QATAR UNIVERSITY

COLLEGE OF EDUCATION

THE EFFECT OF USING APPLIED MATHEMATICS LESSONS ON 7TH GRADE STUDENTS' ATTITUDES TOWARDS MATHEMATICS

BY

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ABSTRACT

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Title: The Effect of Using Applied Mathematics Lessons on 7TH Grade Students' Attitudes Towards Mathematics .

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This study aims to explore the effect of using applied mathematics lessons on 7th grade students' attitudes towards mathematics in Qatari preparatory governmental schools. It investigates the change in students' attitudes after being exposed to a series of applied math media content, customized based on the students' environment. A quantitative research design approach was used by implementing an attitude towards mathematics measurement inventory (ATMI) before and after experiment for an experimental group and controlled group. The ATMI covers four dimensions which represent different aspects of the attitude. Eighty eight participants responded to the assessment surveys and provided their responses to the forty items in the questionnaire. The results showed a significant difference between the experimental group and the controlled group data in the dimensions of value and motivation. However, the analysis didn't provide evidence of a significant change in participants' enjoyment and confidence. This can be a result of the limited time of the experiment and the short duration of the media content compared to the length of the math classes. Therefore, a list of further investigation areas were provided, such as studying the proper media duration and the type of content that links mathematics more to daily life experiences.

DEDICATION

Dedicated to my supportive family

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CHAPTER 1: INTRODUCTION

Background

The relationship between mathematics and school students has been a topic of discussion through the educational research history (Vigilante, 1969; Haladyna, Shaughnessy, & Shaughnessy, 1983). As one of the major keys for students to be able to study other topics such as physics, engineering, and accounting, mathematics used to be a concern for students and became one of their challenges (Haladyna, Shaughnessy, & Shaughnessy, 1983; Attrad, 2012; Kilman, 2015). The psychological long-term side effects of having negative feelings towards mathematics was found to be a serious concern in the educational field, especially among school students (Bishop, 1997). Researchers have studied the psychology in this relationship and developed tools to investigate different angles of it, like students' behavior related to mathematics or math anxiety, to diagnose the challenges before developing solutions and measure the effect of its implementation (Afari, 2013; Dutton, 1962; Grootenboer, Lomas, & Ingram, 2015).

Beside other psychological factors, negative attitudes towards mathematics have shown a significant impact on students' futures and have many consequences like limiting their options of majors to choose from in universities, limiting their job selections, or even as simple as affecting their performance on math exams (Mata, Monteiro, & Peixoto, 2012; Núñez-Peña, Suárez-Pellicioni, & Bono, 2013; Choi & Chang, 2011). Researchers suggest that adults who carry negative attitudes toward mathematics from their childhood and teenage period, are most likely to avoid academic or career choices that include arithmetic tasks or even dealing with numbers (Núñez-Peña, Suárez-Pellicioni, & Bono, 2013; Randhawa, Beamer, & Lundberg, 1993; Chen, et al., 2018; Hemmings & Kay, 2010). Therefore, researchers came up with possible

reasons that could be behind students' negative attitudes toward mathematics such as lack of ability to present math lessons in an appealing way, or the disability of solving complicated problems (Kele & Sharma, 2014; Randhawa, Beamer, & Lundberg, 1993).

One of the common factors that play a role in negative attitudes is teaching math without linking it to students' lives , which results in students feeling that studying math is not really important and is a waste of time (Choi & Chang, 2011; Williams, 2012; Sanchal & Sharma, 2017). Students who find themselves learning math just because they have to and not because they will actually need it in their daily lives, are found to have negative attitudes toward mathematics (Choi & Chang, 2011; Wilkins & Ma, 2002).

As a solution, researchers suggested teaching applied mathematics in math classes to decrease the negative attitudes toward math (Kilman, 2015; Bryson, 2011; von Konsky, Ivins, & Gribble, 2009). Educators carried many experimental researches to measure the effect that teaching applied mathematics has on students' attitudes toward math. The definition of applied mathematics varies from a researcher to another. In this research, applied mathematics is defined as teaching math through customized videos created based on students' local environments. In doing so, the teacher links the math lesson to students' personal lives and interests. The usage of technology in this study accomplishes one of the chief six Principles for School Mathematics of the National Council of Teachers of Mathematics NCTM, namely the Technology Principle (NCTM, 2000).

The Purpose of This Study

This study aims to investigate the effect of explaining mathematics through presenting customized videos related to students' lives on students' attitudes towards mathematics. This will help educators consider redesigning the curriculum in order to

increase positive attitudes towards mathematics. Increasing the positive attitudes towards mathematics can significantly increase students' achievements and academic performances (Anthony & Walshaw, 2009; Kilman, 2015; Chen, et al., 2018).

Research Question

This study aims to answer the following research question:

How do the attitudes of 7th graders differ when comparing between students that learned through implementing applied mathematics, and students that learned through implementing traditional mathematics?

Significance of the Study

This study provides a suggestion to improve students' attitude towards mathematics using applied math lessons and contributes to literature of attitude towards mathematics. The growth of negative attitude towards mathematics from early stages can reflect on students' performance and achievement in math assessments. On the other hand, increasing the students' positive attitude towards mathematics can help students in improving their academic achievement in mathematics. The findings of this study may motivate mathematics educators to create more initiatives in applied math teaching methods. Furthermore, this study contributes to international literature on applied mathematics implementation in math classrooms and attitudes towards mathematics.

Research Hypothesis

7th graders who are taught applied math lessons will display more favorable attitudes toward learning math than students who are taught math in a traditional way.

Variables

The dependent variable of this study is the students' attitudes towards mathematics, whereas the independent variable is using applied mathematics lessons.

This research will study the relationship between the independent and dependent variables based on the research hypothesis.

Operational Definition of Terms

Ky phrases used among the current study are defined as follows:

i. Attitudes: Opinions, thoughts, and feelings towards mathematics (Kilman, 2015)
ii. Applied mathematics: customized videos created by the researcher shows the application of the lesson topic in real daily life, and used inside the classroom in the beginning of the math class.
iii. Participants: 7^{th} grade male students in Qatari governmental schools that follow K-12 educational system.

Organization of the Thesis

This study explores applied math media implementation in seventh grade math classes in Qatari governmental schools, and investigates how students' attitudes towards mathematics are affected by this implementation in terms of value, enjoyment, motivation, and confidence.

To achieve this target, the first chapter of the thesis starts by reviewing the background of the study, the purpose of the research, the research question, definition of the terms, and the significance of the study. The second chapter of the study presents previews of researches that studied the attitudes towards mathematics, possible factors behind negative attitude towards mathematics, and methods that the literature suggests on how to improve positive attitudes.

The third chapter mentions the methodology that was followed to achieve the research goal and the detailed steps taken during the gathering of data for the study. It presented the stages of creating applied math media content and the steps followed in

order to implement the experiment correctly and with ethical standards intact. A review on the instrument tool used in this study and its validity was also discussed, followed by the data collection procedure and data analysis method.

Chapter four presents the findings of the study and the computed results that demonstrate an image of the experimental and controlled groups' attitudes towards mathematics within the scope of the research question. In chapter five, the findings are discussed within the frame of the previous studies, followed by limitations and recommendations to be considered for future studies.

CHAPTER 2: LITERATURE REVIEW

Applied Math

Applied math can be defined as the skill of applying mathematical reasoning and problem-solving methods to work-related problems (Kilman, 2015)

Teaching applied mathematics requires redesigning the instructions inside the classroom from presenting concepts with only practice problems, to presenting them in a context of real-life situations (Keif & Stewart, 1997).

The argument of how mathematics should be tough is a classical fight between progressivism and traditionalism, where progressivism is the concept that mathematics should be delivered to the students as part of their daily life practice, and that they should learn math as a problem based subject to solve problems they face in everyday life (Klein, 2007; Schoenfeld, 2004)

Although teaching applied math was strongly desired in the early 1980s, only small changes were actually applied in math text books. For example, instead of giving the students a traditional subtraction question such as three subtracted of four, they will instead read a story problem such as "Mary has 4 oranges. Jacob has taken 3 oranges from Mary. How many oranges does Mary have left?" (Schoenfeld, 2004). Additional sections of problem solving were also added in the curriculum as optional practices for students (Schoenfeld, 2004).

The progressivism mathematics education group clarifies that the applied mathematics teaching technique should include authentic instruction as a major part of the learning process. Authentic instruction is defined as a learning experience that provides students with feasible, real-life applications in the subject that they may face and apply in their personal lives (Ormrod, 2006)

The strife between the progressivism mathematics educators and the traditionalism mathematics educators has increased more in the 1990s and has been known since then as the "math war" (Schoenfeld, 2004). Researchers started to focus more on documenting and identifying the positive and negative effects of reforming the mathematics learning experience after the math war, and the new practices were implemented with different levels of success through the K-12 education system (Kilman, 2015).

The effect of teaching applied math has been investigated from different angles such as students' scores, anxieties, behaviors, attitudes, etc. Tanner & Chism (1996) studied how students who have been given applied math instructions scored in SAT-M exam compared to their counterparts who have been given traditional math instructions. The results showed a significant and positive difference in applied math students' achievements as opposed to traditional math students' achievements (Tanner & Chism, 1996).

Many educators believe that the learning experience becomes more interesting for students when they taught applied math (Keif & Stewart, 1997; Bryson, 2011; Vigilante, 1969). The engagement with mathematics and connection between students and learning is a result of students' attitude towards the importance of mathematics in real life (Attrad, 2012; Sanchal & Sharma, 2017).

Educators have examined many different applied math instructions and its effect on students. Williams (2012) conducted a research using LEGO Mindstorms-based education as an example of applied mathematics in a classroom by redesigning the lesson plan activities to reflect the applied mathematics concept while using LEGO robots in different math topics, such as measurements and statistics. Students showed

positive improvement in attitudes for math and science when they applied the math concepts on LEGO robots (Williams, 2012).

Sanchal & Sharma (2017) examined the effect of teaching applied math on students' attitudes by designing the context in relation with sports activities. The study suggests that students' enjoyment of math will increase if the subject is related to an area of the students' interests (Sanchal & Sharma, 2017; Attrad, 2012). To examine this, lesson plans were designed based on a game called Ki-O-Rahi. Ki-O-Rahi is a familiar sport game played in schools on a circular field, and students are asked to scale the Ki-O-Rahi field on a paper (Sanchal & Sharma, 2017). The research results showed how linking mathematic tasks to real life situations can develop positive attitudes toward mathematics and increase students' confidence in solving math problems (Sanchal & Sharma, 2017; Anthony & Walshaw, 2009). One of the findings from the positive transition is that when students face familiar situations, they deal with less information that needs to be processed, which encourages them to move forward and successfully solve the problem (Sanchal & Sharma, 2017).

Other educators have followed a dramatist approach by involving talented students in acting scenes inside math classroom, to familiarize their copartners with the real life situations related to the mathematical concepts planned to be taught in a certain class (Bryson, 2011; Kariuki & Steven, 2010). Researchers suggest that simulating mathematical concepts using fun acting scenarios based on students' environment and interests, can increase the positive attitudes towards mathematics and improve students' academic achievements (Bryson, 2011; Yilmaz & Olkum, 2010; Attrad, 2012).

Kariuki & Steven (2010) carried a one-week study on the effect of teaching geometry with creative dramatics. The participants in the study have expressed the

lesson's concepts physically instead of drawing it on the board, as they would have done in their previous mathematics class. The results showed that there was no significant difference in the attitude for the experimental group after applying dramatists activity such as acting scenes, and the participants performed lower in the final test (Kariuki & Steven, 2010). Kariuki and Steven suggested that the short duration of the study can be considered as a reason for not showing significant positive improvement in participants' performance and attitudes. In addition, the researchers questioned if conducting drama activities should be after the students feel confident enough to attempt activities inside the class room (Kariuki & Steven, 2010).

In the Turkish city of Izmir, researchers experimented with another type of representation of mathematics scenes (Ufuktepe & Ozel, 2002), where they toured performing mathematics shows for more than ten thousand students. The event was presented by students talented in theater and singing clubs in schools, and they were asked to perform scenes and songs related to mathematics subjects (Ufuktepe & Ozel, 2002). Over three years of submitting presentations to students and teachers, researchers took the audiences' data to study the effectiveness of this type of mathematics teaching method. The survey results indicated the improvement of the attendees' and presenters' attitudes towards mathematics. Moreover, the teachers who attended the mathematics presentations and saw the interaction of their students, stated that these activities have illuminated their minds towards new ways that can be applied in classes to attract students' interests towards the topics of the various lessons (Ufuktepe & Ozel, 2002).

In 2008, George Gandanidis led an active change movement in Canada called Students as Performance Mathematics, where teams of students from different schools recorded videos showing a singing performance or an acting performance of one of the

math topics they teach at schools (Gadanidis, 2009). After submitting the videos to the competition committee, a group of famous actors and singers evaluates the videos, and the candidate videos are chosen for display on their websites as a kind of motivation for students. George believes that mathematics is a very interesting subject that can be put in its rightful place of students' hearts if it is presented properly, and there is no better way than students themselves inventing their preferred methods of presenting the lesson (Gadanidis, 2009). In the same year of 2008, George and Hughes published a guidebook for teachers who want to engage their students with this event to facilitate ideas and demonstrate ways to clarify mathematics through drama, poetry and singing (Gadanidis & Hughes, 2008)..

Bryson (2011) designed a nine lessons unit by involving scenario writing, to study the effect of conducting drama in math lessons. Scenario writing as defined by Bryson (2011), is where students are asked to write a paragraph in every lesson of the unit with given actions and dialogs, starting with a simple scene in the first lesson which gradually expands to mathematical equations in the following lessons. Being a theater artist, Bryson has contributed with a mathematical teacher by requesting her to design the unit that they have called "Dramath Unit" which is a compound of the two words, drama and math (Bryson, 2011). Bryson was inspired by Dorothy Heathcote who claims that drama can help teachers achieve goals with their students that cannot be achieved in any other way (Wagner, 1976; Bryson, 2011). The study found that using drama in such a simple scale has developed students' enjoyment inside math classes and enhanced their ability to apply mathematical concepts in their different daily life situations and to solve life problems related to math (Bryson, 2011).

Attitude

Attitude towards mathematics

Learning mathematics is not limited to reasoning and critical thinking, it is also a relation between the learner and the learning subject (Grootenboer, Lomas, & Ingram, 2015; Anthony & Walshaw, 2007; Kele & Sharma, 2014).

Performance and achievement in math assessments can drop significantly for students across all age groups due to their high level of negative attitudes towards mathematics(Wu, Barth, Amin, Malcarne, & Menon, 2012). One of the findings of Wu, Barth, Amin, Malcarne, & Menon, 2012, is that negative attitudes towards mathematics more severely affect performance in questions that require complex verbal reasoning and problem solving (Wu, Barth, Amin, Malcarne, & Menon, 2012).

On the other hand, increasing positive attitudes towards mathematics can help students increase their academic achievements in mathematics, as Hemmings and Kay (2010) concluded in their study. They suggested that achievements in mathematics could be predicted based on students' attitudes towards mathematics (Hemmings & Kay, 2010). The study of Choi and Chang (2011) supported this conclusion through their study conducted on 900 students in the United States that found that the possibility of higher performance in mathematics is related to positive attitudes towards mathematics. (Choi & Chang, 2011).

In a study conducted at Stanford Medical University, for the first time, researchers were able to find the brain paths that link human attitudes toward mathematics with how well they perform in math subjects (Chen, et al., 2018). 240 students aged between seven to ten years old have been assessed using questionnaires. and Their parents were also interviewed to scale their IQ levels and attitudes towards

mathematics. The participants were then asked to answer arithmetic questions while under a functional magnetic resonance imaging scanner (fMRI) (Chen, et al., 2018).

The study concluded that positive attitudes toward mathematics are directly connected to an important part of the brain called hippocampus, which is located in the center of the brain, and is responsible for memory (Chen, et al., 2018). Over the past years, researchers have monitored students with high achievements who are enthusiastic about learning mathematics and express themselves as being better at it than students with low achievement, but this study explored the effect of attitude on other capacities such as memory and intelligence (DIGITALE, 2020; Chen, et al., 2018). Therefore, students attitude levels can play a serious role in performance and achievement the same way that students' IQ levels can (DIGITALE, 2020).

Measuring attitudes towards mathematics

The most straight-forward way to figure out and assess someone's attitude is to simply ask them about it, and that is what self-report measures represent. They are simple to use, straight forward, and do not require high costs (Lam, 2003; Ranganath, Smith, & Nosek, 2008). People's attitudes are often of varying degrees, therefore the format of the response option in attitude's self-reports (surveys) are designed in a LIKERT scale, a scale named after Rensis Likert who developed this type of technique in 1931 (Joshi, Kale, Chandel, & Pal, 2015). In Likert scale there is a gradient of response options from one to five, where the third option represents the neutral point. The neutral option is important because without it, the researcher may end up with data that was likely forced from the participants because of limiting them to only opposing or supporting options (Joshi, Kale, Chandel, & Pal, 2015; Lam, 2003).

It is important in the attitude measurement tools to frame the items in an impartial form, since the way of asking the question can influence the participant to

answer in a specific way. Another important consideration in designing the self-report form is to not rely solely on one question to assess someone's attitude, and that's why attitudinal scales are built on a series of questions that all focus on some particular topic. By collecting data from a variety of different questions, participants' attitudes can be assessed in a more sophisticated, complex, and complete way which makes the final result obtained more reliable overall than just simply using one single measure (Ranganath, Smith, & Nosek, 2008; Lam, 2003).

Another way of measuring attitude is using covert measures, which is not a straightforward approach like the self-report method. In covert measures, the researcher tries to assess the participants' attitudes without them really knowing through monitoring their body language, eye contact, etc.. For example, the researcher may talk to a participant about the importance of learning math in schools and notice him nodding his head, which can be considered as an indication that he approves of the message being said. Conversely, if the participant was shaking his head , this shows that he disagrees with what is being said . Covert measures is simply a series of small behavioral cues that give a sense of participants' feelings about a topic (Lam, 2003) (Joshi, Kale, Chandel, & Pal, 2015).

Educators have used different techniques of measuring attitude since the middle of the 20th century to try and develop the optimal measurement tools that are appropriate to measure specific topics (Guce & Talens, 2013; Afari, 2013; Mazana, Montero, & Casmir, 2019). These tools have been tested and verified repeatedly using statistical analysis approach, by the developers themselves or by other researchers who were investigating attitude in their respective environments (Afari, 2013). In 1954, Dutton has developed the first measurement instrument to study the human attitude towards arithmetic problems, which is known as Dutton's Arithmetic Attitude Scale (Cleon,

1965; Guce & Talens, 2013; Dutton, 1962). Using his measurement tool, Dutton concluded that far too many teachers in elementary schools carry a negative attitude towards mathematics that originated from when these teachers themselves were in elementary school (Dutton, 1962).

Scientists in math education fields continued to develop further tools to study the dimensions within attitude towards mathematics (Kilman, 2015). The factor Enjoyment of mathematics was introduced by Aiken in 1972, and two years later, Aiken constructed one of the most commonly used scales for the measurement of attitudes towards mathematics (Picos, Arias, & Arias, 2014; Guce & Talens, 2013). Aikens' scale tool included two dimensions in its first edition, which were the value of mathematics and the enjoyment of mathematics. The second edition of Aiken's scale created five years later, in 1979, was updated with two more dimensions: mathematical motivation and fear of mathematics (Guce & Talens, 2013). The two versions of Aiken's scale have been widely adapted, with its users agreeing on its original reliability and its four factors structure (Picos, Arias, & Arias, 2014).

In 1996, Tapia introduced one the most popular measurement tools in the last three decades: the Attitude Towards Mathematics Inventory (ATMI). ATMI includes 40 items consisting of four sub scales that indicate the value of mathematics, enjoyment of mathematics, motivation towards mathematics, and students' confidence (Tapia, 1996; Kilman, 2015). Tapia collaborated with Marsh in 2004 to produce the updated version of the ATMI, which included 49 items and assesses six dimensions instead of four. The ATMI has been commonly used among the educational academic community and translated to several languages (Picos, Arias, & Arias, 2014; Schackow, 2005; Afari, 2013; Guce & Talens, 2013; Tapia & Marsh, 2004).

Factors drive attitudes towards mathematics

As a step to increase the positive attitudes towards mathematics, researchers investigated the reason behind the negative attitudes towards mathematics (Haladyna, Shaughnessy, & Shaughnessy, 1983; Kilman, 2015). Yılmaz, Ç, Altun, S. A., & Olkun, S. (2010) used semi structured interviews with students to investigate the reasons behind the negative attitudes towards mathematics. Their study was performed on 24 students selected from a public school in Ankara, Turkey, based on their different levels of academic performance.

Yilmaz & Olkum (2010) suggested that factors behind negative attitudes can differ from high achievers to low achievers. For example, they stated that high achieving students' negative attitudes come from not liking the boring way that math is delivered or when they are unable to solve math problems because of their high levels of difficulty, while low achieving students declared that their negative attitudes come from fear of getting punished by math teachers (Yilmaz & Olkum, 2010).

Math teachers' competence and their ability to build a healthy classroom environment based on trust, appreciation, respect, motivation , etc.. is also an important factor that plays a role in increasing the positive attitudes towards mathematics (Haladyna, Shaughnessy, & Shaughnessy, 1983)

Mazana et al (2019) carried out a research in Tanzania to investigate the nature of attitudes towards mathematics and reasons that make students build positive or negative attitudes. The investigation covered 869 students including male, female, primary, secondary, and college students using quantitative and qualitative data, and found that negative attitudes increase as the students move up to higher academic levels (Mazana, Montero, & Casmir, 2019). The negative attitude towards mathematics grows with the students during their journey of learning in schools, creating a unique challenge

for math teachers to help students overcome their negative feelings toward the subject (Cline, Miller, & Frederickson, 2008).

The term “attitudes towards mathematics” became popular for describing the feeling of value or confidence that arises among some people when they are asked to solve mathematic problems or attend mathematic classes (Kilman, 2015; Sanchal & Sharma, 2017). This attitude can develop to a negative one because of any task that requires dealing with numbers, whether in their future careers or simple real life situations (Núñez-Peña, Suárez-Pellicioni, & Bono, 2013). Reasons behind negative attitudes toward mathematics can be based on the conditions that the students are surrounded with. .For instance, one of the reasons behind negative attitudes towards mathematics for females was the gender role stereotyping of mathematics as a male domain (Brophy & Good, 1970). Other research suggested that attitudes toward math can be affected by the motivation and social support received by the student’s family and teachers (Mata, Monteiro, & Peixoto, 2012)

Students’ positive attitudes can be caused by different reasons such as having a good math teacher or getting encouragement and support from parents or fellow classmates to practice more and to keep trying even when they are faced with topics they don’t understand (Mazana, Montero, & Casmir, 2019).

Anthony & Walshaw (2009) concluded in their research that connecting mathmatics lessons and problems to what students experience in their daily lives can increase the effectiveness of the classroom environment, as the students’ attitudes can positively develop. As an example, asking students how long the dragonfly takes to reach 110 meters if it flies 18 meters every 2 seconds, will increase the students’ excitement to solve the problem (Anthony & Walshaw, 2009).

The study also found that five out of seven students believe that mathematics has nothing to do with real life outside school. Therefore, it is recommended to consider connecting the curriculum context to real life situations (Yilmaz & Olkum, 2010).

Wilkins & Ma (2002) suggested several steps to decrease the negative attitudes towards mathematics such as putting high expectations or improving the relationship between math teachers and students. Also, their study recommended teachers to change their methods of presenting math to students and to try choosing examples that show the value and usefulness of mathematics in real life (Wilkins & Ma, 2002).

Randhawa, Beamer, and Lundberg (1993), concluded that mathematics classes need to include a clear link between the subject and its application in daily problems such as calculating the required amount of carpet to cover a certain area in the house (Randhawa, Beamer, & Lundberg, 1993). Zahorik (1996) found how giving the instruction in mathematics classrooms can effectively increase the students' engagement and found a good method to stimulate the students' interests during the learning process. His research was built based on simple, hands on activities to calculate the percentage of sugar in a chewing gum pack, and to compute the price of different foods (Zahorik, 1996).

One of the findings of Petric (2011) was that converting a traditional mathematics equation to a real life story problem will not only increase the engagement of the students, but it will also provide students with different skills such as critical thinking, estimation and mathematical communication (Petric, 2011).

Many researchers have analyzed the relationship between attitude and the different learning instructions in a mathematics classroom (Kilman, 2015). Williams (2012) for example has examined the effect of implementing applied math in mathematics lessons on the attitude of the students. His research showed that teaching

math as a real life application (Sanchal & Sharma, 2017) results in more favorable attitude toward math. His research was on facilitating the subject using LEGO Mindstorms-based education and was implemented to different grades within the K-12 education system (Williams, 2012).

In his research, Kilman (2015) concluded that both students' attitudes and their academic achievements as a result can be improved if educators can effectively instruct the students how to exactly apply mathematics learned in the classroom in their everyday lives (Kilman, 2015).

Negative attitudes towards mathematics can be caused by different reasons. Teachers can detect the level of attitude of the individuals using specific assessment tools (Tapia, 1996), so they can pinpoint what aspects they need to change in the class to reduce the negativeattitudes and increase the positive attitudes toward math. One of the methods for that approach is to change the traditional instructional method to a problem-solving instructional method, where the subject is linked directly to daily problems students face outside the classroom (Gadanidis, 2009; Bryson, 2011; Kilman, 2015).

Integrating technology in education

Technology has now become an important part of students' daily lives, and educators have integrated different types of technologies in lesson planning as part of preparing students for the future and linking their daily technical tools to the learning process (Eyyam & Yaratan, 2014). Using technology in classrooms resulted in improving many different aspects such as students' motivation and enjoyment while also easing and simplifying the knowledge transferred to students (Maag, 2006; Williams, 2012; Eyyam & Yaratan, 2014). The benefit of using technology not only reflected positively on students but it also helped lesson facilitators save more effort

and increase the variety of modern teaching strategies (Williams, 2012; Eyyam & Yaratan, 2014).

Using technology in teaching can differ from an instructor's perspective to another, based on the demand and the nature of every classroom environment and lesson criteria. The diversity in using new hardware devices like smart boards, virtual reality labs, smart phones, tablets, and advanced software programs such as assessment applications or 3D visualization programs, has become an interesting field to study in the educational academia It has resulted in many positive outcomes related to performance, achievements, and attitudes (Yilmaz & Olkum, 2010; Giannakos, Jaccheri, & Krogstie, 2015; Kele & Sharma, 2014; Eyyam & Yaratan, 2014).

Using videos in teaching math

It has been observed in recent years that interest in the production and use of educational videos has increased in the educational field, and educational platforms specialized in providing digital educational content are increasing, such as Khan Academy and educational channels specialized in explaining science and school curricula on YouTube (Giannakos, 2013). Educational videos began playing a prominent role in the educational field, where prestigious universities such as Harvard and Oxford and other prestigious universities started using them in various ways, such as direct broadcasting and uploading videos on university or public digital platforms or using it for the purpose of holding live meetings with students to answer their questions and review for exams (Maag, 2006).

Using technology in classrooms can increase engagement between students and instructors (Traphagan, Kucsera, & Kishi, 2010; Walls, et al., 2010). Students who had video instructions in their classrooms have found the lessons more interesting, enjoyable, and attractive (Traphagan, Kucsera, & Kishi, 2010). Researchers have

carried several studies on different ways of implementing videos and digital media in the learning process and its effect on enhancing attitude, behavior, and performance (von Konsky, Ivins, & Gribble, 2009).

Giannakos, Jaccheri, & Krogstie (2015) conducted a study to explore the relationship between video lecture usage patterns and students' attitudes towards learning. The researchers investigated the students' usefulness and intention to use the video lectures by developing eight hypothesis Four of the hypothesis were developed about the usefulness of the current video lectures, and the other four hypothesis were developed about the intention of using video lectures in the future (Giannakos, Jaccheri, & Krogstie, 2015). The study analyzed the usage pattern of the videos and concluded that students' attitudes and emotions can be significantly effected by educational video-based multimedia (Giannakos, Jaccheri, & Krogstie, 2015; Liao & Lu, 2008).

CHAPTER 3: RESEACH METHODOLOGY

Research design

This study used the Quasi-experimental research design approach, a design that is often used in educational researches that focuses on the effect of what is applied in classrooms (Ross & Morrison, 2004). In the Quasi-experimental design, two groups are compared after exposing one of them to new instructional strategies, while other factors remain the same and similar for both groups (Ross & Morrison, 2004). The group exposed to the new strategy is called Experimental group and the other group is called Controlled group. The following diagram demonstrates the standard flow of Quasi-experimental method (Ross & Morrison, 2004):

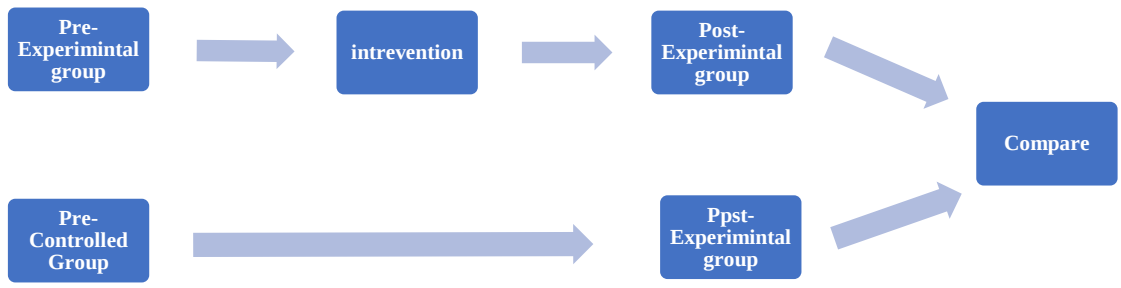

Figure 1. Flow of Quasi-experimental method

This method can be used to conclude the effect of specific interventions on students' achievement, attitude, behavior, and etc.. An example of using Quasi-experimental design on measuring the long-term effect of providing educational technology in classrooms for elementary students, is a study carried out by Ross (1991),

where students of one elementary class are provided with in-class computers and home computers as part of Apple Classrooms of Tomorrow program (ACOT). The study included another class that has similar characteristics of the experimental class but without providing them with computers (Ross, 1991). The students' academic achievement of both classes was measured before the intervention and a second time after one year of providing the computers. The results were then compared and conveyed that the experimental group's scores have positively improved compared to the controlled group's scores (Ross, 1991).

Using the Quasi-experimental method, this study included four classes taught by two different math teachers, one teaching a controlled group and one teaching an experimental group.. The lesson plans for the experimental group were modified to include applied math videos as an intervention, and the lesson plans for the control group remained unchanged. All groups were exposed to a pre- assessment and a post-assessment and results were then compared.

Due to the large amount of data collected and the age of the population, the study used a quantitative data collection method using validated questionnaire as a measuring tool developed by Tapia in 1996. More details about the measuring tool will be described in the following pages.

Participants

This study used a sample form Ali Bin Abi Talib Preparatory Boys School, a school located in Al-Thumama area in the capital of Qatar. Four out of nine classes from grade seven were selected as a sample for this study. The total population of grade-seven students is 225, and the sample of the study included 88 of these students..

The classes selected are taught by two different math teachers who volunteered to apply the independent variable in their classes. The following table shows the classes and whether they are controlled or experimental:

Table 1. Classes Numbers and Types

Teacher	Teacher 1		Techer 2	
Class number	7-3	7-4	7-5	7-6
Number of students	24	22	22	24
Type	Controlled	Experimental	Controlled	Experimental

Measurement tools

In this study, one measurement tool was used; an Attitude Towards Mathematics Inventory (ATMI) developed by Tapia (Tapia, 1996).

Attitude Towards Mathematics Inventory (ATMI)

In 1996, Martha Tapia promoted an attitude towards mathematics measurement tool. The tool consists of 40 items that aim to measure attitudes towards mathematics. The items are designed to cover four dimensions comprised under attitude, which are: value, sense of security in learning math, motivation, and students' enjoyment in studying math (Tapia, 1996).

Tapia has examined the ATMI on over 544 students in one of the private schools in Mexico city, and concluded that the inventory is reliable after the reliability coefficient was found to be 0.96 by computing the Cronbach alpha for the (Afari, 2013) whole original instrument that initiated with 49 items (Tapia, 1996). Tapia has deleted the weakest items in the instrument and ended up with 40 items, which increased the Cronbach alpha to 0.97 (Tapia M. , 1996; Sisson, 2011; Schackow, 2005; Afari, 2013).

ATMI efficiency has been used in several studies in different countries and continents after it was promoted by Tapia, to enhance the validation of inventory in different environments and different time stages (AbdulMajeed, Darmawan, & Lynch, 2013) (Karjanto, 2017) (Afari, 2013). It was also used to measure the attitude change through certain durations under different circumstances, which included testing the reliability factor (Sisson, 2011).

Schackow (2005) studied the attitude towards mathematics of 33 university students who are enrolled in a mathematics methods course as part of the elementary education majors, preparing them to be elementary teachers in the future. The study focused on the reasons behind their attitude scores and used the ATMI to determine the participants' attitudes. It was found that Cronbach alpha factor resulted in a high number of 0.98, although the sample population consisted of 33 participants compared to 544 participants in Tapia's research and the age stage was also diverse in both studies (Schackow, 2005; Tapia M. , 1996).

In 2010, Sisson (2011) started a study in Florida and included a sample of 217 community college students who were registered in Beginners Algebra course during the fall semester. Students who have participated in the study carried the two ATMI during the semester to assess their attitude towards mathematics and how it develops after completing the course (Sisson, 2011). The pre-assessment was completed in the first week of the semester and the post-assessment was completed after 12 weeks of taking the course (Sisson, 2011). The population of the study was reduced to 158 where 59 students dropped the course. However, the reliability coefficient factor in the study resulted to 0.97, which enhanced the consistency of the inventory over the years (Sisson, 2011).

In the United Arab Emirates (UAE), Afari (2013) examined the ATMI by applying it to 269 middle school students to measure their attitudes towards mathematics. Although the ATMI developed by Tapia was designed basically to measure undergraduate students' attitudes (Tapia, 1996), The study made by Afari concluded that the ATMI is reliable to measure the attitudes of middle school students (Afari, 2013).

In this study, the reliability coefficient has been analyzed twice, one for the pre-data and second in the post-data using SPSS software. In each analysis, both controlled and experimental data were put in one sheet to run the computed analysis. For the pre-data analysis, the Cronbach's Alpha resulted as 0.79, which is in the acceptable / fair range. While for the post-data, the Cronbach's Alpha was found to be 0.83, which is in the good range. The following table demonstrates a guideline for evaluating Cronbach's Alpha (Cortina, 1997):

Table 2. Cronbach's Alpha Guideline

Coefficient of Cronbach's Alpha	Reliability level
>=0.90	Excellent
0.80 to 0.89	Good
0.70 to 0.79	Acceptable
0.60 to 0.69	Questionable
0.50 to 0.59	Poor
Less than 0.50	Unacceptable

The 40 items in the ATMI are classified into four dimensions, 10 items to explore the value, 10 for the enjoyment, 5 items for the motivation, and 15 items for the confidence. The following table shows the items' numbers in the ATMI according to the dimension it covers:

Table 3. ATMI Items Distribution in Relation With The Four Dimensions

Dimension	Item number
Value	1, 2, 4, 5, 6, 7, 8, 35, 36, 39
Enjoyment	3, 24, 25, 26, 27, 29, 30, 31, 37, 38
Motivation	23, 28, 32, 33, 34
Confidence	9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 40

Procedures

After setting the research plan with the research supervisor, a meeting was set with the principle of Ali bin Abi Talib Preparatory School to explain the plan and steps that will be followed in the research before getting the permission from the Ministry of Education. A verbal agreement was taken from the principal who welcomed having the research carried out in the school.

The researcher then met with the coordinator of the mathematics department to specify the classes and the lessons that will be covered by the research. The coordinator suggested the assignment of another meeting with the teachers who volunteered to have a discussion about the changes that need to be applied on the lesson plans and the best way of carrying out the experiment.

The researcher contacted the department of policies and educational research in the Ministry of Education to get the authorization of conducting the study in Ali bin Abi Talib Preparatory School. The form was reviewed and signed by the authorities and the researcher included a commitment statement that he will follow the research plan and will ensure the commitment of confidentiality of the information.

A meeting was set with the volunteered teachers to select the lessons that will be included in the research. Lesson selection was driven by time limitation and feasibility. As the first semester was about to end, the decision was made to carry out

two lessons included the first semester curriculum and three lessons included in the second semester curriculum, considering the time needed for the researcher to produce the videos that will be used in the classes and the time needed to carry the pre and the post assessments. The following table shows the lessons titles and dates:

Table 4. Lesson's Titles And Dates

Lesson's title	Lesson's date
Proportion	14th of November 2018
Percentage Change	21st of November 2018
Algebraic Expressions and Sequences	7th of January 2019
Ratio	10th of January 2019
Sequences	17th of January 2019

The researcher started to write the scenarios of the videos to be created according to curriculum. The scenarios were aimed to be simple, short, and representative of students' local environment and interests. They wer e mainly designed to be lesson introductions, as all lesson plans need to include a starter that is linked to the subject that aims to hook the attention of the students for the rest of the lesson.

Applied Math Videos' scenarios

Scenario of proportion video

The teacher (Mohammed) is having a picnic with his friend (Abdulla) on a sunny day in the Museum of Islamic Art Park in the capital of Qatar (Doha). While sitting in front of the city's downtown view, drinking a local famous drink (Karak), Abdulla mentions to Mohammed how amazed he is by the beautiful view of Doha, and Mohammed agrees with his amazement. Abdulla then curiously asks Mohammed if he

has noticed this strange sculpture in the park that is unique and looks different from everything else. Mohammed gets excited after Abdulla's question and actively stands up and asks Abdulla to walk with him to explain where this sculpture came from.

This sculpture was designed by an artist called Richard Serra and it is one of his biggest works. He used the name 7 for the sculpture to demonstrate the importance of the number 7 in the Islamic culture, as number 7 was mentioned several times in the Holy Quran.

Abdullah says its looks very high, how high do you think it is?

"Yes it is one of the longest sculptures made by Serra, and to answer your question about how high it is, we can simply measure it by this tool" Muhammad replies while he suddenly pulls out a simple measuring tool from his backpack. Abdulla wonders where Mohammed got this tool from and how it will be useful since they can't reach the top of the sculpture to take the measurement.

Mohammed replies that it is not necessary to reach the top and it can be measured from the ground, and to demonstrate this technique, he needs to explain a mathematics lesson.

Three school tables and chairs land from the sky into the park, and when both of them turned back slowly, they saw two students seated on the chairs holding their pencils and waiting for the lesson to start. Abdulla asks Mohammed excitedly how all this happened so suddenly. Mohammed said that is a very good question but there is no time to explain. Mohammad asked Abdulla to take his seat so the lesson can begin.

A digital classroom board appears in the video and the teacher starts by greeting the students and explaining how the curiosity of Abdulla lead him to ask his question about the length of Richard Serra's sculpture and how it can be measured from the

ground and that this is actually an application of proportion, which is the subject of today's lesson.

Scenario of ratio video

When Abdul Rahman graduated from university, he decided to open his own coffee shop, but it is not like any other coffee shop, as it provides special kinds of coffee. Special kinds of coffee require a precise method and ratio to prepare each type, such as cortado, latte, espresso, cappuccino and many others.

A cup of latte in Abdul Rahman's shop, for example, requires 40 ml of espresso and 260 ml of milk. This is called a proportion and is read in the following way:

The ratio of espresso to milk in a cup of latte is 40 to 260, and we can simplify it by dividing the two numbers by the greatest common factor, and in this case, the number will be 20. So 40 will be divided by 20 and 260 will be divided by 20 as well, and the ratio will be 2 to 13.

Why does Abdul Rahman need this information? Because if he decides to sell a bigger cup of latte, and say the size of the new cup is 450 ml, he will be able to know how many ml of espresso he needs, and how many ml of milk he needs. Therefore, he will be able to make a large latte cup with the same unique taste as the small latte cup.

He will divide 450 by the sum of the ratio which is 2 plus 13, so the problem becomes 450 divided by 15 which equals to 30. He will then multiply the result by 2 to obtain the amount of espresso in the large cup, which is 60 ml, and the result will be multiplied again by 13 to obtain the amount of milk in the large cup, which is 390. Proportion can be written in this form (2:13) or can be written as a fraction.

Ratio has many uses in all fields, even in the field of steel makers, as it is necessary to calculate the ratio of carbon to iron to make solid steel in factories.

Scenario of Algebraic Expressions and Sequences video

The video starts inside a restaurant where the teacher (Mohammed) and his friend (Abdulla) are sitting and waiting for the waiter to take their order. The waiter arrives and asks them if they are ready to order, and both of the friends start saying what they would like from the menu in a fast way while the waiter tries to keep up and write down everything. Mohammed wonders how the waiter manages to keep up and write everything that quickly, then he asks Abdulla to check what he wrote. Abdulla checks the waiter's notes and was surprised that it contained only symbols, and asks the waiter about it, to which the waiter answers: it is Algebra.

The video then continues with a voice recording by Mohammed to explain what algebra is, while his explanation is demonstrated by 3D drawings displayed in the video. The voice recording content is as follows:

Algebra is a method invented by the scientist Muhammad Bin Musa Al-Khwarizmi. One of its uses is to formulate dealings with symbols and variables, xy or any other letter of your choice. To give an example, the restaurant we went to has several options, and every drink or meal has a set price. French toast for 20 riyals, cappuccino for 10 riyals, and a bottle of water for 2 riyals.

Mohammed asked for French toast, cappuccino and a bottle of water, and Abdullah asked for 2 French toasts, After that, Mohamed asked for an additional French toast, and , Abdullah asked for a cup of cappuccino, and cancelled his request for one French toast.

Imagine if the waiter wrote the requests as full words. He definitely wouldn't be able to keep up with the requests. To do this, he used a symbol for each request, making the French toast symbol as "f", cappuccino symbol as "c" and water bottle symbol as "w". So the food order form that was written from the beginning became:

f + c + w + 2f + f + c -f

So how many f's did we end up with? The total is 3f, and the total number of c is 2 and the w is 1.

Then. the formula became:

3f + 2c + w =

But how much will the bill be? To answer that question, replace the symbols with the value of each product. Replace the f with 20 and the c with 10 and the w with 2, and you will find that the result is 82 Qatari riyals.

The video ends by the teacher telling his friend how Algebra is a simple method and can easily be learned

Scenario of Percentage Change lesson

The video starts with the presenter (Mohammed) saying that he is shooting the film in a local market called Souq Waqif, and he is standing in front of a jewelry shop owned by one of his friends (Abdelaziz). He enters the shop and finds his friend watching a football game between Barcelona and Valencia. After finishing the greetings and asking Abdelaziz about his life after getting his bachelor's degree in accounting, Abdelaziz starts talking about his business and how it has ups and downs.

Mohammed then asks about the method used to calculate the profits gained from selling the jewelry. Abdelaziz starts explaining that he first has to calculate the net cost of running his shop, and that includes buying the gold, electricity costs, workers' wages, etc.. Then, he added an example that a gram of gold costs him 140 in his shop, and he weighs a piece of jewelry which resulted as 13 grams. He then multiplies it by 182, but Mohammed interrupts Abdelaziz to ask him why 182 when he just said it costs 140?! Abdelaziz clarifies then that he added 42 riyals to the price as a profit.

Mohammed asks what the percentage of his profit is. Abdelaziz replies that he doesn't know the answer yet but has something that can help answer his question. He then goes and pulls out a mathematics textbook from his drawer and opens it to the percentage of change lesson. By reading the book, they notice the following mathematical formula:

$$Percentage\ of\ change\ for\ profit\ or\ loss$$

$$= 100\%\ \frac{profit\ amount\ (or\ loss\ amount)}{cost\ price}$$

They apply the formula to their case and substitute the values to get the following result:

$$\%\ of\ profit = 100\%\ \frac{42}{140} = 30\%$$

The discussion leads the two friends to how trading can lead to some losses based on the market situation. For example, an item can stay on the shelf for a year or two until the owner decides to reduce the price of it even lower than the cost price just to get rid of it. Let's say that he sold it for 119 riyals, in this case, he lost 21 riyals, and by applying the same formula we can know the percentage of loss.

$$\%\ of\ loss = 100\%\ \frac{21}{140} = 15\%$$

Finally, Mohammed and Abdelaziz, discuss why it is important to calculate the profit and loss in a percentage, and how it makes it easier to measure the business performance.

Scenario of Sequences video:

A voice over video of footage inside a mini cooper cars showroom tells a story about Khalid, a fresh graduate who faced troubles in his early life stages:

After Khaled graduated from university and got his first job and his first salary, he decided that it was time to buy the car he had always dreamed of. However, Khaled

has just started his career and has not yet collected the sufficient amount to buy the car, which is worth 150,000 Qatari riyals, and car agencies do not sell cars in installments directly to the customer. Khalid could not wait for the sum to be collected, so he decided to go directly to the bank to take a loan.

Of course the bank welcomed Khalid and the bank employee assured him directly that the bank will give him the required loanamount of 150,000 riyals, provided that Khaled pays a specific amount per month until he finishes paying off the debt. The bank employee adds that the bank will add a profit of only 5%. Khaled was happy and said only 5% !! I will sign the required papers immediately. Six years later, Khaled still pays his monthly installments and doesn't understand why the debt he owed has not ended yet. What happened?

Khaled did not know that when he signed the car purchase contract, he committed himself to the compound interest sequence. So what does this mean? It means that in the first year (and we will call it the first term in the sequence) the sum of the loan owed from Khalid was 150 thousand riyals plus 5% of it and would equal 157,500 as shown in the following formula:

$$Term\ 1 = 150{,}000 + (0.05\ x\ 150{,}000) = 157{,}500$$

In the second year, which is the second limit, the total debt will be the first limit plus 5% of the value of the first limit and it will equal 165,375 riyals, as shown in the following formula:

$$Term\ 2 = 157{,}500 + (0.05\ x\ 157{,}500) = 165{,}375$$

Thus, in the third year or the third term, the total debt owed by Khalid was the value of the second limit plus 5% of the second limit, until the total debt that he owed in the sixth year with his paid and unpaid divisions amounted to more than 200 thousand riyals.

In this sequence, a mathematical sequence has been produced, the value of the term equal to the previous term plus 5% of the previous term.

$$T_n = T_{n-1} + (0.05 \; x \; T_{n-1})$$

Where:

T = Term

n = Term's number

Sequences may come in many different types and uses, and even banks use different sequences to determine their benefits. Many young people drowned in debts because their loans accumulated without knowing what was happening. Young people should be more aware of the math and financial principles to avoid falling into these disasters.

Video shooting and production

After writing the scenarios for the lessons agreed with math coordinator in Ali ben Abi Talib school, the researcher communicated with his friends to find who would agree to participate in the videos as actors. Also, three of the researcher's friends (Ibrahim Yasser, Nawaf Al-Hammadi, and Abdulla Al-Moathen who are experienced in film making have volunteered by offering their help to produce two videos (the video of Proportion and the video of algebra). The researcher with his limited experience in filming has filmed and produced the other videos.

The researcher used a smart phone for video recording and wired microphone for sound recording to insure the clearance of the sound as shown in Figure 2. The videos also included visual graphics when required to demonstrate the calculation parts related to the subject. Then a simple video editing application called CuteCut, has been used by the researcher for video editing and exporting.

Figure 2. The researcher with two friends while filming the ratio video

The videos were uploaded in YouTube with limited access to those who got the link shared by the researcher, to insure that the video is only watched by the experimental group during the period of the research. After the post assessment completed, the videos were published to public and can be found via the following links:

Table 5. Videos' Titles and Links

Video titles	Link to the video
How to measure a tower from the ground (Proportion)	https://youtu.be/N6xWbzMy0aY
Percentage Change (percentage of profit and loss)	https://youtu.be/WhyC96suXnU
Math in restaurants (Algebraic Expressions and Sequences)	https://youtu.be/VAfjqfaZx1A
Mathematics and specialty coffee (Ratio)	https://youtu.be/1buueMEaNTE
Depts and youths (Sequences)	https://youtu.be/bxDkO6bkUFQ

Translation of the ATMI

As Arabic language is the mother language in Qatar, and the research is carried in one of the governmental schools, therefore, the ATMI had to be translated for the participants to make it easier for them to read. The ATMI was translated to Arabic by a bilingual translator and translated back to English by another translator to ensure the consistency of the translation.

The word “high school” in item 7 have been replaced by the word “preparatory” in the Arabic volume to match the age of the students. The English and Arabic ATMI can be found in Appendix E and Appendix F.

Letter of consent

By coordinating with the school administration, the researcher have visited the experimental groups and the controlled groups at their classes, to give them a brief idea about the study that will be carried on their classes during the upcoming weeks. He also explained to them have the right to not participate in any study if they are not willing to. Therefore, a letter of consent will be distributed to them, to be signed by them it if they agree on participating in the study and they are totally free to reject participating, which will not affect them in any way. A second copy also was distributed among the students to ask their parents for an approval signature since the participants are under the age of 18. The consents then have been signed by the researcher and a hard copy has been given to the participants.

The researcher has collected the students’ consents and asked another teacher in the second day to collect the parents’ consents. the consent was created in Arabic to match the students’ mother language. Students’ consent form can be found in Appendix H and parents’ consent form can be found in Appendix G.

The consent stated that the participant is invited to be part of a study that aimed at measuring the impact of the use of applied mathematics on math classes on the attitudes of seventh graders towards mathematics, and his participation in this study is completely voluntary, and he is free to refuse or stop at any time, and he will not be affected in any way if he decides to stop. It also clearly stated that all data will be treated in strict confidence and will be used for scientific research purposes only.

lesson plans:

Teachers have been asked to change the starter in the lesson plans to include the videos. In the starter section of the lesson plan, it has been written that the teacher will provide a short video about the today's subject, in a step to engage the students in the rest of the class, and the students will be asked about their opinion and ideas regarding what they have watched in the starter video. The remaining sections of the lesson plan remained the same. The duration of the starters varied from 5 to 8 mins based on the videos' length and the discussion part after the each video. Lesson plans can be found in Appendix I.

Collecting data

For the pre-assessment, the researcher has conducted with math coordinator to agree on a suitable date to carry out the survey. The researcher has visited the groups in their classes personally and asked the students to fill out the questionnaire. To make students feel comfortable, they have not been asked to write their names, and the researcher confirmed that their opinion will not reflect in anyhow on their scores or on how they will be treated in the future. The researcher also asked the participants to feel free in asking any questions related to the questionnaire items in case of un-clarity and to ask for help if any of them have reading difficulties.

The post-assessment was carried after all videos have been displayed for the experimental group with the same steps and instructions taken for the pre-assessment. All data was gathered through paper surveys, as mobiles, tablets, or computers were not available inside the classrooms. The researcher then entered the data manually to the computer using Microsoft Excel.

Data analysis

The data collected was filtered by comparing the negative questions to the positive questions and checking if any contradictions were found, which resulted in the exclusion of 20 surveys from the total pre and post-assessments. The controlled groups were combined as one group of data and the same was done with the experimental groups. Each data group was given a name to ease the analysis process as follows:

Table 6. Data Group Tags

Data group name	Description
Pre-Examined	Pre assessment data for the two experimental classes
Pre-Controlled	Pre assessment data for the two controlled classes
Post-Examined	Post assessment data for the two experimental classes
Post-Controlled	Post assessment data for the two controlled classes

The difference between the pre-examined and post-examined data was calculated as well as the difference between the pre-controlled and post-controlled data, in order to apply the paired T-test for both differences which provide the P factor that indicate whether there is a significant statistical difference or not using SPSS software, which is a platform that provides advanced statistical analysis developed by the IBM company.

A box plot analysis was then conducted by SPSS to present the distribution of controlled and experimental data among the experiment to help the researcher in concluding where there was a general effect of applied math on students' attitudes towards mathematics.

An independent T-test was also carried out on the data overall and on each of the four dimensions to investigate the effect of the applied math on each of them.

CHAPTER 4: RESULTS

This chapter presents the results computed using SPSS software, and a brief explanation of the findings.

T-test on the pre and post differences for the controlled and for the experimental groups showed that the experimental group gives a highly significant difference between pre and post (p=0.001), while for the controlled group, the difference is not significant (p=0.524).

Table 7. Pairs T-Test For The Pre and Post Differences in Examined and Controlled Groups

					95% Confidence Interval of the Difference	
	t	df	p	Mean Difference	Lower	Upper
Experimental_diff	-3.439	39	.001	-.16000	-.2541	-.0659
Controlled_diff	.643	39	.524	.02500	-.0536	.1036

Plot box diagram showed improvement in participants' results for the experimental group compared with the controlled group. The experimental group's plot demonstrates the positive improvement of the participants who didn't show interest in the pre-assessment, while it did not show a significant change for those who showed high positive attitudes in the pre-assessment.

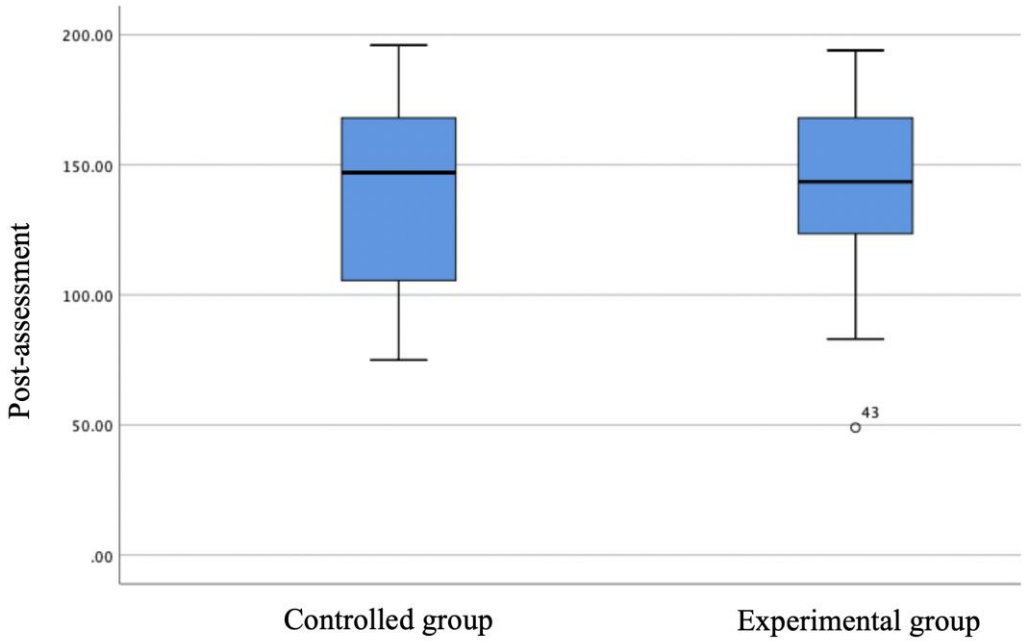

Figure 3. Box plot results

A correlation test has been conducted on pre-assessment and post-assessment data for both experimental and controlled groups. Results showed a positive correlation between the four dimensions of attitude to the attitude towards mathematics overall. Results also showed a correlation improvement in general in the post-assessment compared to the pre-assessment.

A high increase from 0.551 to 0.823 (more than 49.3%) has been found in the correlation between the value and enjoyment dimensions in the experimental groups' pre-data (0.551) compared to the post-data (0.823), which may suggest that increasing the enjoyment in teaching math can increase students' feelings of value towards learning mathematics.

In general, the correlation test results show a positive correlation between the dimensions included in attitude, and shows the close ties between each dimension and the attitudes overall. Results are demonstrated in Table 8 to Table 11 as follows.

Table 8. Pre Examined Dimensions Correlation

Correlations – Pre Experimental					
	Value	Enjoyment	Motivation	Confidence	Total
Value	1	.551	.661	.691	.823
Enjoyment	.551	1	.837	.669	.857
Motivation	.661	.837	1	.654	.858
Confidence	.691	.669	.654	1	.918
Total	.823	.857	.858	.918	1

Table 9: Post Experimental Dimensions Correlation

Correlations – Post Experimental					
	Value	Enjoyment	Motivation	Confidence	Total
Value	1	.823	.734	.771	.902
Enjoyment	.823	1	.807	.839	.944
Motivation	.734	.807	1	.773	.868
Confidence	.771	.839	.773	1	.945
Total	.902	.944	.868	.945	1

Table 10. Pre-Controlled Dimensions Correlation

Correlations – Pre-Controlled					
	Value	Enjoyment	Motivation	Confidence	Total
Value	1	.767	.657	.619	.838
Enjoyment	.767	1	.598	.830	.933
Motivation	.657	.598	1	.647	.770
Confidence	.619	.830	.647	1	.929
Total	.838	.933	.77	.929	1

Table 11. Post Controlled Dimensions Correlation

Correlations – Post controlled					
	Value	Enjoyment	Motivation	Confidence	Total
Value	1	.882	.742	.676	.901
Enjoyment	.882	1	.794	.791	.954
Motivation	.742	.794	1	.742	.863
Confidence	.676	.791	.742	1	.908
Total	.901	.954	.863	.908	1

An independent-sample t-test was conducted to compare the value of mathematics for the post-experimental group data and post-controlled group data (

Table 13) . There was a significant difference in the scores for experimental group (M=39.36, SD=8.71) and controlled group (M=34.81, SD=9.56) conditions; t (70)=2.114, p = 0.038. Results suggest that teaching applied math has an effect on the students' beliefs of value in learning math. Specifically, results suggest that when students are exposed to applied mathematics media, their belief of mathematics value increases.

Table 12. Group Statistics for Post Experimental and Controlled Groups' Value Data

Group Statistics					
	Grouping	N	Mean	Std. Deviation	Std. Error Mean
Value	1	36	39.36	8.71	1.452
	2	36	34.81	9.56	1.593

Table 13. Independent Samples Test for Post Experimental and Controlled Groups' Value Data

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	p	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Value	Equal variances assumed	.268	.606	2.114	70	.038	4.56	2.155	.25664	8.85448

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	p	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Value	Equal variances not assumed			2.114	69.41	.038	4.56	2.155	.25599	8.85512

An independent-sample t-test was conducted to compare self-enjoyment towards mathematics for the post-experimental group data and post-controlled group data (Table 15) . There was no significant difference in the scores for experimental group (M=31.75, SD=10.67) and controlled group (M=33.64, SD=10.5) conditions; t (70)=-0.757, p = 0.451. Results suggest that teaching applied math has no significant effect on the self-enjoyment aspect of the attitude towards mathematics.

Table 14. Group Statistics for Post Experimental and Controlled Groups' Self-Enjoyment Data

Group Statistics					
	Grouping	N	Mean	Std. Deviation	Std. Error Mean
Self-Enjoyment	1	36	31.75	10.67	1.77790
	2	36	33.64	10.50	1.74945

Table 15. Independent Samples Test for Post Experimental and Controlled Groups' Self-Enjoyment Data

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	p	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Self-Enjoyment	Equal variances assumed	.296	.588	-.757	70	.451	-1.89	2.494	-6.863	3.086
	Equal variances not assumed			-.757	69.98	.451	-1.89	2.494	-6.863	3.086

An independent-sample t-test was conducted to compare the motivation towards mathematics for the post-experimental group data and post-controlled group data (Table 17) . There was a significant difference in the scores for experimental group (M=18.03, SD=4) and controlled group (M=14.69, SD=4.21) conditions; t (70)=3.444, p = 0.001. Results suggest that teaching applied math has an effect on the motivation aspect of the attitude towards mathematics. Specifically, results suggest that when students are exposed to applied mathematics media, their motivation towards mathematics increases.

Table 16. Group Statistics for Post Experimental and Controlled Groups' Motivation Data

Group Statistics					
	Grouping	N	Mean	Std. Deviation	Std. Error Mean
Motivation	1	36	18.03	4.00	.66725
	2	36	14.69	4.21	.70127

Table 17. Independent Samples Test for Post Experimental and Controlled Groups' Motivation Data

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	p	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Motivation	Equal variances assumed	.929	.338	3.444	70	.001	3.33	.968	1.403	5.264
	Equal variances not assumed			3.444	69.828	.001	3.33	.968	1.403	5.264

An independent-samples t-test was conducted to compare self-confidence towards mathematics for the post-experimental group data and post-controlled group data (

Table 19). There was no significant difference in the scores for the experimental group (M=14.98, SD=2.50) and controlled group (M=13.63, SD=2.27) conditions; t (70)=-0.757, p = 0.451. Results suggest that teaching applied math has no significant effect on the self-confidence aspect of the attitude towards mathematics.

Table 18. Group Statistics for Post Experimental and Controlled Groups' Self-Confidence Data

Group Statistics					
	Grouping	N	Mean	Std. Deviation	Std. Error Mean
Self-Confidence	1	36	49.56	14.98	2.50
	2	36	51.81	13.63	2.27

Table 19. Independent Samples Test for Post Experimental and Controlled Groups' Self-Confidence Data

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	P	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Self-Confidence	Equal variances assumed	.221	.640	-.666	70	.507	-2.25	3.38	-8.984	4.484
	Equal variances not assumed			-.666	69.38	.507	-2.25	3.38	-8.985	4.485

An independent-samples t-test was conducted to compare self-confidence towards mathematics for the post-experimental group data and post-controlled group data (

Table 21). There was no significant difference in the scores for the experimental group (M=14.98, SD=2.50) and controlled group (M=13.63, SD=2.27) conditions; t (70)=-0.757, p = 0.451. Results suggest that teaching applied math has no significant effect on the self-confidence aspect of the attitude towards mathematics.

Table 20. Group Statistics for Post Experimental and Controlled Groups' Total Data

Group Statistics					
	Grouping	N	Mean	Std. Deviation	Std. Error Mean
Total Post	1.00	36	138.69	35.32	5.89
	2.00	36	134.94	34.45	5.74

Table 21. Independent Samples Test for Post Experimental and Controlled Groups' Total Data

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	p	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Total post	Equal variances assumed	.086	.770	.456	70	.65	3.75	8.22	-12.65	20.15
	Equal variances not assumed			.456	69.38	.65	3.75	8.22	-12.65	20.15

CHAPTER 5: DISCUSSION AND CONCLUSION

Discussion of results

Overall, there was a significant improvement in the attitude towards mathematics in the experimental group compared to the controlled group. That is the result of linking mathematics lessons to the participants' real lives, which supports the findings of Kilman (2015) (Kilman, 2015). This indicator shows that there was an effect of teaching applied math on students' attitudes towards mathematics for those who participated in the study as an experimental group.

Results showed that students' beliefs in mathematics' value improved after implementing applied math in math lessons. For example, students in the experimental group showed more interest in developing their mathematics skills. This can be a result of being exposed to the applications of mathematics in real life, which may have increases their attitude towards improving their mathematical skills which will contribute in being able to solve daily life problems. Also, applied math lessons showed an effect on experimental group students' beliefs of the value of math classes in high school, regardless of their future disciplines, which may be a result of realizing how important math is in general and in real life practices. Teaching applied mathematics has also helped in opening participants' minds to using mathematics outside the boundaries of school, which is a direct goal of teaching applied math (Keif & Stewart, 1997; Williams, 2012; Petric, 2011).

In the dimension of motivation towards learning mathematics, data analysis showed that there was a significant statistical difference between the experimental and controlled groups' data. Participants in the experimental group showed improvement in their motivation towards learning math. This can be a result of bringing the value of math in real life to their attention, as suggested by (Mata, Monteiro, & Peixoto, 2012;

Kilman, 2015; Yilmaz & Olkum, 2010). For example, the capability of learning math has increased in experimental group students, which implies that students' awareness of mathematics' importance reflected on their motivation to learn more mathematical concepts. Also, the desire to avoid joining academic disciplines that include mathematical skills in the future seemed to be decreased in the experimental group compared to the controlled group. These results are aligned with previous research results that suggest improving the positive attitude towards mathematics in early stages as a solution of avoiding disciplines and careers that include dealing with numerical content (Kilman, 2015; Dutton, 1962; Kele & Sharma, 2014).

Unlike value and motivation subscales, self-enjoyment results did not show a significant statistical difference between the experimental group and controlled group. For example, experimental group students did not show that math classes are more enjoyable than other classes compared to the controlled group. Experimental group data also did not show significant predictors of students' excitement in solving mathematical problems or feeling comfortable in answering or expressing mathematical problems. This absence of significant difference was also found in the subscale of confidence results. Students in the experimental group for example didn't appear to be significantly different than the controlled group in the aspect of feeling under strain in math classes, or feeling uncomfortable when hearing mathematical terms. This was also found in the feeling of self-confidence when solving math problems or studying math.

The non-significant statistical difference found in the dimension of enjoyment and confidence as part of the attitude towards mathematics between experimental and controlled group, may be explained by the extensive amount of time it takes to build a negative attitude compared to the duration of this study (Chen, et al., 2018). It also can be related to other factors in the educational system that limits the enjoyment of going

to school in general, which can reflect on enjoying math classes and other classes as well.

Correlation analysis showed positive correlation between all four dimensions and attitude in general. However, the positive correlation has noticeably increased in the post-assessment results for the experimental group. For example, the correlation between value and enjoyment has increased from 0.551 to 0.823, which is more than 49%. This indication can be a useful key to increase enjoyment in math classes which is considered as a challenge for math teachers (Kilman, 2015; Yilmaz & Olkum, 2010). Data also showed an increase of correlation between confidence and enjoyment, which has increased about 25% from 0.669 to 0.839, showing how improving the math class environment is important to increase students' confidence in learning math.

In the box plot diagram analysis, there was an improvement found in participants' data of the experimental group compared to the controlled group. The experimental group's plot demonstrated the positive improvement of the participants who didn't show high positive attitudes in the pre-assessment while it did not show a significant change for those who showed high positive attitudes in the pre-assessment. This result demonstrated the positive effect of teaching applied math on the participants' attitudes towards mathematics.

The results were found to indicate that, at least for the research sample, implementing applied math inside school math classes, can on average improve students' attitudes towards mathematics, especially on the dimension of value and motivation. The findings of negligible difference in value and confidence between the controlled group and experimental group have surprised the researcher, however, similar findings were found by Ma (1997) and Kilman (2015) who concluded that one

dimension of the attitude towards mathematics can increase alone more than other dimensions.

Limitations

1. This research was conducted on participants of grade seven in a governmental preparatory school in Qatar. Therefore, the research results may not be generalized on other grades or geographical areas, as the negative attitude levels may vary through students' academic journeys.
2. Schools in Qatar follow a strict schedule provided by the Ministry of Education and Higher Education. Therefore, the researcher had to follow the subjects assigned to students within the research period, which is limited to two units, the percentages and algebra. This limitation prevented covering more applications of other math fields, which may limit the result from being generalized to higher levels of math subjects.
3. Qatar's governmental education system follows gender segregation policy, and access of a female researcher was not an available choice. Therefore, this research was limited to male participants and may not be generalized to both genders.
4. Although the researcher contributed with volunteers experienced in video production to produce two educational videos, he had to produce the other three videos by using his mobile and limited experience in video production. The videos would be produced in much higher quality if all of them were produced by professionals, which of course would require a higher budget.
5. The study result was based on self-report questionnaire filled by seventh grade student during school classes, which brings the possibility that participants

could for some purpose distort the results or fill the questionnaire in a rush without giving it enough attention.

Recommendations

This study recommends math educators to use the following suggestions as a step towards increasing students' positive attitude towards mathematics in math classrooms:

1. Teachers are suggested to Implement applied mathematics context to link the lessons to daily life situations.
2. Teachers are recommended to get benefit of available videos if it meet their curriculum.

The following recommendations may be considered in further researches:

1. Research could be conducted on both genders in different schools which may bring more accurate results that could be generalized.
2. Research may include qualitative interviews with high achieving students and low achieving students to get more feedback about students' preferences, which can help in improving future implementation of applied mathematics.
3. Although it might be uncomfortable for preparatory students and may increase the probability of misleading the results, researchers could ask the participants to specify their names or provide a tag number in the pre and post-assessments, which may increase the sensitivity of the data.
4. Future research may consider including exam performance data for both groups to analyze the relation between increasing positive attitudes and academic performance.
5. Qualitative approach could be followed in future to investigate if it will provides different results.

Conclusion

The purpose of this study was to explore the effect of using applied mathematics lessons on 7th grade students' attitudes towards mathematics. It explored the change in attitude dimensions caused by the implementation of applied math lessons. The results showed progression in two dimensions out of four, value and motivation. However, changing the attitudes would require longer implementation, and the prevention of negative attitudes in early learning stages can prevent future side effects that may limit students' career preferences. Teaching applied math is a wide area of development and requires continuous effort in innovation and research.

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APPENDIX A: ACKNOWLEDGMENT LETTER

مدير إدارة السياسات والأبحاث التربوية

التاريخ : 30/ 08/ 2018م

التـــعـهد والإقـــرار

أتعهد أنا الموقع أدناه : محمد عبدالرحيم إبراهيم الجناحي

والمسؤول عن البحث الميداني أن أزود إدارة السياسات والأبحاث التربوية في وزارة التعليم والتعليم العالي بنسخة مطبوعة وإلكترونية منه بعد انتهائه ، وأن أكون مسؤولا أمامكم عن تنفيذه وفقا للخطة المعتمدة، وأن ألتزم بسرية المعلومات والبيانات الخاصة والتقارير التي تم تزويدي بها من قبل إدارة السياسات والابحاث .

وهذا إقرار مني بذلك .

المتعهـد والمقـر بمـا فيـه :

الاســـــم : محمد عبدالرحيم إبراهيم الجناحي

الهاتف : 55653635

الايميل : 200502670@teachforqatar.org

الجهة التابع لها : جامعة قطر

التاريخ : ---------- 2018/08/30 ----------

التوقيع : ----------

APPENDIX B: FACILITATING THE TASK OF A RESEARCHER LETTER

التاريخ: ٢٠١٨/٨/٣٠م

تسهيل مهمة القائم بالبحث الميداني في المدارس

السيد : مدير مدرسة علي بن أبي طالب الإعدادية المحترم

السلام عليكم ورحمة الله وبركاته

نود إحاطتكم علما بأن الباحث / الباحثون المذكورة أسماءهم أدناه ، بصدد إجراء دراسة ميدانية في مدرستكم وبياناتهم كالتالي :

- اسم الباحث :محمد عبدالرحيم إبراهيم الجناحي
- جهة البحث : جامعة قطر
- عنوان البحث : أثر استخدام الرياضيات التطبيقية في حصص الرياضيات على اتجاهات طلاب الصف السابع نحو الرياضيات
- هدف البحث : قياس أثر استخدام الرياضيات التطبيقية في حصص الرياضيات على اتجاهات طلاب الصف السابع نحو مادة الرياضيات
- عينة البحث : طلاب الصف السابع
- التاريخ : 1/09/2018

عليه ، يرجى التكرم بتسهيل مهمة الباحث ، علما بأن البيانات ستكون سرية ولأغراض البحث العلمي.

مع شكرنا لحسن تعاونكم معنا ،،،

د. عزيزة أحمد السعدي

مدير إدارة السياسات والأبحاث التربوية

APPENDIX C: QU-IRB SIGNED FORM

QU-IRB
Request for Ethics Approval
Application Form 1: Research involving Human Subjects

For QU-IRB Use Only:

Research No.:	Received on:

Note to Applicants: Please TYPE the details requested below and put N/A where the information is not relevant or not required on your part.
Often filled application forms are sent back to researchers for additional information. If care is taken to provide sufficient details in the original application, then delays in the approval can be avoided.

Title of the Research Project
The effect of using applied mathematics lessons on 7th grade students' attitudes towards mathematics

External Sponsor(s) / Collaborator(s):

Expected start date Expected end date
Start: After getting the IRB approval
End: June 2019

A. Details of All Investigators

Name, Position & Department	PI, Co-PI Others: Specify	Faculty: Post-Doc. Student: Graduate / Undergraduate	Previous and/or Current Training related to Research
Mohammed Al-Janahi / CIA student in Qatar university	Student	Graduate	Current Graduate CIA student- master thesis
Dr. Areej Barham / Associate Professor of Mathematics Education	Supervisor	Professor	

B. Lay Summary (Max 300 words)
This should be accessible to non-scientist who is a member of the QU-IRB.
Specify the research problems this project addresses

Mathematics is a subject that seems to have a negative reputation in student's discussions, sentences such as "I hate math" "why do we study math anyway", etc. have been common to be noticed by math teachers from their students. This negative attitude can affect the achievement of the students in math and related subjects such as physics, finance, etc.

This research will investigate the effect of teaching mathematics in 7th grade male classes with customized videos that link the math subject directly to real-life situations from the local environment on students' attitude toward mathematics. The videos also will be followed by customized activity to simulate similar forms of the situation viewed in the video.

C.	Details of the Research
C1	**Methodology (step by step process of the research):** - Getting the IRB approval within the first month of the academic year 2018-2019 - Before the second month of the academic year of 2018-2019, the required documents will be prepared and the teachers involved in the study will be contacted together with the school administration by the researcher to agree on the steps that will be followed. - The researcher will prepare the videos from the real life related to the subject prior the classes after consulting the teachers to make sure that the video will match the goals of the math lessons. - The pre-assessment (Attitudes towards mathematics questionnaire) will be taken within the first month of the academic year for both experimental and controlled groups, as the students are known to be collaborative in this period. - In the following weeks, the videos will be implemented in the experimental groups' math classes. - Controlled and experimental classes will be observed by the researcher to follow the plan agreed with the teachers. This part will be conducted over a period of four weeks, and the videos will be distributed through this period. - After the four weeks of implementation, a post assessment (Attitudes towards mathematics questionnaire) will be taken by the students in both groups. - The Data will be then analyzed using SPSS software to enhance writing the results, discussion, conclusion and recommendations.
C2	Subjects: - -Students in four classes of Grade 7 at Ali Bin Abi Talib preparatory boys school -Number of recruited students is estimated to be 90-100 students
	Inclusion and Exclusion Criteria: **No students will be Excluded**
C4	What data collecting instruments will be used? Attitudes towards mathematics questionnaire will be distributed to the students to be filled through the research stages. The instrument tool that will be used is obtained from the research done by N. Karjanto in 2017 to measure the students' attitudes toward mathematics in the Nazarbayev University Foundation Year Program. The questionnaire will be modified to fit the age of the participants. i.e. "high school mathematics" in the questionnaire will be replaced by "preparatory school mathematics".
C5	**How will the results be analyzed?** Data collected will be analyzed using SPSS software by the researcher him self.
C6	**Will results be acted on in any way? (e.g. will patients screened +ve be followed up/offered treatment?** N/A
C7	**Materials to be administered or used in the research:**

	i) Drugs or Chemical Hazards:			
	ii) Biohazards:			
	iii) Radioactive Isotopes or Radiation:			
	iv) Special Diet:			
	v) Others (specify): Educational videos			
C8	**Possible hazards from using these materials:**			
	i) None: x			
	ii) Contagious to people:			
	iii) Controlled Drug:			
	iv) Carcinogen:			
	v) Others (specify):			
C9	**Approved by University Chemical and Biohazard Safety Committee:** N/A			
	Yes	**No**	**Pending**	**N/A** **X**
C10	**Approved by Radiation Safety Officer: N/A**			
	Yes	**No**	**Pending**	**N/A** **X**
C11	**Samples to be taken: N/A**			
C12	**Procedure: N/A**			
C13	**Other Tests: N/A**			
C14	**Where will the study be carried out?** Ali Bin Abi Taleb preparatory school			
C15	**Please list possible risks, discomforts, inconveniences, side effects, and costs that could be experienced by the subjects:** **There are no risks or costs incurred by participants. Time for implementing the research activities during each lesson is expected to be ranged between 5-7 minutes in two classes weekly extended for 4 weeks , approximately 40- 56 minutes. Also , times needed for collecting data by the questionnaire is expected to be 10-15 minutes twice before and after the implementation of the research experiment.**			

D.	Informed Consent
D1	**What information will be given to subjects and how will it be given?** . Participants will be provided with a written consent highlighting a brief description of the study, the nature of their participation in it, task and time required to complete the study, voluntary participation, right to withdraw at any time without penalty, no foreseeable risks involved, confidentiality, and contact information of principal researcher.
D2	**From whom and how the Consent will be obtained?** Informed consents will be distributed to participated students by the researcher to be signed by their parents.

D3	**A copy of the consent form should be attached to include the following information :** • Title, Purpose and Nature of the Research • A brief understandable description of the study, in level-appropriate language for the study group. • Clear explanation of the possible risks, harms and benefits to the subject. • Task and Time required of the participant and/or any remunerations • Costs, or voluntary participating in the study • Provides for the withdrawal policy • Description of any recording devices to be used. • Provides the opportunity to see the results • Fate of the Sample (Disposition and/or Storage for future use) • Provides for confidentiality • Gives contact information for researcher, supervisor (if appropriate) • Any additional information relevant to the Consent • Provides confirmation that all stakeholders/employers have been informed and approvals obtained
E.	**Confidentiality**
E1	**How and where will the study data/sample be stored and secured?** It will be collected and stored in the researcher PC, QU E-mail, and shared only with the authorized individuals and institutes.
E2	**Will it be reused in the future?** No
E3	**How would subject's confidentiality be protected?** No identifying information about participants' names is requested. All data will be kept strictly confidential and secured at all times.
F.	**Any Other Information/Comments that could be helpful pertaining to this application**
.....	
.....	
.....	
.....	

G.	**Declaration Statement from the Applicant**

I confirm that all information reported in this application form is true and accurate. I agree to report ANY DEVIATIONS from the reported procedures and methodologies to the QU-IRB. I agree to maintain adequate records of all procedures. I agree to become informed and comply with the principles outlined in the "Handbook for Ethical Rules and Regulations" as published by Qatar University and comply with all Acts and Regulations in the state of Qatar pertaining to the use of human subjects in research.

Name: Mohammed Al-Janahi
Address: Doha-Qatar
Phone Nos.: +97455653635
Email: 200502670
Fax:

Signature of the Applicant: Mohammed Al-Janahi 26/11/2018

Signature of the PI: Dr. Areej Barham 26/11/2018

****

Please do not write below this line. This part is for QU-IRB use only:

Approval of the above procedures for a period **not exceeding one year** is hereby given:

Chairperson, QU-IRB: _____ Date: _____

Previous Protocol ID: _____

Approval Date: _____ Renewal Date: _____

APPENDIX D: QU-IRB APPROVAL

جامعة قطر
QATAR UNIVERSITY

Qatar University Institutional Review Board
QU-IRB

December 4, 2018

Dr. Areej Barham
Graduate Student Supervisor
College of Education
Qatar University
Email: areejbarham@qu.edu.qa

Dear Dr. Areej Barham,

Sub.: Research Ethics Review Exemption / CEDU Graduate Student Project
Ref.: Graduate Student, Mohammed Al-Janahi / Ph: 55653635 / Email: 200502670@student.qu.edu.qa
Project titled, "The effect of using applied mathematics lessons on 7th grade students' attitudes towards mathematics"

We would like to inform you that application of the above mentioned student, along with the supporting documents provided for this protocol, is reviewed and having met all the requirements, has been exempted from the full ethics review.

Please note that any changes/modification or additions to the original submitted protocol should be reported to the committee to seek approval prior to continuation.

The Research Ethics Approval No. for this protocol is: **QU-IRB 997-E/18**
Kindly refer to this number in all future correspondence pertaining to this project.

Best wishes,

Dr. Mashael Al-Shafai
Chairperson, QU-IRB

جامعة قطر
QATAR UNIVERSITY
Institutional Review Board
(IRB)
Office Of Academic Research

APPENDIX E: ORIGINAL ATMI

ATTITUDES TOWARD MATHEMATICS INVENTORY

Name _____ *School* _____

Teacher _____

Directions: This inventory consists of statements about your attitude toward mathematics. There are no correct or incorrect responses. Read each item carefully. Please think about how you feel about each item. Enter the letter that most closely corresponds to how each statement best describes your feelings. Please answer every question.

PLEASE USE THESE RESPONSE CODES:

A – Strongly Disagree
B – Disagree
C – Neutral
D – Agree
E – Strongly Agree

1.	Mathematics is a very worthwhile and necessary subject.	
2.	I want to develop my mathematical skills.	
3.	I get a great deal of satisfaction out of solving a mathematics problem.	
4.	Mathematics helps develop the mind and teaches a person to think.	
5.	Mathematics is important in everyday life.	
6.	Mathematics is one of the most important subjects for people to study.	
7.	High school math courses would be very helpful no matter what I decide to study.	
8.	I can think of many ways that I use math outside of school.	
9.	Mathematics is one of my most dreaded subjects.	
10.	My mind goes blank and I am unable to think clearly when working with mathematics.	
11.	Studying mathematics makes me feel nervous.	
12.	Mathematics makes me feel uncomfortable.	
13.	I am always under a terrible strain in a math class.	
14.	When I hear the word mathematics, I have a feeling of dislike.	
15.	It makes me nervous to even think about having to do a mathematics problem.	
16.	Mathematics does not scare me at all.	
17.	I have a lot of self-confidence when it comes to mathematics.	
18.	I am able to solve mathematics problems without too much difficulty.	
19.	I expect to do fairly well in any math class I take.	
20.	I am always confused in my mathematics class.	
21.	I feel a sense of insecurity when attempting mathematics.	
22.	I learn mathematics easily.	
23.	I am confident that I could learn advanced mathematics.	
24.	I have usually enjoyed studying mathematics in school.	
25.	Mathematics is dull and boring.	
26.	I like to solve new problems in mathematics.	
27.	I would prefer to do an assignment in math than to write an essay.	
28.	I would like to avoid using mathematics in college.	
29.	I really like mathematics.	
30.	I am happier in a math class than in any other class.	
31.	Mathematics is a very interesting subject.	
32.	I am willing to take more than the required amount of mathematics.	
33.	I plan to take as much mathematics as I can during my education.	
34.	The challenge of math appeals to me.	
35.	I think studying advanced mathematics is useful.	
36.	I believe studying math helps me with problem solving in other areas.	
37.	I am comfortable expressing my own ideas on how to look for solutions to a difficult problem in math.	
38.	I am comfortable answering questions in math class.	
39.	A strong math background could help me in my professional life.	
40.	I believe I am good at solving math problems.	

APPENDIX F: TRANSLATED ATMI

المواقف تجاه لائحة الرياضيات

تعليمات: تتكون هذا اللائحة من إفادات حول موقفك تجاه مادة الرياضيات. لا توجد ردود صحيحة أو ردود خاطئة. اقرأ كل عبارة جيدًا، وفكر بشأن كيفية شعورك تجاه كل عبارة. علّم على الخانة التي تتوافق إلى حد كبير مع الطريقة التي تصف بها كل عبارة مشاعرك على نحو أفضل. يرجى الإجابة على جميع الأسئلة واستخدام الردود التالية: 1 (أعترض بشدة)، 2 (لا أوافق)، 3 (محايد)، 4 (أوافق)، 5 (أوافق بشدة)

الرقم	الإفادة	1	2	3	4	5
1	إن الرياضيات مادة مهمة وضرورية.	☐	☐	☐	☐	☐
2	أريد تطوير مهاراتي الرياضية.	☐	☐	☐	☐	☐
3	أحصل على قدر كبير من الرضا من حل مسألة رياضية.	☐	☐	☐	☐	☐
4	تساعد الرياضيات على تطوير العقل، وتعلم الشخص التفكير.	☐	☐	☐	☐	☐
5	الرياضيات مهمة في الحياة اليومية.	☐	☐	☐	☐	☐
6	الرياضيات هي واحدة من المواد شديدة الأهمية التي يدرسها الناس.	☐	☐	☐	☐	☐
7	ستكون حصص الرياضيات في المرحلة الثانوية مفيدة للغاية بغض النظر عن ما أقرر دراسته.	☐	☐	☐	☐	☐
8	يمكنني التفكير في طرق عدة أستخدم فيها الرياضيات خارج المدرسة.	☐	☐	☐	☐	☐
9	الرياضيات هي واحدة من أكثر المواد التي أرهبها.	☐	☐	☐	☐	☐
10	يتطاير كل شئ من ذهني وأكون غير قادر على التفكير بشكل واضح عندما أتعامل مع الرياضيات.	☐	☐	☐	☐	☐
11	دراسة الرياضيات تجعلني أشعر بالتوتر.	☐	☐	☐	☐	☐
12	الرياضيات تجعلني أشعر بعدم الارتياح.	☐	☐	☐	☐	☐
13	أنا دائما تحت ضغط رهيب في صف الرياضيات.	☐	☐	☐	☐	☐
14	عندما أسمع كلمة الرياضيات، أشعر بالنفور.	☐	☐	☐	☐	☐
15	أتوتر من مجرد التفكير في الاضطرار إلى حل مسألة رياضية.	☐	☐	☐	☐	☐
16	لا تخيفني الرياضيات على الإطلاق.	☐	☐	☐	☐	☐
17	أمتلك الكثير من الثقة بالنفس عندما يتعلق الأمر بالرياضيات.	☐	☐	☐	☐	☐
18	أنا قادر على حل المسائل الرياضية بدون الكثير من الصعوبة.	☐	☐	☐	☐	☐
19	أتوقع أن أقوم بعمل جيد في أي صف رياضيات أخذه.	☐	☐	☐	☐	☐
20	أنا دائمًا مرتبك في صف الرياضيات.	☐	☐	☐	☐	☐

21	أشعر بعدم الثقة بالنفس عندما أحاول دراسة الرياضيات.	☐	☐	☐	☐	☐
22	أتعلم الرياضيات بسهولة.	☐	☐	☐	☐	☐
23	أنا واثق من أنني أستطيع تعلم الرياضيات المتقدمة.	☐	☐	☐	☐	☐
24	عادة ما استمتعت بدراسة الرياضيات في المدرسة.	☐	☐	☐	☐	☐
25	إن الرياضيات مملة.	☐	☐	☐	☐	☐
26	أحب حل مسائل رياضية جديدة.	☐	☐	☐	☐	☐
27	أفضل القيام بواجب في الرياضيات عن كتابة مقال.	☐	☐	☐	☐	☐
28	أود تجنب الرياضيات في الجامعة.	☐	☐	☐	☐	☐
29	أحب حقًا الرياضيات.	☐	☐	☐	☐	☐
30	أنا أسعد في صف الرياضيات من أي صف آخر.	☐	☐	☐	☐	☐
31	إن الرياضيات مادة مثيرة جدًا للاهتمام.	☐	☐	☐	☐	☐
32	أنا على استعداد على استيعاب مقدار أكبر عن المطلوب.	☐	☐	☐	☐	☐
33	أخطط لأخذ أكبر قدر ممكن من الرياضيات خلال فترة دراستي.	☐	☐	☐	☐	☐
34	يستهويني تحدي الرياضيات.	☐	☐	☐	☐	☐
35	أعتقد بأن دراسة الرياضيات المتقدمة هو أمر مفيد.	☐	☐	☐	☐	☐
36	أعتقد أن دراسة الرياضيات تساعدني في حل المشكلات بالمجالات الأخرى.	☐	☐	☐	☐	☐
37	أشعر بالراحة في التعبير عن أفكاري حول كيفية البحث عن حلول لمسألة صعبة في الرياضيات.	☐	☐	☐	☐	☐
38	أشعر بالراحة في الإجابة عن الأسئلة في صف الرياضيات.	☐	☐	☐	☐	☐
39	يمكن لخلفية قوية بالرياضيات أن تساعدني في حياتي المهنية.	☐	☐	☐	☐	☐
40	أعتقد أنني جيد في حل المسائل الرياضية.	☐	☐	☐	☐	☐

الصف:.....

التاريخ:.....

APPENDIX G: PARENT'S CONSENT FORM

إخطار موافقة

عنوان الدراسة

The effect of using applied mathematics lessons on 7th grade students' attitudes towards mathematics

أثر استخدام الرياضيات التطبيقية في حصص الرياضيات على اتجاهات طلاب الصف السابع نحو الرياضيات

عزيزي ولي الأمر

السلام عليكم ورحمة الله وبركاته،

ابنك مدعو للمشاركة في دراسة بحثية تهدف إلى قياس أثر استخدام الرياضيات التطبيقية في حصص الرياضيات على اتجاهات طلاب الصف السابع نحو الرياضيات

إن مشاركة ابنك في هذه الدراسة هي مشاركة تطوعية كلياً، وله حرية الرفض أو التوقف في أي وقت، ولن يتأثر بأي حال إذا ما قرر التوقف.

ستتم الدراسة عبر استبيانات يتم توزيعها خلال الفصل الدراسي الأول لقياس أثر تدريس الرياضيات التطبيقية على اتجاه الطالب نحو مادة الرياضيات.

إن جميع البيانات سوف تعامل بسرية تامة وسوف تستخدم لأغراض البحث العلمي فقط.

إذا رغبت بالحصول على ملخص لنتائج الدراسة بعد تمامها فيمكنك الاتصال على الهاتف النقال الخاص بالباحث: 55653635، أو على البريد الإلكتروني: 200502670@qu.edu.qa
أو التواصل مع المشرف الأكاديمي على الرسالة، الدكتورة أريج برهم على البريد الالكتروني: areejbarham@qu.edu.qa

ولك جزيل الشكر...

محمد الجناحي، الباحث الرئيسي

بيان الموافقة

أوافق على مشاركة ابني في هذه الدراسة:

توقيع ولي الأمر:_____ التاريخ:_____

توقيع الباحث:_____ التاريخ:_____

APPENDIX H: STUDENT'S CONSENT FORM

إخطار موافقة

عنوان الدراسة

The effect of using applied mathematics lessons on 7th grade students' attitudes towards mathematics

أثر استخدام الرياضيات التطبيقية في حصص الرياضيات على اتجاهات طلاب الصف السابع نحو الرياضيات

عزيزي الطالب

السلام عليكم ورحمة الله وبركاته،

انت مدعو للمشاركة في دراسة بحثية تهدف إلى قياس أثر استخدام الرياضيات التطبيقية في حصص الرياضيات على اتجاهات طلاب الصف السابع نحو الرياضيات

إن مشاركتك في هذه الدراسة هي مشاركة تطوعية كلياً، ولك حرية الرفض أو التوقف في أي وقت، ولن يتأثر بأي حال إذا ما قرر التوقف.

ستتم الدراسة عبر استبيانات يتم توزيعها خلال الفصل الدراسي الأول لقياس أثر تدريس الرياضيات التطبيقية على اتجاه الطالب نحو مادة الرياضيات.

إن جميع البيانات سوف تعامل بسرية تامة وسوف تستخدم لأغراض البحث العلمي فقط.

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أو التواصل مع المشرف الأكاديمي على الرسالة، الدكتورة أريج برهم على البريد الالكتروني: areejbarham@qu.edu.qa

ولك جزيل الشكر...

محمد الجناحي، الباحث الرئيسي

بيان الموافقة

أوافق على مشاركتي في هذه الدراسة:

توقيع الطالب:_____ التاريخ:_____

توقيع الباحث:_____ التاريخ:_____

APPENDIX I: EXAMPLE OF A MODIFIED LESSON PLANE

اسم المعلم	أحمد بدوي	اليوم	الاربعاء
الوحدة	الوحدة الثالثة (المقادير الجبرية والمتتاليات)	التاريخ	2019-1-9
عنوان الدرس	كتابة المقادير الجبرية وإيجاد قيمها	المستوى – الشعبة	السابع

معايير المناهج	• يكتب مقادير خطية وصيغ لتمثيل موقف ما. • يوجد قيمة مقادير جبرية وصيغ.			7.4.4 + 7.4.1
المصطلحات والمفاهيم الرئيسة	الوسائل التعليمية		مصادر التعلم	
Algebraic Expressions المقادير الجبرية Value القيمة	السبورة البيضاء ☒ أوراق العمل☐ الوسائل التعليمية اليدوية ☐ الفيديو☐	الألعاب☐ الملصقات☐ البطاقات☐ جهاز عرض☒	كتاب الطالب	صفحة 7-12
			مصادر التعلم المساندة	- https://media.pearsoncmg.com/curriculum/math/enVision6-8/enV6-8_html5tools_launch/index.html

الزمن	التهيئة
10 دقائق	يعرض المعلم مقطع فيديو قصير يتكون مم مشهد لصديقين في مطعم يطلبان من النادل طلبات منوعة بشكل سريع، ويبديا استغرابهما من مواكبة النادل لسرعة طلباتهم وكتابتها، ليكتشفا بعدها أن النادل كان يستخدم الحدودة الجبرية لتسجيل الطلبات. ثم يشرح الفيديو كيفية قراءة المقادير الجبرية وكتابتها وجزء من تبسيطها. يناقش المعلم مع الطلاب ما جاء في الفيديو ويطلب منهم أمثلة أخرى من الواقع يمكن توظيف الجبر به

أنشطة التعليم والتعلم التي تحقق الكفايات الأساسية				
أهداف التعلم	طرائق وأساليب تدريس المعلم (الإستراتيجيات التعليمية)	أنشطة الطالب التعلمية	التقويم من أجل التعلم	الزمن
في نهاية الدرس سوف يكون الطالب قادرا على أن: 1-يكتب الصيغ الجبرية وإيجاد قيمتها	**مثال (3) صفحة (9):** (التعلم بالأقران) • يطلب المعلم من الطلبة العمل في ثنائيات للتعرف على كيفية استعمال معدلات الوحدة في المثال حيث يقوم أحد الطلاب بقراءة المثال ويقوم الاخر بتحديد خطوات الحل واكتشاف العمليات المذكورة في المثال والاستعداد لمناقشة المعلم من خلال الإجابة على الأسئلة الاتية: 1. ما هو نصيب على من العائد الاجمالي؟ 2. ما هي تكلفة الغداء الأسبوعي لعلي؟ 3. ما المبلغ الذي كسبه الأصدقاء الأسبوع الماضي؟ **تدريب 1: تدرب وحل مسائل صفحة (9):** (عمل فردي) أوجه الطلبة إلى حل التدريب بصورة فردية ومناقشة الحل مع المعلم عند المرور لتصويب الأخطاء. 11 صفحة 8التمايز: حل تدرب وحل مسائل رقم التكامل: يكون من خلال التكامل الرأسي مع موضوعات المادة.	• يقوم الطلاب بقراءة المثال المذكور في ثنائيات حسب دور كل طالب والاجابة عن الأسئلة التي يقوم المعلم بطرحها من خلال الاطلاع على إجابة المثال في الكتاب صفحة 9. ✓ $\frac{1}{3}m$ ✓ 125.5 QR ✓ 3870 **حاول ان تحل:** ✓ $32x + 12 = y$ **إضافي: تمرين** ✓ $0.6y + 2$	ملاحظة المعلم. الأسئلة الشفهية المشاركة الصفية	10 دقائق
2- يكتب المقادير الجبرية لتمثيل المواقف	يقوم المعلم بعرض تمارين متنوعة من (تدرب وحل مسائل) 11صفحة حيث يقوم الطلاب بحل السؤال الاتي: السؤال رقم 9 صفحة 11 لتحقيق الهدف 3	يقوم الطلاب بحل التمارين فرديا ثم يقومون بمشاركة هذه الحلول مع زملاؤهم وتصويب الخطأ فيها ومن ثم مناقشة ذلك على السبورة مع المعلم. ✓ *16*	ملاحظة المعلم. الأسئلة الشفهية المشاركة الصفية	10 دقائق

3- يوجد قيم المقادير الجبرية	يقوم المعلم بعرض تمارين متنوعة من (تدرب وحل مسائل) 12صفحة حيث يقوم الطلاب بحل السؤال الآتي: 1. السؤال رقم 18 صفحة 12 لتحقيق الهدف 2	يقوم الطلاب بحل التمارين فرديا في الكتاب المدرسي ثم يقومون بمشاركة هذه الحلول مع زملاؤهم وتصحيح الخطأ مع المعلم. ✓ $5.75g + 2.75f$	ملاحظة المعلم. الحل من الكتاب المشاركة الصفية	5 دقائق
	يقوم المعلم بعرض تمارين متنوعة من (تدرب وحل مسائل) صفحة 113 حيث يقوم الطلاب بحل السؤال الآتي: 1. السؤال رقم 17 صفحة 11 لتحقيق الهدف 1 التربية القيمية: يشير المعلم الي قيمة الانضباط ومدي أهميتها في تنفيذ خطوات الحل.	يقوم الطلاب بحل التمارين فرديا في الكتاب المدرسي ثم يقومون بمشاركة هذه الحلول مع زملاؤهم وتصحيح الخطأ مع المعلم. ✓ A	ملاحظة المعلم. الحل من الكتاب المشاركة الصفية	5 دقائق

الغلق الختامي	من خلال الأسئلة السريعة ومناقشة طلاب الفصل جميعاً فيما درسوه في موضوع المعدلات ومعدلات الوحدة. 10يعرض المعلم ملخص المفهوم صفحة	5 دقائق
التعينات	من الكتاب المدرسي.11 ص ,14 10حل تمارين من: تدرب رقم	

المعايير المهنية للمعلمين

.الطلبة وتحصيل أداء لتطوير 1.التخطيط☒
كمتعلمين. وتطويرهم التعلم عملية في الطلبة 2.إشراك☒
للتحدي. ومثيرة وداعمة آمنة تعلم بيئة 3. توفير ☒
.الأداء لتحسين التقييم بيانات واستخدام الطلاب تعلم تقييم 4.☒