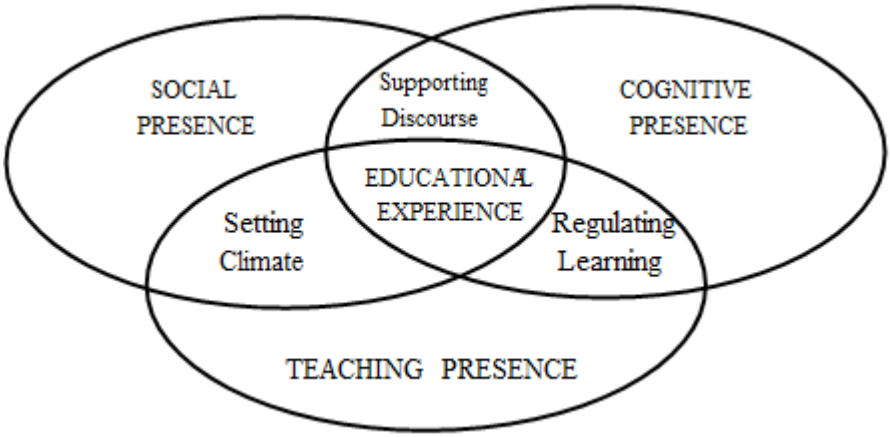


Figure 1: The Community of Inquiry (COI) model. (Garrison and Anderson, 2003)

The social presence is the ability of the learner to project his individual digital presence in order to communicate with the other members of the online community and develop inter-personal relationships to reach collaboration and group cohesion (Center For Teaching Support and Innovation, 2016).

The cognitive presence is the extent to which the learners are able to acquire meanings and construct knowledge. In this presence, students explore a new situation, challenge or question. They share information and resolutions, apply and connect new ideas(Center For Teaching Support and Innovation, 2016).

The teaching presence is the design of the instructor through-which he guides his students and facilitates their digital educational experience. For that, the instructor is due to focus on discussion, define topics, share new meanings with his students and motivates them(Center For Teaching Support and Innovation, 2016).

Based on the Community of Inquiry and its components, students in grade 12, section general sciences might be taught the lesson "metric relations in a triangle" through their social and cognitive presence, and the teacher's teaching presence, which as a result creates a unique online educational experience.

1.3 Purpose of the Study

This study has aimed, through the literature, at enlightening on the possibilities of teaching through the social media platforms and networking sites.This study has also aimed at determining if the lesson "metric relations in a triangle" and other math chapters could be taught to students through the WhatsApp platform, and if they are capable of solving the assigned exercises after the experiment on their own. In addition, this study has aimed, through its online survey, at estimating the percent of students who believe that the role of the teacher is important in delivering the information to the student through the WhatsApp and those who are willing to study a second lesson in mathematics via the same platform.

1.4 Significance of the Study

Through its experiment, this study has added to the practice according to its findings on the impact of teaching a lesson in mathematics to 23 students in grade 12, section general sciences, in a public school in Beirut.

1.5 Research Questions

According to students' answers in grade 12, section general sciences:

1) Can the lesson "metric relations in a triangle" be taught to other students via the WhatsApp and through collaboration with the teacher?
2) Can students solve the assigned exercises after completing discussing the lesson through the WhatsApp?
3) Is it possible teaching other math lessons via WhatsApp to students in other classes and levels?
4) What percent of students believe that the role of the teacher is important in delivering the information to the student through the WhatsApp?
5) After this experiment, what percent of students are willing to study a second lesson in mathematics via WhatsApp?

1.6 Limitations of the Study

This study has had one limitation to deal with. At the time of the experiment, it was not possible for the researchers to examine the impact of teaching the lesson "metric relations in a triangle" to other students in other schools or to replicate it even once.

1.7 Delimitations of the Study

All 23 studentsin grade 12, section general sciences, in the public school in Beirut have collaborated extremely well with the researchers, which as a result has positively influenced the accuracy of the results of the study.

2. Literature Review

Social media has expanded immensely among people. Due to its presence, some teachers took it upon themselves to facilitate students' learning through the social media

platforms and networking sites. However, it is very important to know that usage of social media in education is not that simple. Its usage has its benefits, drawbacks and things to avoid. It is a must to remember that planning a lesson through social media requires safeguarding students' privacy and productivity.(Fuglei, 2014).

Jeff Borden, the former vice-president of instruction and academic strategy at Pearson, assured that social media has the ability to extend learning beyond the classrooms. It allows students to interact with those who are more experienced, like their teachers, outside the school at any time or when it fits both of them (Fuglei, 2014).

When social media platforms are used correctly, students can move on from the lower to higher order thinking level because they can work on exercises that tackle their critical thinking. However, to achieve this point, students must not remain fascinated with the entertainment luxuries provided by social media and try to avoid the distractions that can disrupt their learning as much as possible. Meaning, that students must look at the social media platforms and networking sites as a way that can help their learning and not as amusement tools (Fuglei, 2014).

On the other hand, when social media is used outside the classes, it can be functionalized like a professional development for teachers. They can gear their social media usage towards looking for resources that can be beneficial for the learners, which they can share with their students using the available diversified platforms and networking sites. For example, the National Council of Teachers of English (NCTE) produced a fast-paced interactive social network that provides the teachers with the new techniques, lesson plans and many researches about teaching and learning. This networking site can be considered as a highly professional development to teachers through-which they can expand their knowledge(Fuglei, 2014).

Eventually, teachers have to separate their personal accounts from their professional ones when they interact with their students for educational purposes because everything they say and write reflects on them. Thus, they should not say anything on social media that they wouldn't say in class. However, a successful social media experiment does not only rely to the teachers; on the contrary, teachers and students must explicitly agree on how to conduct themselves online(Fuglei, 2014).

Some teachers might ask why they should use social media as a teaching tool. In his interview, DrAddyson-Zhang (2018) clarified that students have become digital learners and by that it means that they prefer social media to be engaged in a self-paced and directed learning. Students nowadays are not the same ones who were taught through the traditional teaching. Decades ago, teaching was only provided in classes or specific predetermined places. Things now are different. Students do not want to be locked inside the walls of their classes to learn. They want to learn from everywhere and anywhere. They aspire a global learning environment that exists outside the walls of the classes through-which they can learn from their teachers and colleagues outside their classes; and make no doubt about it, teachers disseminating information on social media would definitely help creating such environment(Rodgers, 2018).

Teachers have to walk the walk when it comes to changing the old fashioned educational system.They can become responsible for a paradigm shift in education by interacting with their students outside the school. They can support students' needs in their subject material and they can also provide them with information about the content of an upcoming session to read and discuss in class later on. This way students become aware of what they are going to be taught before the actual session. Teachers become more like a facilitators and students start to take the leading role in teaching andlearning(Rodgers, 2018).

Moving forward, according to Norman (2019), in the last decade, education has quickly adapted to the digital transformations as many educational systems integrated laptops, tablets and active boards into the learning environment of their classes (Norman, 2019).

Enter social media that has obviously played a significant role not only in the digital world but also in our lives, in the way we plan, act, have fun and interact. In addition, there is no way to stop students from using their social media whenever and wherever they can. However, these platforms are not only for our entertainment. On the contrary, usage of social media platforms is not about having fun. It is not all downhill. These platforms, like every other technical devices, have their own benefits. They can be used for what is best for teaching and learning (Norman, 2019).

Unfortunately, because many teachers still do not believe in the role that social media can play in education and because of the dark image that surrounds it, due to many reports warning about its negative effects, students and teachers are still not aware of what social media can bring to the table. They have yet to be encouraged to open the doors to a world of teaching and learning like they have never seen and examined before (Norman, 2019).

A few years back, no one imagined that anyone can interact with another one sitting at the other end of the world. Learning nowadays is no longer locked by the walls of the classes. Students have to realize that they can study together even if they were at a distance, learn and share ideas, and team for what is best for them thanks to the social media platforms and networking sites. Now even-though the concept of social media is to socialize people from all around the world, there are many potential ways that can be used to invest its platforms and networking sites in education. It is not enough that some networking sites are promoting learning for students. Students and teachers have to have the courage to divert their usage of their social media for what is best for teaching and learning (Norman, 2019).

One can believe that social media platforms can make the networking sites a forgotten thought. These platforms, due to their flexibility from anywhere, can benefit both teachers and students. Students can collaborate with each other and their teachers, while teachers can access other experts in

their domain at any place in the world and benefit from their expertise to acquire new skills (Norman, 2019).

It is very important to take the positive impact of social media on students seriously. A student, who hardly participates in class, might thrive online and participate in a way he himself could not have ever imagined. The atmosphere provided by the internet connection may very well positively influence students' participation and interaction with each other and their teachers. Social media platforms and networking sites, when used in the right way, could ignite students' enthusiasm, which might lead to unprecedented participation of the entire class (Norman, 2019).

It is amazing how much information social media provides, yet we still lean to use its platforms and networking sites for our enjoyment. For example, through YouTube, anyone can find a tutorial videos about almost any topic in the world. Students can learn how to write an essay, how to solve exercises in different topics and even how to play piano. In addition, there are several online channels that provide unlimited set of information through videos of different durations that suit all users. People can even publish their own work on these channels and help educating those who are living at a far distance looking for information about specific topics (Norman, 2019).

In this century, students are required to acquire more skills than those who were in their place decades ago. Students of the 21st century have to be creative and capable of communicating with others in a way that serves their learning. Social media can play a significant role in making students achieving those skills. With proper usage of social media, students can even create a decent online etiquette that specifies howthis technology should be used in learning. So, students have to always remember that social media can serve as a very useful tool in education when it is used wisely (Norman, 2019).

Moving forward in other regions of the world, educators at the gulf expressed their own opinionsabout the possibilities of teaching through social media.In his article, DrSarhan (2016) stated that today's specialists speak about the possible extent of usage of the social media networking sites and platforms as an environment that differs from the classic one that has been, and still, ruling the teaching and learning for centuries. An open learning environment that depends on sharing and collaborating and serves as a substitute for traditional lectures and indoctrination (Sarhan, 2016).

It is no wonder that social media has become so widespread among young people and a part of their daily lives. Therefore, using them as means of education will be natural for them. For that there is no excuse for any teacher to avoid using these platforms and networking sites (figure 2), that can break the classroom monopoly of knowledge and make learning really entertaining. Thus, there is no excuse for any teacher to avoidoffering his students a distinguished education without high costs and with no need to wait for the State to implement its e-learning strategy (Sarhan, 2016)

Figure 2: Social Media Platforms and Networking Sites. (Sarhan, 2016)

The Social Media Report in the Arab World, published by the Mohammed bin Rashid School of Government in 2014, focused on the use of social media tools in education because 70% of the active users of these platforms and networking sites are young people. The report presented the results of a questionnaire conducted on the benefits of using social media in education. Most of the respondents expressed a great agreement on the positive aspects of social media in education despite awareness of its negatives. Between 80% and 83% of the respondents said that social media can enhance technical competencies, creativity, collaboration, research skills, interpersonal, communication and work skills of the learners(Sarhan, 2016)

70% of the respondents considered social media as a tool that will enhance the learning experience, both in the classroom by encouraging more interactive discussion, or through distance learning. 74% said that it would also fill the gap between learning at school and home learning, 60% said that social media would reduce the costs of traditional teaching methods, while 66% said it would reduce the time needed to conduct the educational processes inside the classroom by taking it to the outside through online collaboration between the students and their teachers (Sarhan, 2016).

Some argue that in the near future, social media platforms will become a complete alternative to traditional e-learning programs, which could radically change the concept of e-learning. We are embracing an age in which education, entertainment, knowledge and work will be fully mixed to benefit the most of the tools provided to us by this digital world, and all we need is taking the needed steps towards the digital transformation that promotes dialogue, writing and knowledge exchange among all students(Sarhan, 2016).

To sum up what was previously mentioned,in an article published on the All-About-School website, it was stated thatsocial media networking sites and platforms, like WhatsApp, Facebook, Twitter, Yahoo, LinkedIn and many more, have become the most popular among people, and has recently become an integral part of our contemporary daily life. This led many researchers to address this phenomenon through studies to identify its impact in different aspects of life. Some results showed that social media has many positive aspects, and can be exploited in more than one area to achieve more than one goal and many

educational benefits (figure 3).These results confirmed that social media networking sites and platforms can be exploited for educational purposes because of their benefits and positive effects by providing students quality of educationand opportunities to improve their social skills by searching and sharing (All-About-School, 2017).

Figure 3: The educational role of social media networking sites and Platform

3. Methodology

3.1 Design of the Research

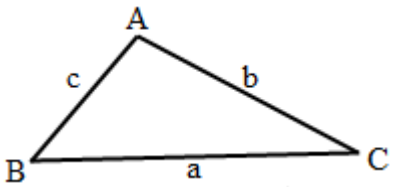
A purposive sampling, also known as a subjective sampling, is a non-probability sample that can be very useful in situations where the researchers need to reach their targeted sample quickly because sampling for curiosity is not their main concern. A maximum variation/heterogeneous sampling is one of the seven different types for a purposive sampling. It is used to provide as much insight as possible about a phenomenon or an event under examination (Crossman, 2019). Since the researchers are examining the WhatsApp platform as a teaching instrument in the lesson "metric relations in a triangle" for students with different needs and skills in grade 12 general sciences in a public school in Beirut, then they have opted to use the maximum variation/heterogeneous type of the purposive sampling. In addition, a quantitative research of descriptive design does not start with hypotheses. The researchers hypothesize after collecting and analyzing the data (CIRT;, 2015).Therefore, this research, through its quantitative approach, has sought at determining the possibility of teaching the whole "metric relations in a triangle" lesson to 23 students in grade 12 section general sciences in a public school in Beirut through the WhatsApp platform.

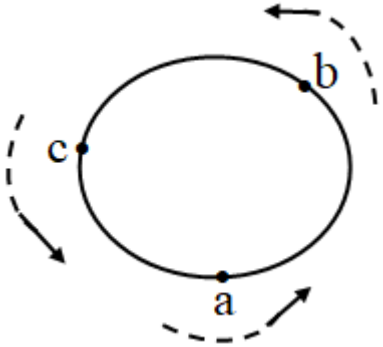
3.2 Research Instruments

First Instrument: For their study, the researchers have prepared the lesson "Metric Relations in a Triangle" according to the objectives illustrated in the curriculum as follows:

1) Cosine Law/Pythagoras Generalized Law/Alkashi's Law. In a skew triangle, where BC= a, AC = b and AB = c, we have:

$$a^2 = b^2 + c^2 - 2 \times b \times c \times \cos(\hat{A})$$





Now, by rotating a, b and c using the adjacent circle, find the other two formulas:

$b^2 =$ _____

$C^2 =$ _____

2) Sine Law.

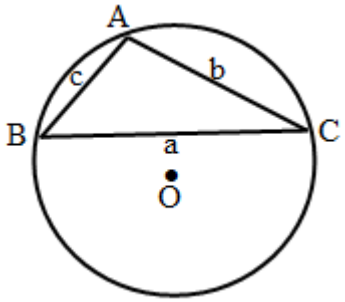
Let (C) be the circle of center O circumscribed about the triangle ABC.

Since ABC is a skew triangle then O is the intersection point of the perpendicular bisectors of [AB], [AC] and [BC].

Let BC = a, AC = b and AB = c.

$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = \frac{a \times b \times c}{2S} = 2R$, where R is the radius of

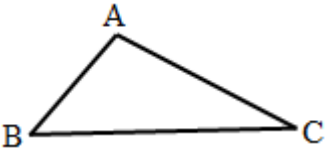
the circle (C) and S is the area of the triangle ABC.



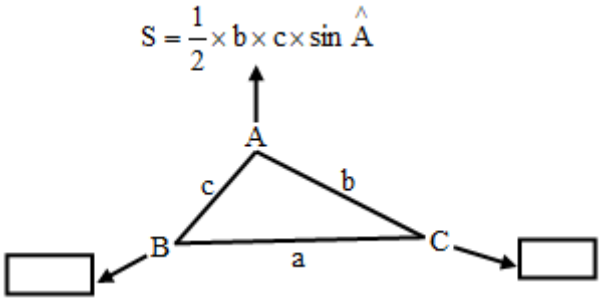
3) Area of a triangle.

Let S be the area of the triangle ABC.

We already know that $S = \frac{\text{hight} \times \text{base}}{2}$.



Note that the area of the triangle ABC can also be determined using the following formulas:

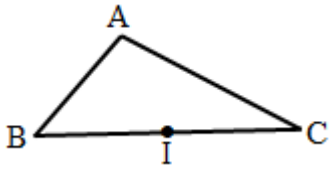


Now, by rotating a, b and c using the adjacent circle, fill the brackets in the figure above to determine the other two formulas.

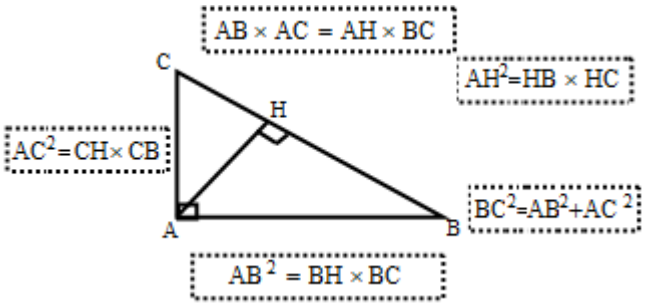
4) Median Theorem.
Let I be the midpoint of [BC].

It is always true that $\vec{AI} = \frac{1}{2}(\vec{AB} + \vec{AC})$.

We have: $AB^2 + AC^2 = 2AI^2 + \frac{BC^2}{2}$.



5) Metric relations in a right angle triangle.
Let H be the foot of the height issued from A to [BC].



Second Instrument: In the current experiment, the researchers have sent the lesson to a WhatsApp group of 23 students in the grade 12 general sciences. The students were given a period of time to read and study the lesson sent. Later on, students have sent their questions and interacted with one of the researchersfor 90 minutes. At the end, the researchers have assessed students' understanding using the following second instrument formed of three exercises validated by two math coordinators in the secondary level who have been teaching the same class for at least ten years.

Exercise 1

Let ABC be a triangle such that $AB = 1 + \sqrt{3}$, $AC = \sqrt{6}$ and $B\hat{A}C = 45^\circ$.

1) Calculate BC and the angles $A\hat{B}C$ and $A\hat{C}B$.
2) Calculate the radius of the circle circumscribed about the triangle ABC and its area.
3) Calculate the length of the height [AH] issued from A to [BC].

Exercise 2

Let ABC be a triangle such that $AB = 1 + \sqrt{2}$, $AC = \sqrt{2}$ and $BC = \sqrt{3}$.

1) Calculate the angle $B\hat{A}C$ and the area of the triangle ABC.
2) [AI] and [AH] are the respective median and height to [BC]. Calculate AI and AH.
3) Let M be a variable point of the plane such that $MB^2 + MC^2 = 2\sqrt{2}$.
   a) Determine the set (T) of points M.
   b) Determine the relative position of A with respect to (T).

Exercise 3

ABC is a right angle triangle at A where AB = c, AC = b and BC = 5.

Suppose that $\sin(A\hat{B}C) = 2\sin(A\hat{C}B)$.

1) Calculate b and c.
2) Calculate $\sin(A\hat{B}C)$ and deduce the area of the triangle ABC.

Third Instrument: The researchers have sent the 5-points likert scale survey shown below to all 23 students to answer the research questions on a scale from 1 to 5 where 1: strongly disagree, 2: disagree, 3: undecided, 4: agree and 5: strongly agree.

		Answers				
Nb	Question	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
1	Metric relations in a triangle can be taught to other students via the WhatsApp and through collaboration with the teacher.					
2	I was able to solve the assigned exercisesafter completingdiscussing the lesson through the WhatsApp.					
3	It is possible to teach other math lessons via WhatsApp to students in other classes and levels					
4	The role of the teacher is important in deliveringthe information to the student through the WhatsApp.					
5	After this experiment, I am willingto study a second lesson in mathematics via WhatsApp.					

4. The Process and Dialogues of the Experiment

Originally, the researchers were determined to investigate the impact of teaching mathematics, not supporting students' math learning, through one of the social media platforms. One of the 23 students suggested teaching through the WhatsApp platform.

The researchers welcomed the suggestion with opened arms and it was up to them to select a math lesson that could be taught completely through WhatsApp.

Selecting this math lesson was very important for the success or failure of the experiment. Teaching a new math lesson was never done before. So, it was very essential to select a math lesson through which the researchers would pave the way for others to examine teaching complete math lessons through WhatsApp or other social media platforms and networking sites.

Through the list of lessons assigned for the general sciences class in grade 12, the researchers were able to select the lesson "metric relation in a triangle" as the first one to be completely taught through WhatsApp because of its objectives that seemed suitable for the researchers to start with.

The researchers and the students took it seriously. It was a new experiment and everyone felt the responsibility of making or breaking the success of this digital experiment.

At first, the researchers detailed the lesson as elaborated about in the first instrument mentioned above. After sending the lesson through the WhatsApp, students were given time to read before interacting with one of the researchers for their questions as elaborated about in the dialogue below.

The researcher: any questions about the lesson?
One of the students: can we use these formulas in any exercise?

The researcher: yes, you may apply them when you need to do so. However, you need to differentiate between the formulas applied in a skew triangle and those in a right angle triangle.

Students: most formulas are clear. However, we need exercises to practice and apply them.

The researcher: does anyone have a question?
Students: How can we know what formula to use? How can we know if it is the cosine or sine law?
The researcher: if you have the length of two sides and the measure of the angle included between them, use the cosine law if you want to calculate the length of the third side of the triangle. However, if you want to calculate the measure of an angle of a triangle, it is easier to use the sine law.
In addition, always use the sine law to calculate the length of the radius circumscribed about a triangle.
Moreover, the area of a triangle has many formulas. If you have the lengths of the height and base use the classic formula $S = \frac{\text{hight} \times \text{base}}{2}$, but if you have the lengths of two sides and the measure of the angle included between them use the new formulas as elaborated about in the explanation of the lesson.
Students: no more questions. All is clear. Please send us the exercises assigned to practice.

The researcher started sending the exercises, one after the other, as shown in the second instrument. Students were given a precise time to solve the first question and they were asked to send their answers through the WhatsApp group.

Students started sending their answers and the researcher started checking them. The digital experiment enabled each one of them to see the answers of the others. Some students asked the researcher not to send them voices about their answers after sending them because they were able to determine their mistakes on their own by reading the correct answers of the others. This point alone showed the power of WhatsApp in teaching mathematics.

After finishing with the first exercise, the researcher sent the second one and asked for students to correct the answers after validating the answer of one of them. It was easy for the students to determine their mistakes. However, it was weird for them to interact with each other to study mathematics instead of spending some fun time as they are used to.

Lastly, in the third question, the researcher became more of an observer than a provider. Students were left on their own to answer each other. They started sending texting and voices to each other to answer their colleagues' questions just like in the following dialogue:

Student: which rule do I have to use for the third question.

Colleague: you have a right angle triangle, so use Pythagoras theorem. In addition, use the fact that $\sin\alpha = \frac{\text{opposite side}}{\text{hypotenuse}}$ and $\cos\alpha = \frac{\text{adjacent side}}{\text{hypotenuse}}$.
Student: ok. Thank you.

Another student: can we use the classic $S = \frac{\text{hight} \times \text{base}}{2}$ to calculate the area of the triangle in the final part of the third question?

Colleague: I think you may do so.

Here the researcher had to interfere and inform the students that they need to use the new formula instead of the classic one because they had to deduce the area and not calculate it.

The experiment ended after this remark and most students were satisfied with the content and the skills they have acquired through this digital experiment.

Data Collection Procedure

The researchers have sent the online survey to the 23 participants through a link on the WhatsApp platform to fill.

Data Analysis

After filling the survey, the researchers have collected the data,imported it from the Excel Spread Sheet into the Statistical Package for the Social Sciences (SPSS) and analyzed it.

Table 1: Descriptive Statistics for the First Research Question (Frequency and Percent)

Metric relations in a triangle can be taught to other students via the WhatsApp and through collaboration with the teacher.		
	Frequency	Percent
Strongly disagree	1	4.3%
Disagree	0	0%
Undecided	0	0%
Agree	13	56.5%
Strongly Agree	9	39.1%
Total	**23**	**100%**

To answer the first research question, the table above has showed that "metric relations in a triangle" can be taught to other students in other schools via the WhatsApp and through collaboration with the teacher.

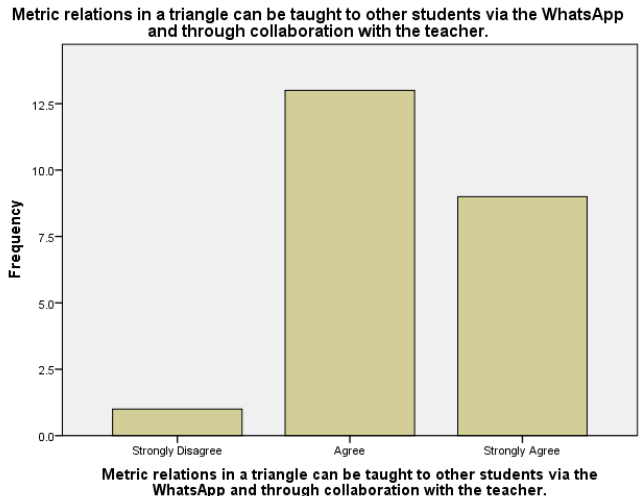


Chart 1: Bar Diagram for the First Question of the Survey

As seen in the above diagram, the majority of students believe that metric relations in a triangle can be taught to other students in other schools via the WhatsApp and through collaboration with the teacher.

Table 2: Descriptive Statistics for the Second Research Question (Frequency and Percent)

I was able to solve the assigned exercises after completing discussing the lesson through the WhatsApp.		
	Frequency	Percent
Strongly disagree	0	0%
Disagree	1	4.3%
Undecided	3	13%
Agree	13	56.5%
Strongly Agree	6	26.1%
Total	23	100%

To answer the second research question, the table above has showed that, even-though 1 student disagree and 3 are undecided, the majority of the participants were capable of solving the assigned exercises after completing discussing the lesson through the WhatsApp.

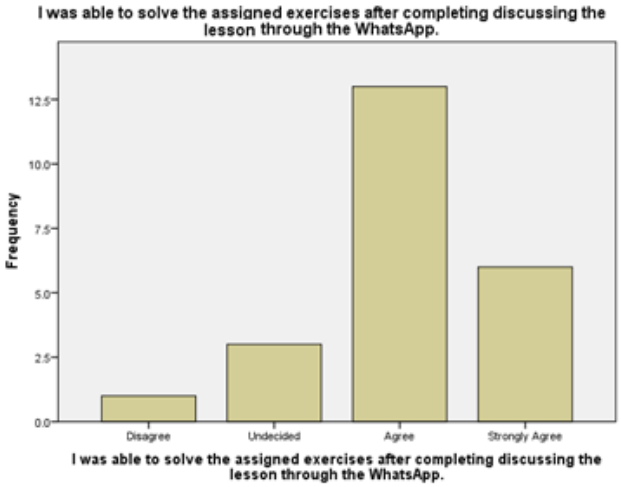


Chart 2: Bar Diagram for the Third Question of the Survey

As seen in the above diagram, most students were capable of solving the assigned exercises after completing discussing the lesson through the WhatsApp.

Table 3: Descriptive Statistics for the ThirdResearch Question (Frequency and Percent)

It is possible to teach other math lessons via WhatsApp to students in other classes and levels.		
	Frequency	Percent
Strongly disagree	0	0%
Disagree	1	4.3%
Undecided	3	13%
Agree	18	78.3%
Strongly Agree	1	4.3%
Total	23	100%

To answer the third research question, the table above has showed that,even-though 1 student disagree and 3 are undecided, the majority of the participants believe that it is possible to teach other math lessons via WhatsApp to students in other classes and levels.

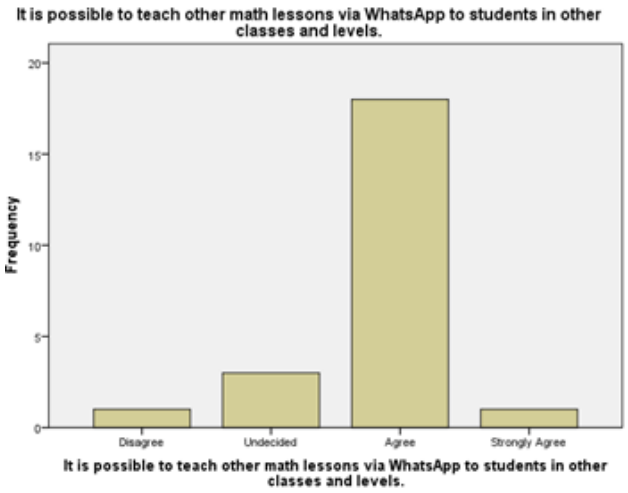


Chart 3: Bar Diagram for the Third Question of the Survey

As seen in the above diagram, most students believe that it is possible to teach other math lessons via WhatsApp to students in other classes and levels.

Table 4: Descriptive Statistics for the Fourth Research Question (Frequency and Percent)

What percent of students believe that the role of the teacher is important in delivering the information to the student through the WhatsApp?		
	Frequency	Percent
Strongly disagree	0	0%
Disagree	0	0%
Undecided	1	4.3%
Agree	1	4.3%
Strongly Agree	21	91.3%
Total	23	100%

To answer the fourth research question, the table above has showed that 95.6% of the participants believe that the role of the teacher is important in delivering the information to the student through the WhatsApp.

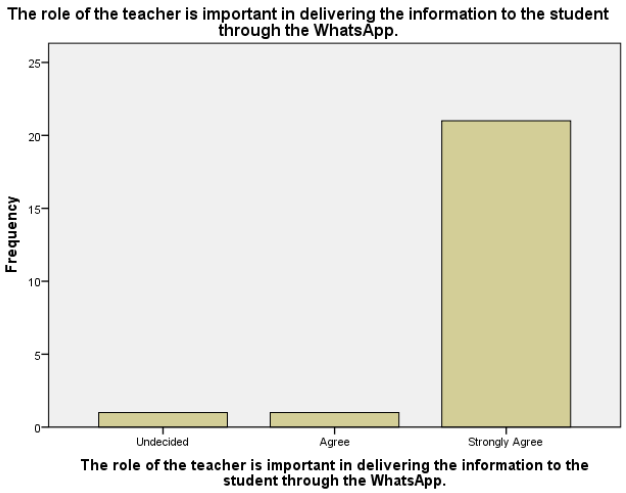


Chart 4: Bar Diagram for the Fourth Question of the Survey

As seen in the above diagram, the majority of students strongly believe that the role of the teacher is important in delivering the information to the student through the WhatsApp.

Table 5: Descriptive Statistics for the Fifth Research Question (Frequency and Percent)

After this experiment, what percent of students are willing to study a second lesson in mathematics via WhatsApp?		
	Frequency	Percent
Strongly disagree	1	4.3%
Disagree	0	0%
Undecided	2	8.7%
Agree	17	73.9%
Strongly Agree	3	13%
Total	23	100%

To answer the fifth research question, the table above has showed that 85.9% of the participants are willing to study a second lesson in mathematics via WhatsApp.

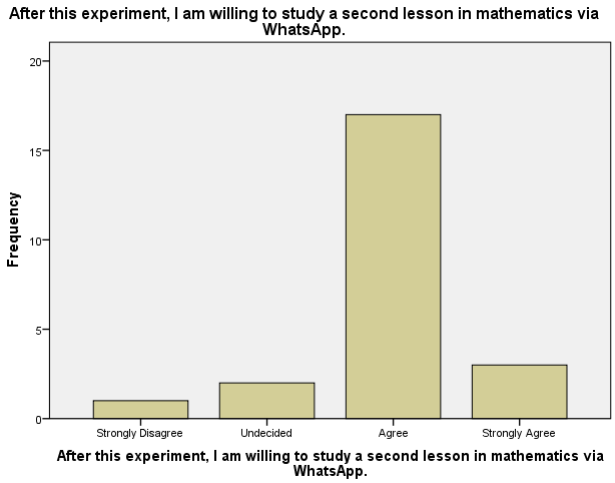


Chart 5: Bar Diagram for the Fifth Question of the Survey

As seen in the above diagram, the majority of students are willing to study a second lesson in mathematics via WhatsApp.

5. Open-Ended Interview

An open-ended interview is a way to gather information from the people. It is considered as open-ended because the interviewer does have a prior idea about the content of the answer. This type of interview usually focuses on the thoughts and feelings of the interviewees (Thibodeaux, 2019).

As a final step, the researcher has purposely interviewed three students out of the 23 participants. The researcher has interviewed two students who were heavily involved in the experiment through their questions and one student who had his own thoughts about the experiment's positives and negatives.

The first student has declared that studying in school or through books in front of the teacher is old news. Though, this way of teaching will exist forever even with the evolution of ages. However, even with this fact, new unconventional methods are always examined to change the ways of teaching as much as possible.

Teaching through WhatsApp is one of those methods I have talked about at the start. It is a new teaching pattern that takes advantage of the internet connection and the revolution of technology. This pattern is very much in line with the current era and very effective in cases where the teacher and his students cannot meet directly.

At the beginning, I did not believe that teaching through WhatsAppcould actually lead to good results, especially in mathematics. Luckily, I was mistaken.

First, the teacher has sent a detailed explanation of the lesson and gave us an hour to read it. For the first time in my life, I had to rely on myself to read a new mathematical content before interacting with the teacher, something I was not familiar with.

At the end of the hour, the teacher was present online and started to answer our questions through voices that we all benefited from. It was similar to being in class but with one additional thing. I had access to all the questions and answers through my phone, which benefited me when I wanted to cement my understanding of the lesson even-more.

Even-more, I found myself and my colleagues asking our teacher questions we usually don't ask in class. It was really strange how comfortable it was for us.

In addition to the group collaboration, the way the teacher has handled our deficits and explained the formulas in details was one of the main reasons for making teaching "the metric relations in a triangle", through WhatsApp, a success and it was proved when we solved the exercises assigned to the chapter on our own. So, without a well-skilled teacher, teaching mathematics through WhatsApp will be hard to achieve.

In the end, it was a useful experience for me, even-though it was not easy because students of this era do not have the culture of reading and most of us are used to receiving information instead of building their knowledge.

On a very important note, if WhatsApp was not used to teaching other mathematics lessons in the future, it is important to use it to support the students with additional exercises that can improve their performance in exams because in my opinion, in our curriculum, extra additional math exercisesfor sure lead to improved performance.

The second student has indicated that by using WhatsApp in teaching the lesson "metric relations in a triangle" and through detailed explanation provided by the teacher along with the interaction, the most important factor in this experiment in his opinion, they were capable of understanding the content of the lesson.

What differed this time is that for the first time ever they found that they have to rely on themselves to study new math content before interacting with the teacher, something was completely original for him and his colleagues because they are used to be the recipients in class while the teacher is the one providing the information and the main source to deliver any new mathematics content.

He has assured that sending detailed explanation through voices is extremely beneficial for the student because he can listen to it as much as he needs until he believes that he completely understands it. Though, the teacher has to be patient because he is attracting his students in a digital reality to teach mathematic, a subject material that many don't feel comfortable about. Thus, the online interaction between the teacher and his students needs efforts from both of them to make this type of teaching a success story.

For that, the second student has endorsed and supported teaching "metric relations in a triangle" to students through WhatsApp. However, the elephant in the room will be about teaching a much deeper math content through WhatsApp. It might be hard for students to understand another lesson with too many properties and formulas. Though, it might also be possible to understand if the teacher have the required knowledge, skills, patient, time and background in online teaching. In a much deeper math lesson, it is very possible that he teaches his students through online interaction then cements their understanding in the class later on.

The third and final student interviewed has revealed that even with the successful teaching of the lesson "metric relations in a triangle" through the WhatsApp, and the consistent follow up by the teacher, he still believes that this way of teaching has its positives and negatives.

Concerning its positives, students are not locked in class to study like they are used to. They are studying a new content outside the school, something refreshing for many and a kind of a needed change.They can ask questions that might be silly to ask in class because they have no time constrains and they are not wasting time class by doing so. The teacher is free to follow his students and has all the time he wants, and they are able to review everything provided by the interaction later on through their smartphones.

Concerning its negatives, students may believe that they have understood the idea, while in fact they have not. Students asking at the same time is annoying for the teacher and other participants. That is why everyone needs to ask, listen and wait for others for a smooth and successful experiment.

This experiment was for sure a success but to achieve success in other math lessons, the teacher needs to cement his students' understanding after the digital teaching through a follow up in class.

6. Conclusion, Hypotheses and Recommendation

6.1 Conclusion and Hypotheses

Results of the study conformed to Devi, Gouthami and Lakshmi (2019), Fuglei (2014), Rodgers (2018), Norman (2019) and Sarhan (2016) who assured that quality teaching could be provided the social media platforms and networking sites.

Teaching the lesson "metric relations in a triangle" the WhatsApp was a success. However, we need to admit that achieving such success can put a lot of load on the teacher.

The success or failure of the experiment and future ones relies on many elements. The teacher has to have patient, required skills and deep knoweledge in the lesson, while students need to take it seriously and interact in a way that benefits everyone. It is a combination of responsibilities that luy on the shoulder of everyone, the students and the teachers.

Due to the success of the experiment and based on the answers provided by the online survey and the interviews of 3 of the 23 students who participated in the this online teaching, the researchers can hypothethize that:

H_1: the lesson "metric relations in a triangle" can be taught via the WhatsApp and through interaction with the teacher.

H_2: Students can solve the assigned exercises after completing discussing the lesson "metric relations in a triangle" through the WhatsApp.

H_3: It is possible teaching other math lessons via WhatsApp to students in other classes and levels.

6.2 Recommendations

For the teachers

- In a stuffed curriculum, like the Lebanese one, math teachers have not enough time to explain everything in details. Almost in all classes, many lessons are not explained like they should be because of time constraints. The learning sessions are not enough to cover the mathematical content properly that is why the ministry of education and higher education alleviated some of the lessons and objectives in 2014. For students to get better in math, they need to master progressively harder math problems by employing the deliberate practice strategy also known as the purposeful practice (Kee, 2019). Math teachers can take advantage of the social media platforms and networking sites, and make a purpose out of it by supporting their students with extra exercises that can aid them in performing better in exams.

For the researchers

- Teaching mathematics to students is not easy. It never was and won't be. Due to the success of teaching the lesson "metric relations in a triangle" through WhatsApp, the researcher recommends examining the impact of teaching deeper mathematics lessons to students in different classes and levels through WhatsApp and other social media and networking sites.
- The researchers also recommends other researchers to examine the impact of interacting and collaborating in mathematics through other social media platforms and networking sites on students' performance in math.

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