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Analysis of students' perception of good mathematics teachers and teaching using informal conversations from Twitter and Quora

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Dedication

This research study is the result of hard fought effort to acquire this valuable, cherishable and veritable qualification. For this reason and many others, I am ever thankful to the Lord Almighty; who granted me his grace and protection so that I could triumphantly complete my studies.

I will not forget my loving and caring aunty Eunice M Ngulube and my cousin Clara Ngulube, who have shown me love and the value of perseverance, determination and hard work even in the midst of the greatest adversity. Their words and deeds have become my guiding example in life. For them I pray that the Almighty God grant them his peace, grace and blessings

Finally; last but not least, I dedicate this thesis to all those of my teachers who built my academic confidence especially my grade 12 mathematics teacher Mr Mwewa, my Lecturer and mentor Prof. Patrick Azere Phiri who enabled me to see the dawn of the powerful subject called mathematics now lying at my feet, and am so anxious for students to learn it and come to value it as I have also done.

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Resumen

El uso creciente de las redes sociales en los últimos años ha abierto la posibilidad de utilizar datos de redes sociales como Twitter y el foro de discusión en línea de preguntas y respuestas Quora con fines de investigación educativa. Mientras que otras disciplinas, especialmente en Ciencias de la Salud, han utilizado con éxito los datos de las redes sociales para obtener valiosos resultados, la pregunta sigue siendo si Twitter y Quora pueden proporcionar resultados también relevantes para la investigación educativa en matemáticas, especialmente en términos de las perspectivas de los estudiantes con respecto a la buena docencia en matemáticas y a los buenos docentes de matemáticas. El objetivo de este estudio de investigación fue el de analizar la comprensión, los pensamientos, los sentimientos y las opiniones de los estudiantes sobre lo que significa ser un buen profesor de matemáticas y lo que es una buena docencia en matemáticas. Este estudio de investigación utilizó datos ya disponibles de dos plataformas sociales: Twitter y Quora. Los resultados muestran que los docentes de matemáticas son considerados buenos docentes cuando motivan, se preocupan por los estudiantes, tienen una buena comprensión de la disciplina y muestran pasión por la enseñanza y por sus estudiantes, apoyándolos y alentándolos.

ABSTRACT

The growing use of the social media in recent years has opened up the possibility of using social media data like Twitter and Q&S online discussion forum Quora for educational research purposes. While other disciplines -specially in health sciences- have used social media data successfully in obtaining valuable results the question still remains as to whether Twitter and Quora can provide significant results even for mathematics educational research, especially in terms of the perspectives of students with regard to good mathematics teachers and teaching. The objective of this research study was to analyse students' understanding, thoughts, feelings and opinions about good mathematics teacher and teaching. This research study used two distinct already available data from social media platforms: Twitter and Quora. According to this research study, mathematics teachers are regarded as good when he or she is a good motivator who cares and concern about students, has good sound of mathematics and passionate about teaching and their students, being supportive and encouraging.

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List of Abbreviation

AAMT: Australian association of mathematics standards

CVA: Carrabassett Valley Academy

HFBT: Hoffman Boston (HFBT) elementary school

Q&S: Question and Answer

1. Introduction

1.1 Background of the Study

Teachers have an ability to have an enormous impact on the lives of their students. But it is good teachers that spark inspiration, confidence, beliefs and values that last a lifetime in their student's life beyond the classroom (Bain, 2004). Clearly, the role that parents have in teaching their children in life is massive but we cannot disregard the fact that students spend half of their lives in schools. In Spain just like in many other countries, by the time children are 3 years old they would have already started and they do most of their interactions in the classroom walls. The present generation of students learn about the world through the interactions and socialisations with people they meet in schools and on social media. Within the educational contexts, students learn from friends by engaging in informal conversations in the playgrounds, at home, social media etc. Informal conversations are exchange of views, attitudes, observations, opinions, or ideas through face to face, electronic mails, text messages and phone calls between socializing people. With the birth of technology, there have been online tools supporting new ways in which conversations are formed and new ways in which people can connect with each other.

It is apparent that teachers are significant influential people in the lives of students. For example, people like legendary talk show host Oprah Winfrey, Bill Gates, poet Maya Angelou and 42nd president of the united states of America Bill Clinton to mention a few all give credit to their teachers for cultivating their self-confidence, passion, hard work and talent, allowing them to lead successful lives. Teaching is a profession that creates other professions: doctors, artists, philosophers, engineers etc. Behind every profession is a teacher; for this reason, teaching is an important and significant job in the entire world. Because of the teachers valuable role in society, there are so many organisations

recognizing the work of teachers, for example the Global Teacher Prize, also referred to as the Nobel Prize for teaching recognises the work of teachers all over the world. Their objective which is to support the teaching profession and quality of education by awarding teachers who have impact on the children, schools and community. Their website reveals that a best teacher is one that 1) employs effective instructional strategies that influence and improve the quality of education. 2) uses innovative strategies to address challenges of a school, community and country 3) achieves the learning outcomes of his class and improve the teaching process by raising its bar 4) impacts his community beyond the classroom and 5) help students become global citizens of the world who are informed socially and economically and equip them for the world where they would live, work and socialise with people from different cultures and religions. Maarit Rossi and Colin Hegarty are mathematics teachers who were recognized as among the 10 best teachers of the world, Colin Hegarty from the United Kingdom teaches students ages 11-18 and he believes that no child is bad at mathematics as they just need the right support. While Maarit Rossi from Finland who also teaches mathematics by incorporating fun activities and enabling students see the relevance of it in their lives, these teachers are innovative who employ effective instructional strategies that influence and improve the quality of education globally. There is a substantial amount of research regarding the calibre of a good teacher. Students are the most significant people who are close to the teachers because they spent most of the times with them. Therefore, it is important that views and opinions of students representing different backgrounds and culturally diverse are considered. Although the context of this research study is mathematics teachers and teaching, it also contributes to a broader discussion of teachers in different subjects and disciplines. Defining a good mathematics teacher can sometimes be difficult. At hand, many researchers have made attempts to describe good mathematics teachers and teaching. According to Ball et al (2008) a mathematics teacher needs to know the mathematics content and processes for teaching mathematics. Their concept was based on Shulman's model of Pedagogical Content knowledge (PCK). However, the

way students and teachers can define good teaching can clearly differ depending on the culture and subject discipline (Young, 2009). One man's meat is another man's poison. This is true when it comes to teaching and learning, what may be considered good mathematics teaching by some students others might not. Nevertheless, there should still be a key aspect of good mathematics teacher and teaching. The focus of this research question is, to gain students understanding of a good mathematics teacher and teaching dependent on grade level, country, cultural background and student level information. The conclusion is that students are the main beneficiaries and their views are significant. I realize that with questions like depends exactly on how and whom you ask. The more information that can be gathered about teachers and teaching the more informed changes will be made to improve the quality of teaching. These will be beneficial to both the students and teachers as well as the educational system. There are several ways and sources of information can be gathered about the teachers. Social media has become a crucial part of human life in today's era. People can now easily find answers to questions they are curious about via the internet. The easy-peasy and free environment that twitter and Quora provides is what attracted the researcher to regard social media data as significant platform for exploring the topic. On both twitter and Quora questions on any topic are asked and responses are obtained. The members of the forums are a combination of students, teachers, educators, researchers and parents. Every day, people ask thousands of different types of questions on these sites and get answers relevant to their question of interest. The frequent use of online forum sites by students has led to the selection of twitter and Quora as data source for this research study.

1.2 Problem Statement

The methods of data collection have been generally self-reporting through surveys, interviews, questionnaires, observations and opinions, views and beliefs about good mathematics teaching and teachers (Grootenboer & Ingram, 2015). If beliefs, views, and opinions values of students on good mathematics teachers and teaching are to move to more informal environments then this would be significant contribution to research in mathematics education. Twitter and Quora are free environments where users are free to express their opinions, they are flexible, operating uninterrupted with unlimited number of content providers. It captures content from everyone regardless of grade level, field of study, culture, race and country of origin. Additionally, evidence in existing literature shows that twitter and Quora has an enormous and substantial source of information (Le, Dobele & Robinson, 2018; Wang et al, 2013), and as such this is an area especially in mathematics education that needs attention and consideration. This research study explores student's perspectives of good mathematics teachers and teaching using informal conversations on twitter and online discussion forum Quora.

1.3 Research Objectives

To explore already existing informal conversations by students on online discussion forums. However, previous research studies have made use of traditional methods like qualitative, quantitative and mixed methodologies. This research study offers in-depth insights and understanding of student's opinions, views and experiences with regard on how they perceive good teachers and teaching. The following objectives guided the research study.

- a) To explore students' perspectives of good mathematics teacher and teaching using informal conversations on Twitter
- b) To explore students' perspectives of good mathematics teacher and teaching using informal conversations on Quora.

1.4 Research Questions

The primary focus of this research study was to examine student's perspectives of good mathematics teachers and teaching using informal conversations on twitter and Quora. This study was guided by the following research questions.

- a) How do students perceive a good mathematics teacher and teaching through informal conversations on twitter?
- b) How do students perceive a good mathematics teacher and teaching through informal conversations on Quora?

1.5 Definition of Terms

Informal conversations- In this research study an informal conversation is a causal form of communication where information is exchanged spontaneously between two or more persons on twitter and Quora without conforming to prescribed official rules and processes.

Student-A student in this study is primarily a person enrolled in university or educational institution and attends classes in a course to attain the appropriate level of mastery of a subject under the guidance of an instructor.

Hashtag- A hashtag is a keyword or phrase or topic used on social networks such as Twitter. It has the symbol # in front of it. It makes it possible for others to easily find messages with a specific

content. The hashtag may contain letters, digits, and underscores. For example, on twitter, the hashtag #goodmathteacher allows users to find all the posts that have been tagged using that hashtag.

Tweet -Tweet is a message or text posted on Twitter with 280 or fewer characters

Retweet -A retweet means a tweet that had been forwarded or "resent" on Twitter by someone, but was originally written and sent by someone else. To retweet means to send someone else's tweet to your followers and it reflects the popularity of individual tweets.

@username- The @ sign is used to refer to individuals on Twitter. It is combined with a username and inserted into tweets to refer to that person.

1.5 Scope of Study

The main goal of this research study was to explore student's perspectives on good mathematics teachers and engaged in informal conversations on twitter and online discussion forum Quora. Data was collected from Quora and Twitter. The data on twitter was collected on the 3rd and 4th week of June, 2009. The data is restricted only tweets of students engaged in informal conversations on both twitter and Quora.

1.6 Research Purpose

The purpose of this research study was to explore student's perspectives of good mathematics teachers and teaching through informal conversations on twitter and Quora. This research study used already existing informal conversations on Twitter and Quora which contributed to the methodological perspectives on the previous studies commonly used traditional based approaches when collecting data using interviews, questionnaires etc. Generally, this research study add knowledge to the evolution of methodologies that have been used in the past in exploring students perspectives on "good mathematics teachers and teaching" These perceptions of students are regarded as a result of personal experience

from their school years but at the same time the researcher is attempting to capture students diverse views on this important topic regardless of their geographical areas, grade levels, educational system and cultural backgrounds. It is hoped that the results will be of practical value in teacher training in helping educators to ensure that all future teachers have not only cognitive but also affective skills and tools for creating a safe class environment for students of all types regardless of their culture and diversity of students. It is also hoped that teachers, educators will not only consider as a platform for learning or enhancing learning but also a significant platform which can be used for students voices with regard to improving the quality of learning and also be seen as a new of developing methodological strategies for improving the educational system. Finally, it is hoped that the results will be of practical value in mathematics learning and learning in general in other subjects as well.

1.7 Theoretical Framework and Literature Review

1.7.1 Theoretical Research Background

It has been over decades since the actualisation of interest on mathematics teacher and teaching. From Shulman's pedagogical knowledge for teachers in the mid-1980s to Ball's and colleagues model for pedagogical knowledge for mathematics teachers and teaching. There have been significant research focusing on good, excellent, effective teachers and its impact on learning (Haider & Jalal, 2018; Kaur, 2009; Leong, 2012; Sierra, 2012). Different instruments and methodologies have been administered to close this gap that is of serious concern in the education system. A teacher is one of the vital elements in teaching, however it is good, effective and excellent teachers with competences that transform the educational system and lives of the students (Romero, 2015). Their significant roles in education have led to enormous research being carried out. Attention for this research study is being focused from the beginning that is mathematical pedagogical knowledge by Ball, Thames & Phelps (2008), a model for teachers' mathematical knowledge for teaching, which is based on a Shulman's

theoretical framework. Shulman (1987) model involved seven categories of knowledge that supports good teaching: (1) content knowledge (2) general pedagogical knowledge; (3) curriculum knowledge; (4) pedagogical content knowledge (PCK); (5) knowledge of learners and their characteristics; (6) knowledge of education contexts; and (7) knowledge of educational ends, purposes and values. The categories of knowledge described by Shulman have played important roles in developing research models and are still relevant up to date. For example, Ball and others developed the model of mathematical knowledge for teaching (MKT) which had six main categories. 1. Common content knowledge (CCK): the mathematical knowledge teachers are responsible for developing in students. 2. Specialized content knowledge (SCK): the mathematical knowledge that is used in teaching, but not directly taught to students. 3. Knowledge at the mathematical horizon: understanding the broader set of mathematical ideas to which a particular idea connects. 4. Knowledge of content and students (KCS): the amalgamated knowledge that teachers possess about how students learn content. 5. Knowledge of content and teaching (KCT): the design of instruction, including how to choose examples and representations, and how to guide student discussions toward accurate mathematical ideas. 6. Knowledge of curriculum: ways to sequence and structure the development of a mathematical topic.

Ball et al (2008) models of mathematical content knowledge is the focuses on the knowledge needed by mathematics teachers to teach effectively. According to Ball, Thames and Phelps (2008) “teaching,” is everything that teachers must do to support the learning of their students. Clearly the interactive work of teaching lessons in classrooms and all the tasks that arise in the course of that work. But it also means planning for those lessons, evaluating students’ work, writing and grading assessments. Ball and others focus on the work of teaching and its knowledge and processes. Obviously, teachers need to know the content they teach and that students are expected to master. Our question is how students perceive the definition of a good mathematics teacher and teaching. Considering mathematical content knowledge that teachers should have when teaching mathematics

adds more value when it comes to understanding student's perspectives of what they think of good mathematics teachers and teaching. This however, not only adds knowledge to this area of research but also bridges the gap by understanding student's beliefs, thoughts, feelings and understanding by considering informal conversations from social media like twitter and Quora.

This research study has no research model but the findings of this research study will be based on already existing theoretical frameworks. These frameworks are now providing a way of moving from traditional approach of teaching (teacher-centered) to a more student-centered approach. As mentioned before, rapid increase of technology is rapidly influencing the way in which content should be taught. This study will be informed by the framework that allows and encourages excellent teaching and learning of mathematics. According to the Australian association of mathematics standards (AAMT Standards) (2006), standards for excellence teaching in mathematics are defined according to three domains: professional knowledge, personal attributes and professional practice. This research study adopts the AAMT framework to understand the student's perception of a good mathematics teacher through informal conversations on twitter, as much as there is enormous research informing current frameworks the gap still exists because none of these studies is using student's informal conversations to understand their perception of a good mathematics teacher and teaching. Mathematics teachers need to have competences to understand and become aware of the mathematical processes and norms that support the learning of students. An implication of AAMT framework is a much needed model of teachers to effectively teach mathematics to develop competencies that enable them carry out pedagogical scrutiny of their own practice, which takes into account of the different domains identified in AATM model.

1.7.2 Background on the AAMT Framework

This research study contributes to the growing body of research describing previous work in teaching. The concept being explored in this research study is student's perception of good mathematics teachers and teaching using students informal conversations on twitter. This research study adopts AAMT standards for excellence teaching. AAMT is an initiative in Australia which involves the development domains with a set of standards for teaching mathematics in Australian schools recognized. The development of the Standards for Excellence in Teaching Mathematics in Australian Schools (AAMT, 2002) recognized within a national and international context. First, the framework has three domains (1) Professional knowledge: Knowledge of students, knowledge of students learning of mathematics and Professional attributes. (2) Personal attributes, personal professional development and community responsibility (3) professional practice: the learning environment, planning for learning, teaching in action and assessment. The AAMT is used as a basis for identifying highly accomplished teachers for teaching mathematics. The AAMT attempted to establish guidelines for teaching as a standard language about high quality teaching in the Australian learning context. The AAMT Standards for excellent teaching motivates diversity rather than advantaging a particular style of teaching. Teachers having attributes that allow students to engage in learning and become spontaneous, self-directed learners who enjoy mathematics. This research study adopts the AATM model because this frameworks possess a breadth related to the quality of good, effective or excellent teachers and teaching that are related to both cognitive and affective attributes professional. The relationship between these is how the teacher presents content that demonstrate both affective and cognitive attributes.

After analysis of range of views from significant number of previous research, personal attributes that student's holds about learning particularly in relation mathematics education are aspects of the affective domain: beliefs, attitudes, emotions. These are likely to change depending on the teachers and

teaching. It is very important that teachers understand students beliefs about them when it comes to teaching of mathematics, because students attitudes and beliefs students hold about mathematic will have an influence on the way they learn (McDonough & Sullivan, 2014). Most studies have shown that students self-belief or confidence, positive attitude are the determining factors of the students' to achieve academically. (Tigelaar et al, 2004) emphasized that teaching should be student-centered in which students are seen as active and self-regulating learner who creates their own learning experiences in a way that is meaningful. Teaching is drifting from the traditional approaches centered on the teacher. In this modern society constructivist way of teaching is very significant in mathematics education. A framework is needed which is adapted to current learning needed for today's society. A teachers and teaching competences are known to be integration of personal attributes, knowledge, skills, and attitudes in the teaching of mathematics. Common attributes in most of the frameworks discussed above are if teachers are to be regarded as good, excellent and effective if teachers have competences in pedagogical content knowledge. Nevertheless a mathematics teacher is regarded as good, excellent and effective it should contain a domain with aspects of a teacher's personality that are conducive to being a good teacher. A framework used should the one that is adapted to modern approaches to teaching. This research study adopted the AAMT (2006) framework on standards for excellence teaching, allowing this research study to adopt it as a framework.

1.7.3 Good Mathematics Teaching

Teaching can be sometimes be seen as a complex and dynamic process. For students with diverse background and experiences, learning is different. The teacher is in a better position to assess these differences. However it is good teachers that are able to access these differences. In teaching one-size-fits-all does not apply. A study carried out in Australia by Attard (2009) upper primary students considered a good mathematics teacher as someone with attributes such as passionate, fun, caring,

loving and knew their content very well. Similarly Martinez-Sierra (2013) carried out a study on Mexican high school students to understand their perspectives on good mathematics teaching. In this study the students consider a good teacher to be someone with knowledge and who knows how to transmit the knowledge; someone who provides a step-by-step explanation and does not leave doubts in the minds of the students; someone who is patient/comprehensive and someone who does not make classes tedious/boring; someone who teaches in a simple and fun way, and arouses interest in students. Similar findings have been reflected in research by (Kaur, 2009; Kutnick, 1993; Leong, 2012) who agree that a good mathematics teacher should know how to teach mathematics, have good teacher–student relationship, loving and caring. The students assessed a good mathematics teacher as someone who not only explains mathematics well, but also takes into account the positive teacher-student relationship. They also expressed that they learn better when the mathematics teacher teaches mathematics by relating it to real life. In a study by (Yesildere-Imre, 2017) Mathematics teachers defined a good mathematics teacher in terms of knowledge of mathematics, knowledge of mathematics teaching methods, and affective features. So far, the few research studies (Kutnick, 1993; Kaur, 2009; Leong, 2012; Martinez-Sierra, 2012; Haig and Sexton, 2013; Attard, 2009) that have been done to date have focused on the qualities of the good mathematics teacher and their characteristics based on both students and teachers perspectives conducted in upper, middle schools, colleges and universities. While these studies provides this research study general features of good mathematics teachers and teaching but there is need for other perspectives from different environments to be understood. A free unstructured environment like twitter and Quora will be able to provide an overview understanding to the already existing knowledge on the topic. Even when the topic is addressed from the perspectives of students, the main beneficiaries of the services provided by teachers, they will be able to provide understanding that is diverse representing different academic and cultural backgrounds, experiences, abilities and students grade and school levels which the previous researches have been lacking

Lee Shulman (1987) foundation on teaching has a major impact in this research culture. Shulman's version and inventiveness led to birth of many studies and through these studies teachers understood subject matter and underlying components of teaching including planning, assessment, evaluation, classroom goals and aims. The major traditional attribute mathematics teaching reflects is its significance of mathematical knowledge. Equivalently to teach effectively, it is believed that teachers needs to confidently, effectively know how to teach mathematics in order for students to be able to effectively and confidently use mathematics in their everyday demands of their daily lives.

Defining good teachers and teaching according to Kleinhenz and Lawrence (2007) needs to cater the differences in who teachers are teaching, subjects, levels of the students. The same also applies to who are assessing the performance of the teachers. For example, standards required for an early childhood teacher is different from that of a high school mathematics teacher or university lecturer. However having a framework like the AAMT standards for excellent teaching which has been adopted in the Australian schools and has proven to be successful.

For teaching to be good, it has to be effective, excellent and successful. Kleinhenz and Lawrence (2007) points out that Teaching can be good but not successful and vice versa. These concepts matter when it comes to the successful learning of students and when it comes to applying the AAMT for excellent teaching. However teachers can be regarded as good if the students succeed in learning. Equivalently for students to succeed in learning they also need to put in effort to learn and have a supportive environment and tools to enable them to learn. According to Kleinhenz and Lawrence (2007). If these conditions are met by the students, then good teaching becomes one of the factors related to the student's achievement. The teaching only becomes successful if good teaching exists and thus successful teaching is dependent on good teaching. Therefore in order for learning to be good, at least the conditions that the teacher has no control over needs to meet.

1.8 Literature Review

This chapter is a review of studies on the evolution of the topic historically, theoretically, geographically and methodologically. It highlights the overall view of the topic with the help of preliminary statistical analysis of literature and information on the topic. The sources reviewed in this section were obtained from books, journals, and institutional or organizational reports both print copy and on the internet. The review helped identify and explains the gaps for this study.

1.8.1 Analysis of Web of Science (WoS) Literature

Using web of science (WoS) 244 articles were obtained using the keyword “good mathematic\$ teacher\$” and teaching, 452 articles were obtained using the keywords “good mathematics teacher” and 16 articles were obtained using the keywords “student\$ perspective\$ good mathematic\$ teacher\$ and teaching”. A total of 712 articles were obtained but only 37 were relevant to this research study. Figure 1 shows the summary analysis of the classification of the top document types from WoS.

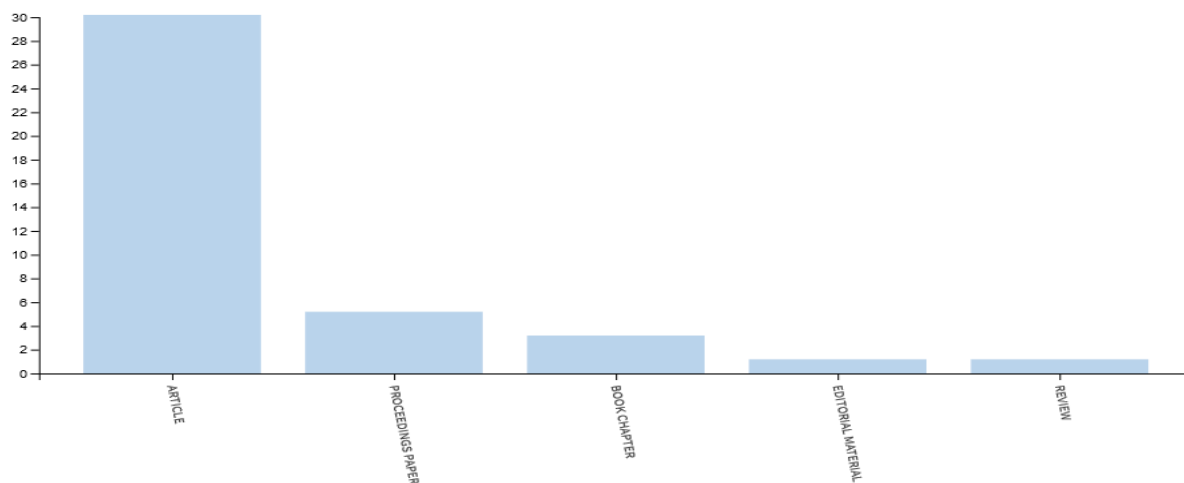


Figure 1. Bar graph showing summary information of document types from the WoS

1.8.2 Twitter and Quora as Source of Data in Educational Research

Using WoS a total of 429 articles were obtained using the keyword “Quora”, “twitter as source of data”, “social media as source of data” and “Quora as source of but only 84 were relevant to this research study. A summary of the 84 relevant research articles are seen in figure 2, and figure 3 showing the total number of articles published in each year.

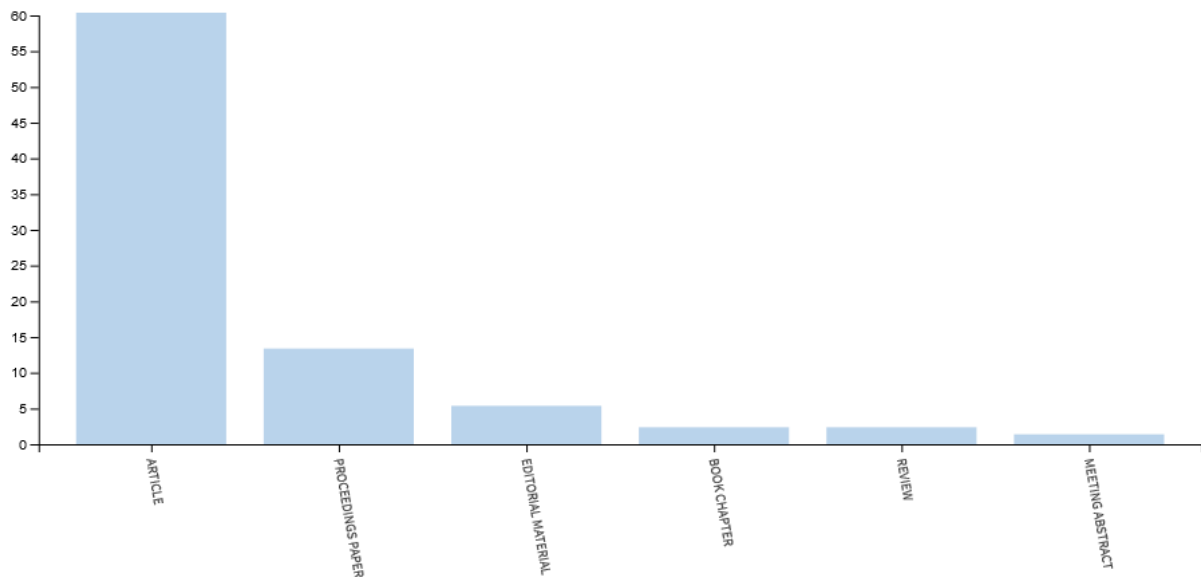


Figure 2. Bar graph summary information on the document types from the WOS

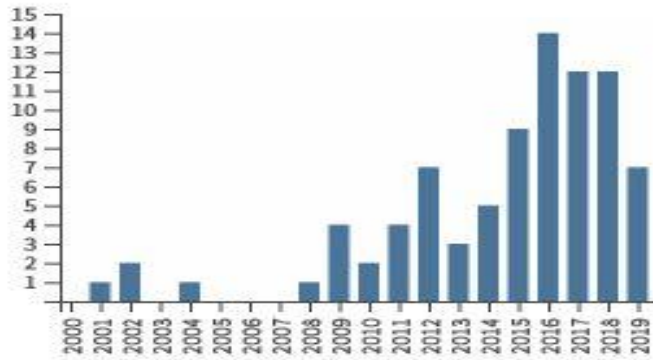


Figure 3. Bar graph showing total publications by year

The search in the WoS database found 84 articles published from 2000 to 2019. Figure 3 shows the growth in the number of publications in the WOS literature on the 84 relevant articles for this study. The highest number of publications was in 2016, with 15 records, followed by 2017 and 2018 with both 13 publications. The year 2016 has no records because twitter was launched in 2006 and Quora 2009. The years 2001, 2002 and 2004 have few articles because one of the searches included social media as a data source, those articles represent online educational forums, blogs etc whose analysis is relevant to this research study. The analysis of the number of publications on the topic during the time investigated showed that there is an increasing trend in the number of published articles, thus showing the growth of twitter and Quora being used as data sources and that they are current and relevant.

1.8.3 Twitter and Informal Conversations

Researchers studying informal conversations on twitter constantly raise the fact that they freely expressed allowing for deep and meaningful discussions among people. In a research setting define formal (e.g. traditional) conversations as “structured environments with a specified procedure” and informal conversations as “not following a specified procedure and not being restricted to certain environments”. Informal conversations by students on social networks can contribute to proving an

overview of student's thing about their learning environment allowing educators understand them.

Moreover, Bain (2004) suggested if you want to understand the students take them in an actual informal setting rather than in a formal one. Both Yavuz (2014) and Power (2013) research focus was on the informal conversations of teachers on twitter

1.8.4 Evolution of Research Methodologies on Good Mathematics Teachers and Teaching

The past approaches for getting students perspectives on “good mathematics teacher” have been the use of traditional methods, qualitative, quantitative and mixed methods approaches. Literature shows that the most common and frequently techniques for soliciting student views on how they would define a good mathematics teacher has been surveys and questionnaires (Hapsari, Putri & Raharjo, 2017; Scarboro, 2012), interviews (Attard, 2009; Murray, 2011), video records of teachers (Kaur, 2008), for example Murray (2011) conducted interviews on 90 students aged 10 and 11. The focus question was for the students to describe a really good mathematics teacher. In the similar vein Attard (2009) carried out a qualitative longitudinal study in the south of wales in England on year 6 students in their final year of primary school who were asked to provide their perspectives on mathematics teaching and learning through individual interviews and focus group discussions. The students were also asked to discuss their favourite mathematics lesson and the qualities of a good mathematics teacher. Similarly Scarboro (2012) study involved Istanbul students who were asked through a questionnaire to rank characteristics of teachers that made students successful in their learning. In another study carried by Raufelder et al (2015) employed thematic analysis to extract themes and subthemes from 8th and 9th grade secondary students interviews of their perception of good and bad teacher. Their study indicated that interpersonal dimensions where crucial when it came to their perception of a good teacher. In this study the interviews lasted between 20 and 30 minutes. At college level, Hapsari, Putri and Raharjo (2017) explored the students and lectures perspectives in determining the characteristics of good

mathematics lecturers through questionnaires and interview. The students were from the first level through the third level and some mathematics education lecturers of a private university in West Java. In addition, teacher's perspectives have also been considered, (Sullivan & Mousley 1994: Yang, 2012) conducted studies on the qualities of good teacher according to teachers perspectives.

A review of literature, however, indicates that the evidence base on the students and teachers perspectives on definition of a good mathematics teacher and teaching has many gaps with traditional methodologies. For instance, in a study conducted by Murray (2011), the interview question was for students to describe a really good mathematics teacher, however in this study students were also given an option of describing someone they imagined. Similarly, in a study conducted by Kaur (2008) strict requirement for participation in the study was that the teacher had to teach the way she/he did all the time, i.e. no special preparation was allowed. In the study by (Haig and Sexton, 2014) none of the teachers for the students were present during the time the students were been interviewed because of fear that the students might not be free to express themselves. The fact that the students are aware that they are been asked because of research affects their responses. It is important that the researcher obtains data that is rich in order to generate truthful and honest answers to the research question. One of the findings of (Sullivan & Mousley 1994) shows the lack of commonality of teacher's responses on what good mathematics teaching. Literature shows inconsistency when it comes to what constitutes good mathematics teacher and teaching. Yang (2012) points out that cultural differences are important when defining good mathematics teacher and teaching. This issue of inconsistency remains an aspect that has to be addressed. The methods of data collection used remain that of self-reporting through survey, focus groups, autobiographies, interviews and document analysis, with informal environment being largely absent. If investigations are to move to more free and social environment then it is important that informal conversations of students about the educational environment become an

integral part of research. There is good reason to believe that informal conversations from social media have potential impact than any of the traditional channels. This research study offers a more extensive overview by expanding on existing research findings. This research study approach is purposefully designed to offer a more desirable and effective understanding of students' perception of "good", "great" and "excellent" teachers than a traditional approach would allow. This research study uses student's informal conversations which provide well-rounded, which is rarely the case in educational research. The result of Raufelder et al study suggests that an in-depth and extensive understanding of when and why students perceive their teachers as "good" or "bad" is important for educational research. This research study provides a rigorous understanding of diverse student's perceptions and this will help teachers, educators and the education practice well to develop informed and insightful teacher profiles through the training programs. The primary purpose of this is to have a general diverse view about student's perspectives of a "good mathematics teacher" and "good mathematics teaching" and to contribute to the revolution of quality teaching of mathematics. Students do not have polished definitions of what it means to learn in a particular discipline (Bain, 2004). This research study embraces Bain ideology, that it becomes difficult to rely on the statistics alone to tell us whether students are learning and being helped by the teachers if we want to know if students think that something has helped and encouraged them to learn, what better way to find out than to ask them. Thus in order to have the reality of the picture is by not asking the teachers but observing the teachers or hearing from the students themselves. Previous researches have asked the students, observed them, interviewed them and similarly have done the same to the teachers. It is for this reason that the researcher looks at the conversations that students have with themselves and capitalize on the traditional methods that have already been used in the past studies. Therefore, this article argues that it is students, who spend much of their time with teachers, who are able to inform us about what makes a good mathematics teacher and teaching. The students' perspectives and environment sought in this

research study are important with the aim of understanding them. Therefore, this research study concentrates on informal conversations of students in public educational forums. By exploring Student's perspectives on an environment that they are free and express themselves freely on this matter gives the research study an honest and accurate insights of their perspective. Informal conversations capitalizes on all the traditional methods of data collection. The environment is free and comfortable and self-created and organized thus allows for an atmosphere that is rich, free and allows for richer understanding. According to (young, 2009) Thomas Guskey, the keynote speaker at the 2008 Phi Delta Kappa Summit. The focus of the summit was exploring the question " what makes great teachers" Guskey outlined that not all great teachers are alike because when she posted this question to the audience, there were all sorts of responses. Half of the audience selected teachers who were harsh, demanding, and authoritative as great teachers and the other half selected those who were nurturing, warm and endearing as great teachers. Research shows that according to student's teachers who are friendly, loving and caring are considered as good teachers. Researchers like Bain and Guskey point out the fact that the notion of defining "good", "best", "great" and "excellent" teachers is difficult to define because according to Guskey teachers can be identified as great in one setting and poor in another setting. For instance teachers who are effective in rural schools fail when they are put in urban schools and vice visa even when they are doing the things they did in their respective schools. According to young (2009), Guskey went on to say that the definition of a great teacher depends on where you are and the kind of students you are teaching and the kinds of communities they are teaching. He acknowledged the importance of listening to students' perspectives in a research context in over to get the overall understanding of the phenomenon.

Over the past two decades, student's perspectives were explored through traditional or rather conventional methods such as surveys and questionnaires, interviews and the analysis of diaries and

classroom observations (Lauritsalo, Saakslahti & Puttonen, 2015). Social media makes this possible, on social media there are students from different cultural backgrounds, school background, age and race. The numerous online discussion forums and twitter that make it possible for students to express themselves freely (Lauritsalo, Saakslahti & Puttonen, 2015). Just like in Saakslahti and Puttonen and research study, Quora and twitter will be used as data sources in exploring student's perspectives. It is through social media where new ideas are expressed and exchanged on issues and these provide rich perspectives in which traditional does not. With these comes with many benefits for researchers, social media now makes it easier for researchers to reach participants electronically, thus also social media has become an important platform to be used as a data source. The greatest advantage of using social media data is that online users freely express themselves naturally without been aware that they might be observed for research thereby avoiding the observer effect (Marín, 2017). All these reports and articles highlight the need for a using twitter and Quora as valuable research data sources.

1.8.4.1 Visual representation of previous studies on good mathematics teachers and teaching

There is a great number of studies that have taken interest on studying about teachers and what attributes or characteristics are needed to be regarded as good, great, best or excellent teachers. However what the previous studies lacked was using an environment like Twitter and Quora as means of data sources. Figure 4 shows a visual analysis representation of previous studies on the topic good mathematics teachers and teaching with VOSviewer being for analysis

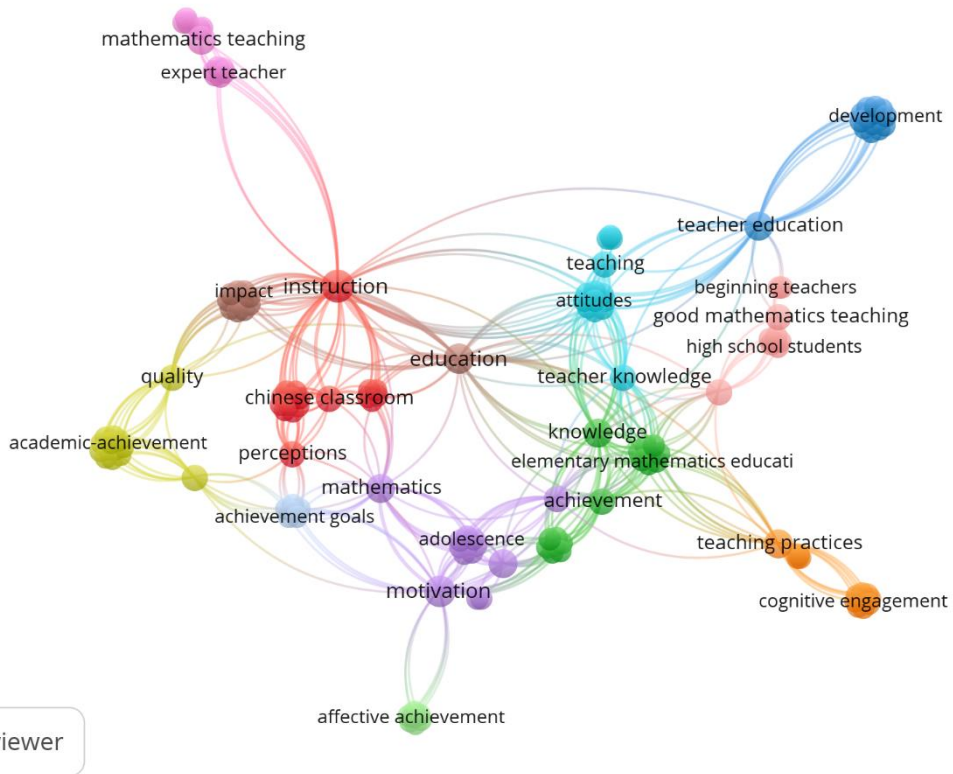


Figure 4. Visualisation map based on 12 clusters of 152 items

Figure 4 shows an analysis of co-occurrences and 213 all keywords from 37 research articles with link strength of 929 on good mathematics teachers and teaching relevant to this research study. The clusters can easily be recognized as meaningful, because they show relationship with each other. The clusters in red shows good mathematics teachers being related to instruction, perception and Chinese instructions and these have strong relationship with expert teacher and mathematics teaching. A lot of research has been conducted on the teachers because of the successfulness of students in mathematics. The clusters in blue, green, orange and purple indicate variables in which good mathematics teachers and teaching has been researched with.

1.8.5 Use of social media as data source

Schools are established for the idea of imparting knowledge on their pupils, shaping and developing them to be responsible human beings in society. One way of achieving this is making sure that students are able to communicate effectively. With the advancements in technology, teachers are now finding ways of incorporating technology in their curriculum regardless the discipline. Society demands people who are technologically literate. In today's society technology is unavoidable. It has become part of our lives. Whether it is talking, communicating, socializing, working or playing technology is part of it. Furthermore, technology has continued to play an important role in education, medicine, research, engineering etc. However, the growth in technology has also resulted interest by research scholars. Researchers are now incorporated new ways of collecting data, social media like twitter, Facebook, LinkedIn, YouTube are now being used as a data sources. The point is that there is need to keep up with technology as teachers, educators and research scholars. Twitter, youtube, educational forums, Facebook all have been incorporated into learning. Conversely, research also shows that students use social media more for socializing than anything else. Thus from review of the literature, it has been established that Students of this era are increasingly relying on the Internet as a means for Communication and building and maintaining relationships. People have social media tools at their fingertips. Mobile phones, laptops and these are widespread. From these platforms users easily share content in a quick and easy way. As of January 2019 according to Statista (2019), Twitter ranks 11th behind Facebook, Instagram, YouTube of being the most popular social media network worldwide with 326 billion active users. Data from such twitter environment can provide valuable information with so many users being students. Students now use social media platforms like twitter to share about their educational experiences. They share ideas, interact with other users and even express opinions, feelings, and concerns about the learning process. Sugiura, Wiles & Pope (2017) agrees with the

richness of social media data. The fact that it has created new opportunities and options for researchers to conducting research.

There are various different research areas that considered social media like twitter, educational forums, question and answer websites like Reddit and Quora as a data sources, Amongst the studies are those conducted in disciplines such as Health (Ahmed et al, 2009 ; Chen et al, 2018; Gillespie et al, 2016; Khan et al, 2018; Kronbergner & Wagner, 2012; Park & Conway, 2018; Shatz, 2017:), Engineering (Chen, Vorvoreanu & Madhavan, 2014; Patil & Kulkarni, 2016;Singh, 2016) and Education (Le, Dobele & Robinson, 2018; Lauritsalo, Saakslanti & Puttonen, 2015; Marshall et al, 2016; Powell, 2013;Yavuz, 2014). Relevant literature shows very few studies focused on informal conversations of students on twitter in mathematics education. The majority of researches are those conducted in health were social media data like twitter and online discussion forums were used as data sources forums on health related topics. With problems that students are experiencing in mathematics in terms of achievement, effective teaching and learning, learning difficulties, attitudes, beliefs. The lack of research demonstrates a gap in mathematics education regarding the value of using social media like Twitter and online discussion forums as a medium for data collection for educational purposes. Only articles by Yavuz (2014) and Powell (2013) in education focused on using Twitter to collect informal conversations as data for the research. These articles explored the informal conversations of teachers on twitter. In an investigation carried out by Yavuz (2014) who used twitter as a data source to explore Turkish twitter users writings about teachers. The study used the keyword teacher and Tweets that had the word teacher were collected and analysed. Similarly, Powell (2013) explored the teacher's online educational chats they had on twitter from a professional learning perspective. In earlier study by Le, Dobele and Robinson (2018), whose study was to use information that already existed on the online question and answer educational forums Quora, the focus of the research was to sought

information that was asked by prospect students during the university choice process. Only Lauritsalo, Saakslahti & Puttonen (2015) comes close to this study research, where in their used online discussion forums to explore student's perspective on physical education. More specifically, further research especially in mathematics education is needed to examine the depth of informal conversations taking place on twitter and online discussion forums among students irrespective of their geographical area, grade and age. The purpose of this research is to help fill the gaps in the research literature with respect to the use of Twitter and online discussion forums of student's informal conversations. The studies above have demonstrated how twitter has been a useful tool in exploring students learning experiences, how online internet forums have added value in getting perspectives of students and how twitter has played an important role in the professional development of teachers. The possibilities in education that could come as a result of making use of social media data are endless. Social media has provided the environment that is free and students find it comfortable which can aid valuable answers in the challenges students are experiencing in mathematics. Social media has not just proved to be a useful tool for communication and enhancing learning but has also proved to be a valuable research tool. Lauritsalo, Saakslahti & Puttonen, (2015) explored students informal conversations by using online educational forums as data source. Zulkefli & Baharudin (2014) conducted a study on Malaysian users to explore the sharing behaviour of travel information on social media. According to Zulkefli & Baharudin people use social media to catch up on many experiences because of the so many sharing on these social media sites. Hite et al (2018) examined students' affective and social experiences that were derived from blog posts published on the YouthMappers website. His conclusion was that information from social media provides authentic response that have explored been explored to a smaller extent. The findings from their paper was that student's social interactions had a positive impact on their emotional experiences enabling an authentic learning experience and building impactful social experiences. In another paper on a similar theme, Murzintcev and Cheng (2017) used social media data

to analyse the social impact of hazard processes and human behaviour in disaster situations.

Murzintcev & Cheng (2017) states that hashtags make it easy to find information as they attract more attention to a message and they connect you to the same topic messages, they increase the number of data sources and they are not just used on twitter.

Research scholars pointed out the need of social media being used as a valuable tool in educational research. There has been emerging evidence with regard to data collection with social media data but little to none research in mathematics education has been done on student's informal conversations with twitter and online discussion forums with regard to mathematics. This research study is a response to the lack of research of social media data in mathematics and mathematics education. Attention needs to be drawn on lack of studies in mathematics education on the use of social media data like twitter and online discussion forums to explore the informal conversations of students in order to improve the teaching and learning process.

1.8.5.1 Visual representation of previous studies on good mathematics teachers and teaching

There is a great number of studies that have used twitter as a data source, most studies have being carried out in health, marketing and elections studying the people voting behaviour based on tweets. However, even though twitter has been successful in other areas no studies have been carried out in studying student's perception of a good mathematics teacher and teaching. Figure 5 shows a visual analysis representation of previous studies conducted using twitter and Quora as a data source.

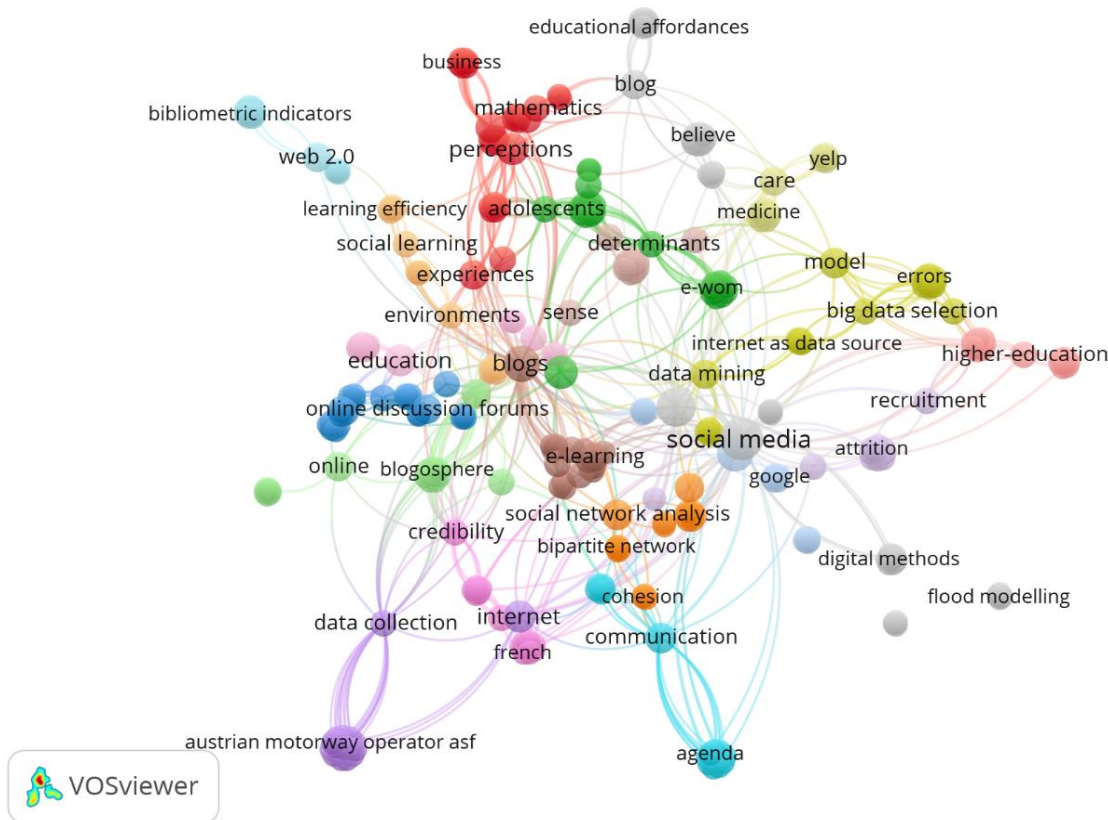


Figure 5. Visualization map based on 29 clusters with 359 items

Figure 5 shows co-occurrence and all keywords analysis of published articles on twitter and Quora being used as data sources. The map is visualization in which VOSviewer was used. The bigger the cluster and the thicker the line the more strength of co-occurrence between the words. As mentioned before, social media is largely used as data source, but twitter is among the mostly used type of social media as a data source as can be seen in figure 5. However areas like health, business, earthquake managements and politics are among the most disciplines that have used social media like twitter as a data source. Social media has been used in health to gain information about cancer patients, information on certain drugs, it has been used in political analysis to gain information about peoples voting behaviour and used in business, advertising, marketing, branding and to gain information on consumer buying behaviours. This information is reflected in the map in form of clusters or nodes. Most of these studies have been carried out in the United States, Australia, Canada and India. With this

in mind, this research study's approach of using twitter and online discussion will be of great importance as it provides much need in-depth understanding of students representing a diverse society and culture and from different countries.

1.2.2.6 Why online forums and twitter in mathematics education research

The richness of information on social media data has led to interest by researchers in using it as a source of data. Informal conversations among teachers on professional learning of teachers was explored by using twitter (Powell, 2013; Yavuz, 2014). Similarly, Kascak, Pupala & Mbugua (2015) conducted a study by using Facebook platform as a data source to capture experiences in which teachers dealt with the process of the 2013 national curriculum in Slovak Republic. In the a similar vein, Terlumun et al (2018) investigation of a mathematics YouTube channel and its academic effects on the viewers. In the similar vein Gillespie (2016), used forums to evaluate nursing students personal reflections, the study focused on understanding the experiences of the college nursing students that they shared on the forums. This analysis of literature shows how valuable social media data has become among research scholars. However, this vast analysis of literature has also revealed that very few studies have been published regarding the use of twitter and online discussion forums as source of data especially in obtaining students perspectives in mathematics education. Informal conversations of students on social media platforms like online discussion forums and twitter allow students to engage in colloquial language, which shed more light into their educational experiences. Informal conversations enables students to express their opinions, feelings, and concerns about the learning process. Information from such unstructured environments provides valuable information about students learning practices. Mathematics has and is still proven to be a challenging subject for most students. For over two decades now, researchers are still trying to find ways to improving the teaching and learning of mathematics. In previous years, studies have been conducted to see exactly

what is leading to students of being unsuccessful in mathematics. It has been concluded from these studies that for students to be successful in the learning of mathematics there are so many factors that come into play. One major factor is the teacher (Haider & Jalal, 2018; Haig & Sexton, 2014; Kutnick & Jules, 1993; Sanders, 2010; Scarboro, 2012). The problem is still as fresh as it was 10years ago. It is for this reason that this research study tries to look at this situation using a different angle, this research study does not bash the traditional methods of collecting information but simply capitalises on the traditional methods. Instead of using traditional methods maybe research needs to move as technology is moving, what was new yesterday is old today, for this reason, this research study is proposing a new way of looking at the problem of mathematics education that has been faced for over two decades now. Who is a good teacher, this question can be effectively be answered by using an environment that students feel comfortable with. As Bain puts it, this questions depends on who, how and where you ask it. Informal conversations are free and without restrictions or conditions and provide insights into student's opinions. With such conversations on social media like twitter and online discussion forums students exchange information unofficially and are free to express their opinions with people they may have relations or not. The shortfall of studies investigating this issue in educational research on student's informal conversations taking place on educational forums and Twitter environment led to the exploration of this topic. Therefore, this research study fills the gap in literature by exploring informal conversations of students on social media. These conversations are happening in the school playgrounds, social media, school hall ways and school buses but little formal research exists. Perhaps the highest degree of interactions and socialisations happens in informal interactions (Sanders, 2010). Informal conversations are by choice and happen freely over the content because participants are not asked to follow a strict path or conditions. As a result participants enjoy the interactions and associations. In actual fact, most educational systems worldwide have resorted to informal learning because of the freedom to explore and the degree of knowledge to acquire and also the order in which

knowledge is gained are determined by the learner. Conversations on social media only requires willingness to join the conversations. Conversations are more relaxing as they are close to natural setting and people tend to join these forums and social media outlets that suits their individual needs. Aze et al (2014) Chen et al (2018) and Marshall et al (2016) regarded information from forums as rich. In all of these studies internet health forums were used as data sources to collect information exchanges of patients. Similarly, Bell (2006) study “Concerns and expectations of students participating in study abroad programs: Blogging to reveal the dynamic student voice” the study indicated that, using the internet as data source allowed the researcher to capture the in-the-moment student’s concerns, opinions and experiences. The process of using social media and as data source is lacking in educational research especially mathematics education but these in-the-moment conversations and free environments that social media provides an in depth to understanding of student’s views, opinions and perspectives. Gathering and collecting the information is easier in this era owing to the comprehensive social media tools and softwares that are available. It is hoped that the informal conversations on online discussion forum and twitter would bring more perspective to the topic and capture a rich source of conversations amongst students that this research study aims to capture.

1.2.2.7 Gaps in the literature review

Few studies in education have focused on the use of social media data as a data source. The few that have particularly looked at overall professional teacher development with the use of twitter, evaluation of teachers on the use of twitter and have not considered the student’s perspectives of teachers and teaching by use of twitter and online discussion forums. In this research study, the researcher examines the impact of social media data as a data source by exploring posts of students on their understanding of good mathematics teachers and teaching, this research study looks at written posts only. Although the use of twitter as a data source is quickly growing in other areas like health, business and political

analysis it is not quite at the same level as in mathematics education research. There are a variety of issues in mathematics education that can benefit from social media. The lack of studies exploring student perspectives evident in informal conversations taking place on platforms like Twitter has led to interest in conducting the present research study

2. Methodology

This chapter outlines the methodology that was used in this research study. It constitutes the research strategy, data description and procedure.

2.1 Research Strategy

This study used a qualitative research design. The qualitative research is used to gain understanding of the primary reasons, opinions, motivations and beliefs (Denzin and Lincoln, 2005), so a qualitative approach is regarded as suitable for this research study. Qualitative data collection methods range from unstructured or semi-structured techniques. Some common methods include focus groups (group discussions), individual interviews, and participation/observations. A qualitative research approach just like other methods has begun to make the shift to the digital world. A digital qualitative approach includes methods such as chat rooms, discussion boards, videoconference systems, and social networks. These methods may or may not need a mediator but they all lead the participants into giving the information that the researcher is looking for. All research methods, regardless of whether they are traditional or digital. With regard to social media either researchers can send invitations to users to participate or use already. However, it must be noted that with twitter the researcher does not get to pick their participants, rather, the participant (potentially unknowingly) chooses to be a part of the study. Even though twitter does not provide information about the users except for the general statistics on the site but it allows for more flexibility since they do not require an invitation. More responses will be given from a more diverse group of participants, which could lead to a broader view of opinions and understanding. When conducting a Twitter study, it must be noted that the only indication on who the users are may be the general statistics on the site. This does not negate any research but the study must be conducted with this frame of reference. More responses will be given from a more diverse group of

participants, which could lead to a broader view of opinions. This could lead to a lack of focus, but will also help to formulate more targeted and accurate recommendations for further research. With twitter time no longer is an issue since content is going to be constantly generated by the users

2.2 Twitter data description

The articles authored by Twitter users of Turkey about teachers were collected using the automated whole matrix analysis of actor-topic networks on twitter by Hellen and Leydesdorff (2019). The approach involves mapping of co-occurrences of actors (participants) and topics (content). This approach is new and unconventional in terms of analysis of social media data. This novel approach was used to analyse Twitter informal conversations of keywords and then co-occurrences of Twitter-specific #hashtags and @usernames being the focal point of analysis. In order to extract data from twitter, a twitter account is needed. In this research study, the researchers twitter account was used and using twitter information to apply for the developer's app. The application form was filled in with the relevant credentials. After reading the Twitter Developer Agreement, the application was submitted. Once all the details were filled in and verified by twitter then the researcher was granted the customer and access keys which were then used in the R 2019 version 3.6.0 package to access the tweets on the 18th May, 2019. The R package comes with its own standard set of packages and also allows for undemanding download and installation for other packages if needed. Connecting twitter account to R, required tweets were extracted.

The data to be analysed consisted of 607 tweets about “good math teachers and teaching” on www.twitter.com. The tweets were collected during the month of June 2019. The twitter search API searches a sampling of recent tweets published in the past 7 days. Special attention was paid to locate the word ‘math teacher’ in selected tweets, of which were written by different users but after

debugging only 410 tweets were left for analysis. For the purpose of analysis, all the tweets, replies and retweets related to any aspect of good math teacher were included for the analysis, tweets having the hashtag goodmathteacher and tweets having the keywords good math teacher were pre-processed for the analysis. All tweets written in languages other than English were excluded. The swear words were removed and incomplete words were completed. Any tweets not related to written by educators, teachers and researchers other than students but had the keywords good math teacher and hashtags goodmathteacher were excluded from the analysis. Tweets linked to articles were also excluded.

2.3 Twitter Data Preparation in R

The tweets returned by the twitter API was not analysed immediately. Twitter search index has a 7 day limit, No tweets will be found for a date older than a week. The twitter API could only twitter a total of 607 tweets. The 607 tweets were converted to a CSV format for formatting process. Before data can be analysed, it has to be pre-processed. The Text data contains white spaces, punctuations, stop words etc. These characters do not give much information and are hard to process. The formatting procedure is described below.

Step 1-Create a data frame: data frame is a two dimensional data structure in R. A data frame is the most common way of storing data in R, and if used systematically makes data analysis easier. Each component form the column and contents of the component form the rows.

Step 2 – Convert text to lowercase: each word found in the text was be converted to lowercase so ensure that you don't get duplicate words due to variation in capitalization.

Step 3 – remove URL: Looking at the data above, it becomes clear that there is a lot of clean-up associated with social media data. First, there are Url's in your tweets. If you want to do a text analysis to figure out what words are most common in your tweets, the URL's won't be helpful. Let's remove those.

Step 4- Removing numbers and punctuations: numbers and all punctuations such as periods, commas etc were removed from your list of words

Step 5 - Removing stop words: Stop words are frequent words occurring in the data set that provide no meaning, words such as “a” “of”, “the”, “is”, “and”, “or”. The stop words were removed using the `tm_map` package in R.

Step 6 – Remove white space: We removed excessive whitespace such as newlines, double spaces and tabs.

After continuous reprocessing data both manually and using packages in R, 197 tweets were deleted out of the total of 607 because they provided no meaning in any context of this research study, the tweets were from users such as researchers, teachers and educators, advertisement. Therefore, were not included in the data analysis as the research was only interested in tweets from students

2.4 Preliminary Quora dataset collection procedure

Quora is being used for this data set because of its features, its public and you do not need to have an account to have access to the dataset. The question posted contains complete list of answers, user information and votes (up votes and shares) on each answer. In this research study the researcher was interested with questions on good mathematics teachers and teaching. The researcher took interest on the questions involving mathematics teachers and teaching. The answers are mostly from teachers, educators and researchers because the question tagged groups such as mathematics teachers, teaching mathematics and mathematics education. Before presenting analytical results of this research study, we begin by presenting some preliminary results from the second data source of this research study Quora Q&A online discussion forum. Below is a table showing a summary of questions on social Q&S site Quora on good mathematics teachers and teaching.

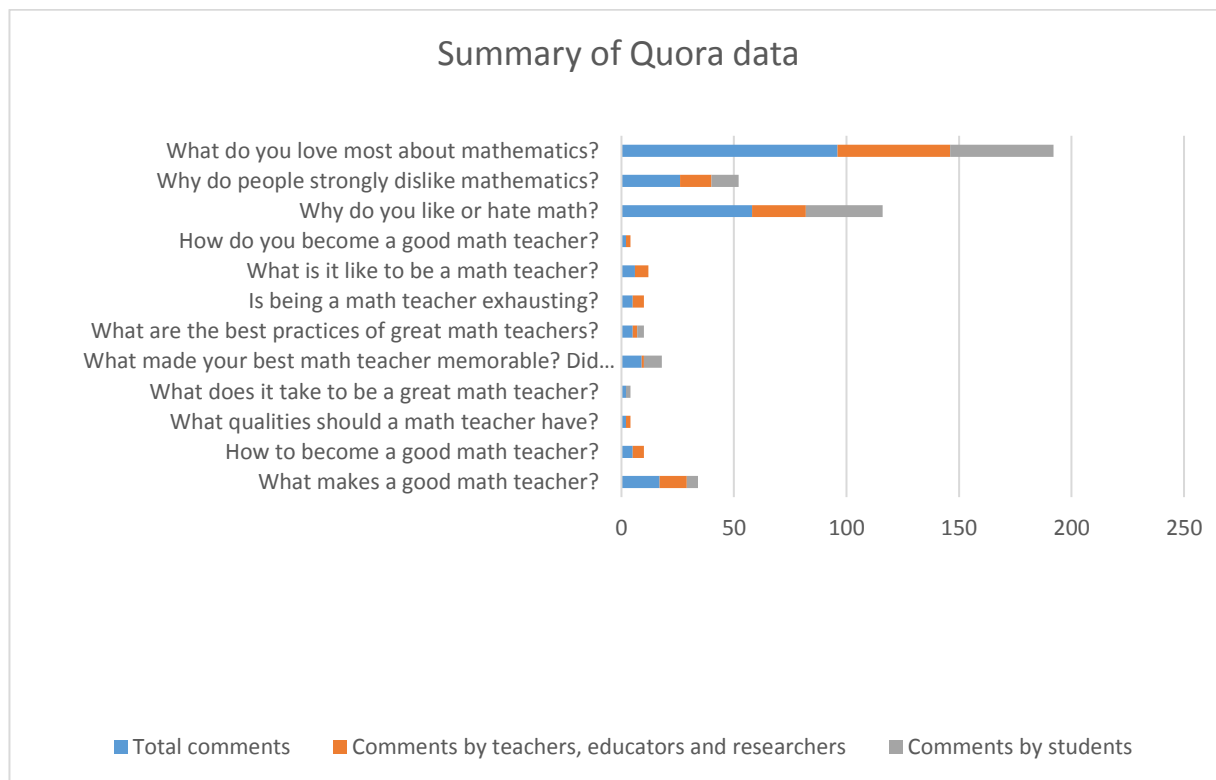


Figure 6. Bar graph showing summary Quora questions related to good mathematics teachers

Figure 6 already existing questions and their respective number of comments on Quora. The answers represent diversity as they represent answers from users with a diverse background in terms of grade level, country and field of study. The answers are those from teachers (retired and in-service), educators (lecturers, school principals etc), researchers, writers and authors. The students are those in grade school, degree, masters and post graduate studies students from India, United States, United Kingdom, Australia, Tanzania, Ghana etc. These students in universities are majoring in different fields such as mathematics, science, chemistry, physics, engineering, marketing, music, acting and computer science etc.

3. Results

3.1 Twitter Data Collection

Data analysis for this research study involved replicating the automated whole matrix analysis of actor-topic networks on twitter by Hellen and Leydesdorff (2019). The aim of this study was to analyse using Hellen and Leydesdorff method, the tweets of students during the first three month of June 2019. For this approach, a tweet can be considered as a unit of analysis to which both the addressed actors (@usernames) and topics (#hashtags) are assigned. For this research study the analysis was performed according to the basic procedure is based on arranging like data together according to definite themes, and then to interpret them by organizing them in such a way that readers can easily understand them. While performing research for this study, the analysis procedure was performed according to the process used in the study by Hellen and Leydesdorff (2019). Research data for this research study were collected using the twitter API and analysed using actor-topic networks analysis by Hellen and Leydesdorff. Tweets analysed were those with good math teacher and teaching obtained on the 5th and 13th of June, the tweets were examined by the researchers both manually and using R. The punctuation errors and curse words in the tweets were removed and corrected. The results were then analysed using semantic networks, social networks and socio-semantic networks.

3.2 Semantic Networks

A semantic network approach involves a visual analysis of concepts in relation to other concepts in the data set. The relationship of the concepts is determined by their relations to other concepts represented in terms of nodes with labelled links. In the case of this research study the concepts are the hashtags and usernames which represent a greater relationship.

3.3 Social Networks

A social network is a social framework constructed from a set of social actors. In the context of this research study the actors represents tweets from individuals with hashtags and usernames. The social networks shows the relationship between the actors represented in the dataset

3.4 Socio-Semantic Networks

The socio-semantic network shows visual representation of relevant concepts. The concepts in the actual data set showing strong relationship are shown in the socio-semantic network approach. It allows visual representation of the relevant keywords from the actual data set.

3.5 Findings from Twitter Data

We show the results of the semantic networks, social networks and the socio-semantic networks. Firstly, visualization based on the co-occurrence matrix of 15 hashtags used ≥ 2 times in 410 Twitter messages on “good math teacher” (Figure 7) shows two largest components contain 4 nodes each one. For visualization, VOSviewer was used for the layout and clustering. Node size represents the frequency of use of the word and line thickness the frequency of co-occurrence between the words. Figure 7 shows the main hashtags #ITEACHMATH (cluster 1 in green colour) and #KINDNESS, #GOBIGDOGS, #EXAMWEEK and #GOCVA (cluster 2 in red colour) located centrally in the network together.

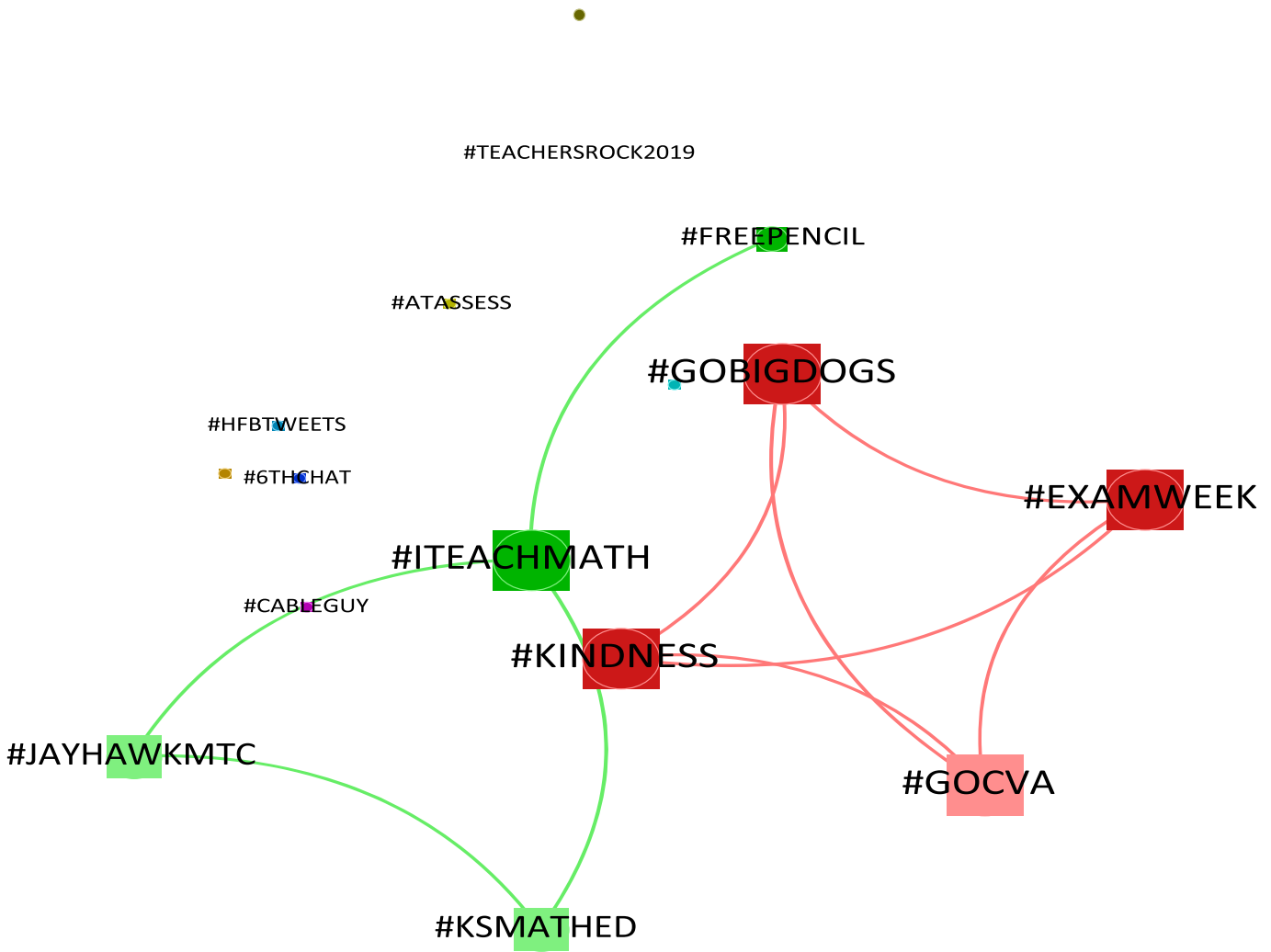


Figure 7. Semantic map (co-occurring hashtags)

In figure 8 co-occurring usernames is shown. Visualization is based on the co-occurrence matrix of 106 usernames used ≥ 2 times in 410 Twitter messages on “good math teacher”. For visualization, VOSviewer was used for the layout and clustering. Node size represents the frequency of use of the word and line thickness the frequency of co-occurrence between the usernames. Largest component (cluster 1 in red) contain 5 nodes (usernames) @cathmckenna, @ruthinvancouver, @pinetreesd43, @ronmckinnonlib, and @justintrudeau. The main addressed usernames were @amplify, @curriculummatrs and @melodyarabo. Moreover, @catherinehanaps, @herbinjessica, @hfbprincipal and @hfbpbis (Figure 8 in blue) form one of the main clusters. As it can be seen a greater diversity of actors has been addressed.

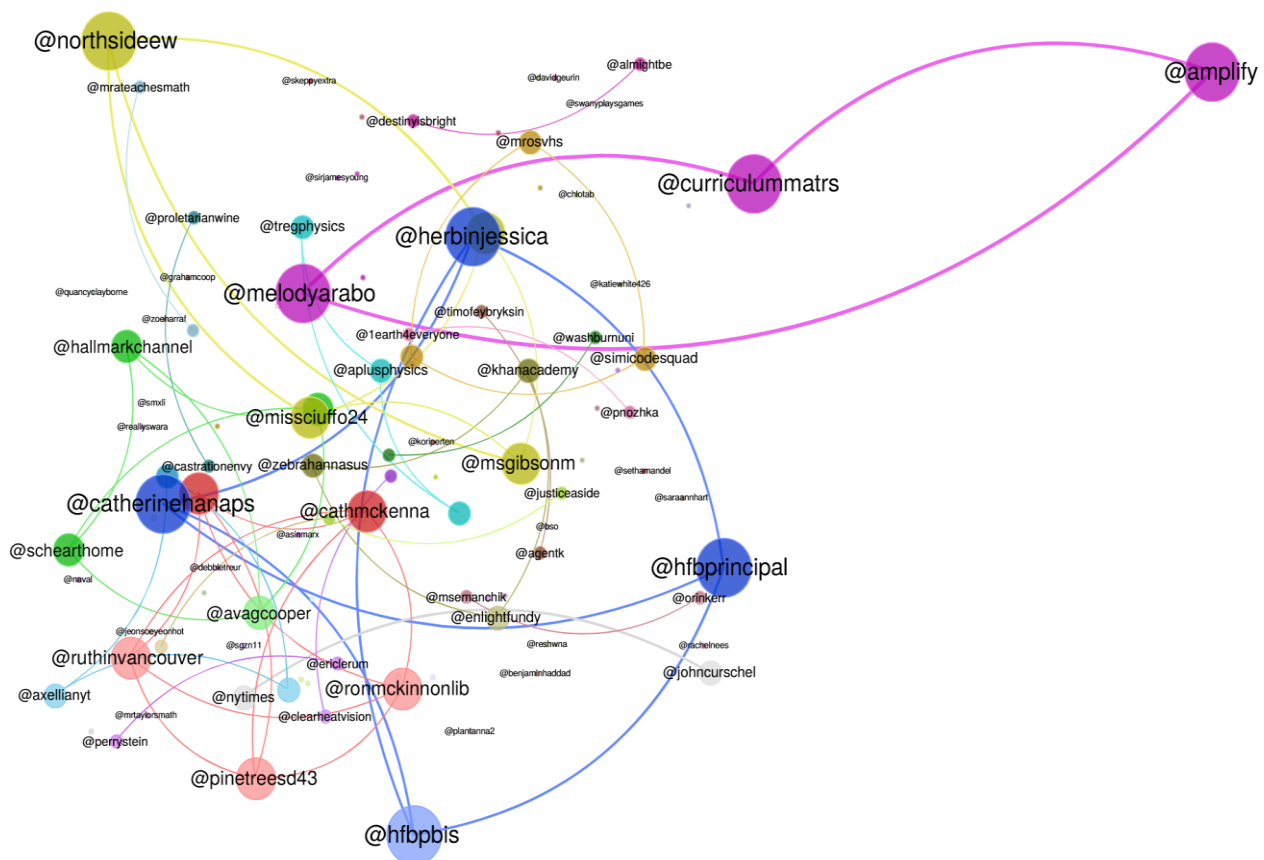


Figure 8. Social network (co-occurring usernames)

We also applied an automated network analysis to examine the co-occurrences of @ username (passive addressees) and #hashtag (topic) networks (Hellsten & Leydersdorff, 2017). Figure 9 shows co-occurring hashtags and usernames (socio-semantic network) with 10 hashtags and 37 addressed usernames (≤ 2) in the 410 Twitter messages on “good math teacher”. Figure 9 reveals the main hashtags #HFBTWEETS, #ITEACHMATH and #EWLEARNS as central for the network together with three addressees: @catherinehanaps, @herbinjessica and @hfbprincipal.

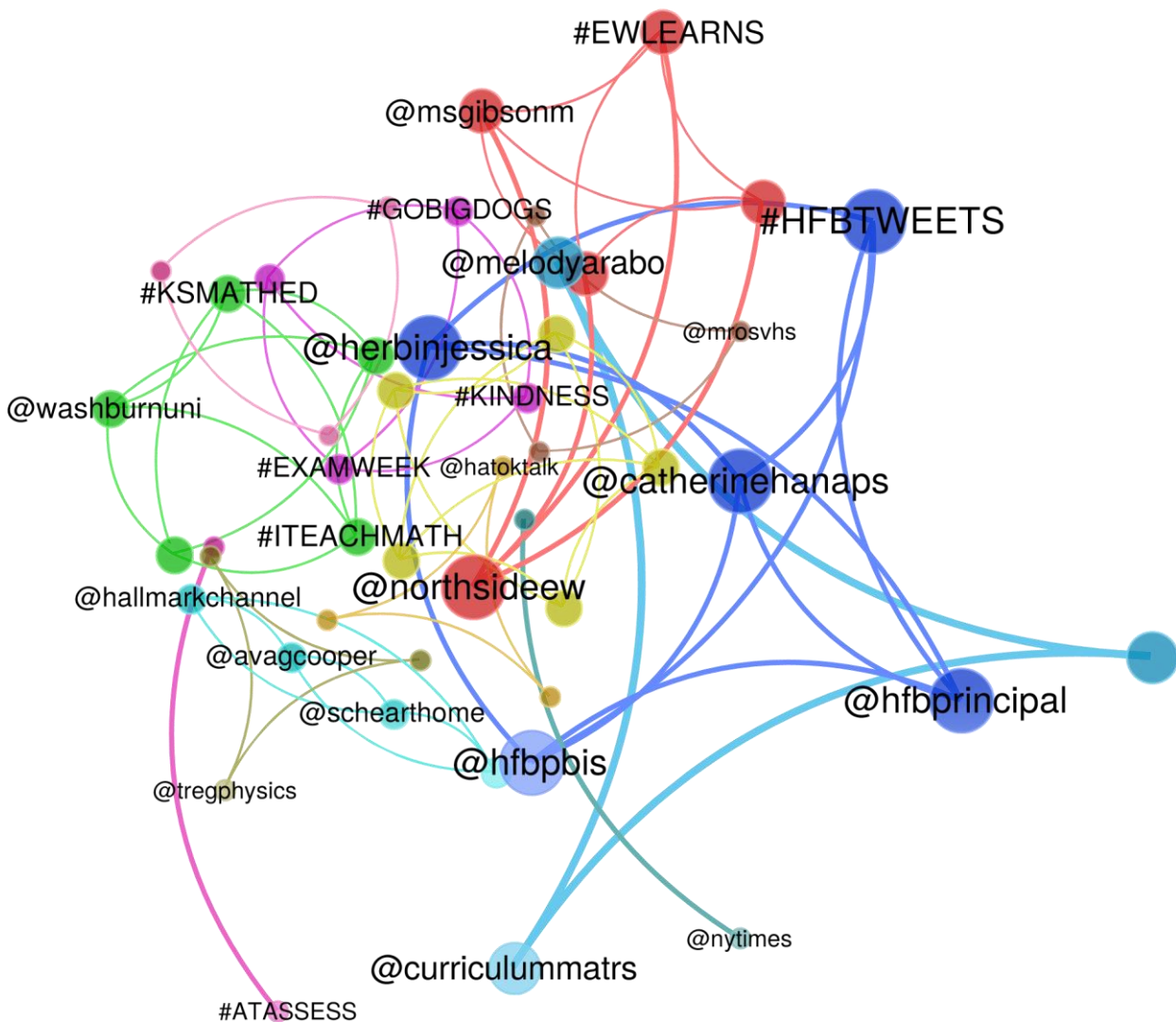


Figure 9. Socio-semantic network of co-occurring hashtags and usernames

3.6 Analysis of Findings

The hashtag #GOCVA #GOBIGDOGS #HFBTWEETS and usernames @hfbprincipal @hfbbis @catherinehanaps belonged to the largest clusters mainly because content attached to these hashtags and usernames are all from teachers, principals and students of Hoffman-Boston Elementary School. The school provides students with a real environment that encourages collaborative, critical thinking and problem solving skills. It focuses on enhancing communication skills, lifelong learning and embracing diverse learning respecting all students' background. Creating solutions for real life problems and teachers instilling in students to have respect, perseverance, integrity and building strong values, attitudes and characters to become responsible citizens. The activities that the teachers use at the Hoffman-Boston Elementary School are what defines good teaching according to informal conversations of students on twitter. The teaching activities used by the school involves good communication between teachers and learners, interaction among learners, teachers giving feedback and respecting diverse talents of students and ways of learning. The tweets posted by Hoffman-Boston Elementary School allowed conversations among teachers, educators and teachers. The tweets also had a lot of retweets of the above usernames and hashtags reflecting popularity in the tweets.

#ITEACHMATH

The hashtag #iteachmath is used by the educators and teachers, students and community that share ideas, opinions about teaching and learning on teaching in mathematics in 280 characters or less where everyone can join in the conversation. The hashtag #iteachmath was originally known #MTBoS (Math Twitterblogosphere) and later changed to #iteachmath (i teach math). #MTBoS community represented only the insignificant fraction of mathematics teachers thus the need to change the hashtag. By using

the hashtag #iteachmath helps the content of the hashtag to just go beyond the followers of the user using it but also people interested and using the hashtag.

"Find a pencil, pick it up! For a math teacher, it's good luck! #iteachmath #freepencil

"@iteachmath97 That's amazing!!!! I needed a good math teacher back then!!!"

#EXAMWEEK

The hashtags #Examweek is mostly used by students. The hashtags is seen to have a big cluster because the data was collected when students were preparing for exams. Mostly students were giving opinions or sharing feelings about the exams. The data of this research study was collected in 3rd and 4th week of June which is mostly the month of exams for most schools and this explains why the hashtag has a big cluster.

"Spreading kind words and boosting moods before final exams. Thank you to math teacher Erin Demshar for creating this inspiring bulletin board. \nGood luck on your exams next week Big Dogs!
#examweek #kindness #GoBigDogs #GoCVA <https://t.co/BBKYlhAmSi>"

#JAYHAWKMTC

The Jayhawk Math Teachers' is a circle of K-12 mathematics teachers from Northeast Kansas with university mathematics instructors to practice mathematical thinking, discussion, and collaboration. Their activities involves teaching mathematics by incorporating fun activities that allow students to enjoy mathematics, making it fun for their students without making it all about patterns and rules and using activities that students get to enjoy. The teachers use 21st century skills that help students learn.

The hashtag thus has a big cluster because the hashtag was mostly retweeted by most students involved in the conversations, students tend to love and enjoy mathematics when teachers incorporate activities that are fun be it games, projects or assignments.

Great first day of #JayhawkMTC !! A huge thank you to @EulersNephew for leading our sessions today!

#KSMATHED

The hashtag stands for Kansas mathematics education, the hashtag is used mostly if tweets are concerned Mathematics Education of Kansas students. Any content related to learning and teaching, students, teachers, teaching activities the hashtag is used.

I love @wheeler_laura course packs. Really thoughtfully laid out. Purposeful notes for students to use *during* their learning. #ksmathed

#HFBTWEETS

The hashtag mostly has content replying to or addressing to usernames @hfbprinciple(principle) and @hfbpbis @herbinjessica @CatherineHanAPS(assistant principle), because these are principles, assistant principle and teachers of Hoffman Boston (HFBT) elementary school. Hoffman Boston is a diverse community with students from several different countries who speak several languages. The students, parents and staff share and learn about the cultural traditions of their friends and classmates because they come from different countries, background etc. The hashtag has a big cluster because it is addressed to the above mentioned usernames.

"This student cashed in 50 good behaviour twinkle tickets to be teacher for an hour! He taught morning meeting, math workshop, graded math papers, and now he's doing our read aloud! #HFBTweets @hfbpbis @HerbinJessica @CatherineHanAPS @HFBPrincipal <https://t.co/PeAI4eGVwX>"
Content night at Hoffman-Boston. #hfbtweets

#GOCVA

CVA stands for Carrabassett Valley Academy, it is a private winter sports academy, providing a sports training in skiing and snowboarding to its students. Students given experiences to carry the skills they learn to face their challenges in their lives with strength and grace. They learn how to win, lose, and how to pick themselves up and keep going. The academy is pushes students to higher levels of competence both academic and athletic. The hashtag #GOCVA and #GOBIGDOGS is used to support and cheer on students at CVA and are all related to the user name @GoCVA

@hfbprincipal @hfbbis @catherinehanaps @herbinjessica

These are usernames belonging to accounts of the principle and teachers of Hoffman Boston elementary school. The teachers allow students to engage in hands-on activities that lead to learning by discovery. Mathematics instruction adopted by the teachers is adapted from the five Process Standards for Mathematics developed by the National Council of Teachers of Mathematics and promoted by the Virginia Department of Education that is (1) Problem Solving in which students build new mathematical knowledge by solving problems in mathematics and applying it in other contexts. (2) Students being able to communicate their mathematical thinking logically and clearly to classmates, teachers, and others, students being able to use mathematical language to express mathematical ideas.

(3) Students being able to make and carry mathematical investigations mathematical, Develop and evaluate mathematical arguments and proofs; Select and use various types of reasoning and methods of proof. (4) Students able to make mathematical connections and understand how the concepts are they interconnect and build on one another to produce a coherent whole. (5) Students being able to create and use representations to organize, record, and communicate mathematical ideas; Select, apply, and translate among mathematical representations to solve problems; Use representations to model and interpret physical, social, and mathematical phenomena.

3.7 Emergent key attributes from the usernames and hashtags about good teachers and teaching

The themes obtained through this approach included good math teacher and teaching were analysed and the following information arose from the tweets. The tweets provide students perception of a good math teacher. According to the tweets, a good math teacher is one that believes in themselves and abilities (Teacher Efficacy), a caring and concerned teacher in and out of the classrooms, a supportive and encouraging teacher and one who has good relationship with his students. However the tweets also showed concerns of students worry about their mathematical competence and lack of the conversations on good mathematics teachers mostly involved conversations on. We cannot stress enough the point that Twitter provides a free and open environment that is extensively used by people. Due to this substantial advantage, it is regarded by many researchers as a favourable and important data source for today's society. However this has made twitter becoming advantageous aiding the understanding of students opinions, feelings, thoughts on their perception of a good mathematics teacher, hence being the purpose of this research study.

After analysis of the students tweets through informal conversations on twitter. it was discovered that most students don't really have memories of how powerful the lesson was or the coolest methods that the teacher used in class, a lot of tweets showed that students defined a good mathematics teachers as those that showed kindness, empathy, care and concern, motivators, encouraged and complimented students when it was due. According to the students tweets a good mathematics teacher is one of the following attributes

3.7.1 Teachers having a relationship with students

The importance of teachers having a good relationship with their students is that it has a lasting impact on the development of a child. Research has shown that Teachers who have strong bonds with their students have been shown to achieve higher levels of academic success. The following tweets demonstrate just how much of a significant of teachers having powerful bonds with students. Thus this allows a positive atmosphere for learning and leads to a great impact in the life of a student. The tweets below shows the value and impact of teachers having great relationships with their students.

“I have one classmate in tenth grade who love math her fav teacher is our math teacher and she is always our main source of answer on our hard math homeworks, i hope she has a good life now with her love for math”

“Happy birthday to the best Math teacher Miss rsjnrml, insert LSM here I love you keep shining keep growing a whole new world awaits good luck on your first day stay pretty”

“whughes elijahjack Mrs Pickett and Dorton was like the only good teacher I mean the math suck but those two took time after class to help me can't say much about the rest”

“i like my own math class i dont wanna be with other people on physics though next year the teacher is so good i dont want to be stuck with everyone else”

“ok so i had a math teacher that was the best like they were my absolute favorite and were chilling with student funny was good at teaching etc a lot of student love them and my class did so well with this teacher that they move up and taught us for a second year”

“A few month ago I went for a coffee with my high school math teacher. He was my idol back at the time but he my good friend now Good luck for every high school senior tomorrow”

3.7.2 Teachers believing in their students

Obviously students tend to do better academically when their teachers and even parents believe in them. However having a teacher that not only believe in you but takes time and go beyond so that you can learn changes students' whole approach.

“I feel like Elizabeth Warren is our teacher who believe in us and yell at us the most when we say iam just not good at math Ms Warren and then one day we find out she does karate and were like What but it makes sense”

“To say goodbye to one of my favorite teacher of middle school and by far the one who has had the biggest influence on me So take this as a good bye thank you for make be enjoy math and someone to laugh at when I was down Goodbye and thank you for teaching me”

“ibizoboi I was alway the only hispanic kid in my AP classes. The only reason I was ever in them was because a teacher noticed I was good at math and fought on my behalf. My parent had no idea that was even an option”

“My math teacher wrote me this letter two years ago today and it still makes me feel good proof that kind words stick with you”

“My rd grade teacher say I suck at math and give me detent for it Ps my th grade teacher said I was so good at math dure math hour she gave me a middl school math textbook and told me to just do it”

“sotshepi Geometri was my favourite In fact the reason i was good at math was one teacher who taught me for only month and was brutally murdered by the girlfriend, Mr Sekhukun was genius. That evil women rob generations”

3.7.3 Teachers who supports and motivates their students

Students tweets about their mathematics teachers who played great roles in their life. It was observed in the tweets of how students appreciated the way their teachers supported and encouraged them, the students showed appreciation by posting tweets.

“@CAAstroComm I love math but wasnt really good at it I knew however that with the right teacher it was worth the try to take the subject to the finals I had that teacher all the way true and remain fascinated by the subject Have support teacher matters I was still horrible though”

“juliemcg MissLHrgrv I dont think there can be a better compliment than your a good math teacher, you make this world a better place to live in is a close second but be a good math teacher already cover that no. Thank again Mrs M, I am walking on sunshine Good luck MissLHrgrv”

3.7.4 Teachers who care and are concerned about students learning

Teaching focuses on both content being taught and the students being taught. A good math teacher cares about her students. She recognizes when a student is having a bad day or needs some encouragement and addresses the problem to help the student refocus on the material. In the tweets below show that a good mathematics teacher is one who cares about their students and has is passionate about them

@Reshwana my math teacher told me about becoming angry to someone and giving them some shit in front of people in society doesn't make it right thus reminding them in such a thing called privacy and adding some good advice will be better in every way.

“@kaitisgold Yeah he is a great teacher cause he was supposed to break bad news to me and like he did it like after class and honest got me back into my math groove so I actual appreciated him a lot Man these like a select few good teacher there”

“No what the coolest math teacher I ve ever had swear always play hella good music and love Jack Johnson and would try his best to make sure everyone succeed Good luck”

Mr. Sanford was the shit and was such a good math teacher He never gave up on me even though I was one lazy ass kid when I had his class truly a great teacher and great person he deserves the recognition

3.7.5 Teacher who believes in the students abilities

It is believed that motivation is affected by behaviour of teachers, students began to develop an idea of learning both in schools and homes. Therefore students need to have a supportive and encouraging teacher who stimulates their confidence to learn. Motivation has proven to enhance the effectiveness of the teaching process.

“Thinking about doing a ukulele song about how to enjoy math, I fell prey to the mindset. I was naturally bad at math. One good algebra class with an encouraging teacher taught me I could handle it with patience and practice can't wait to take calculus this year”

“This happen to me too I was struggling with math and convinced I couldn't do it, one course with a good teacher changed that and I went on to major in math and applied physics”

3.7.6 Teacher using Learning Methods that cater benefit the students

Every student learns differently, there are many learning methods that a teacher can incorporate in their lessons to cater for each student's needs. According to Bruner (1960) some students learn better visually in form of images, others through symbolic representation and languages. Some learning methods work better than others, and each topic responds best to a different method of teaching. It is the teacher's job to know which method works for the benefit and betterment of the learners.

"I remember my teacher made a song to go with this to make it easier for the class to remember and to this day I have never forgotten it appreciate good math teachers"

"The year is 2004 you are in math class, The teacher decides to teach you how to calculate using la bote de Picbille Everyone wants to participate Life is good"

@ROCKDOG visual explanations are way better for everything generally and then giving a quicker way after that is good unfortunately almost every math teacher ive had was so bad that even if they used a good method people didn't understand

@scnmathdude its seriously frustrating to watch people, thats a dumb way to do it. how I learned was much better literally the exact same people I was never good at math I hated class and it didnt make any sense The teacher just wanted us to do stuff and wouldn't explain why.

@ClearHeatVision @GirMenon It doesn't make sense to us since we have a good math background already but this is for elementary kids.They are doing the same thing, the teacher is just describing the method as if to children.

@AsInMarx Yeah this seems like a genuinely good way to teach intuitive arithmetic skills Just because you who know how to do multiplication can do it quickly doesnt mean a teacher trying to teach students who dont know how going slower is bad You try teaching 4th grade math.

3.7.6 Teachers who give compliments to students

Students who believe that they are smart often learn better and have greater achievement academically as opposed to those who don't. Thus praising students in the classrooms motivates students towards performing better academically. When a teacher acknowledges a student for a good job motivates them to even perform better. Thus, praising students were fit is an important factor in the learning process.

“My teacher told me good job today so i guess Isaac newton finally let me have the one math brain cell that the gays have to share”

“I kill my math test. My teacher said I deserve applause and then other start to clap for me be appreciated feels good”

“My math teacher came up to my dad and was say how proud he was of me and how good of a student I am and that he hope my dad is proud of me and I swear I almost crying”

3.7.7 Teachers self-belief and abilities of their students

This shows students willingness to accept their strengths and weaknesses because of a good math teacher. Learners who had a bad mathematics teacher in a lower grade their beliefs changes when they meant a good mathematics teacher in an upper or later grade or vice versa just shows of an impact it is to be a good mathematics teacher in teaching. The students thinking shares and so is their belief system in themselves and their abilities. When students have self-efficacy their overview of learning also changes. They will always remember that you helped them get them and they can't forget that.

“I used to hate..... but now I

“From year 1 to year 3 I hated Math and my mom had lost hope that I'd ever be good at Math like the rest of the family but one day my math teacher was replaced by this amazing man who believed I could love math and be good at it His name was Mr Mohammad Hammad Today he died”

“Math used to be my worst subject and then in the 8th grade I had an awesome teacher and it turned into my best one I have a harder time with English tbh Like after feeling dumb for so long it just clicked and then I loved it, good teachers are powerful”

Thank you.

A teacher spends an excessive amount of time with their students and has great influence on them, not only imparting knowledge but also preparing to be responsible citizens in society. When teachers are appreciated it shows that their students are grateful and they continue on knowing that they did a good job. Thank you is probably what people who are making a difference would like to hear and the same applies to teachers but never hear enough. Even when you don't hear it, never believe you're not making a difference as a teacher. Perhaps the words thank you by students to their teachers describe a teacher, based on a metaphor that teachers are gardeners, Teachers plant seeds of truth and wisdom inside of their students to ensure that We do everything they teach them today will blossom tomorrow.

Mrs Welch who will never see this but, thank you for being the raddest math teacher ever imma miss you good luck w baby Welch

@MrTaylorsMath You were the only math teacher I had that taught in a way I comprehended.. and took the time to truly make sure we understood because you actually cared. Thank you for that Still hate math but you have good taste in shoes and music

Although she might not be there for my senior year, my geometry teacher from freshman year has inspired me to do good in math and ultimately leading me to figure out what I wanna do with my life
Thank you for letting me vent my frustrations and being there for me since day 1

I was told that.....but

Mathematics, like many acquired skills, requires practice. The more students practice and believe in their abilities the better they become, some students are faster to grasp the concepts and others are not, it is therefore the teacher's job to encourage them to keep at it because it is so important. When students are having a hard time they should be reminded that not to give up.

“My 8th grade Alg. I teacher Mr. Kelleher who read the newspaper daily during my class said to me & my dad Maybe she's just not that good at math Swore I'd never take another math class
Awesome teachers later now have B.S. & M.A. in math and math education”

“At a parent teacher conference my parents had to shut up the math teacher who was taking up all the meeting time just to say i wasn't good at math They said ok we get it but she is good in French and English and Spanish and every other class, no one can be good everywhere”

Based on student's tweets, some attributes of good mathematics teachers are motivating students, a teacher who is caring and concerned, a teacher who compliments students after a good job, friendly and funny. Some other characteristic mentioned were: having teaching methods that benefit each and every students, the writings expressed that visual representations should be used apart from the symbol representation. The writings also suggests that female students tend to concentrate when they have female teachers and vice versa. However this result may not be generalized for each and every classroom situations, for example:

@BSO Yeah I had one good looking math teacher in my high school that was in her 20s Otherwise the female teacher's weren't good looking.

"i would just like to thank god for my goodlook seat mate and my goodlook math teacher yes i will studi well amen."

3.8 Findings Quora Data

The comments on Quora were initially part of this research study, Data had to be collected manually from Quora's search function, as the site lacks the automatic querying that twitter provides.

Consequently topics on student's perspectives about good mathematics teachers has only a small number of comments from students. Even with the small number of comments, the research study was able to gather significant and valuable findings that were significant for the study. However results were from Quora were retrieved by hand, keeping analysing only comments relevant to this study something even if not a lot to the large volume of tweets collected on twitter. The knowledge adds meaningful knowledge to this research study, however the educators and teachers comments also hand more meaningful knowledge to this research study.

Most students when they are asked about mathematics they will tell you that they hate it because it is boring, students according to responses on social Q&S site Quora consider a mathematics teacher as good when they incorporate creativity in their lessons, making mathematics more fun by incorporating activities that will leading to students enjoying mathematics and at the same time understanding mathematical concepts. Students who show interest in students and showing enthusiastic about teaching, good sound of the knowledge of mathematics, able to communicate with students by giving them feedback on their progress as well as motivating are some of the attributes for a good

mathematics teacher that emergent from the conversations on Quora. The online discussion forum like Quora is a potential data source, as it provides an environment that is free where people can express their feelings, opinions and thoughts. This free environment is important because it allows users to have conversations that are genuine that taking place on a public setting (Reddy, 2015 & Wang et al, 2013). Generally, student’s perspectives of good mathematics teachers has similarities with findings of the conversations taking place on twitter. While Quora is a place where people share their knowledge with detailed information regarding specific questions, Twitter is a place where people share personal thoughts, breaking news, sentiments regarding products or politics in a brief format. Below are some photographs captured from Quora showing some of the answers from the question posted on Quora “what makes a good math teacher?”

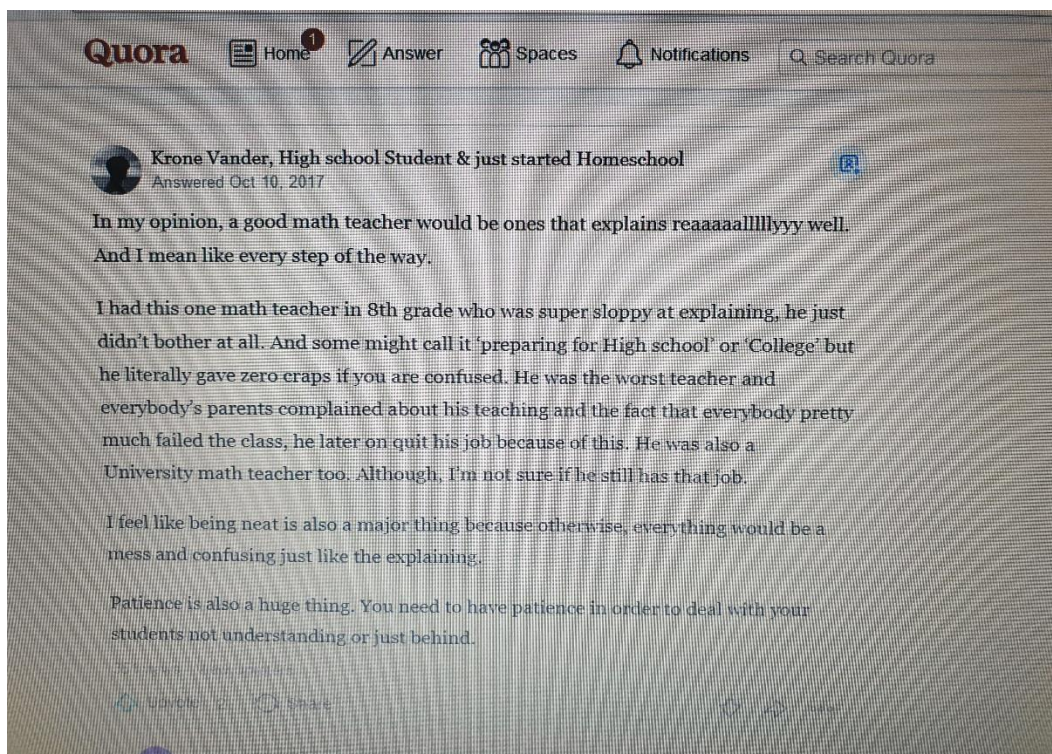


Figure 10. Photography from Quora showing answer for the question “what makes a good math teacher”?

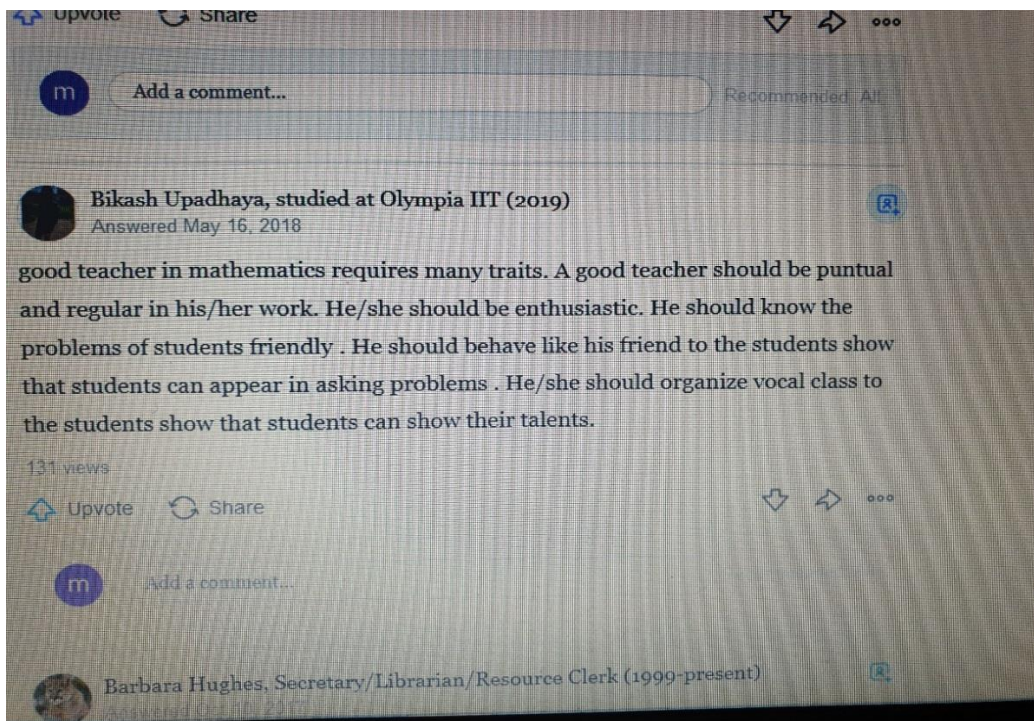


Figure 11. Photography from Quora showing answer for the question “what makes a good math teacher”?

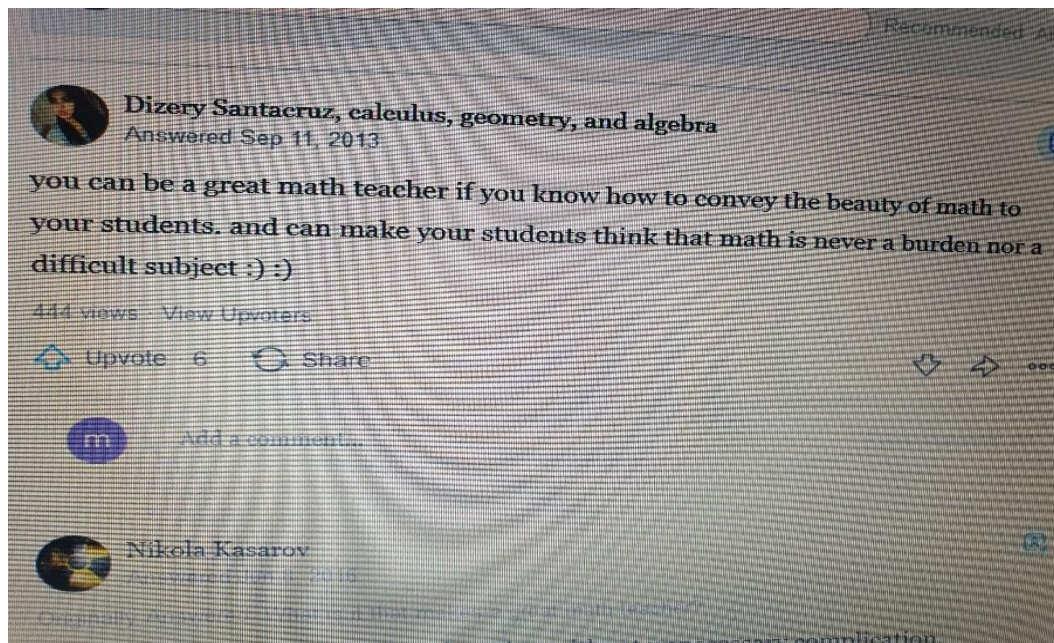


Figure 12. Photography from Quora showing answer for the question “what makes a good math teacher”.

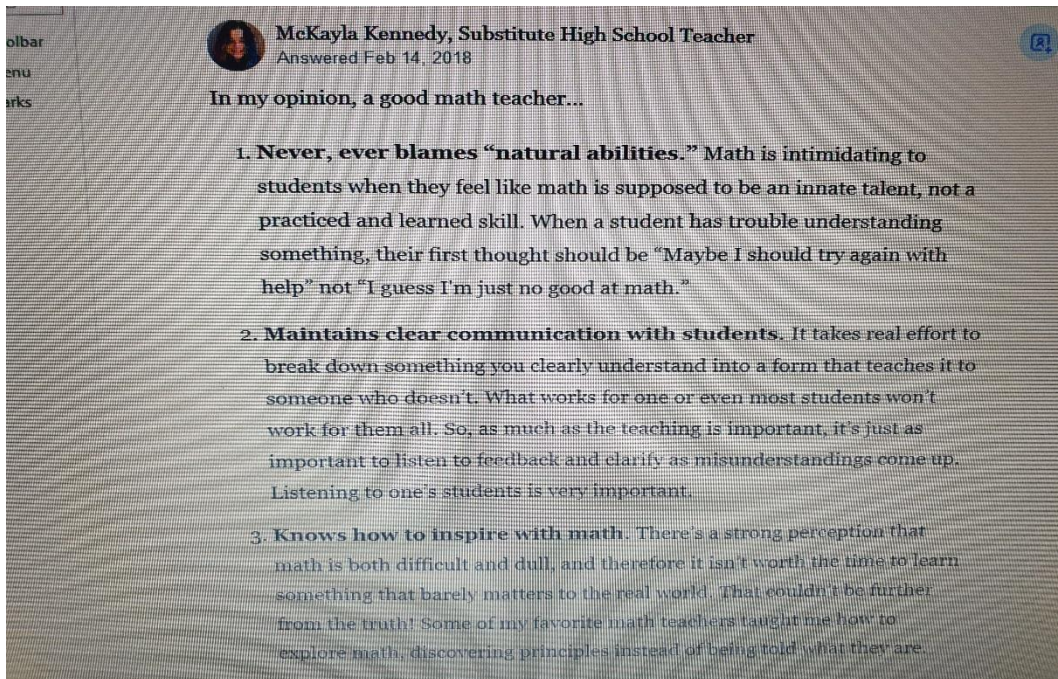


Figure 13. Photography from Quora showing answer from the question “what makes a good math teacher”?

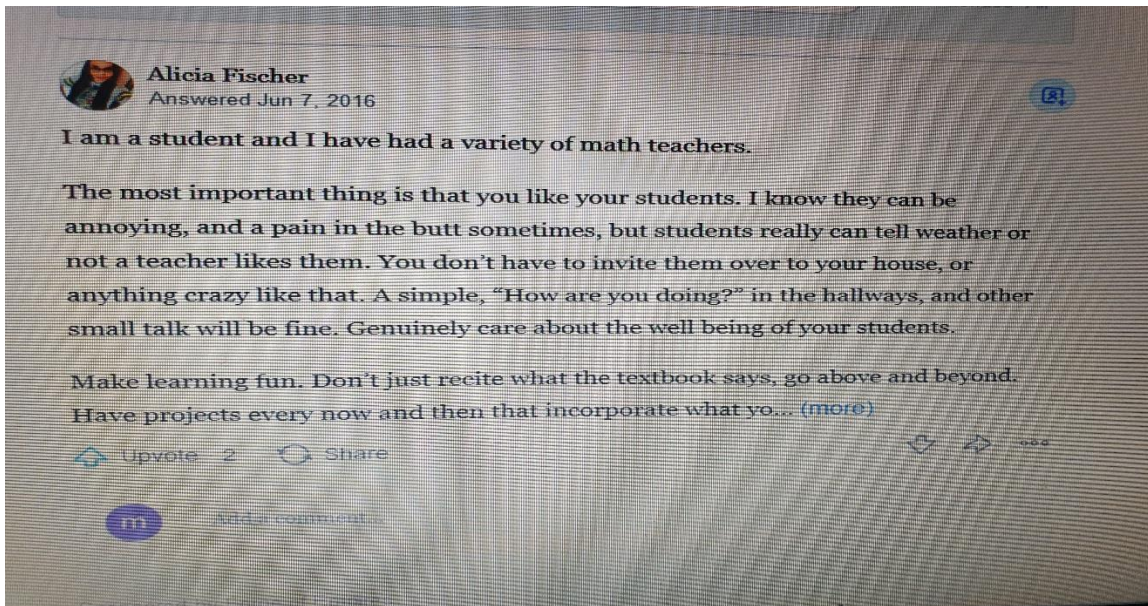


Figure 14. Photography from Quora showing answer from the question “what makes a good math teacher”?

Figure 10, 11, 12, 13 and 14 show some of the answers that students gave to the question “what makes a good math teacher. It can be observed that the student’s answers have similarities with the student’s tweets. Regardless of geographical area, grade level, age and school background, the students have made it clear that a good teacher is one who not only teaches but also cares about the students, maintains a clear communication with students, incorporates activities that make mathematics funny and has a good sound of mathematics knowledge. These findings are similar to the findings from the tweets.

4. Discussion

There are so many studies conducted on understanding a good mathematics teacher, other studies have taken the route of understanding a good mathematics teacher by looking at the qualities or characteristics getting both student and teachers perspective. Therefore this research already has very strong theoretical foundation. Consequently the researcher feels that there is room for further research methodically and content wise. Firstly with regard to research methods mostly and previously used to understand good mathematics teachers, qualitative, quantitative and mixed methods have been used by most existing studies. However, slowly changing process of living, teaching and increasing use of social media networks. Student's opinion and views about their reality and ways to effectively understand that changes as well. Therefore the traditional methods of collecting information such as interviews, questionnaires may have limitations and other ways of collecting data through twitter may compliment the limitations. This research study found that the students' evaluation of Twitter and Quora as data sources are very effective and valuable sources for mathematics educational research. Most of the comments on twitter and Quora, both positive and negative, collected through students informal conversations gave insight regarding the students understanding of a good mathematics teacher. The content in the comments was very positive to this research study because it gave proof that informal conversations allowed positive feedback which lead to understanding the overall objective of this research study. Therefore the direction that this research study took is very valuable and effective. The freedom that Twitter offers to express opinions, views, has yet opened great insight in educational research, and enriched the processes lived by students in the teaching and learning process regardless of geographical location, age, grade level and cultural background. However, the greatest strength of analysing student's informal conversation on Twitter is that it avoids interviewer bias. Due to the qualitative nature of this research study, interpretation of results might be different if repeated by

another researcher. However this research study categorized the key attributes emerged by matching with some (Romero, 2015) subcategories of an excellent teacher. The attributes of good mathematics teacher identified in the student's tweets through informal conversations are mostly teacher's personal attributes and these are similar with those described in (Australian association of mathematics standards (AAMT Standards), 2006). These attributes are mostly teachers personal attributes such as having a good relationship with the students, showing care and respect for students and helping students learn and achieve their learning. Nevertheless, in this research study student's tweets expressed teacher's lack of good mathematics teacher which is a quality of a good mathematics teacher in most studies. This result allows direction of more research in considering informal conversations of students and this if taken with great consideration may contribute significantly to the lower levels of achievement currently being expressed in schools.

Compared with the previous research work, this work is the first research study to primarily focus on students informal conversations on twitter as a data source for understanding student's perspectives of a good mathematics teacher and teaching. This research complements already existing research Hapsari, Putri, and Raharjo (2017) explored perspectives of students and lectures of good mathematics lecturers, themes that emergent from this study was lecturers understanding of the students, friendly, good understanding of their work. These attributes are the common attributes that have emergent from numerous studies for example (Uitto, 2012 and Murray, 2012). According to Uitto (2012) based on students memories, good mathematics teachers are those who have good relationships with their students, telling students about themselves, families, hobbies and interests. Additionally the results indicated students want teachers who can teach and have knowledge of content quiet alright but they show also show a person touch, caring, good sense of humour. Equivalently in a study conducted by Murray (2012) indicates that students depict good mathematics teachers with respect to explanation, teachers one on one help with students and achievement of understanding. Teacher's personal attributes

are important in teaching, most studies report that students appreciate teachers who are caring, respectful and have patience. Teacher's social emotions in teaching are very valuable as they add to students learning apart from the knowledge represented by the teacher. The present study results have similarities with findings from other studies. Other findings highlighted in this research study are very valuable.

According to tweets and comments on Quora, a good mathematics teacher has a good sound of content knowledge, boasts the student's confidence and self-perception regardless of their abilities. Student's tweets showed of how their teachers brought their students by breaking down their confidence and self- belief. The attributes are similar with the standards in the AAMT framework, a good mathematics teacher according to AAMT should have a good sound of knowledge base. Thus a knowledge base will help them in decision making, planning and interactions. A teacher with a good sound of knowledge has knowledge of students, knowledge of students learning of mathematics and knowledge of mathematics. A mathematics teacher's job is to teach their students mathematics, help them achieve their goals through support and encouragement academically and emotionally. Teachers being the most knowledgeable person in the classroom and when they make mistakes in front of the students that can be humiliating. Thus when students see that mistake they question your competence in that subject matter. Student's tweets highlighted teachers making mistakes on questions in class and making incomplete students work correct. These might be seen as mistakes in teacher's eyes but not so by students. Consequently the tweets of the students also showed.

This research study presents the understanding of a good mathematics teacher through informal conversations of students on twitter and Quora. Twitter and Quora as a tool has proven to be valuable as much as the traditional tools, therefore incorporating them as a data source into educational research would add more knowledge. Through the informal conversations students revealed that a good

mathematics teacher is who one motivates his or her students, cares and is concerned about them, teacher compliments after a good job, has a good sense of the subject matter knowledge and uses learning methods that cater for the students learning interests and background. The findings of this research study has at least similarities with the conclusions of other studies (Kaur, 2009: Sierra, 2012: Leong, 2012: Haider & Jalal, 2018). The most common similarities of other studies to the findings of this research study is that students emphasize that good mathematics teacher should have both good sound good relationship with students, caring and concerned about the student affairs.

However, keywords good math teacher and teaching proved difficult to get as many tweets as compared to getting tweets using keywords good teacher, effective teacher, great teacher, affective teacher, successful teacher and motivator teacher which were the attributes that emergent from (Romero, 2015) study of an excellent teacher. Equivalently this research study has similar results except that for a mathematics teacher to be considered they have to have a good knowledge of mathematics. Similarly from the findings of this research study and (Romero, 2015), a good mathematics teachers needs to have a good self-relationship with the students, practice and Epistemology. In this research study, the students tweets not only lead identifying the attributes of a good mathematics teacher through informal conversations but their tweets also expressed teachers lack of knowledge of mathematics. Examples of such tweets are:

“My math teacher screw up a question scantron and now we only had to do a good last day fella”

“My middle school algebra teacher who was awl and unqualified by the way would feel bad about herself if she knew how good I came to be at math”

“magatron Also some of the teacher who teach math aren’t real good at it either I remember my sister in law show me my nephew homework that the teacher had mark incorrect and she look at it and it look right to her so she ask me and Chris about it and yeah my nephew”

“My math teacher of last year said that he was not good at and didn’t like English but French was OK
So he said if we had some question French would be OK”

Students tweets also negative experience of students with teachers in which teachers told students that they were terrible at math, female students were told that math was for boys etc. examples of such tweets include:

@starstrickenSF I was told over and over again that I wasn't good enough at math that I'd never be able to get into something like this and stick with it that I wouldn't understand it The 1 time I actually paid attention to that teacher I wish I hadn't

As irrat as it sounds i still have a deepli root belief system that Im no good at maths becaus my male year math teacher told me repeat that boy are general better at math than girl despit that I was first in the class We need this

“My grade math teacher totally destroyed my confidence He was incredibly unkind in his casual dismiss of me as a student who just couldnt learn and I had no tool to deal with his bullying. Now I do math all the time and iam good at it Suck it Mr Hayes”

“yall remember that time my hs math teacher told me I should start at a communiti colleg as if that an insult because I wouldn’t do well start off at a year becaus some people just arent good at math and never will be went to use and never fail a math class”

The fact that the most significant and meaningful data found from students tweets involved positive aspects, apart from meeting the objectives of this research study by understanding students perception of good mathematics teachers and teaching. Equivalently this research study was able to find complaints, issues, and problems shared by students in informal conversations through tweets and comments on Quora. Even though this research study chose to focus attention of meeting the objective. It is important that future research can compare both the good and bad aspects of student's informal conversations. From another angle is that students tend to complain about issues, criticism and problems on twitter. This may imply that twitter data through informal conversations serve as a significant platform for students to vent their emotions, opinions, thoughts and beliefs. Therefore, future research can be conducted in a way that both negative and positive emotions, thoughts and opinions are taken into consideration. Various of these issues may be of great interest to mathematics education researchers and practitioners.

5. Conclusions

5.1 Conclusion

The main aim of this research study was that of unveiling student's perception of a good mathematics teacher and teaching through students' informal conversations on Twitter and Quora. Firstly semantic, social and socio-semantic networks were used to obtain the results. From the analysis of tweets it was found that for mathematics teachers to be considered good they need to possess some attributes and behaviours such as having a good relationship with students, believing in their students, supporting and motivating their students, caring and being concerned about students learning, believing in the students' abilities and using learning methods that benefit the students. Teachers confidence in their students and their abilities helps build students self-confident and motivates to working hard, leading them to having positive attitude of I "can" rather I "cannot" to learning. Conversely, if a student lacks confidence their motivation is also affected. Therefore it is a teacher's responsibility to nurture student's feelings of self-worth and self-belief. These outcomes from analysis of tweets show similarities with the student's comments on Quora. The analysis of hashtags and usernames showed that they mostly belong to teacher's accounts such as @herbinjessica, @catherinehanaps and @hfbprincipal, institutions such as northsideew, HFBTWEETS, Hoffman Boston (HFBT) elementary School and Carrabassett Valley Academy and groups such as Jayhawk Math and KSMATHED whose focus was on enhancing students' communication skills, collaborative, critical thinking and problem-solving skills and instilling students with respect and perseverance to become responsible citizens.

The findings and results reported in this research study provide a better understanding of how students perceive classroom situation and their feelings and opinions about teachers and the teaching process. The results are useful to improve the teaching quality in mathematics education. In order to

improve the quality of educating, the way the teacher presents the lessons changes as well, the interactions with the students and the material. As this research has shown, Teachers the driving force of students learning in the classroom. A good teacher knows what and how to go about teaching. They determine how what content, what type of method and what activities to incorporate in teaching. Their dedication, abilities, preparation and knowledge determines of how they will be able to shape their students. This research has shown that to be a good mathematics teacher, teachers need to have personal attributes that will help bring about the successful of the lessons and students. Students need teachers who are caring, motivating, loving and encouraging. Thus when the teacher quality is improved, teaching quality also improves and hence improves the overall quality of mathematics education.

Although this list is certainly not all-inclusive, this research study narrows down the attributes of good mathematics teacher according to students' tweets through informal conversations. The attributes presented in this research study are found to be very substantial to mathematics education and the quality of teaching provided by mathematics teachers. The research main goal was to capture through informal conversations understanding of student's perception of a good mathematics teacher regardless of age, grade level, educational level and geographical location, and this research study achieved just that. Although the goal of this research study was to capture the student's perception of a good mathematics teachers, there was a handful of tweets in which students expressed concern about teacher's lack of competencies, breaking down students confidence by telling them that they are bad at math, thus this also opens up areas for research to be conducted. Informal conversations on Twitter and Quora have demonstrated how much value and significant they offer to academic research and it is important that they are used not just in the field of mathematics but also in other areas.

This research study found a number of important attributes that emerged from the analysis of the student's informal conversations on Twitter and Quora. However, this research study also unveiled results leading to threatening consequences that must be resolved urgently. This research study profiles a methodology which is new and a significant tool serving a useful guide in using informal conversations on twitter. Data from such informal environments provides significant knowledge to inform student learning. Analysing such data using automatic data analysis techniques presents a methodology and results show how an informal environment like Twitter provides insights into students' perspectives about mathematics teachers and teaching. Students' informal conversations on Twitter helped this research study adds more light into the educational research of students' opinions, feelings, thoughts and concerns about teachers and teaching process. The results are likely to provide mathematics education research considering informal conversations as significant sources of data. Nevertheless, this research study does not suggest that surveys, interviews, documents, notes, etc should be replaced by social media data but informal conversations could complement traditional methods that have been used in previous research.

Moreover, this research study has demonstrated the potentiality of Twitter and Quora. Through knowledge is gained and information was obtained. Thus, the results show that Twitter data can be a potential source to offer great knowledge providing an opportunity to gain greater insight on student's views and opinions through informal conversations.

5.2 Limitations

One of the limitations in this study was that the research used just 410 numbers of tweets as compared to the 72,077 and 20,139 tweets that were used in Hellen and Leydesdorff (2019) study. Students' perspectives gave this research study the deep insights to understanding of a good mathematics teacher. Certainly, results of the study cannot be generalized because of a number of limitations. The factors

such as age, gender and geographical location were not put under consideration. In future research such factors can be considered. When analysing informal conversations through tweets and comments on Quora, their limitation is that they only reflect the online population. However, the objective of this study is to examine conversations that taking place on Twitter and Quora from a public setting through student's perspective, rather than to generalize findings to the offline population. This research study generalizes findings to the users who are active and are able to unveil their opinions, feelings and thoughts.

5.3 Implications for Further Research

Clearly previous research has already laid a solid foundation for theory for current research but there is still room for further research in this field. Further research can be explored particularly with regard to the data sources and analysis. From the researcher's critical analysis, this research study is a first approach in mathematics education to use Twitter and Quora as a data source using the perspective of students. For future research, it would be recommended that perspectives of mathematics teachers and contrasting those views with the opinions of their students. Twitter as a potential source of research should refine the methodology used in this research study as well as Hellen and Leydesdorff (2019) study and should include statistical analysis of the results which both papers lack. For the statistical analysis used in this study, the research suggests that firstly statistical analysis should be carried out for future work than just relying on visualization of the data. The method used for this Twitter data analysis was just visual representation. Secondly, Twitter search index has a 7-day limit, and no tweets will be found for a date older than a week for the analysis to observe more details and also ensure the results are reliable and not affected by some events. This could be done by considering tweets for the whole term of the academic calendar. This way the results could be generalizable. The sample of this

research study was restricted to student's tweet, for future research more variables could also be considered to include teachers and other educators to try and compare the tweets of all the variables.

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Appendices

Appendix 1: Twitter data analysis in R

Code:

```
#load libraries
library(twitteR)
library(RCurl)

#identify twitter API account
consumer_key<-"gakGZdC22PvcUfYnWMLfjHEpC"
consumer_secret<-"s2NfxaSj6goc8t5cSt1D9nYpyQeirzzbtzkgsPJ4lZxgXz8GdO"
access_token<-"1113756331964620801-RJLuMGk5iL6vbEy63HgVg2k5hiRUb6"
access_secret<-"t5gY2rar1CUREvEe6YO5ZudKGMHsIFWtgHYyiT878c109"
setup_twitter_oauth(consumer_key,consumer_secret,access_token,access_secret)

#identify twitter API account
goodmathematicsteaching_tweets<-searchTwitter("good mathematics
teaching",n=500, lang="en", since="2011-03-01", until="2019-05-31")

#create dataframe with the original data from twitter
tweets.df <- twListToDF(goodmathematicsteaching_tweets)

# see "orig_data_from_twitter_marg.xlsx"

#Text Cleaning library(tm)
# build a corpus, and specify the source to be character vectors
myCorpus <- Corpus(VectorSource(tweets.df$text))
myCorpus[[25]]$content

#[1] "RT @MaryCurnockCook: "The UK is not very good at mathematics #education because we teach
students to pass exams rather than #teaching them m..."

# convert to lower case
myCorpus <- tm_map(myCorpus, content_transformer(tolower))
myCorpus[[25]]$content

#[1] "rt @marycurnockcook: "the uk is not very good at mathematics #education because we teach
students to pass exams rather than #teaching them m..."

# remove URLs
```



```

removeURL <- function(x) gsub("http[^[[:space:]]*", "", x)
myCorpus <- tm_map(myCorpus, content_transformer(removeURL))

# remove anything other than English letters or space
removeNumPunct <- function(x) gsub("[^[:alpha:][:space:]]*", "", x)
myCorpus <- tm_map(myCorpus, content_transformer(removeNumPunct))
# remove stopwords
myStopwords <- c(setdiff(stopwords('english'), c("r", "big")), "amp")
myCorpus <- tm_map(myCorpus, removeWords, myStopwords)
myCorpus[[25]]$content
#rt marycurnockcook uk good mathematics education teach students pass exams rather
teaching
#m"

# remove extra whitespace
myCorpus <- tm_map(myCorpus, stripWhitespace)
myCorpus$content

# keep a copy for stem completion later
myCorpusCopy <- myCorpus

# count word frequency
wordFreq <- function(corpus, word) {
  results <- lapply(corpus,
  function(x) { grep(as.character(x), pattern=paste0("\\<", word)) }
  )
  sum(unlist(results))
}
n.miner <- wordFreq(myCorpusCopy, "math")
n.mining <- wordFreq(myCorpusCopy, "mathematics")
cat(n.miner, n.mining) myCorpus[[27]]$content

# replace oldword with newword
replaceWord <- function(corpus, oldword, newword) {
  tm_map(corpus, content_transformer(gsub),
  pattern=oldword, replacement=newword)
}
myCorpus <- replaceWord(myCorpus, "mathematicsby", "mathemat")
myCorpus[[27]]$content

#Result:

```

```

#"life good two things discovering mathematics teaching mathematicsby simeon poisson"
#"life good two things discovering mathematics teaching mathemat simeon poisson"

#Build Term Document Matrix
tdm <- TermDocumentMatrix(myCorpus, control = list(wordLengths = c(1,
Inf)))
idx <- which(dimnames(tdm)$Terms %in% c("life", "math",
"mathematics"))
as.matrix(tdm[idx, 1:27]) #Top
Frequent Terms
# inspect frequent words
freq.terms <- findFreqTerms(tdm, lowfreq = 2)

> freq.terms

library(RColorBrewer)
# calculate the frequency of words and sort it by frequency
word.freq <- sort(rowSums(m), decreasing = T)
# colors
pal <- brewer.pal(9, "BuGn")[-(1:4)]

# plot word cloud
library(wordcloud)
wordcloud(words = names(word.freq), freq = word.freq, min.freq = 1,
random.order = F, colors = pal)

#Associations
# which words are associated with 'math'?
findAssocs(tdm, "math", 0.6)
> findAssocs(tdm, "math", 0.6)

#Network of Terms
library(graph)
library(Rgraphviz)
tdm <- TermDocumentMatrix(myCorpus, control = list(wordLengths = c(1,
Inf)))
freq.terms <- findFreqTerms(tdm, lowfreq = 2)
plot(tdm, term = freq.terms, corThreshold =
0.6, weighting = F)

```

#Topic Modelling

```
dtm <- as.DocumentTermMatrix(tdm)
library(topicmodels)
library(data.table)
# find 8 topics
lda <- LDA(dtm, k = 8)
term <- terms(lda, 7) # first 7 terms of every topic

term <- apply(term, MARGIN = 2, paste, collapse = ", ")

topics <- topics(lda) # 1st topic identified for every document (tweet)
topics <- data.frame(date=as.IDate(tweets.df$created), topic=topics)

ggplot(topics, aes(date, fill = term[topic])) +
  geom_density(position = "stack")
```

Sentiment Analysis

```
# install package sentiment140
```

```
library(sentiment)
```

```
# sentiment analysis
```

```
library(sentiment)
```

```
sentiments <- sentiment(tweets.df$text)
```

```
table(sentiments$polarity)
```

```
#negative neutral positive
```

```
# 2 10 15
```

```
#examples:
```

```
#The UK is not very good at mathematics education because we teach students to pass exams rather  
#than teaching them | negative
```

```
#Life is good for only two things, discovering mathematics and teaching mathematics. --by Simeon  
Poisson positive
```

```
# sentiment plot
```

```
sentiments$score <- 0
```

```
sentiments$score[sentiments$polarity == "positive"] <- 1
```

```
sentiments$score[sentiments$polarity == "negative"] <- -1
```

```
sentiments$date <- as.IDate(tweets.df$created) result
```

```
<aggregate(score ~ date, data = sentiments, sum)
```

```
plot(result, type = "l")
```


Appendices 2: Inferential statistics prior to data collection

Good mathematics teacher and teaching

Using web of science 244 articles were obtained the web of science (WOS) using the keyword “good mathematic\$ teacher\$” and teaching, 452 articles were obtained using the keywords “good mathematics teacher” and 16 articles were obtained using the keywords “student\$ perspective\$ good mathematic\$ teacher\$ and teaching”. A total of 712 articles were obtained but only 37 were relevant to this research study. A summary of the 37 relevant research articles are seen in table 1 and figure 1a

journal	Volume	Issue
JOURNAL OF TEACHER EDUCATION	62	4
JOURNAL OF EXPERIMENTAL EDUCATION	72	2
OXFORD REVIEW OF EDUCATION	24	2
EDUCATIONAL STUDIES IN MATHEMATICS	82	1
TEACHING AND TEACHER EDUCATION	15	6
INTERNATIONAL JOURNAL OF EDUCATIONAL RESEARCH	75	
INTERNATIONAL JOURNAL OF SCIENCE AND MATHEMATICS EDUCATION	9	4
TEACHING AND TEACHER EDUCATION	71	
ZDM-MATHEMATICS EDUCATION	49	3
EDUCATIONAL RESEARCHER	46	4
INTERNATIONAL JOURNAL OF SCIENCE AND MATHEMATICS EDUCATION	12	6
EDUCATIONAL STUDIES	28	2
EURASIA JOURNAL OF MATHEMATICS SCIENCE AND TECHNOLOGY EDUCATION	14	2
STUDIES IN EDUCATIONAL EVALUATION	55	
HACETTEPE UNIVERSITESI EGITIM FAKULTESI DERGISI- HACETTEPE UNIVERSITY JOURNAL OF EDUCATION	31	3
PROFESORADO-REVISTA DE CURRICULUM Y FORMACION DE PROFESORADO	19	2

PME 33: PROCEEDINGS OF THE 33RD CONFERENCE OF THE INTERNATIONAL GROUP FOR THE PSYCHOLOGY OF MATHEMATICS EDUCATION, VOL 5	5	
INTERNATIONAL JOURNAL OF MATHEMATICAL EDUCATION IN SCIENCE AND TECHNOLOGY	50	3
INTERNATIONAL JOURNAL OF SCIENCE AND MATHEMATICS EDUCATION	17	1
JOURNAL OF MATHEMATICS TEACHER EDUCATION	21	6
ASIA PACIFIC EDUCATION REVIEW	19	4
EDUCATIO SIGLO XXI	36	3
NUANCES-ESTUDOS SOBRE EDUCACAO	29	3
STUDIES IN EDUCATIONAL EVALUATION	58	
PROCEEDINGS OF THE 2018 8TH INTERNATIONAL CONFERENCE ON SOCIAL SCIENCE AND EDUCATION RESEARCH (SSER 2018)	238	
INTERNATIONAL JOURNAL OF ASSESSMENT TOOLS IN EDUCATION	5	4
INTERNATIONAL JOURNAL OF EDUCATIONAL SCIENCES	21	1-3
PROFESORADO-REVISTA DE CURRICULUM Y FORMACION DE PROFESORADO	22	1
ZDM-MATHEMATICS EDUCATION	49	7
2017 7TH INTERNATIONAL CONFERENCE ON EDUCATION AND SPORTS EDUCATION (ESE 2017), VOL 1	79	
ASIA-PACIFIC EDUCATION RESEARCHER	24	1
2014 2ND INTERNATIONAL CONFERENCE ON ECONOMIC, BUSINESS MANAGEMENT AND EDUCATION INNOVATION (EBMEI 2014), VOL 37	37	

Table 1: summary information on the relevant articles from the WOS

Twitter and Quora as source of data in educational research

Using web of science a total of 429 articles were obtained the web of science (WOS) using the keyword “Quora”, “ twitter as source of data”, “ social media as source of data” and “quora as source of but only 84 were relevant to this research study. A summary of the 84 relevant research articles are seen in table 1 and figure 2 which shows the total number of articles published in each year.

Journal	Volume	Issue
MARKETING SCIENCE	23	4
JOURNAL OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE AND TECHNOLOGY	60	11
JOURNAL OF COMPUTER ASSISTED LEARNING	27	2
NEW MEDIA & SOCIETY	14	5
COMPUTERS & EDUCATION	55	1
IEEE INTELLIGENT SYSTEMS	31	2
BRITISH JOURNAL OF EDUCATIONAL TECHNOLOGY	43	5
JOURNAL OF THE ASSOCIATION FOR INFORMATION SCIENCE AND TECHNOLOGY	68	9
PLOS BIOLOGY	6	9
IEEE TRANSACTIONS ON LEARNING TECHNOLOGIES	7	3
INNOVATIONS IN EDUCATION AND TEACHING INTERNATIONAL	46	2
DISTANCE EDUCATION	33	1
JOURNAL OF TEACHER EDUCATION	52	4
INTERNET AND HIGHER EDUCATION	28	
JAMA CARDIOLOGY	1	9
JOURNAL OF FLOOD RISK MANAGEMENT	10	3
PUBLIC UNDERSTANDING OF SCIENCE	23	8
COMPUTERS IN HUMAN BEHAVIOR	64	
JOURNAL OF MEDICAL INTERNET RESEARCH	18	3
INTERNATIONAL JOURNAL OF QUALITATIVE METHODS	14	
EDUCATIONAL ASSESSMENT EVALUATION AND ACCOUNTABILITY	21	3
CURRENT PSYCHIATRY REPORTS	17	12
INFORMATICS FOR HEALTH & SOCIAL CARE	37	3
TURKISH ONLINE JOURNAL OF EDUCATIONAL TECHNOLOGY	10	2
AUSTRALASIAN JOURNAL OF EDUCATIONAL TECHNOLOGY	30	2
EDUCATIONAL STUDIES	28	2
ISPRS INTERNATIONAL JOURNAL OF GEO-INFORMATION	6	7
VOPROSY OBRAZOVANIYA-EDUCATIONAL STUDIES MOSCOW		4
JOURNAL OF THE AMERICAN ACADEMY OF AUDIOLOGY	26	2
BRITISH JOURNAL OF EDUCATIONAL TECHNOLOGY	42	2
URBAN STUDIES	56	4
EDUCATION AND INFORMATION TECHNOLOGIES	22	4
AUSTRIAN JOURNAL OF STATISTICS	44	2
INTERNATIONAL JOURNAL OF HEALTH CARE QUALITY ASSURANCE	31	2
SURVEY METHODOLOGY	43	2

INTERNATIONAL JOURNAL OF EMERGING TECHNOLOGIES IN LEARNING	11	10
PHI DELTA KAPPAN	90	6
EUROPEAN JOURNAL OF PHYSICS	23	5
HEALTH INFORMATION AND LIBRARIES JOURNAL	36	1
JMIR PUBLIC HEALTH AND SURVEILLANCE	4	1
EXPERT OPINION ON DRUG SAFETY	17	8
COMPARE-A JOURNAL OF COMPARATIVE AND INTERNATIONAL EDUCATION	47	3
JOURNAL OF RESEARCH IN INTERNATIONAL EDUCATION	15	3
JOURNAL OF EDUCATIONAL COMPUTING RESEARCH	54	2
OPEN LEARNING	31	3
KURAM VE UYGULAMADA EGITIM BILIMLERI	14	3
RHEUMATOLOGY INTERNATIONAL	39	5
INTERNET RESEARCH	29	1
JOURNAL OF HIGHER EDUCATION POLICY AND MANAGEMENT	41	1
IEEE ACCESS	7	
EDUCATION AND INFORMATION TECHNOLOGIES	24	1
INTERNATIONAL JOURNAL OF MEDICAL INFORMATICS	120	
IEEE INTELLIGENT SYSTEMS	33	6
IET INTELLIGENT TRANSPORT SYSTEMS	12	9
TELEMATICS AND INFORMATICS	35	7
TECHTRENDS	62	5
PHYSICAL EDUCATOR-US	75	3
SPORT IN SOCIETY	21	2
MATERIALS TODAY-PROCEEDINGS	5	1
INNOVATIONS IN EDUCATION AND TEACHING INTERNATIONAL	54	5
INTERNATIONAL JOURNAL OF EDUCATIONAL SCIENCES	19	1
JIMS8M-THE JOURNAL OF INDIAN MANAGEMENT & STRATEGY	22	1
THE JOURNAL OF LEARNER-CENTERED CURRICULUM AND INSTRUCTION.	17	6
EARLY CHILDHOOD EDUCATION JOURNAL	44	6
LEARNING AND TEACHING MATHEMATICS IN THE GLOBAL VILLAGE: MATH EDUCATION IN THE DIGITAL AGE	6	
JOURNAL OF THE KOREAN SCHOOL MATHEMATICS.	19	4
BLOOD	126	23
ATTIC-REVISTA D INNOVACIO EDUCATIVA		15
STUDYING TEACHER EDUCATION	11	3
PHYSICAL EDUCATION AND SPORT PEDAGOGY	20	1
ENERGY EDUCATION SCIENCE AND TECHNOLOGY PART B-SOCIAL AND EDUCATIONAL STUDIES	4	4
4TH WORLD CONFERENCE ON EDUCATIONAL SCIENCES (WCES-2012)	46	
EDUCATIONAL LEADERSHIP	68	4

Table 2: summary information on the relevant articles from the WOS

Appendices 3: All tweets



all_tweets.txt

Below are some of the tweets used in the analysis.

"1", "math teacher I said to bring your protractor to class boy with cowboy hat Im just a good old fashion countri boy I aint need nothin fancy this simpl tractor should do the job just fine maam"

"2", "calciumpjm I have a history math and English exam also my teacher is make me rewrit an entir paragraph essay in days J have Civic work to catch up on and Im just not do good "

"3", "jeffmark Oh that painful Im a better math teacher than that But I am not a good PE teacher "

"4", "The best math teacher to ever do it was Hawk she save a villag from a corpor goblin and onli maintain connect that felt good to her"

"5", "math teacher I said to bring your protractor to class boy with cowboy hat Im just a good old fashion countri boy I aint need nothin fancy this simpl tractor should do the job just fine maam"

"6", "What the right age to quit maths The question that come from one who has never had a good math teacher And their name is Legion hollyhonderich BBCNorthAmerica BBCWorld BBCBreak BBCNew BBCSport themathmyth nytim "

"7", "HelloCullen Random teacher burst into my math class one day and then just stood there look veri confused Final she yelled Drink and do drug are NOT good kids then walk to the door look over her shoulder and said If you do them at the SAME TIME Never saw her again"

"8", "My QuarkNet teacher workshop group was discuss tool for math and graphing and Desmo is the big one must of us have heard good thing about but just need to play with to check it out "

"9", "taylornation WE LOVE A GOOD MATH TEACHER"

"10", "Bill TheNVIndi JackieValley Well I have it from a high school math teacher that she would rather have the dean Our school are way understaf especy in counsel staff A good dean can fill some of that"

"11", "cherrydidi Lol i confus the high school counsellor She was like whi do you so good in social studir but not so good in math amp science I was like it just the way i am And the scienc teacher had that year sucked He was always hungov in class "

"12", "My Math teacher screw up a question scantron and now we onli had to do question it a good last day fella"

"13", "Hey mom can you Venmo me buck for lunch today Sure just be sure to buy your math teacher someth good so shell bump your grade "

"14", "math teacher I said to bring your protractor to class boy with cowboy hat Im just a good old fashion countri boy I aint need nothin fancy this simpl tractor should do the job just fine maam"

"15", "daasilvaa TheSocialCTV Amen Peopl are be Dumb Down enough already Math teach more than number it teach concept and discipline More math with realli good Teacher who are realli good at teach Math The Teacher are the key Bad teacher produc bad students"

"16", "math teacher I said to bring your protractor to class boy with cowboy hat Im just a good old fashion countri boy I aint need nothin fancy this simpl tractor should do the job just fine maam"

"17", "math teacher I said to bring your protractor to class boy with cowboy hat Im just a good old fashion countri boy I aint need nothin fancy this simpl tractor should do the job just fine maam"

"18", "triciaebarvia Whew Late to this thread but yes as a former English teacher disrupt stereotyp of Asian American as foreign and onli good at mathscienc amp as a teacher educ disrupt submissivedefer Asian stereotyp thr activ antiracist advocaci"

"19", "math teacher I said to bring your protractor to class boy with cowboy hat Im just a good old fashion countri boy I aint need nothin fancy this simpl tractor should do the job just fine maam"

"20", "ClappertonMegan I had a Math amp Physic teacher who use to say to us girl when we ask a question in class Dont worri too much you are girls so you will never be veri good at this this was in the earli s"

"21", "math teacher I said to bring your protractor to class boy with cowboy hat Im just a good old fashion countri boy I aint need nothin fancy this simpl tractor should do the job just fine maam"

"22", "AMathTeach teacherteach MsKentAACPS MrsSummerHow RewardingEdu NAEmanuel historywithmsoc JenRoberts ustaazacasey jcd MrVaudrey SabbaghELA Good question thank you"

"23", "math teacher I said to bring your protractor to class boy with cowboy hat Im just a good old fashion countri boy I aint need nothin fancy this simpl tractor should do the job just fine maam"

"24", "irisgailtd Good morning class she joy exclaim as she enter the room not know that the math teacher was behind her With her eye wide open and her jaw on the floor Iris quick ran to her seat and wore her scratch glasses"

"25", "i would just like to thank god for my goodlook seat mate and my goodlook math teacher yes i will studi well amen"

"26", "As irrat as it sounds i still have a deepli root belief system that Im no good at maths becaus my male year math teacher told me repeat that boy are general better at math than girl despit that I was first in the class We need this "

"27", "sollux is a ravenclaw and hes had enough magic he want to learn math again he miss call of duty hes get vision of the futur and he tire of the divin teacher pester him he want a redbull the onli good thing about hogwart is aradia drag him place"

"28", "math teacher I said to bring your protractor to class boy with cowboy hat Im just a good old fashion countri boy I aint need nothin fancy this simpl tractor should do the job just fine maam"

"29", "sollux is a ravenclaw and hes had enough magic he want to learn math again he miss call of duty hes get vision of the futur and he tire of the divin teacher pester him he want a redbull the onli good thing about hogwart is aradia drag him place"

"30", "As irrat as it sounds i still have a deepli root belief system that Im no good at maths becaus my male year math teacher told me repeat that boy are general better at math than girl despit that I was first in the class We need this "

"31", "As irrat as it sounds i still have a deepli root belief system that Im no good at maths becaus my male year math teacher told me repeat that boy are general better at math than girl despit that I was first in the class We need this "

"32", "gcfbeomjun bro no when it come to math as long as they can teach me proper im good and im besti w the ap stat teacher so yk"

"33", "sollux is a ravenclaw and hes had enough magic he want to learn math again he miss call of duty hes get vision of the futur and he tire of the divin teacher pester him he want a redbull the onli good thing about hogwart is aradia drag him place"

"34", "sollux is a ravenclaw and hes had enough magic he want to learn math again he miss call of duty hes get vision of the futur and he tire of the divin teacher pester him he want a redbull the onli good thing about hogwart is aradia drag him place"

"35", "sollux is a ravenclaw and hes had enough magic he want to learn math again he miss call of duty hes get vision of the futur and he tire of the divin teacher pester him he want a redbull the onli good thing about hogwart is aradia drag him place"

"36", "sport are realli onli good when your winning mi hs math teacher"

"37", "You know educ hate you when in math your teacher isnt a good one and when youv been told by a teacher that you couldnt sing to your face despit be in honor chorus The same class they were the teacher of"

"38", "LionelMedia I was in my th grade math class and my teacher thought it was a good idea for us to watch the verdict Needless to say she was pissed And the minor student knew OJ did it but were relief becaus of the work of the LAPDwild"

"39", "PLUMS you never told me what your math teacher said about that exercis i thought was wrong also Good luck mate your gonna ace it"

"40", "Homework and some good music Work toward those goals Im go to be a math teacher if it take forev to accomplish"

"41", "both have gym togeth and she still freak out so in gym we just walk the track and came up with a good ass stori if we were questioned and at this point i was freak out too becaus my math teacher and her math teacher are in the same room dure lunch which meant"

"42", " One time our math teacher who was good friend with our german teacher put a chocol santa into the hood of her shirt dure recess and she didnt notic until she got to class and we ask her whi she was carri a chocol santa around in her hood"

"43", "SwamyVik FSDVike Skylar is quit an exampl of a good teacher leader Math teachersher she comes "

"44", "HEAD OF MATHS Hackney Hackney JOB TITLE Head of Math Hackney ABOUT THE SCHOOL Prospero Teach is look for a Head of Math Teacher for an Ofsted Good Secondari school in Pudsey Leeds The school is a For More Job gtgtgt Pleas Go our Page"

"45", "My favorit three teacher pull up to my math class with my other favorit teacher to talk shit abt the English department say that im a good student and say goodluck on exams FUCK U SATTAUR"

"46", "Jhope is good at most thing but he not realli the smartest when it come to Math so noJungkook By now they already reach the auditorium and chose to sit at the back They continu chat until the teacher aid came It was their room mate the elus Kim Taehyung"

"47", "I use to have a grouchi math teacher name Tovar This year my friend said Tovar is a good name for a character I never expect to write they were rescu by Tovar and have it be an emot moment But here we are"

"48", "I use to have a grouchi math teacher name Tovar This year my friend said Tovar is a good name for a character I never expect to write they were rescu by Tovar and have it be an emot moment But here we are"

"49", "i have ONE classmat in tenth grade who love math her fav teacher is our math teacher and she is alway our main sourc of answer on our fvcking hard math homeworks i hope she has a good life now with her love for math"

"50", "Happi birthday to the best Math teacher Miss rsjnrm insert LSM here I love you keep shining keep growing A whole new world awaits Good luck on your first day Stay pretty "

"51", "CheckTheResum My son father is a math teacher thank God I hate math I didnt get good at it until real estat school "

"52", "Cass Tech Miah Cain is head off to Harvard in the fall She thank her math teacher for help her rise through her high school journey at DPSCD She know when StudentsRise we all rise Congratul and good luck Miah DPSCDProud casstechalumni "

"53", "i had my histori oral exam today and the teacher said i pass it omg that good news after the flop math exam i did yesterday"

"54", "good morn i dont have ani test today and my math teacher told me my hw was one of the best yas a thrive today"

"55", "akleewrit We are current watch our yo get a grip on the basic arithmet oper nd grade and it veri fascin to see how often everybodi use them without realis it Math is super import and if you have or had a good teacher it shows Agreed on the never"

"56", "alexlikegranola omg me with my math teacher and good job with the hug move instead lol if a high five"

"57", "joanaseyelin im not good in math mayb bc i dont listen to the teacher but that besid the point"

"58", "ProfFeynman Too mani peopl have never had a good attitud about math They just tune out I dont know if it start with parent or teachers A great third grade math teacher is worth her or his weight in gold"

"59", "Cass Tech Miah Cain is head off to Harvard in the fall She thank her math teacher for help her rise through her high school journey at DPSCD She know when StudentsRise we all rise Congratul and good luck Miah DPSCDProud casstechalumni "

"60", "math teacher I said to bring your protractor to class boy with cowboy hat Im just a good old fashion countri boy I aint need nothin fancy this simpl tractor should do the job just fine maam"

"61", "MetroSchool has a tech magnet school Stratford high school But Stratford cant keep an advanc math teacher on their faculty Good thing the council gave amazon million dollars Its realli gonna help our communiti and students "

"62", "EvyZorzi Evi help I have two huge math test tomorrow and Thursday and I have no clue what to do My teacher is disappoint in my learn skill and is put me down I dont feel good enough "

"63", "Cass Tech Miah Cain is head off to Harvard in the fall She thank her math teacher for help her rise through her high school journey at DPSCD She know when StudentsRise we all rise Congratul and good luck Miah DPSCDProud casstechalumni "

"64", "in th grade my math teacher miss stoner a whole bitch with her eyelin and eyebrow tattoo to her face lookin like crayola was realli strict abt turn in hw n if we didnt hav it we had to have a Realli Good excus and write it on this sheet of paper"

"65", "Cass Tech Miah Cain is head off to Harvard in the fall She thank her math teacher for help her rise through her high school journey at DPSCD She know when StudentsRise we all rise Congratul and good luck Miah DPSCDProud casstechalumni "

"66", "ckdkhtk Well I do see a coupl of error in my time in school Miss space after the comma and U is slang for you But If I hand in to my teacher She would have taken off point for that That whi Im good at basic math"

"67", "CodyBelling Good day sir as high school final come up my Math Honor teacher has come up with a deal If we get a sign basebal bat by you we do not have to do our Math final Pleas help us Dodger Dodger highschool"

"68", "My math teacher sang as a good bye gift and I cri"

"69", "Cass Tech Miah Cain is head off to Harvard in the fall She thank her math teacher for help her rise through her high school journey at DPSCD She know when StudentsRise we all rise Congratul and good luck Miah DPSCDProud casstechalumni "

"70", "Cass Tech Miah Cain is head off to Harvard in the fall She thank her math teacher for help her rise through her high school journey at DPSCD She know when StudentsRise we all rise Congratul and good luck Miah DPSCDProud casstechalumni "

"71", "Cass Tech Miah Cain is head off to Harvard in the fall She thank her math teacher for help her rise through her high school journey at DPSCD She know when StudentsRise we all rise Congratul and good luck Miah DPSCDProud casstechalumni "

"72", "opdroid PuratchiThala Veenabhakta That so true I was superinterest in Math till XI we had a realli good teacher but it all chang in XII we got a terribl substitut mi folk couldnt afford tution for me"

"73", "I ruin a perfect good meme with my mess up math skills Its like my best friend aint even a math teacher Go to bed"

"74", "LandMooseReject TiDan JustinTrudeau Find a PM who is dumber I will help you out The name are NO ONE The idiot has fail at everyth he has done which is basic nothing Well he might have been a good part time drama teacher but FFS that is the bottom of teaching If he taught math OMG um ah"

"75", "dsmezel Also I dont see how everyon complain bout math If u was good in it you wouldnt blame the teacher would you"

"76", "My goal as a futur teacher is to make sure that everi kid who isnt good at read and math and convent school subject doesnt feel stupid and realiz that they are smart in other area and have other talent"

"77", "my math teacher came up to my dad and was say how proud he was of me and how good of a student I am and that he hope my dad is proud of me and I swear I almost cri"

"78", "Good evening th grade math and scienc teacher in Arizona Ive never tri my hand at sketch notes BetterTogetherCA"

"79", "EthanMidPen druinok mphsdragon I use it for my math class too My student are the last cohort in my school to take it the least accelerated and the read aspect doe need some support But the teacher support materi do a good job help you come up with way to support it"

"80", "in high school our math teacher told us to buy tinspir becaus wed be abl to use it in college and it was a good investment FALSE it too advanc and nO TEACHER WILL LET U USE IT"

"81", "wingularita peachyyoongii Well done As a math teacher it make me so happi to see a student realiz the valu of their effort It realli doe pay off Keep up the good work"

"82", "Foxjupit Good lord dont tell me your the math teacher now"

"83", "funni how peopl who arent empath actual think they can be ArtCritics that like give a math teacher a machet amp ask them to cure cancer on that note the jungl might be a good place to start is that how european end up wear the literari crown they stole it"

"84", "GoodShawni My teacher said I had Dyscalculia and ban me from his math classroom"

"85", "One of the worst part of be a math teacher is ask student to put their book away dure class Today PatrickRothfuss I had to ask a student to stop read NOTW when they were in the last pgs and whisper Im sorry I know it good"

"86", "CAufdemort I agree Thanks I actual enjoy work with the math teacher and the trainer at West Jefferson High I have some good best practic to share with our new math teacher"

"87", "A few month ago I went for a coffe with my high school math teacher He was my idol back at the time but he my good friend now Good luck for everi high school senior tomorrow"

"88", "sotshepi Geometri was my favourite In fact the reason i was good at math was one teacher who taught me for onli month and was brutal murder by the girlfriend Mr Sekhukun was genius That evil women rob generations"

"89", "Whi Good Teacher Quit Teach via WeAreTeach"

"90", "I hate my math teacher okay good morn all"

"91", "math SAT teacher oh u guessed haha good job u got the right answer haha but ill teach u the right way english SAT teacher u gUESSED u DUMBASS just fuckin LOOK AT IT u NEOPHYTE jesU wack me with a fli swatter the ENERGIES MAN"

"92", "SsssamanthaaMUA I have fibromyalgia so Im not work right now tri to find good treatment The last job I had was as a tutor for age amp up in english math French etcand teach is definit my passion But I want to be a high school music teacher and that my passion "

"93", "FrontRowAmi A former math teacher and all around good dude"

"94", "A Student can becom use to tradit classroom structur some student are veri good at oper under these systems and can be uneasi when face with more respons in their own learning I think the teacher need to be prepared tgchat"

"95", "For OKCPS Teacher of the Year finalist Kati Alsup be an educ isnt just about teach math and science Good teacher show student their voic MATTER "

"96", "Whi doe everi math teacher have good handwrit "

"97", "math teacher I said to bring your protractor to class boy with cowboy hat Im just a good old fashion countri boy I aint need nothin fancy this simpl tractor should do the job just fine maam"

"98", "longlivekcx Not onli did a train profession law enforc offic with a gun fail to act he order other offic away from the build and prevent them from entering So the familiar NRA cult mantra about a good guy with a gun is proven garbage Now they expect math teacher win"

"99", "longlivekcx Not onli did a train profession law enforc offic with a gun fail to act he order other offic away from the build and prevent them from entering So the familiar NRA cult mantra about a good guy with a gun is proven garbage Now they expect math teacher win"

"100", "trinamina Awwh but I heard he a good teacher I have math mw "

"101", "NardaGraham TheEconomist I think you are right Some of the most success school have class size of students If Mrs Brown is a great math teacher onc all the kid can see the board and hear her and she them how is the size of the class a factor Individu attent is good But necessary"

"102", "There are mani way to be an effect teacher just as there are mani way to be an effect coach But all good teachers like good coaches communic that they care about your goals iowamath mtbos iteachmath "

"103", "math teacher I said to bring your protractor to class boy with cowboy hat Im just a good old fashion countri boy I aint need nothin fancy this simpl tractor should do the job just fine maam"

"104", "Im sure it wasnt their intention but FoxNew is debunk the good guy with a gun myth Even a train law enforc offic freez when confront with an activ shooter If onli he was a math teacher "

"105", "mylifeisanmem FreeMediaHub realDonaldTrump Oh your a math teacher What good would ask your follow for support vers ask on a page that million will see How mani more peopl will you reach by ask a harmless question"

"106", "There are mani way to be an effect teacher just as there are mani way to be an effect coach But all good teachers like good coaches communic that they care about your goals iowamath mtbos iteachmath "

"107", "RT mrsstipemath There are mani way to be an effect teacher just as there are mani way to be an effect coach But all good teachers like good coaches communic that they care about your goals iowamath mtbos iteachmath "

"108", "new math and scienc teacher pleas be good to us"

"109", "Realiz I have a few more iReadyFL good news pic to post of Mrs Duff student in iReadi instruct made their expect growth goal So that anoth th gr Math Teacher with great learninggain mdchambers OCSD bagboy ddk CurriculumAssoc "

"110", "My rd grade teacher say I suck at math and give me detent for it Ps my th grade teacher said I was so good at math dure math hour she gave me a middl school math textbook and told me to just do it"

"111", "intheclique sadmaleslut plus after that i start watch math video on youtub like short one about the rule of differenti and integration and it was a w e s o m e i realiz i was rob of math and a good teacher "

"112", "BDChiefsFan GodLovesUSA Kid hate sci amp math becaus they arent told whi they need to learn these subject or the use of them even when student ask they never receiv a good response Once I had a teacher explain it like it should have been done in st grade my whole percept chang"

"113", "AllisonCecilia henryfseanf JoinerSandi MVP Alls good Symptom have improv due to time medicine and just as import her math teacher stop teach the MVP way Sadly while she gonna pass with a solid C got rd Q and Q sever in class are gonna fail"

"114", "peternguyenn I respond the way my high school math teacher would when told good morning"

"115", "DeeDeeNS FunnyNora gtconwayd GChernack Yes My mother was extrem intelligent mildlymoder narcissistic veri function and truli good high school math teacher but as organ cognit impair slowli increased all hell broke loos for years"

"116", "math teacher I said to bring your protractor to class boy with cowboy hat Im just a good old fashion countri boy I aint need nothin fancy this simpl tractor should do the job just fine maam"

"117", "There are many ways to be an effective teacher just as there are many ways to be an effective coach. But all good teachers like good coaches communicate that they care about your goals. iowamath mtbos iteachmath "

"118", "Eghtheadilili That all I've got right now I see you go to teach grade I've been a high school math teacher for a year and this fall I'm going to teach Grade math. In a lot of ways I'm starting over. Good luck to both of us "

"119", "There are many ways to be an effective teacher just as there are many ways to be an effective coach. But all good teachers like good coaches communicate that they care about your goals. iowamath mtbos iteachmath "

"120", "RT mrsstipemath There are many ways to be an effective teacher just as there are many ways to be an effective coach. But all good teachers like good coaches communicate that they care about your goals. iowamath mtbos iteachmath "

"121", "There are many ways to be an effective teacher just as there are many ways to be an effective coach. But all good teachers like good coaches communicate that they care about your goals. iowamath mtbos iteachmath "

"122", "mradamwelcom This week my 9-year-old niece said she wants to be a math teacher because she is really good at math. I want to encourage that confidence. She also loves to sing, dance, draw, play, build, create. I want to support all her passions and my 5-year-old's passions. EmpowerOurGirl"

"123", "There are many ways to be an effective teacher just as there are many ways to be an effective coach. But all good teachers like good coaches communicate that they care about your goals. iowamath mtbos iteachmath "

"124", "Noooooo what The coolest math teacher I've ever had. Always play hell-a good music and love Jack Johnson and would try his best to make sure everyone succeeds. Good luck "

"125", "UnlawfulEntry Try to tell them you're a mathematician. Uncomfortable memory of I was never good at math or a recollection of their last math class which was the last because the teacher was so bad"

"126", "MomSpectrum See I basic math how Common Core math so I would do well under the new curriculum. The old curriculum did it backward and I could never follow that way. If the teacher was good and accepted all right approaches I did very well and if they require a specific way I flunk"

"127", "MrVaudrey I went from a coach position to Math Intervention and haven't looked back. Working as a Math Teacher is a GREAT job. Good luck"

"128", "Noooooo what The coolest math teacher I've ever had. Always play hell-a good music and love Jack Johnson and would try his best to make sure everyone succeeds. Good luck "

"129", "ZaOneAboveAll I wish I've done taxes for two years and never once had to do any math since it mostly just input my information into my computer. Granted I did have a good history teacher in high school who actually taught us about credit and money management so I'm grateful for that"

"130", "My math teacher gave me an A on a quiz even though I got a couple questions wrong just because he's a nice man. Wow, the only teacher ever. Everyone else is cancel. Life is good "

"131", "I havent thought about it until recently but I think Id like to be a highschool math teacher or even communiti college A chill job I actual make a difference and I can put that math degre to work There this Troop to Teacher program Im look into Look good"

"132", "Noratoriou I know I am a math nerd which make this doubli bad lol My physic teacher told me my math was good but I had to stop use it lol I never did"

"133", "So my dad is math teacher and said this was good to post As of Wed June Dear Celiac had it day anniversary So far there have been book sold on Amazon in USA UK and Germani and have sold about copi at events Almost book in days Thank you "

"134", "So my dad is math teacher and said this was good to post As of Wed June Dear Celiac had it day anniversary So far there have been book sold on Amazon in USA UK and Germani and have sold about copi at events Almost book in days Thank you "

"135", "IlhanMN Do you serious want a public school teacher who has a problem teach to the nation standard in math and readingpsycho analys your children If their brain arent mess up befor I am sure they will be good littl robot afterward"

"136", "So my dad is math teacher and said this was good to post As of Wed June Dear Celiac had it day anniversary So far there have been book sold on Amazon in USA UK and Germani and have sold about copi at events Almost book in days Thank you "

"137", "Freerangebison Yes yes I realiz he was wrong about the math But you get the basic idea Good lord he was a comedian not a math teacher Bottom line lot of peopl are not so bright Can we agre to that"

"138", "Unless the end goal of this is the teacher go Good job everyone You can do math amp Wast Paper Now make a three point shot wit into the bin amp let learn whi the BMI scale is near useless After well dive into valuabl fit amp nutrit lessons then they need a talk "

"139", "math teacher I said to bring your protractor to class boy with cowboy hat Im just a good old fashion countri boy I aint need nothin fancy this simpl tractor should do the job just fine maam"

"140", "GunnaLow Navi blue tux with a white shirt a red neckti and brown black shoe match the shoe color with the belt most import dont by a cheap suit becaus it gonna be baggi and youll be look like my th grade Egyptian math teacher from to seem good to me"

"141", "So my dad is math teacher and said this was good to post As of Wed June Dear Celiac had it day anniversary So far there have been book sold on Amazon in USA UK and Germani and have sold about copi at events Almost book in days Thank you "

"142", "Realiz I have a few more iReadyFL good news pic to post of Mrs Duff student in iReadi instruct made their expect growth goal So that anoth th gr Math Teacher with great learninggain mdchambers OCSD bagboy ddk CurriculumAssoc "

"143", "So my dad is math teacher and said this was good to post As of Wed June Dear Celiac had it day anniversary So far there have been book sold on Amazon in USA UK and Germani and have sold about copi at events Almost book in days Thank you "

"144", "SenCarmichaelWV Amaze how you all cant do the math of amount of money spent on raises school aid counselors teacher incent compar to the fraction of spent on the possibl of someon start a charter school or use an ESA Will to throw away a good bill without compromis"

"145", "math teacher I said to bring your protractor to class boy with cowboy hat Im just a good old fashion countri boy I aint need nothin fancy this simpl tractor should do the job just fine maam"

"146", "Realiz I have a few more iReadyFL good news pic to post of Mrs Duff student in iReadi instruct made their expect growth goal So that anoth th gr Math Teacher with great learninggain mdchambers OCSD bagboy ddk CurriculumAssoc "

"147", "This is good stuff especie re homogen in the hedgefundfin world and analyt be use as a cudgel to dismiss player job candid outright From person experience everi math teacher I ever had talk down to me and act hostil whenev I ask questions "

"148", "Student A You are good with with Ms Well and got an award but you are always complain about your read class my friend Student B so what Teacher Dont worry you dont have to like everi singl class Student C Right I fail my class but Im good in Math "

"149", "math teacher I said to bring your protractor to class boy with cowboy hat Im just a good old fashion countri boy I aint need nothin fancy this simpl tractor should do the job just fine maam"

"150", "sadcantaloup Yeah mr math teacher is just kinda not a good teacher I cant wait till the year over"

"151", "I just saw my th grade math teacher amp I cant rememb her name she look good tho"

"152", "Is there ani math teacher armi or armi that are in math analysi and is realli good in math Pleas help me"

"153", "BTS 방탄소년단 V Taehyung If onli my math teacher were like this back in high school Id graduat rank btw how doe taehyung manag to still look this good with no make up on and messi hair "

"154", "This middl school math teacher from El Paso TX is interest in motiv amp stimul his math student by order Break Out Kit for his classroom This is a good project Let get this funded via donorschoos"

"155", "MadiLAlexand Done At one point I was actual quit good at math But with no calculus teacher to check my work my biggest fear is definit just be wrong "

"156", " inches lbs almost less tooth a gain love of math and dance almost day perfect attendance a teacher and student teacher he loved advanc leap and bound in readingst grade was good to us "

"157", "johntenoffici And Im that person who is done with read comprehens and languag profici but still need to work with my math and sci Let teach each other hahahaha jk Im not a good teacher"

"158", "GOOD MORNING to EVERYONE except my th grade math teacher mrs long of moodi middl school who bulli me for show symptom of yetundiagnos social anxieti disord and adhd i hope she has a bad day"

"159", "chemicallywrit As a onetim lesson it could be good to break each part down but for each math homework problem Dont even get me start on solv problem use a lattice Yes teacher pleas teach me the longest rout to solv each problem said no student ever"

"160", "standupmath But if you think about it I realli is the perfect exempel A math teacher not necessarili one that are veri good at math But do joy over the fact it difficult and komplexitet And if thi wrong they keep tri again and again So as I said before A perfect exempel"

"161", "tlcat RobSchneid Perfect good math strategy Are you insane Replac a system quicker and more effect with someth that take that long to finish one problem is not a perfect good math strategy You dont have to be a teacher to understand thator be a cook to tell food tast bad"

"162", "magatron I taught nd grade math By the time i was finish kid were abl to do th grade Then came common core An screw all the kid up my niec want me to help her i show the way i do itteach said it wrongl said is the answer wrong teacher say well no I said good bye"

"163", "I feel like Elizabeth Warren is our teacher who believ in us and yell at us the most when we say Im just not good at math Ms Warren and then one day we find out she doe karat and wer like What but it make sense"

"164", "magatron Also some of the teacher who teach math arent real good at it either I rememb my sister in law show me my nephew homework that the teacher had mark incorrect and she look at it and it look right to her so she ask me and Chris about it and yeah my nephew"

"165", "My math teacher would be a good candid but she is busi teaching I mean she is probabl retir or dead now "

"166", "Just rememb that my th grade math teacher laud my porky sens of humor when I got the good student award for that class"

"167", "Im sure it wasnt their intention but FoxNew is debunk the good guy with a gun myth Even a train law enforc offic freez when confront with an activ shooter If onli he was a math teacher "

"168", "math teacher I said to bring your protractor to class boy with cowboy hat Im just a good old fashion countri boy I aint need nothin fancy this simpl tractor should do the job just fine maam"

"169", "ToddRiss My daughter realli love have u this year ToddRisser Not sure how a CFMath teacher can be her favorit Math teacher ever but that what she says This tell me that you have built a good relationship with her I appreci that more than I could ever put into words "

"170", "ALRIGHT I PLAYED MY SPANISH TEACHERS ONLINE REVIEW QUIZ FOR MINS IT WAS ONLI VOCABULARI SO IM GOOD THERE BUT I DONT KNOW HOW ILL DO IF I HAVE TO ACTUALLI WRITE MY OWN SENTENCES DESCRIBING STUFF AND WHERE IM GOING IN MATH IT GONNA BE EASI SINCE I GET FORMULA SHEET"

"171", "ALRIGHT I PLAYED MY SPANISH TEACHERS ONLINE REVIEW QUIZ FOR MINS IT WAS ONLI VOCABULARI SO IM GOOD THERE BUT I DONT KNOW HOW ILL DO IF I HAVE TO ACTUALLI WRITE MY OWN SENTENCES DESCRIBING STUFF AND WHERE IM GOING IN MATH IT GONNA BE EASI SINCE I GET FORMULA SHEET"

"172", "kaitisgold Yeah he a great teacher tbh caus he was break bad news to me and like he did it like after class and honest got me back into my math groov so I actual appreci him a lot Man these like a select few good teacher there"

"173", "Steve Teach credenti expir this year He was a damn good teacher forevermiss mathteach coronahigh coh highschool teacher istheremathinheaven math missingSteve "

"174", "Good even DitchBook Mandi from MO HS Math teacher My wish for my daughter wed next weekend to be without issue "

"175", "whi is it so hard to find a good math teacher lol ive onli have good math teacher in my entir school career"

"176", "Arming teacher doe far more harm then good just last week an SRO in Pasco counti accident discharg his gun Train profession who deal with gun everyday miss shots whi wouldnt a math teacher Our repres should listen to students not the NRA VoteThemOut "

"177", "GodLovesUSA BigBor That teacher is an idiot anybodi who think that good math educ should be fired"

"178", "I had a good time share my messag tonight at the RTDNEWS Town Square Thank to all who came out or live stream especí this ladi Joan Kloiber McKeever my th grade math teacher who almost inspir me to teach math instead of history "

"179", "adamjpodraza CWBChicago The letter to the parent prove he lost control He never realli had it He a princip that never demand respect like Gren did In over his head I think Pro tip A good math teacher doesnt necessarili make a good principal"

"180", "Alway a good day to have visitors my former students So proud of them and so happi they came back to see their th grade math teacher Lot of laugh as they reminisced Graduat next week goom "

"181", "I feel like Elizabeth Warren is our teacher who believ in us and yell at us the most when we say Im just not good at math Ms Warren and then one day we find out she doe karat and wer like What but it make sense"

"182", "To say goodbye to one of my favorit teacher of middl school and by far the one who has had the biggest influenc on me So take this as a good bye thank you for make be enjoy math and someon to laugh at when I was down Goodbye and thank you for teach me"

"183", "I feel like Elizabeth Warren is our teacher who believ in us and yell at us the most when we say Im just not good at math Ms Warren and then one day we find out she doe karat and wer like What but it make sense"

"184", "It was onli right Becaus the year befor he was in the math class that I got kick out of school over He a good quiet and studious kid So when he went out of his way to reach out to my mother to say the teacher was do me dirty She final believ me"

"185", "I had a good time share my messag tonight at the RTDNEWS Town Square Thank to all who came out or live stream especí this ladi Joan Kloiber McKeever my th grade math teacher who almost inspir me to teach math instead of history "

"186", "All I can say is that I hate this sumer school and everyon in it Except my math teacher He a good comedian"