ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS

BY

V.ARTHI

REG.NO. 19PED001

UNDER THE GUIDANCE OF

Mrs. S. S. MANIMOZHI

A THESIS SUBMITTED TO THE

AVINASHILINGAM INSTITUTE FOR HOME SCIENCE AND HIGHER EDUCATION FOR WOMEN,

COIMBATORE- 641043.

JUNE 2021

CERTIFICATE

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CERTIFIED AS BONAFIDE RESEARCH WORK

SIGNATURE OF THE HEAD OF THE DEPARTMENT

SIGNATURE OF THE GUIDE

DECLARATION

I hereby declare that the matter embodied in the thesis entitled "**ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS**" is the result of investigation carried out by me in the Department of Education, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore under the supervision and guidance of Mrs. S.S.MANIMOZHI, Assistant Professor, Department of Education, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore and it has not been submitted for the award of any Degree/ Diploma/ Fellowship of any other University or Institute.

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CHAPTER I
INTRODUCTION

1.1 EDUCATION IN MODERN ERA

"Education is the manifestation of perfection already inherent in man"

-Swami Vivekananda

Education aims at an all round development of the individual. Its ultimate goal is the harmonious development of the social, physical, emotional, intellectual and spiritual aspects of individual. A child may possess the internal capacities but those capacities are made external through education. Education is actually a continuous process from womb to tomb.

The contribution of many modern techniques in the field of education has made this field an interesting one for the learners. The use of technology in education is highly a positive approach. The use of technology in education can be traced back in twentieth century after the introduction of personal computers in 1980s. In the past two decades, computer technology has progressed in a quite staggering way and the wave of digitalization gained heights with the advent of internet. It is now used in business, online bank transactions, maintaining social connections with people and e-learning. This digital revolution has brought radical changes in the field of education all over the world. Moreover, today's generation is digital native and technology is completely woven in different areas of their life. In the recent years, we have witnessed the increasing use of internet in daily life by everyone including teachers. Online education is known with many names like e-learning, online learning, mobile learning (m- learning), internet learning and many others. However, in simple language, is an electronically supported way of learning wherein, teacher and students interact via internet. It is usually done outside conventional classroom and students access the educational curriculum, complete and submit assignments, and give test through online mode only.

Many teachers believe that traditional methods are not sufficient for the students in today's era. Technology integration can help in better learning of students. Hence, the use of technology by the teacher cannot be ignored and digital literacy has become one of the prerequisite of the teacher's competency. Even though, most of the recent studies have shown teachers' positive attitude towards technology, yet, it has been observed that the use of technology is more prevalent in research than teaching. Many teachers face difficulties while teaching through online mode. Most common barriers faced by teachers are: lack of information and computer technology (ICT) skills, professional training, limited access and rigid curriculum. Insufficient training, lack of time, poor network connectivity, and lack of proper institutional policies for e-learning are some of the perceived barriers towards online education.

Despite, all these barriers, many teachers are changing their beliefs and adapting according to technological advancements. Most of the teachers have the belief that technology can be proved as a useful tool with adequate training. Hence, Teachers should be provided more opportunity of applying new technology periodically in order develop positive attitude towards technology.

1.2 USE OF COMPUTERS IN EDUCATION

Today's exponential rate of technological development is causing fundamental changes in many fields of societies in the world (Zietman, and Hewson, 1986) and also others offer challenges for education and society as a whole (Mcmeen,1987,36). As Wilson (1987) observes technology based instruction in education and training employs various technologies mediate and improve instructional processes and products. The role that computers are playing in education has very vastly increased in recent years (Sandraet .Al., 1986) and attracted the attention of practitioners and researchers. (Singh, et.al., 1991)

Whiting (1985) comments, as a communication and teaching medium, computer provides numerous facilities besides, inter-activity that were previously unattainable

- ❖ Individual tuition to large number of students
- ❖ Rapid, error-free calculation; data analysis and assessment.
- ❖ Color, sound and animation.
- ❖ Electronic communication and data retrieval.
- ❖ Ease of access and use with little restrain in availability.
- ❖ Use at home as well as at school,

1.3 ONLINE EDUCATION

Online education in its various modes has been growing steadily worldwide due to the confluence of new technologies, global adoption of the Internet, and intensifying demand for a workforce trained periodically for the ever-evolving digital economy. Online education is on track to become mainstream by 2025. To teach online, you need to be reasonably comfortable with computers and the internet.

This is because interactions with students will take place through messaging platforms, email, and video calls. In addition, many online teachers need to create digital resources to share with their students, such as PowerPoint presentations, videos, audio lectures, and pdf guides.

The best thing about teaching online is that it is accessible to so many people. As the education expert Elliot Masie, said, “We need to bring learning to people instead of people to learning.”

Online teaching does this beautifully. Anyone with an internet connection can attend live stream college lectures, learn a language via video-call, or coach himself or herself through an online video course. Moreover, students can participate in interactive discussions through the creation of small groups to examine topics from various perspectives.

1.4 VALUES OF MATHEMATICS EDUCATION

The mathematician carried along on this flood of symbols, dealing apparently with purely formal truths, which may still reach results of endless importance for our description of the physical universe

- Kearl Rearson

There is no aspect of life, which is not permitted by mathematics, and a citizen who does not possess knowledge of mathematics cannot intelligently understand the world of today. From concrete beginning, it has passed through the stages of commercial and social uses to build up the civilization of today and there can be no question of teaching mathematics to pupil without emphasis on the use and application of mathematics. Social, commercial and technical application of mathematics are of no doubt, highly useful and valuable forming the core of mathematics education.

Nowadays value of mathematics education has increased because of its applicability's in diverse field of human activities pertaining to industrial, geographical, surveying, scientific, technological, environmental, biological, medical and hygienic problem etc. Mathematics has the scope of its application whenever there are data and intervention of different variable/constraints/ parameters to model the situation.

Mathematics like music and poetry is the creation of mind. The primary task of mathematics education is to extend mental horizon by representation and interpretation.

Darwin said, "Every new body of discovery is mathematical in form".

Mathematics provides a convenient and accurate method of summarizing experience for without some compactification device or formula. It would be impossible for the mind to grasp the complication revealed by laboratory experiments. The mathematical formula is another way of expressing or communicating about all knowledge gained by experiments and observations.

Mathematics as an instrument of education strengthens the power of attention develops the sense of order and faculty of construction and enables the mind to grasp the qualitative differences of phenomenon. The training which mathematics gives is an excellent preparation for other sciences.

1.5 TEACHING MATHEMATICS ONLINE

In the current public health crisis, we are all working quickly to move our classes out of the classroom. Here are some practical strategies that will help teachers plan the mathematics course, including web-based resources for a deeper dive into assessment, learning activities, and other aspects of online instruction.

1. Set realistic expectations

In the current situation, it is essential to become an expert in online course delivery. Many of the students don't have much experience learning online, and they are adjusting too.

- **Keep flexibility and empathy in the forefront.** Some students may not have ideal learning or internet environments — they have family responsibilities, lack privacy or quiet space, have unreliable internet access, be in other time zones, be online at a library or other public space, or have any number of distractions or obstacles.
- To the extent institution allows it, **be particularly flexible with deadlines**, independent study, and extended incompletes. Focus on what students need in order to learn, rather than on structure or deadlines. We are in an unusual situation and this flexibility will make it easier.
- Let the students know that many internet providers are offering **free internet service for a fixed period**. That does not mean it will be easy for everyone, but it should help many students. Some students will still need to be online in a library or other public space.
- Unless the institution requires something different, **it is ok to build the course week by week and adjust to the needs of the students.**
- Some publishers and other organizations are providing access to resources during this current crisis. Even if these are not ideal choice for assessment, you may be able to make them work for you in order to complete this semester.

- While we all strive to offer the best learning experiences we can, in the current quick transition, consider the mantra, " **'Better' is the enemy of 'good enough'**."

2. **Design your course**

There are many tools available: Zoom, Skype, Drop box, Blackboard, Canvas, Slack, Voice Thread, email, online chats, video chats, MS teams, Google docs, and many others.

- **Most institutions have an office that supports online learning.** Check their website to see what training, technology, consulting, or other services they have to offer.
- **Learning Management System (LMS)** are structured learning environments, like Blackboard, Moodle, or Canvas, and are specifically designed for online learning. Students are likely to be familiar with the LMS from other courses.
- **The teachers may be required to use the LMS to ensure** FERPA **and** accessibility **requirements are met.** If needed, there are services online that will caption or transcribe videos. YouTube and Zoom have automatic, if imperfect, captioning services.
- Prioritize the learning goals for the course. **What are the most important things for students to come away with?** As with any teaching, focus on what students want to learn rather than what the teacher want to teach.
- Using videos in online classes for five minutes at a time will make the students stay focused in the subject easily. Also, think about the easy parts of production quality — adjust the lighting to be clear, do not move around too much, and avoid other distractions that are within control.
- **Test all technology**. Do microphones, electronic whiteboards, video cameras work? Can the online platform handle the number of students who will login? But also remember that technical snafus happen.

3. **Develop learning activities**

The online course does not need to replicate everything in face-to-face course. Instead of starting with previous course design and trying to adapt it all to be online, start with goals for the course and the tools available, and figure out what is feasible.

- Some **group and interactive activities** can be adapted to an online setting. For group work, develop ways that all students are held accountable to their group. Assigning group grades is one option. Some instructors require students to make individual submissions of assignments, and then assign everyone in the group the lowest grade; this is great motivation for them to make sure their group-mates understand what students are doing.
- To keep students engaged, **have frequent, small assignments with clearly communicated due dates**, and create learning activities that require students to interact at specified intervals.
- **Ask open-ended questions**. Discussion happens when there is struggle or debate, which does not happen easily with yes-no questions. Ask students to interact about *how* or *why*, not *what* or *whether*.
- **Encourage students to compose their work** *before* **posting it online**, using Word, Latex, by hand, or whatever works in the context. Composing responses directly in a chat box leads to less effective communication.
- Students can solve problems on paper, scan or take a picture of the solution, and upload it somewhere. **Avoid using email for submitting assignments**. It gets messy quickly. But provide a clear alternative.
- Some universities offer **online tutoring**, writing, or other forms of support. Check what is available and refer students to websites like Virtual Nerd, Math is Fun, Khan Academy, or Math Forum.
- There are **applets available online** for students to create and manipulate graphs. One of the best is Desmos, but there are many others.

4. Communicate clearly

Be transparent about decision-making and this will reduce anxiety for everyone. Communicate clearly and often about expectations and deadlines.

- Communicate through multiple modalities, including email, announcements, texts, small peer-support groups, and other means.
- Every week, **provide a list of deliverables**: read this, start this, submit that. *What* should they be working on, *where*, and *with whom*? *Where* and *how* should their work be

submitted? Establish specific deadlines for all work (for example, by Sunday at 11:59 pm) and follow a consistent weekly routine.

- State expectations for participation (how, when, how much). Remind students that even if they are in the course platform frequently, if they don't **speak up and participate**, no one knows they're there. (The same applies to instructors — communicate often).
- **Establish** netiquette **rules up front**. Be clear about expectations for respectful and professional communication. "Tone" can easily be misunderstood online.

5. Rethink assessment

Authentic assessment refers to tools for *formative* (feedback on understanding) and *summative* (evaluating outcomes) assessment that reveal students' understanding, reasoning, and ability to apply key concepts in authentic mathematical contexts.

- Incorporate more formative assessment to support student learning and develop tools for authentic assessment.
- Consider alternatives such as comprehensive projects that synthesize concepts, small frequent quizzes, group assignments, or opportunities to analyze the reasoning represented in sample student work.
- Some textbook publishers have online test banks. Google forms has a feature for creating tests and quizzes in an easy-to-use form, and for multiple-choice and fill-in responses, the quizzes can self-grade. In addition, some companies and organizations are providing access to resources during this current crisis.
- Beware of privacy concerns with video-monitoring software and other proctoring solutions. Recognize that determined students can overcome any obstacles to cheating, whether in class or online. Consider assessments that are open book and open notes, and structure exams to make proctoring less of a concern.
- Talk openly with students about what they need to know in order to be ready for next semester's courses, to help them focus on what is important for them to learn.
- Learn more about basic concepts in Assessing Teaching and Learning, and expand planning and implementation of sound assessment practices.

1.6 ADVANTAGES OF ONLINE EDUCATION

As students' progress through classes, they seek more autonomy and intellectual freedom. Online learning can help them pursue highly personalized learning programs, possibly even college-level courses. These combined with hands-on exercises, real-world exploration, and thorough assessments can be highly beneficial to their learning progress. By trying out introductory topics from different fields, it allows the students to explore their options before committing to any specialization. Online learning techniques make these students become learners that are more independent. Since online learning provides greater control to users with minimal infrastructure, the students can personalize their learning. This enables students to take up new courses and learn almost from anywhere and anytime.

Everyone has a different and unique learning pace matched by delivery of online learning. Online learners benefit from flexible learning schedules. Online learning offers an enhanced discussion element, often in a forum for discussion board. With an estimated 93% of communication being non-verbal, online learners do not have to worry about body language interfering with their message. Online education eliminates physical judgments that can cloud rational discussion. At traditional schools, talking to a teacher after class can be challenging. This is not the case in an online learning environment. Online learning makes parent-teacher collaboration positive and transparent. Online systems permit deep analytical summaries of a students' progress. This helps in creating a personalized learning journey for each student.

Furthermore, with this sudden shift away from the classroom in many parts of the globe, the adoption of online learning will continue to persist post-pandemic, and such a shift would impact the worldwide education market. By following an interactive, collaborative approach, the students and instructors will co-create the learning process and for the better.

All around the world, educational institutions are looking toward online learning platforms to continue with the process of educating students. The new normal now is a transformed concept of education with online learning at the core of this transformation. Today, digital learning has emerged as a necessary resource for students and schools all over the world. Online learning is now applicable not just to learn academics but it also extends to learning extracurricular activities

for students as well. In recent months, the demand for online learning has risen significantly, and it will continue doing so in the future.

1. Efficiency

Online learning offers teachers an efficient way to deliver lessons to students. Online learning has a number of tools such as videos, PDFs, podcasts, and teachers can use all these tools as part of their lesson plans. By extending the lesson plan beyond traditional textbooks to include online resources, teachers are able to become educators who are more efficient.

2. Accessibility of Time and Place

Another advantage of online education is that it allows students to attend classes from any location of their choice. It also allows schools to reach out to a more extensive network of students, instead of being restricted by geographical boundaries. Additionally, online lectures can be recorded, archived and shared for future reference. This allows students to access the learning material at a time of their comfort. Thus, online learning offers students the accessibility of time and place in education.

3. Affordability

Another advantage of online learning is reduced financial costs. Online education is far more affordable as compared to physical learning. This is because online learning eliminates the cost points of student transportation, student meals, and most importantly, real estate. Additionally, all the course or study materials are available online, thus creating a paperless learning environment, which is more affordable, while also being beneficial to the environment.

4. Improved Student Attendance

Since online classes can be taken from home or location of choice, there are fewer chances of students missing lessons.

5. Suits a Variety of Learning Styles

Every student has a different learning journey and a different learning style. Some students are visual learners, while some students prefer to learn through audio. Similarly, some students thrive in the classroom, and other students are solo learners who get distracted by large groups.

The online learning system, with its range of options and resources, can be personalized in many ways. It is the best way to create a perfect learning environment suited to the needs of each student.

1.7 DISADVANTAGES OF ONLINE LEARNING

1. Inability to Focus on Screens

For many students, one of the biggest challenges of online learning is the struggle with focusing on the screen for long periods. With online learning, there is also a greater chance for students to be easily distracted by social media or other sites. Therefore, it is imperative for the teachers to keep their online classes crisp, engaging, and interactive to help students stay focused on the lesson.

2. Technology Issues

Another key challenge of online classes is internet connectivity. While internet penetration has grown in leaps and bounds over the past few years, in smaller cities and towns, a consistent connection with decent speed is a problem. Without a consistent internet connection for students or teachers, there can be a lack of continuity in learning for the child. This is detrimental to the education process.

3. Sense of Isolation

Students can learn a lot from being in the company of their peers. However, in an online class, there are minimal physical interactions between students and teachers. This often results in a sense of isolation for the students. In this situation, it is imperative that the school allow for other forms of communication between the students, peers, and teachers. This can include online

messages, emails and video conferencing that will allow for face-to-face interaction and reduce the sense of isolation.

4. Teacher Training

Online learning requires teachers to have a basic understanding of using digital forms of learning. However, this is not the case always. Very often, teachers have a very basic understanding of technology. Sometimes, they do not even have the necessary resources and tools to conducts online classes.

5. Manage Screen Time

Many parents are concerned about the health hazards of having their children spend so many hours staring at a screen. This increase in screen time is one of the biggest concerns and disadvantages of online learning. Sometimes students also develop bad posture and other physical problems due to staying hunched in front of a screen.

1.8 ATTITUDE

In psychology, an attitude refers to a set of emotions, beliefs, and behaviors toward a particular object, person, thing, or event. Attitudes are often the result of experience or upbringing, and they can have a powerful influence over behavior. While attitudes are enduring, they can also change.

1.8.1 DEFINITION

Psychologists define attitudes as a learned tendency to evaluate things in a certain way. This can include evaluations of people, issues, objects, or events. Such evaluations are often positive or negative, but they can also be uncertain at times.

1.8.2 COMPONENTS OF ATTITUDE

- **Cognitive Component:** thoughts and beliefs about the subject
- **Affective Component:** How the object, person, issue, or event makes students feel
- **Behavioral Component:** How attitude influences the behavior

Attitudes can also be explicit and implicit. Explicit attitudes are those that we are consciously aware of and that clearly influence our behaviors and beliefs. Implicit attitudes are unconscious but still have an effect on our beliefs and behaviors.

1.8.3 ATTITUDE FORMATION

There are a number of factors that can influence how attitudes form. Some of the common factors are:

- **Experience**

Attitudes form directly because of experience. They may emerge due to direct personal experience, or they may result from observation.

- **Social Factors**

Social roles and social norms can have a strong influence on attitudes. Social roles relate to how people are expected to behave in a particular role or context. Social norms involve society's rules for what behaviors are considered appropriate.

- **Learning**

Attitudes can be learned in a variety of ways. Consider how advertisers use classical conditioning to influence attitude towards a particular product. In a television commercial, beautiful people having fun on a tropical beach while enjoying a sports drink. This attractive and appealing imagery causes the development of a positive association with this particular beverage.

- **Conditioning**

Operant conditioning can also be used to influence how attitudes develop. Imagine a young man who has just started smoking. Whenever he lights up a cigarette, people complain, chastise him, and ask him to leave their vicinity. This negative feedback from those around him eventually causes him to develop an unfavorable opinion of smoking and he decides to give up the habit.

- **Observation**

Finally, people also learn attitudes by observing people around them. When we admire someone greatly espouses a particular attitude, we are more likely to develop the same beliefs. For example, children spend a great deal of time observing the attitudes of their parents and usually begin to demonstrate similar outlooks.

1.9 STATEMENT OF THE PROBLEM

The present study is entitled as "**ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS**".

1.10 DEFINITION OF KEY TERMS

The important terms used in the study are online teaching, attitude, educational technology and analysis.

- **ONLINE TEACHING**

Online education is electronically supported learning that relies on the internet for teacher/student interaction and the distribution of class materials.

- **ATTITUDE**

Psychologists define attitudes as a learned tendency to evaluate things in a certain way. This can include evaluations of people, issues, objects, or events. Such evaluations are often positive or negative, but they can also be uncertain at times.

- **EDUCATIONAL TECHNOLOGY**

Educational technology is that branch of educational theory and practice, which is concerned primarily with the design and use of message which control the learning process.

- E.E. Haddan

- **ANALYSIS**

Analysis is examination of data and facts to uncover and understand cause-effect relationships, thus providing basis for problem solving and decision-making.

-Jukka. K. Korpela, 2004

1.11 NEED AND SIGNIFICANCE OF THE STUDY

It is our experience that increase of population and explosion of knowledge are not only affecting the pattern of human life but also inflicting their full impact on education. The population is increasing in geometrical proportion and new frontiers of knowledge are being opened up almost daily. The explosion of population and knowledge has raised the serious question of both quality and quantity of education.

Educationists are of the opinion that the educational problem relating to quantity and quality could be tackled by the development of an educational technology. Therefore, there has been a rapid development all over the world in recent years in the development of communication technology in education at all levels with a purpose of extending educational facilities and upgrading instruction.

1.12 SCOPE OF THE STUDY

This study aims in understanding the Attitude of Teachers and Student Teachers towards online teaching of Mathematics to school students.

1.13 OBJECTIVES OF THE STUDY

1. To study the Attitude of Teachers and Student Teachers in teaching Mathematics through online mode.
2. To study the Attitude of Teachers and Student Teachers in handling online Mathematics class with respect to preparation, presentation and evaluation.

1.14 HYPOTHESIS OF THE STUDY

1. There is no significant difference in the Attitude of Teachers and Student teachers with respect to age in online teaching mathematics.
2. There is no significant difference in the Attitude of Teachers and Student teachers with respect to their marital status in online teaching mathematics.
3. There is no significant difference in the Attitude of Teachers and Student teachers with respect to their qualification in online teaching mathematics.
4. There is no significant difference in the Attitude of Teachers and Student teachers in teaching online mathematics classes.
5. There is no significant difference in the Attitude of Teachers and Student teachers with respect to their locality in online teaching mathematics.
6. There is no significant difference in the Attitude of Teachers and Student teachers with respect to their family income in online teaching mathematics.

1.15 LIMITATIONS OF THE STUDY

- The researcher has taken only limited sample for the study. The sample size is limited to 120.
- The researcher has taken sample only from female mathematics teachers and hence there is no comparison between the attitudes of teachers towards online teaching based on their gender.

1.16 ORGANISATION OF THE THESIS

This study is presented in five chapters.

First Chapter- deals with the introduction, statement of the problem, definition of key terms, need of the study, scope of the study, objectives, hypothesis and limitations.

Second Chapter- gives the account of the review of the literature connected with the topic.

Third Chapter- deals with the methodology, samples, and tools, method of administration and collection of data.

Fourth Chapter- deals with the classification, analysis and interpretation of data.

Fifth Chapter- presents the summary of the findings, discussion, recommendations, suggestions for further study and conclusion.

CHAPTER II

REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION

'Review of literature involves locating, reading and evaluating reports of research as well as reports of casual observation and opinion that are related to the individual's planned research projects'

-Walter R.Borg.1989

A literature review is both a summary and explanation of the complete and current state of knowledge on a limited topic as found in academic books and journal articles.

2.2 THEORETICAL OVERVIEW

Information technology and the Internet are major drivers of research, innovation, growth and social change. The growth in Internet has brought changes in all occupations including the education.

Learning Management Systems (LMSs) are web-based application platforms used to plan, implement, and assess learning processes related to online and offline training, administration and performance management. Online tutoring is the process of tutoring in an online, virtual, or networked, environment, in which teachers and learners participate from separate physical locations. Aside from space, literature also states that participants can be separated by time.

Online tutoring is practiced using many different approaches for distinct sets of users. The distinctions are in content and user interface, as well as in tutoring styles and tutor-training methodologies. Definitions associated with online tutoring vary widely, reflecting the ongoing evolution of the technology, the refinement and variation in online learning methodology, and the interactions of the organizations that deliver online tutoring services with the institutions, individuals, and learners that employ the services. This Internet-based service is a form of micropublishing.

Online education in its various modes has been growing steadily worldwide due to the confluence of new technologies, global adoption of the Internet, and intensifying demand for a workforce trained periodically for the ever-evolving digital economy. Online education is on track to become mainstream by 2025.

2.3 REVIEW OF RELATED STUDIES

Johannes König, et.al, (2020) studied on "Adapting to Online E-Teaching during COVID-19 School Closure: Teacher Education and Teacher Competence Effects among Early Career Teachers in Germany". This paper presents the results of a survey of early career teachers conducted in May and June 2020. Findings from regression analyses show that information and communication technologies (ICT) tools, particularly digital teacher competence and teacher education opportunities to learn digital competence, are instrumental in adapting to online teaching during COVID-19 school closures. Teachers have discussed the implications for the field of teacher education and the adoption of ICT.

Abdulsalam Almanthari, et.al, (2019) studied "The Secondary School Mathematics Teachers' Views on E-Learning Implementation Barriers during the COVID-19 Pandemic at Indonesia". The School closures in Indonesia during the COVID-19 pandemic have left 45.5 million school students and 3.1 million teachers dependent on online teaching and learning. Online teaching and learning are an unprecedented experience for most teachers and students; consequently, they have a limited experience with it. This paper examines the views of secondary school mathematics teachers on E-learning implementation barriers during the COVID-19 pandemic at four barrier levels, namely teacher, school, curriculum and student. Furthermore, it assesses the relationship between barrier levels with teachers' demographic background. Data was collected through an online questionnaire, involving 159 participants from lower and upper secondary schools in Indonesia. The findings of this study suggest that student level barrier had the highest impact on e-learning use. In addition, the student level barrier showed strong positive correlation with the school level barrier and curriculum level barrier. The study showed that teachers' backgrounds had no impact on the level of barriers.

Eddie M Mulenga, et.al, (2019) conducted a study on the title, "Prospective Teachers' Online Learning Mathematics Activities in the age of COVID -19: A Cluster Analysis Approach". The learning situation in the Zambian education sector has changed in the age of COVID-19 when the first two cases of COVID-19 infection were detected in the country rising to 45 local and at least 1.8 million infections globally by 13th April, 2020. Zambia became one of the many countries globally that has prematurely closed all schools. This study examines prospective teachers' online learning mathematics activities in the age of COVID-19 pandemic. Cluster analysis results revealed that online learning mathematics activities have significant mean differences in clustering. Cluster 2 recorded the best performance, implying that students in this cluster exhibited excellent online learning skills for mathematics in technology-rich environments in which they will be forced to study and work in the future.

Jerri Ward-Jackson (2019) studied on "The Impact of Online Learning in K- 12: Effectiveness, Challenges and Limitations for Online Instruction". The overall growth in the total number of high school students currently taking online distance learning courses as well as the importance of distance learning as a solution to educational challenges has increased the need to study more closely the factors that contribute to distance learning outcomes and success rates in K-12. Therefore, the challenge that emerges for educators, researchers, scholars, and advocates for students is to carefully and effectively join the growth and power of K-12 online learning for the benefit of the students involved. This paper provides an overview of factors that contribute to learning outcomes and success rates for K-12 distance education. Some of the challenges, issues, and considerations affecting implementation of K-12 online education are discussed.

Arthur B. Powell, et.al, (2018), studied on "Supporting Students' Productive Collaboration and Mathematics Learning in Online Environments". Digital technologies provide a wide range of tools and functions that can support students' learning of mathematics as well as the development of their mathematical and collaborative practices. Bringing such technologies to mathematics classrooms often do not parallel students' previous classroom experiences, especially when

collaborative practices are emphasized. When facilitating Mathematics learning, discrepancies between students' previous classroom experiences and their expected engagement with new collaborative technologies result in challenges to which teachers need to attend. This chapter describes how a high school mathematics teacher engages his students in an online collaborative environment; Virtual Math Team with Geo Zebra, and addressed students' technological and collaborative challenges to support growth in their geometrical understanding.

Mansureh Kebritchi, et.al, (2017) studied on "The Issues and Challenges for Teaching Online Courses in Higher Education: A Literature Review". Online education changes all components of teaching and learning in higher education. Many empirical studies have been conducted to examine issues in delivering online courses; however, few have synthesized prior studies and provided an overview on issues in online courses. A review of literature using Cooper's framework was conducted to identify such issues. Three major categories of findings were identified: issues related to online learners, instructors, and content development. Learners' issues included learners' expectations, readiness, identity, and participation in online courses. Instructors' issues included changing faculty roles, transitioning from face-to-face to online, time management, and teaching styles. Content issues included the role of instructors in content development, integration of multimedia in content, role of instructional strategies in content development, and considerations for content development. To address these challenges in online education, higher education institutions need to provide professional development for instructors, trainings for learners, and technical support for content development.

Victor C. X. Wang, et.al, (2016) advocated on "The Online Teaching, Change and Critical Theory". While many educators in higher education are using technologies in their teaching, their use of technology is generally restricted to meeting purposes of convenience and efficiency. It is therefore desirable to encourage educators to make some changes to their online teaching practices. Achieving change in teaching practice is a challenging process. The authors suggest that adopting a critical theory perspective has the potential to empower educators to re-examine their roles,

beliefs and assumptions, and ultimately help to reform teaching practice in online environments to the benefit of both educators and their learners. Thus, the authors seek to encourage educators to reconsider their philosophy of online teaching from the perspective of critical theory.

SitiNurul Mahfuzah Mohamad, et.al, (2015) studied on "The Factors Affecting Lecturers Motivation in Using Online Teaching Tools". The objective of this paper is to identify the factors that motivate lecturers to use online teaching tools, such as Web 2.0 tools. There is a variety of online teaching tools available to the lecturers. 30 lecturers from different subject matter experts had completed an evaluation of the lecturer's motivation. The instruments used were interview sessions and classroom observation, which were used to measure four motivation variables: ease of use, enjoyment, usefulness and self-confidence, based on the ARCS Motivation model. Based on the findings, factors that can affect lecturers' motivation in using online teaching tools are knowledge, perceptions and skills.

Mansureh Kebritchi (2014), conducted a study on "Preferred Teaching Methods in Online Courses: [Learners' Views]". The purpose of this study was twofold : first, to identity the recommended online teaching methods in asynchronous discussion boards, and second, to explore learners' perceptions about the identified teaching methods and correlate the learners' perceptions with learners' characteristics, including computer skills, experiences, and activity ratios in online discussions. Descriptive survey and correlation designs were used to examine the perspectives of 30 purposefully selected online students through two sets of questionnaires with close and open - ended questions. Findings indicated that the narrative with a higher interactivity level was the preferred method. The Interactivity of online instructors and perceived success of courses were moderately correlated. Participants with stronger computer skills preferred teaching methods with lower interactivity. Some participants did not prefer a specific teaching method for performing various instructional tasks but rather preferred combining the narrative and episodic methods. Such findings inform educators about possible changes to improve the quality of online teaching.

Jillian J. Downing and Janet E. Dyment (2013) conducted an exploratory study on "Teacher Educators' Readiness, Preparation and Perceptions of Preparing Preservice Teachers in a Fully Online Environment". This research responds to the gap in the literature and reports on an exploratory study that worked with academic staff, teaching in a fully online teacher education course, at a mid-size Australian university. Twenty-seven teacher educators completed a 34-item questionnaire that consisted of closed and open-ended questions. Concerning readiness and preparation for teaching online, the majority of teacher educators reported lacking confidence and competence in the technological and pedagogical skills required to teach online. The teacher educators were generally divided on whether the online classroom was an appropriate method for preparing preservice teachers. This article concludes with several recommendations for consideration by teacher educators who work in an online environment and sets the stage for a more ambitious study.

Jimmy Nguyen and Dr. Cynthia B. Paschal (2013) studied the "Development of Online Ultrasound Instructional Module and Comparison to Traditional Teaching Methods". A Web based teaching device was constructed to deliver information on fundamentals of ultrasound imaging to approximately one half the students in an undergraduate medical imaging course, while the remaining students were taught the same material via traditional lectures and typed notes. The students participating in this study were separated randomly but in such a manner, that prior achievement was statistically equivalent for the two groups. After approximately two weeks of instruction, an ultrasound-imaging exam was administered. Results indicated no statistically significant difference in scores on homework assigned during the instructional period between the traditional and online groups. Similarly, there was no statistically significant difference in the average exam scores of students in the two groups. The traditional group required significantly more time on learning activities than did the online group. These results indicated that level of understanding was not affected by use of the online device, while efficiency of learning improved dramatically. The effectiveness of this device could potentially be improved by implementing enhancements to increase the level of interaction for the user and to help with discipline and time management.

Nicholas D. Ward, et.al, (2013) studied on "The Benefits and Limitations of I-pads in the High School Science Classroom and A Trophic Cascade Lesson Plan". This study explores the utility of a set of tablet-based personal computers in the K–12 science, technology, engineering, and mathematics classroom. A lesson on food-chain dynamics and predator–prey population controls was designed on the Apple® iPad platform. It was given to three sophomore-level ecology classes (roughly 30 students per class with six iPads). Questionnaire feedback indicated that most students greatly enjoyed and were engaged in the activity. Further, student understanding of core concepts generally increased after participating in the tablet-based activity. Here, the iPad was essentially used as a data generator for a calculation-based activity, which is one of many potential applications of a class set of tablets. The collective results of this study indicate that student engagement and concept building is enhanced by immersive, tablet-based activities and a lesson plan that can be readily used in K–12 science classrooms is provided.

Maria de Lourdes Mata (2012), studied on "Attitudes towards Mathematics: Effects of Individual, Motivational, and Social Support Factors". This paper aims to understand how certain different but interrelated variables such as background, motivation, and social support could lead to an explanation of student attitudes towards math and to an understanding of the defining characteristics of these attitudes in the school environment. Participants consisted of 1719 Portuguese students, from fifth-to-twelfth grade. The study utilizes an adaptation of the "Intrinsic Motivation Inventory" assessing main determinants of intrinsic motivation. One section of the questionnaire—"In my Math Class"—also assesses student perceptions of teacher and peer support as well as student attitudes. The results revealed that, in general, students held positive attitudes towards mathematics and highlighted the main effects of grade and math achievement on these attitudes. A hierarchical analysis using structural equation modeling showed that motivation-related variables are the main predictors of attitudes towards mathematics and that teachers and the social support of peers are highly significant in understanding these attitudes.

Afzal Muhammad Tanveer (2011), studied on "Attitude of Mathematics Teachers Related to the Use of Computer Technology in the Classroom". The major objective of the study was to measure the attitude of mathematics teachers to the use of computer technology in the classroom. The researchers recognized that it is necessary to investigate to what extent the mathematics teachers' community accept this change. The mathematics teachers of district Jhelum were the population and the researchers selected teachers teaching mathematics in thirty (Government High School) GHS & (Government Girls High School) GGHS (Fifteen each) randomly as sample of the study. To accomplish this purpose, research tool with sections on personal information and six questions about availability and training in computers was used. Independent Sampled t-test was employed for testing of three null hypotheses. It was found that male teachers had positive attitude as compared to female teachers. In addition, Professional qualification had positive effect on the attitude of mathematics teachers, whereas locality had no effect on attitude of mathematics teachers. It is necessary to equip the classroom teacher with the new technology so, that they can teach mathematics effectively.

Meredith DiPietro, et.al, (2010) studied on "The Virtual School Teachers". Virtual schools are rising in popularity and presence. Unfortunately, there is a relative dearth of research related to teaching and learning in virtual schools. Although there are numerous handbooks addressing teaching online, there is little research on successful online teaching in the K-12 arena. Most of the existing research focused on online teaching is rooted in face-to face content, not focused on content areas; built upon a post-secondary audience, or fails to use data from the teachers themselves to triangulate findings. This paper reports on a study of 16 virtual schoolteachers from the Michigan Virtual School (MVS). It reports on best practices from the interviews conducted with MVS teachers; and also provides research triangulation for those practices. The paper concludes with implications for policy, research, and practice.

Carole R. Beal and Erin Shaw (2009), conducted a study on "An Online Math Problem Solving System for Middle School Students Who is blind". There has been growing interest in designing online learning systems that are accessible to learners with special needs. In this project, blind students modified an existing online math word problem solving system for use. Text-to-speech technology was used to present math word problems in audio format, and to provide audio feedback to students about their answers. The adapted system was evaluated with blind middle school students (N = 11). Results indicated that blind students' problem solving was comparable to that of sighted students who had worked with the original system.

Jennie De Gagne, et.al, (2009) conducted a "Qualitative Study on Online Teaching Experience". Qualitative studies of educators who teach online are crucial to provide direction for practice and research as they offer an emic perspective. Using a qualitative met synthesis (QMS) design, this study investigated the experience of online educators at institutions of higher education in the U. S. Discerning what activities online educators could instigate to bridge the gaps between the best practices and the present instructional realities in online teaching, this study provides an interpretive synthesis of the meaning of teaching online as represented by a body of qualitative literature on online education. The researcher identified nine original qualitative studies involving 203 participants in geographically diverse schools. Close reading of the nine studies identified four key themes that captured the nature and experience of online instructors: (a) work intensity, (b) role changes, (c) teaching strategies, and (d) professional development. Many of these themes were linked to each other and therefore, contributed to a broader picture of the instructor's experience. The results of the study substantiate previous research and can benefit all stakeholders including learners, faculty members, and leaders in colleges and universities that offer online education.

Thomas A. DeVaney (2009) studied the "Impact of Video Tutorials in an Online Educational Statistics Course". This research describes the evaluation of video tutorials used in a graduate level online statistics course. The evaluation focused on attitudes toward the tutorials and differences in academic performance between online sections that used the tutorials and those that did not. Attitude results were based on 78 students who completed an online survey and indicated

positive perceptions of the tutorials. Comparisons of sections with and without access to the tutorials showed no statistically significant difference with respect to academic performance. These results suggest that video presentations used as supplemental materials may provide instructional designers with a tool to create online courses that are as effective as traditional face-to-face courses.

Subhashni Appana (2008) conducted a study on the title “A Review of Benefits and Limitations of Online Learning in the Context of the Student, the Instructor and the Tenured Faculty”. Learning is supported by communications technology such as television, videotape, computers, e-mail, and mail. Online learning is any learning experience or environment that relies upon the Internet/World Wide Web (WWW or Web) as the primary delivery mode of communication and presentation. There are potential benefits of investing in online learning for example, increased access, improved quality of learning, better preparation of students for a knowledge-based society, "lifelong" learning opportunity, profit making, and many more. Limitations are also evident in this popular learning environment. Among them are: (a) online learning start-up funding, (b) organizational preparedness, and (c) student readiness. This article will review the benefits and limitations of online learning from three perspectives namely, (a) the student, (b) the instructor, and (c) the tenured faculty (faculty offering the program).

Salvador Llinares and Julia Valls (2007), studied on “Building of Pre-service Primary Teachers’ Knowledge of Mathematics Teaching: Interaction and Online Video Case Studies”. This study explores how preservice primary teachers became engaged in meaning-making mathematics teaching when participating in online discussions within learning environments integrating video-clips of mathematics teaching. We identified different modes of participation in the online discussions and different levels of knowledge building. The data can be explained by the type of task set in the learning environments and by a gradually improved shared understanding of the teaching. The structure of the learning environments supported inquiry into meaningful topics and knowledge building through activities like identifying, interpreting and designing. These findings suggest that the different types of task and conditions of online discussion in the learning

environments influence the nature of the interaction showing the correspondence between synergistic interaction and higher-order thinking.

Gaea Leinhardt, et.al, (2006) studied on Online Education on the topic "Going the Distance with Online Education". This paper charts the promissory notes and concerns related to college-level online education as reflected in the educational literature. It is argued that, to appreciate the potential and limitations of online education, we need to trace the issues that bind online education with distance education. The paper reviews the history of distance education through the lenses of three historical themes—democratization, liberal education, and educational quality—and charts the current scene of online education in terms of three educational visions that may inform the development of online initiatives: the presentational view, the performance-tutoring view, and the epistemic-engagement view. The paper emphasizes the potential contributions of online education to democratization and the advancement of the scholarship of teaching.

John O'Donoghue, et.al, (2006) studied on "A Comparison of the Advantages and Disadvantages of IT Based Education and the Implication upon Students". The aim of this study is to compare both the advantages and disadvantages that online learning can offer to students. The study will consider how online education is increasing the accessibility of higher education to many previously denied, as well as allowing for any evidence that may provide a link between performance levels of online students compared with their classroom counterparts. Providing an insight to how online graduates may potentially benefit the workforce and society. Opposing views, for example lack of face-to-face interaction, threats of isolation, and the potential creation of a social divide will be covered, whilst considering how educational institutions may be able to reduce or even prevent these issues and aid the development of online education.

Curt J. Dommeyer, et.al, (2002) conducted a study on "The Attitude of Business Faculty towards Two Methods of Collecting Teaching Evaluations: Paper vs. Online". Business professors were surveyed to determine their attitudes towards two methods of collecting students' teaching evaluations of faculty--the traditional paper-and-pencil method conducted in class and the online method conducted via the Internet. Faculty preferred the traditional paper method, mainly because they believed it would produce a higher and more accurate response than the online method. Faculty characteristics were examined to determine whether they were related to attitudes towards the online method of collecting teaching evaluations. No characteristics were found to be significantly associated with attitudes towards the online method.

Linda Harasim (2000) presented a paper titled "Shift happens: Online Education as a new Paradigm in Learning". This paper addresses that paradigmatic shift. It begins by presenting an overview of the history of online education as a context and framework for understanding the state of the art today, especially the use of network technologies for collaborative learning in post-secondary education. Beginning with the innovations of early pioneers as contributing to the paradigmatic shift, it provides a framework for understanding this new field. It then focuses on the Virtual-U, a Web-based environment especially customized to support advanced educational practices. The Virtual-U research team hosts the largest field trials in post-secondary education in the world with empirical results and insights generated from over 439 courses taught by 250 faculty to 15,000 students, attesting to what works in online education.

Thierry Volery, et.al, (2000), studied the "Critical Success Factors in Online Education". The Internet is a major technological advancement reshaping not only our society but also that of universities worldwide. In light of this, universities have to capitalize on the Internet for teaching, and one progressive development of this is the use of online delivery methods. This paper draws upon the results of a survey conducted amongst students enrolled in one online management course at an Australian university. Three critical success factors in online delivery are identified: technology, the instructor and the previous use of the technology from a student's perspective. We also argue that the lecturer will continue to play a central role in online education, albeit his or her role will become one of a learning catalyst and knowledge navigator.

2.4 CONCLUSION

Literature reviews connected carefully and presented well, add much to an understanding of all selected problem and help to place the result of a study in a historical perspective. Without review literature, it would be difficult to build a body of except knowledge on the educational topic.

Review of literature help the investigator to known as to what lines to proceed to make the effect a successful and useful endeavor. It guides the investigator to select the correct procedure at the time of investigation. Finally, these reviews give information, which can aid and support or challenge the conclusion of the investigator's research and therefore provide clues for later research.

CHAPTER III

METHODLOGY

Research has proved to be an essential and powerful tool in leading man towards progress. There would have been very little progress, as we find it today, without systematic research. In order to achieve the objective, it is necessary to use some kind of research tool, which will enable the investigator to collect data.

The methodology of the present study outlines the design of the study, construction of tools, data gathering procedures and data analysis. Selection of an appropriate methodology for the study provided clear direction to researcher with regard to the various steps to be followed in carrying out the research successfully. The hypothesis set for the study suggests the Procedure for conducting the study. The details of the procedure for conducting the study adopted are briefly described below under the following heads:

3.1 INTRODUCTION

"Research may be defined as the systematic and objectives analysis and reading of controlled observations that may lead to the development of generalizations, principles, or theories, resulting in prediction and possibly ultimate control of events".

John.W.Best.2002

Research methodology involves the systematic procedure by which the researcher starts from the initial identification of the problem to this conclusions. The role of the methodology is to carry on the research work in a scientific and valid manner. The methodology consists of procedure and technique for conducting study. The researcher must learn the proper use of research method. Thus, research methodology consists of all general and specific activities of research. Mastery of the research methodology invariably enhances understanding of the research activities.

Research methodology is a way to solve the research problem systematically. When we talk about research methodology we not only talk of research methods but also consider the logic behind the methods we use in the context of our research study and explain why we are not using others so that research results are capable of being evaluated either by the researcher himself or by others.

3.2 METHODS ADOPTED IN THE PRESENT STUDY

In this study, we have created an Attitude scale to measure the Attitude of Teachers and Student Teachers towards Online Teaching of Mathematics. It also compares where they feel difficult in handing online classes like in preparatory phase or presentation phase or evaluation phase.

3.2.1 ESTABLISHING VALIDITY AND RELIABILITY

- **VALIDITY:** Face validity of the tool was established by giving the tool to 8 subject experts. The scale possess a reasonable degree of construct validity, since the items have been prepared using Herbart's theory.
- **RELIABILITY:** The reliability coefficient was calculated by doing a pilot study with 30 teachers. The reliability coefficient was calculated using split-half method. The calculated value was found to be 0.69 which shows that the scale is reliable.

3.2.2 SURVEY METHOD

The term Survey is used for the technique of investigation by a direct observation of a phenomena or systematic gathering of data .The survey is an important type of study. It involves a clearly defined problem and definite objectives.

Link for the tool:- https://forms.gle/aJGJUmMJvvvfcG85A

Along with the personal data sheet, 75 questions of 5 sections, each 15 questions were framed and given to the Mathematics teachers and student teachers. Each section consist of positive and negative questions as shown in the below table.

S.No	Attitude	Sectors	Number of Questions
1	Teachers	Positive	8
		Negative	7
2	Students	Positive	8
		Negative	7
3	Preparation	Positive	7
		Negative	8
4	Presentation	Positive	8
		Negative	7
5	Evaluation	Positive	7
		Negative	8
Total			**75**

3.3 SELECTION OF THE SAMPLE

Simple Random sampling technique is used to select the sample for collecting data. It is the basis for other types of probability sampling. In this method of selection, every item has an equal chance to be selected.

The sample of the present study consisted of 55 Mathematics teachers and 65 Prospective Mathematics teachers summing up to 120 samples.

3.4 VARIABLES USED IN THE STUDY

A variable is a characteristic of a person, object or phenomenon that can take on different values. Variables are the conditions or characteristics that the experimenter manipulates, controls or observes.

Variables used for the study are as follows:

i. Age of Teachers and Prospective teachers.

ii. Marital status of Teachers and Prospective teachers.

iii. Qualification of Teachers and Prospective teachers.

iv. Teacher Vs Student teacher

v. Teaching Experience of the Teachers and Prospective teachers.

vi. Locality of Teachers and Prospective teachers.

vii. Parent's income of Teachers and Prospective teachers.

3.5 TOOLS USED IN THE STUDY

The selection of suitable tool is of vital importance for successful research. Tools employ distinctive ways of describing and quantifying data for testing of hypothesis for the required data as to get objective information. The choice of a tool depends on a variety of factors such as nature of the topic undertaken, the nature of the subject involved, and the time at the disposal of the investigator and so on.

The following tools prepared by the investigator were used in the study.

1. Personal data sheet.
2. Self-made questionnaire with 75 questions.

An online tool- Google forms supported the technological aspect for the study. For statistical analysis of the data, Microsoft Excel and SPSS software are used.

3.5.1 PERSONAL DATA SHEET

The personal data sheet includes basic information about the sample and their family. The basic information section primarily gathers information such as Name, Age, Marital status, Qualification, Subject Specialization, Occupation, Name of the Institute studying or working, locality and other relevant variables needed for the study.

3.5.2 SELF-MADE QUESTIONNAIRE

A self-made tool was constructed with 100 questions in it. It was given to school going Mathematics teachers for review. Considering their opinions, the questions were reformed and finally, the questionnaire was standardized with 75 questions.

The questionnaire was framed based on Johann Friedrich Herbart's (1776-1841) Herbart theory consisting five steps. The questionnaire has five sections, each consisting of 15 questions.

- Attitude of Mathematics Teachers on Online Teaching – 15 questions
- Attitude of Student's on Online Teaching – 15 questions
- Preparatory phase in Online Teaching – 15 questions
- Presentation phase in Online teaching – 15 questions
- Evaluation in Online Teaching – 15 questions

3.7 LOCALE OF THE STUDY

The investigator selected sample from the present and passed out batch Mathematics students of Department of Education of Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore and other known Mathematics teachers in Coimbatore.

3.8 SCORING AND TABULATION

All the responses are scored systematically using scoring keys. The positive questions were ranked 1 to 5 from strongly disagree to strongly agree and negative questions were ranked 5 to 1 from strongly disagree to strongly agree. The total mark gained by a mathematics teacher in each section was calculated and the grand total is tabulated to find their attitude on online Mathematics classes.

3.8.1 STATISTICAL TECHNIQUE USED FOR THE STUDY

The collected data were consolidated, tabulated and analyzed statistically by using the following tests:

i. Test of significance (t-test)

ii. Mean, standard deviation and percentage

3.8.2 TEST OF SIGNIFICANCE (t-TEST)

This test is used to find the significant level of difference between two groups of sample. The t- values are calculated with the help of the mean scores and standard deviation. If the obtained 't-value' is 2.58 and above, then the significant level of difference is 0.01 and if the value lies between 1.96 and 2.58, the significant level is 0.05 and if the value is below 1.96, the difference is not significant.

The Mean, Standard Deviation and Percentage Analysis are done to make simple comparisons wherever necessary.

3.9 CONCLUSION

In this chapter, the methodology of the present investigation was explained. A clear cut view about the method selected, administration of the tool and evaluation of the tool were discussed. Thus, the data obtained was consolidated, analyzed, interpreted and is presented in Chapter IV.

CHAPTER IV

ANALYSIS AND INTERPRETATION

4.1 INTRODUCTION

This section is the heart of the research report. The report should be highly organized and divided depending on the number of objectives of the study, each being devoted for presenting the results pertaining to an objective. The formulae and statistical procedures which were used in the analysis of the data will be clearly specified and explained in detail here. Analysis can be defined as a detailed study of collected data, which is converted to tabulated data, so as to determine the actual facts, which are inherent.

> Analysis is a research technique for the objectives, systematic and qualitative description of manifest content of communication.

(Sukia-2004).

The analysis of data, involves a number of operation , which are performed with purpose of summarizing the collected data and organizing them in such a manner that they will yield answer to the question in research. If analysis involves data organizing in a particular manner, then it is the interpretive ideas that govern this task if the product of analysis is the setting up of certain general conclusions really mean and reflect is the bare minimum that researcher would want to know. Interpretation is the way to gain knowledge. Thus, the task of analysis is incomplete without interpretation coming into play.

This chapter takes the crucial job of analyzing and the interpreting data collected from 120 samples of Mathematics teachers and prospective teachers.

The various statistical procedures adopted were as follows:

i. Descriptive analysis

ii. Differential analysis

4.2 BACK GROUND INFORMATION

4.2.1 DESCRIPTIVE ANALYSIS

Under descriptive analysis, the following details were included. In accordance with selected samples of age, marital status, qualification, experience and locality of Mathematics teachers and prospective Mathematics teachers are listed as follows:

TABLE - I
BACK GROUND INFORMATION OF THE SELECTED SAMPLE

S.No	DISCIPLINE	VARIABLE	NUMBER
1	AGE	20-30 YRS	106
		ABOVE 30 YRS	14
2	MARITAL STATUS	MARRIED	71
		UNMARRIED	49
3	QUALIFICATION	UG	81
		PG	39
4	OCCUPATION	TEACHER	55
		STUDENT TEACHER	65
5	LOCALITY	RURAL	65
		URBAN	55
6	INCOME	ABOVE 5 LAKHS	40
		2.5 TO 5 LAKHS	60
		BELOW 2.5 LAKHS	20

The above shown disciplines help to classify the sample and analyze the data based on our hypothesis using differential analysis. This marks the importance of grouping the data in a correct format.

4.2.2 DIFFERENTIAL ANALYSIS

Under differential analysis, the investigator tried to find out whether there is significant difference in the perception of the following variables.

i. Age of Teachers and Prospective teachers.

ii. Marital status of Teachers and Prospective teachers.

iii. Qualification of Teachers and Prospective teachers.

iv. Teacher Vs Student teacher

v. Locality of Teachers and Prospective teachers.

vi. Parent's income of Teachers and Prospective teachers.

vii. Attitude of teachers on online teaching.

viii. Attitude of students on online learning.

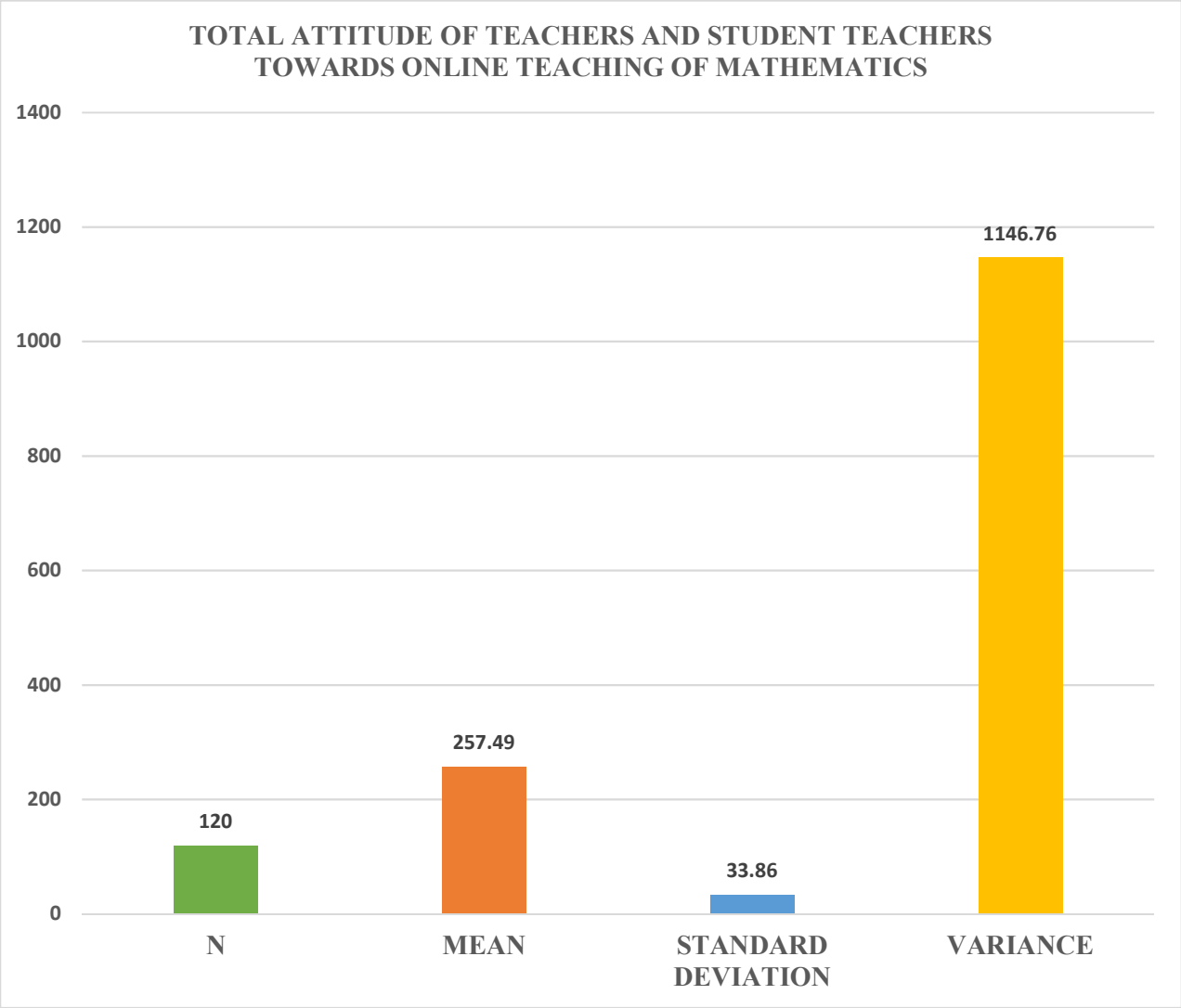
ix. Attitude over preparation for online classes.

x. Attitude over presentation for online classes.

xi. Attitude over evaluation for online classes.

TABLE - II
TOTAL ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS

TOTAL ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHHING OF MATHEMATICS			
N	**MEAN**	**STANDARD DEVIATION**	**VARIANCE**
120	257.49	33.86	1146.76


TOTAL ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS
1400
1200
1000
800
600
400
200
0
120
257.49
33.86
1146.76
N
MEAN
STANDARD DEVIATION
VARIANCE

GRAPH 1

TABLE - III
ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS

ATTITUDE			
N	**MEAN**	**STANDARD DEVIATION**	**VARIANCE**
120	2.91	0.47	0.22

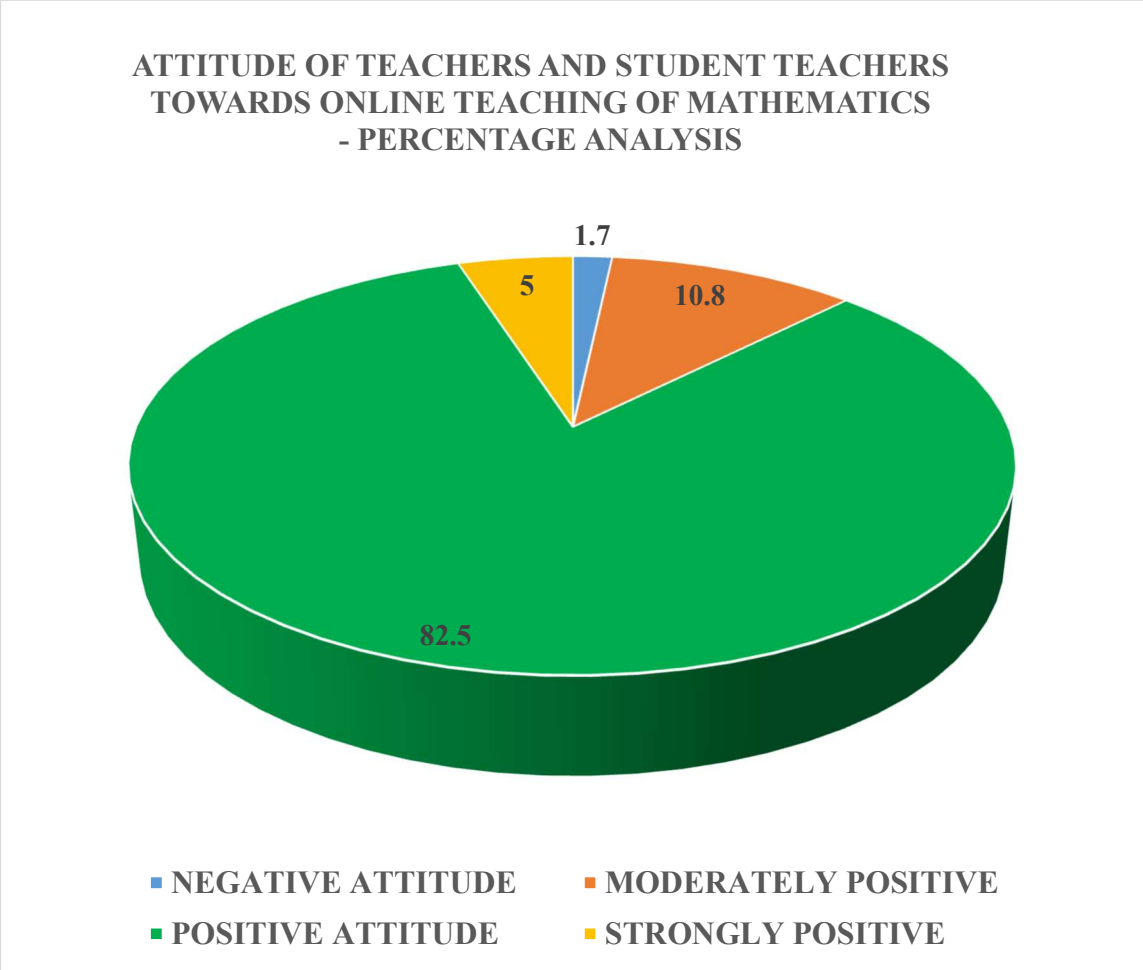
TABLE - IV
PERCENTAGE ANALYSIS

DOMAIN	FREQUENCY	%
NEGATIVE ATTITUDE	2	1.7
MODERATELY POSITIVE	13	10.8
POSITIVE ATTITUDE	99	82.5
STRONGLY POSITIVE	6	5

DISCUSSION

The below pie chart shows the level of Attitude of Teachers and Student Teachers towards online teaching of Mathematics. It is clear from the statistics that many of the teachers have positive attitude towards online teaching of mathematics since it is of 82.5% in the total responses. Following that, teachers have moderately positive attitude, which is 10.8% in the total responses. Moreover, 5% of the teachers have very strong positive attitude towards online teaching and only 1.7% of teachers have negative attitude towards online teaching of mathematics.

This shows that most of the Teachers and Student Teachers have positive Attitude towards online teaching of Mathematics.


ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS - PERCENTAGE ANALYSIS
1.7
10.8
5
82.5
NEGATIVE ATTITUDE
MODERATELY POSITIVE
POSITIVE ATTITUDE
STRONGLY POSITIVE

GRAPH 2

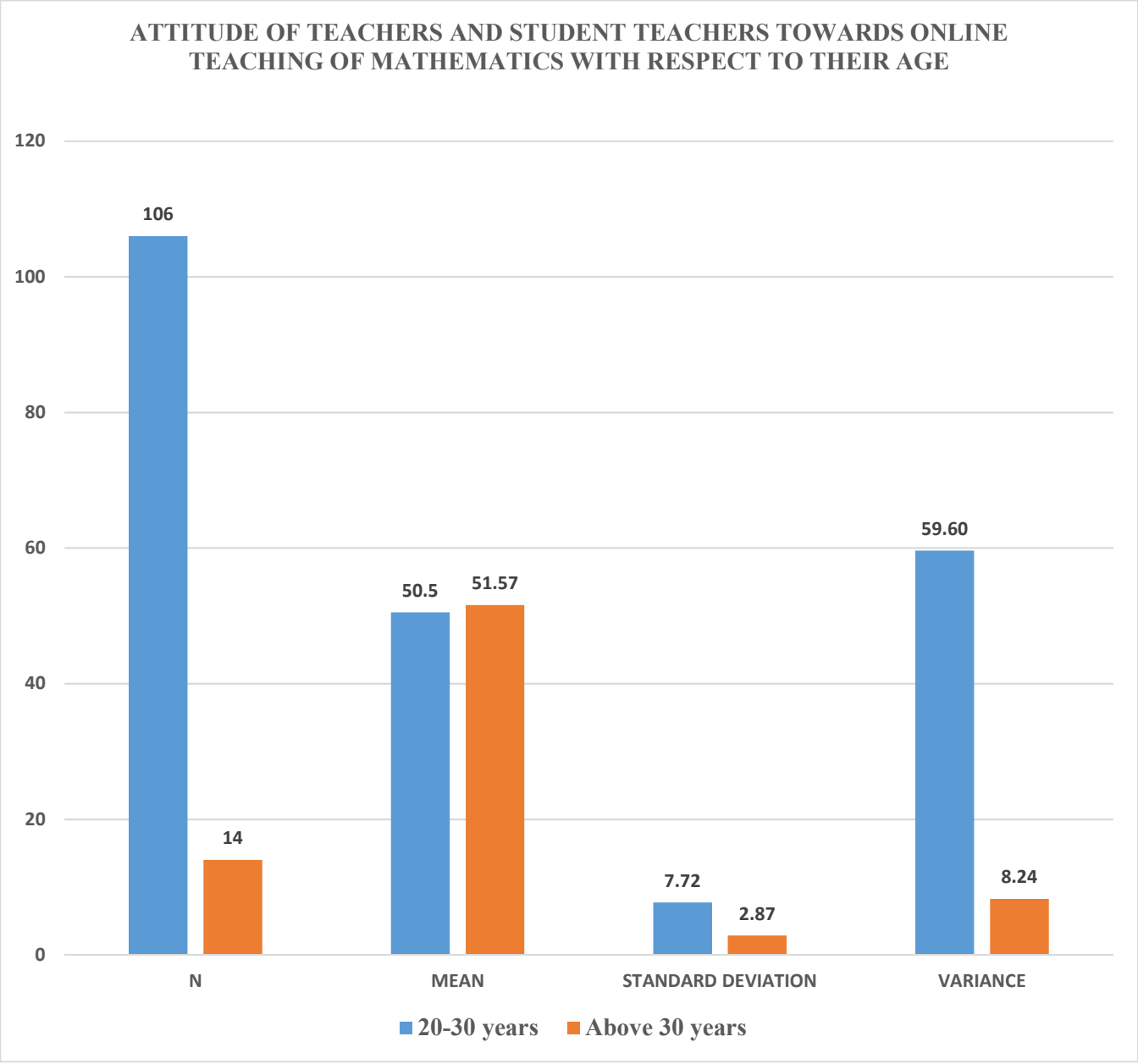
TABLE - V
ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS WITH RESPECT TO THEIR AGE

AGE						
DOMAIN	**N**	**MEAN**	**STANDARD DEVIATION**	**VARIANCE**	**t**	**SIGNIFICANCE LEVEL**
20-30 years	106	50.5	7.72	59.60	0.263	0.609
Above 30 years	14	51.57	2.87	8.24		

DISCUSSION

In the below graph, we can see that the mean of Teachers and Student Teachers in age group between 20-30 years is 50.5 and the mean of teachers above 30 years is 51.57. Therefore, the teachers above 30 years have more positive attitude towards online teaching of mathematics.

The level of significance 0.609 shows that there exist no significant difference between the attitudes of two groups. Hence, the null hypothesis “There exist no significant difference in the Attitude of Teachers and Student Teachers towards online teaching of Mathematics with respect to their age” stated is accepted.


ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS WITH RESPECT TO THEIR AGE
120
100
80
60
40
20
0
106
14
50.5
51.57
7.72
2.87
59.60
8.24
N
MEAN
STANDARD DEVIATION
VARIANCE
20-30 years
Above 30 years

GRAPH 3

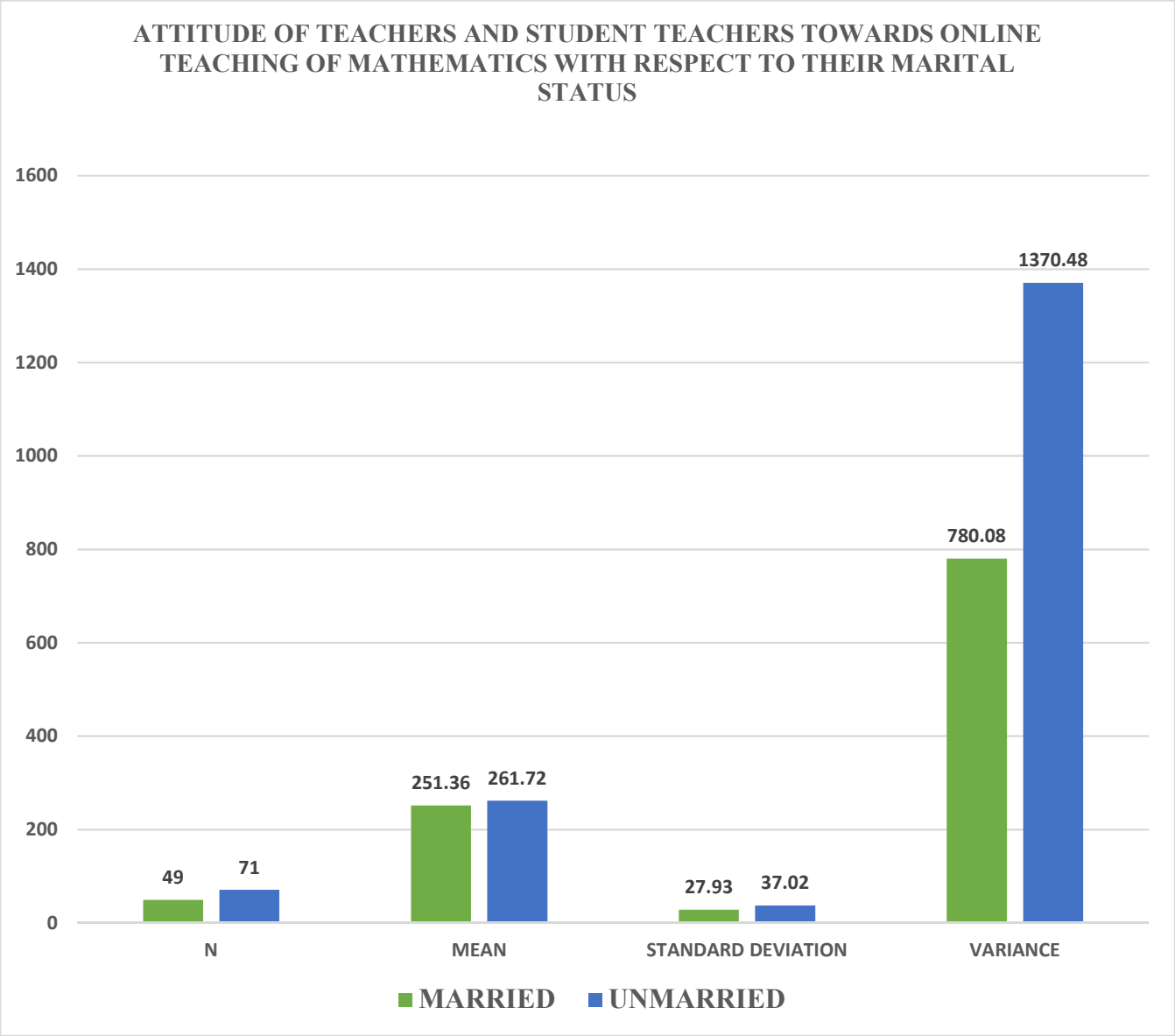
TABLE - VI
ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS WITH RESPECT TO THEIR MARITAL STATUS

MARITAL STATUS						
DOMAIN	**N**	**MEAN**	**STANDARD DEVIATION**	**VARIANCE**	**t**	**SIGNIFICANCE LEVEL**
MARRIED	49	251.36	27.93	780.08	2.749	0.1
UNMARRIED	71	261.72	37.02	1370.48		

DISCUSSION

Among the respondents, the unmarried teachers have more positive attitude towards online teaching of mathematics since their mean 261.72 is higher than the married teachers with mean 251.36.

The t value 2.75 and the significant value 0.1 shows that the two groups are marginally significant. Hence, the null hypothesis “There exist no significant difference in the Attitude of Teachers and Student Teachers towards online teaching of Mathematics with respect to their marital status” stated is rejected.


ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS WITH RESPECT TO THEIR MARITAL STATUS
1600
1400
1200
1000
800
600
400
200
0
49
71
251.36
261.72
27.93
37.02
780.08
1370.48
N
MEAN
STANDARD DEVIATION
VARIANCE
MARRIED
UNMARRIED

GRAPH 4

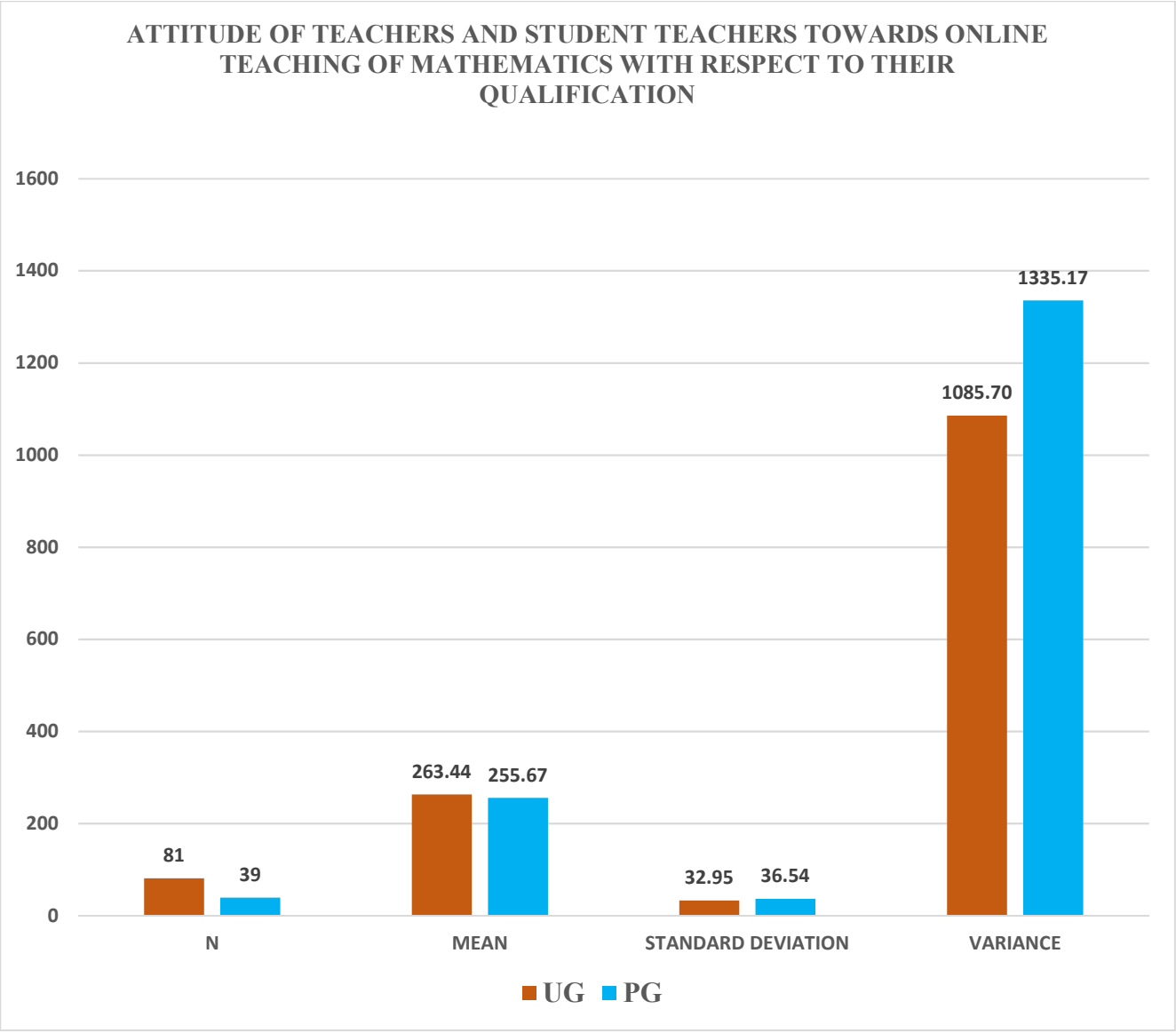
TABLE - VII
ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS WITH RESPECT TO THEIR QUALIFICATION

QUALIFICATION						
DOMAIN	**N**	**MEAN**	**STANDARD DEVIATION**	**VARIANCE**	**t**	**SIGNIFICANCE LEVEL**
UG	81	263.44	32.95	1085.70	1.366	0.245
PG	39	255.67	36.54	1335.17		

DISCUSSION

Among the respondents, most of them have UG degree and their mean is 263.44 while shows that teachers with UG degree have more positive attitude towards online teaching of mathematics than the PG degree teachers whose mean is 255.67.

Their t value 1.366 and significance value 0.245 shows that the UG and PG degree teachers have moderate significance between the two groups. Thus, the null hypothesis “There exist no significant difference in the Attitude of Teachers and Student Teachers towards online teaching of Mathematics with respect to their qualification” is accepted.


ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS WITH RESPECT TO THEIR QUALIFICATION
1600
1400
1200
1000
800
600
400
200
0
81
39
263.44
255.67
32.95
36.54
1085.70
1335.17
N
MEAN
STANDARD DEVIATION
VARIANCE
UG
PG

GRAPH 5

TABLE - VIII

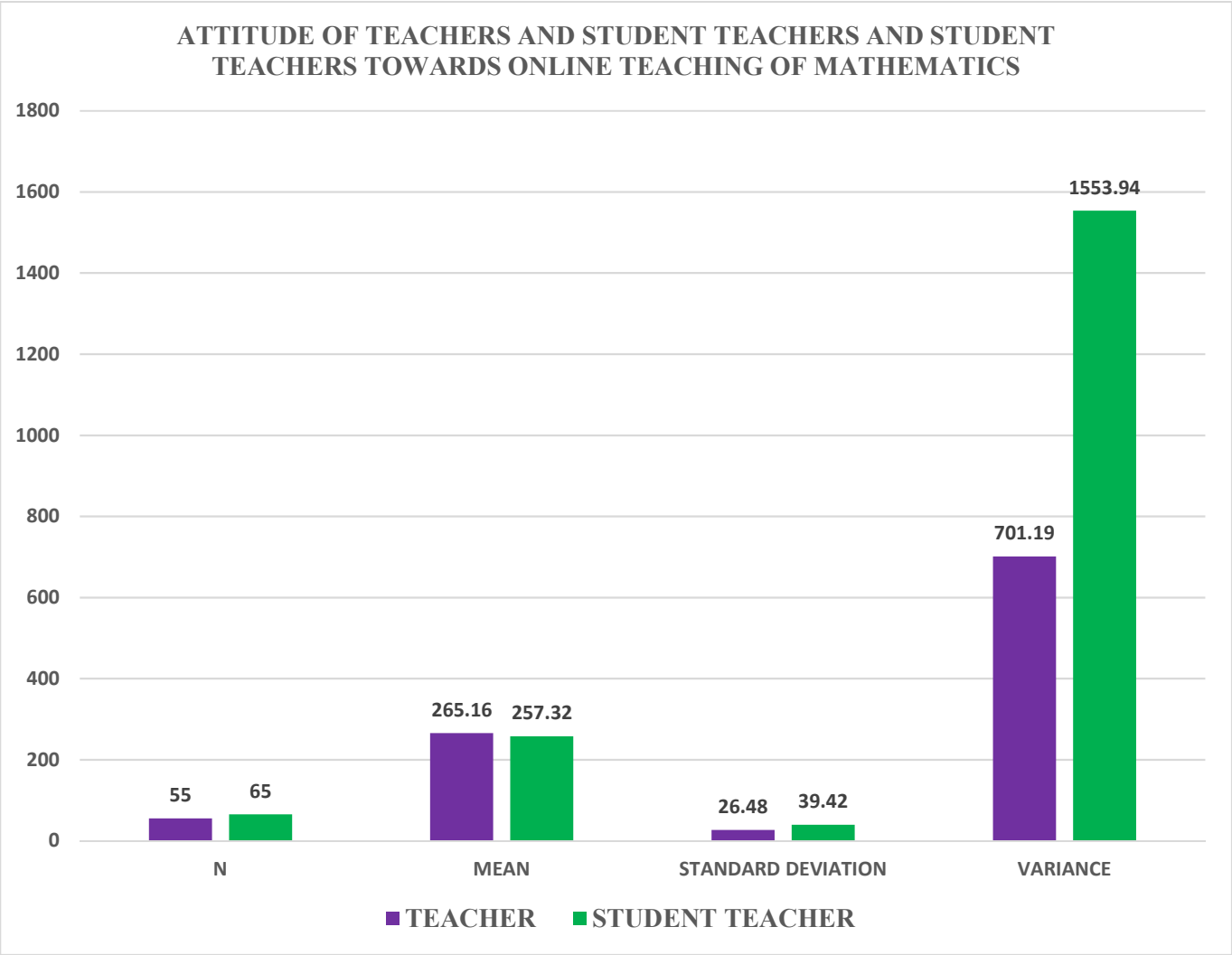
ATTITUDE OF TEACHERS AND STUDENT TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS

OCCUPATION						
DOMAIN	**N**	**MEAN**	**STANDARD DEVIATION**	**VARIANCE**	**t**	**SIGNIFICANCE LEVEL**
TEACHER	**55**	**265.16**	**26.48**	**701.19**	**1.57**	**0.212**
STUDENT TEACHER	**65**	**257.32**	**39.42**	**1553.94**		

DISCUSSION

In the above graph, we can see that the mean of teachers is 265.16 and the mean of student teachers is 257.32. Therefore, the teachers have more positive attitude towards online teaching of mathematics than the student teachers do.

The level of significance 0.212 shows that there exist no significant difference between the attitudes of teachers and the student teachers on online teaching of mathematics. Hence, the null hypothesis “There exist no significant difference in the Attitude of Teachers and Student Teachers towards online teaching of mathematics” stated is accepted.


ATTITUDE OF TEACHERS AND STUDENT TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS
1800
1600
1400
1200
1000
800
600
400
200
0
55
65
265.16
257.32
26.48
39.42
701.19
1553.94
N
MEAN
STANDARD DEVIATION
VARIANCE
TEACHER
STUDENT TEACHER

GRAPH 6

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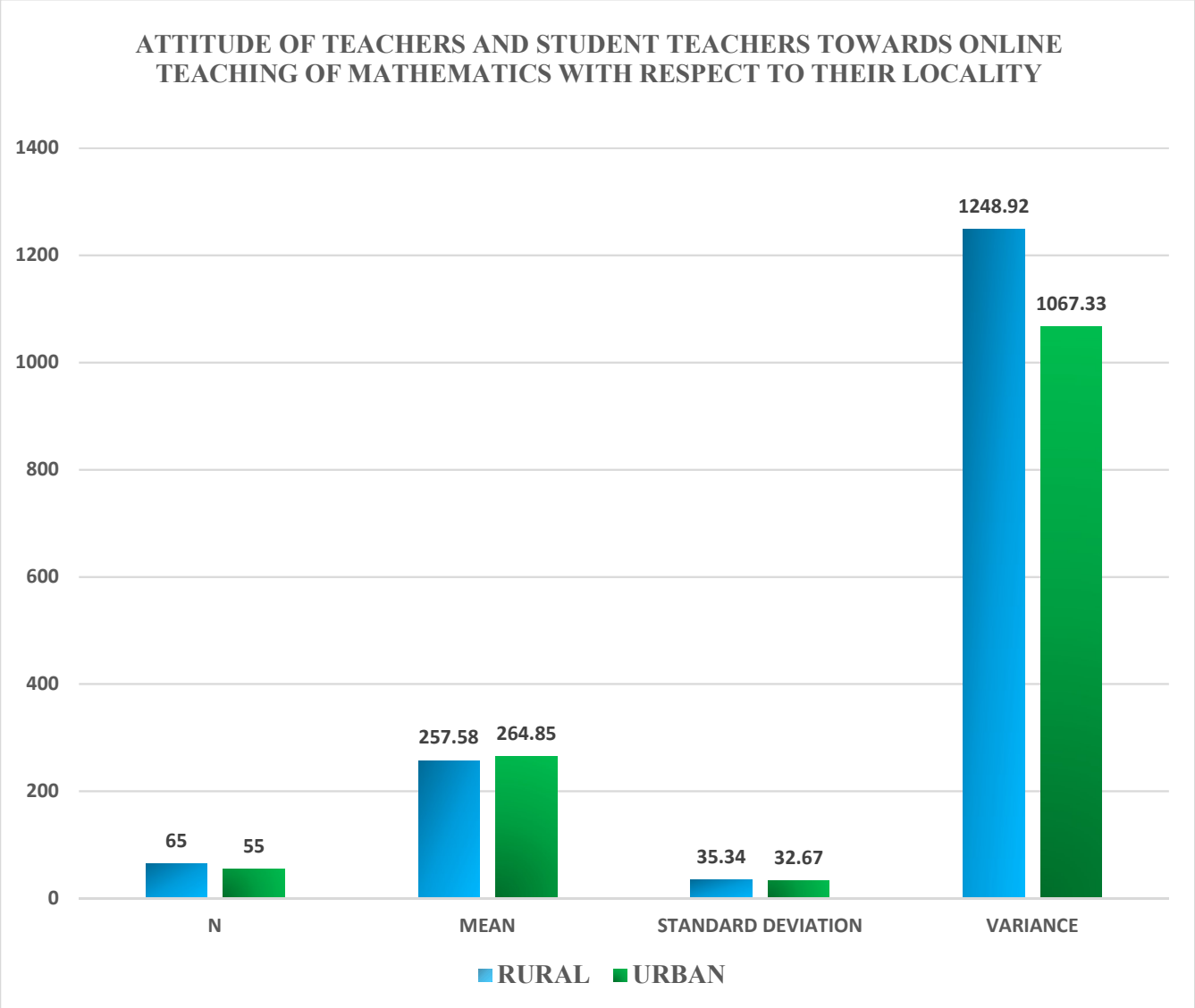
TABLE - IX
ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS WITH RESPECT TO THEIR LOCALITY

LOCALITY						
DOMAIN	**N**	**MEAN**	**STANDARD DEVIATION**	**VARIANCE**	**t**	**SIGNIFICANCE LEVEL**
RURAL	65	257.58	35.34	1248.92	1.35	0.25
URBAN	55	264.85	32.67	1067.33		

DISCUSSION

In the above graph, we can see that the mean of teachers from rural locality is 257.58 and the mean of teachers from rural locality is 264.85. Therefore, the teachers from urban locality have more positive attitude towards online teaching of mathematics as they can have more access to technologies.

The level of significance 0.25 shows that there exist no significant difference between the attitudes of teachers from rural or urban locations. Hence, the null hypothesis “There exist no significant difference in the Attitude of Teachers and Student Teachers towards online teaching of mathematics with respect to their locality” stated is accepted.


ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS WITH RESPECT TO THEIR LOCALITY
1400
1200
1000
800
600
400
200
0
65
55
257.58
264.85
35.34
32.67
1248.92
1067.33
N
MEAN
STANDARD DEVIATION
VARIANCE
RURAL
URBAN

GRAPH 7

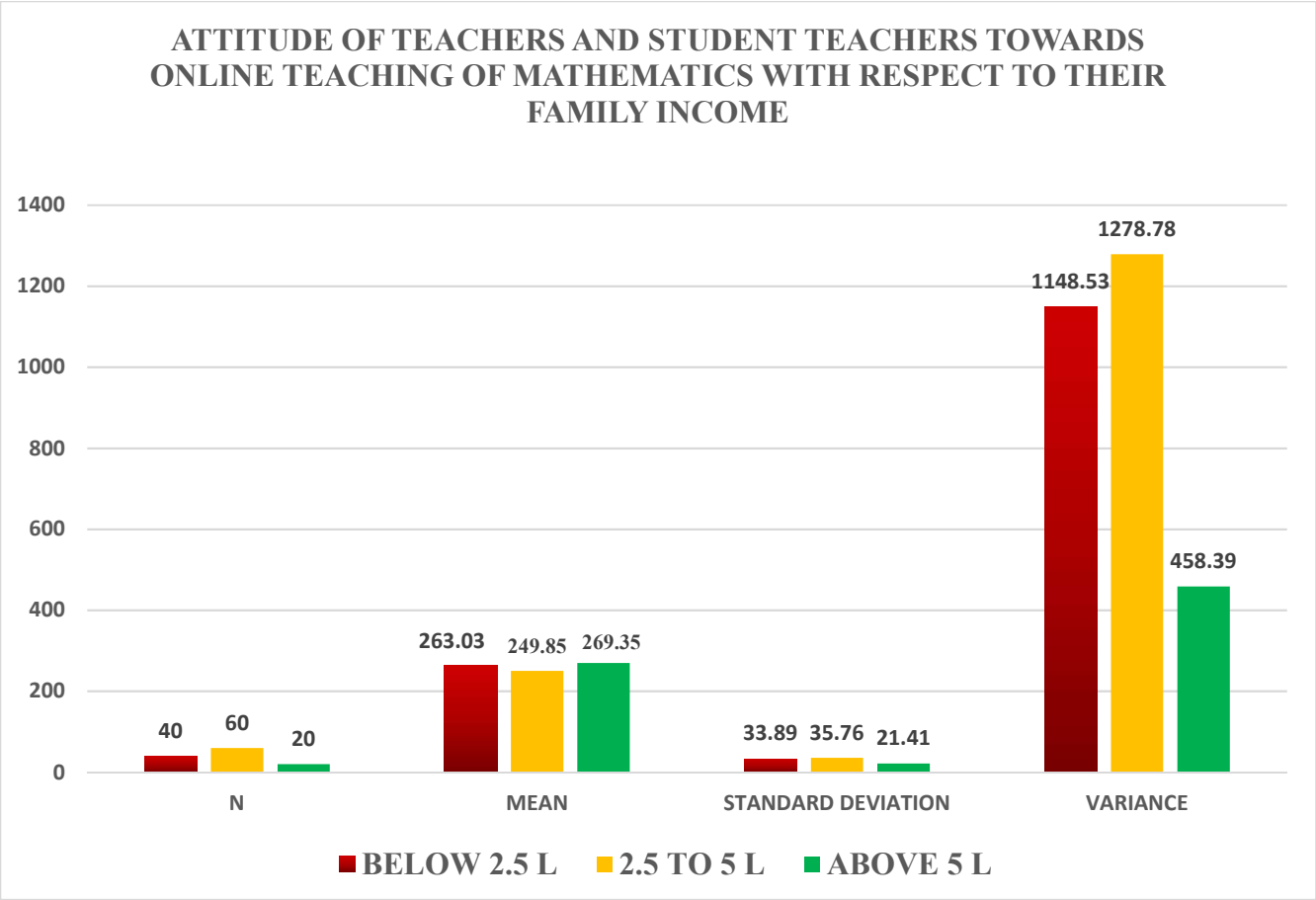
TABLE - X
ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS WITH RESPECT TO THEIR FAMILY INCOME

FAMILY INCOME						
DOMAIN	**N**	**MEAN**	**STANDARD DEVIATION**	**VARIANCE**	**F**	**SIGNIFICANCE LEVEL**
BELOW 2.5 L	40	263.03	33.89	1148.53	3.422	0.036
2.5 TO 5 L	60	249.85	35.76	1278.78		
ABOVE 5 L	20	269.35	21.41	458.39		

DISCUSSION

Among the respondents, the teachers who have family income above 5 lakhs have more positive attitude towards online teaching of mathematics since their mean 269.35. Followed by the teachers with their family income below 2.5 lakhs having their mean as 263.03 and the teachers who have their family income between 2.5 to 5 lakhs have comparatively lower attitude towards online classes in teaching mathematics.

The F value 3.422 and the significant value 0.036 shows that there exist significant difference in the attitude of teachers between three groups. Hence, the null hypothesis “There exist no significant difference in the Attitude of Teachers and Student Teachers towards online teaching of mathematics with respect to their family income” stated is rejected.


ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS WITH RESPECT TO THEIR FAMILY INCOME
1400
1200
1000
800
600
400
200
0
40
60
20
263.03
249.85
269.35
33.89
35.76
21.41
1148.53
1278.78
458.39
N
MEAN
STANDARD DEVIATION
VARIANCE
BELOW 2.5 L
2.5 TO 5 L
ABOVE 5 L

GRAPH 8

TABLE - XI
ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS

ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS			
N	**MEAN**	**STANDARD DEVIATION**	**VARIANCE**
120	50.6	6.67	44.46

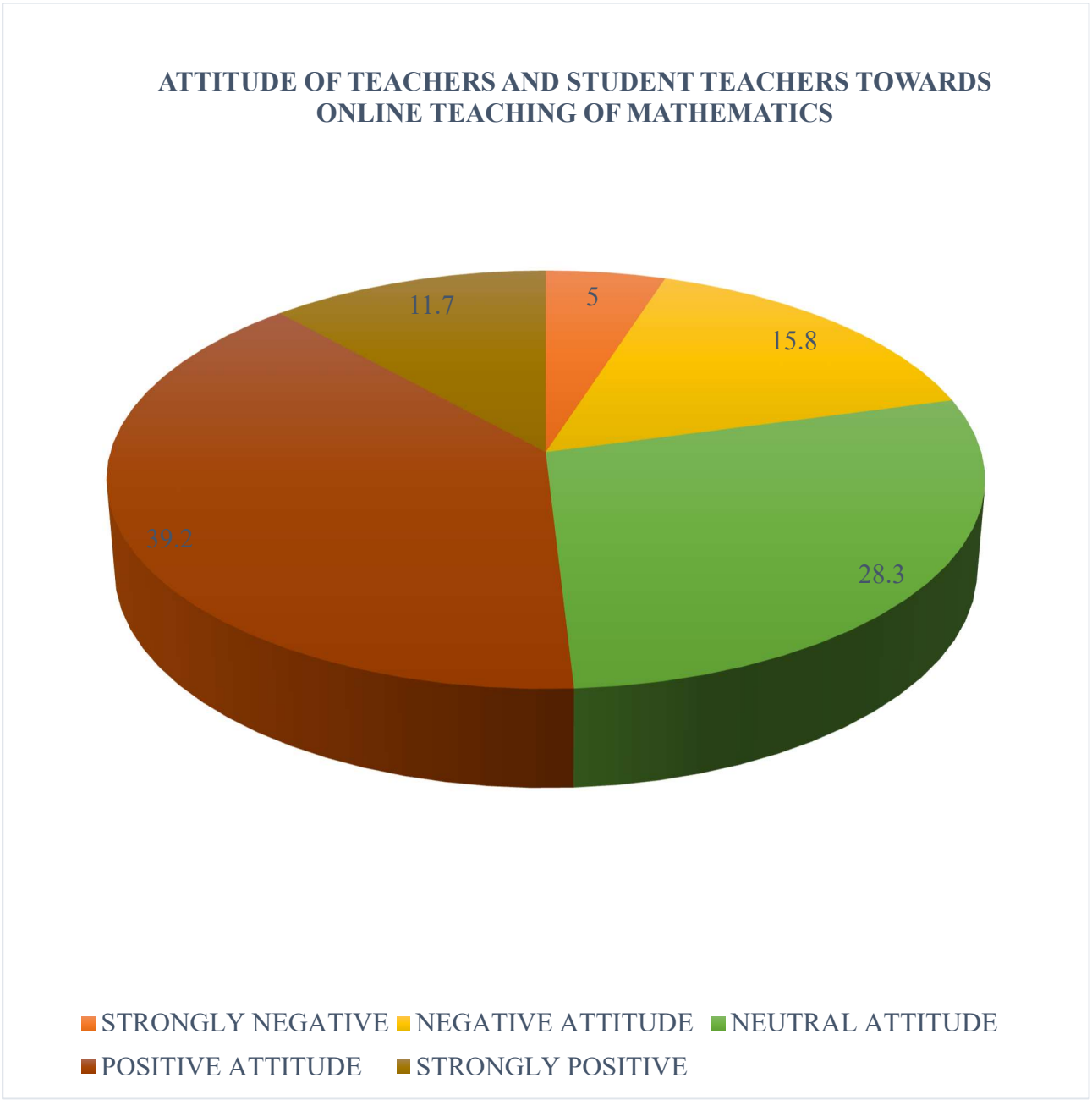
TABLE - XII

PERCENTAGE ANALYSIS

DOMAIN	FREQUENCY	%
STRONGLY NEGATIVE	6	5
NEGATIVE ATTITUDE	19	15.8
NEUTRAL ATTITUDE	34	28.3
POSITIVE ATTITUDE	47	39.2
STRONGLY POSITIVE	14	11.7

DISCUSSION

The below pie chart shows the percentage of level of Attitude of Teachers and Student Teachers towards online teaching of mathematics. It is clear from the data that 39.2% of the mathematics teachers have positive attitude towards online teaching of mathematics and 11.7% of the mathematics teachers have strongly positive attitude towards online teaching of mathematics. Only about 20.8% of teachers have negative and strongly negative attitude towards online teaching of mathematics. This shows that most of the teachers feel comfortable in teaching mathematics in online mode.


ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS
5
15.8
28.3
39.2
11.7
STRONGLY NEGATIVE
NEGATIVE ATTITUDE
NEUTRAL ATTITUDE
POSITIVE ATTITUDE
STRONGLY POSITIVE

GRAPH 9

TABLE – XIII
ATTITUDE OF STUDENTS TOWARDS ONLINE TEACHING OF MATHEMATICS

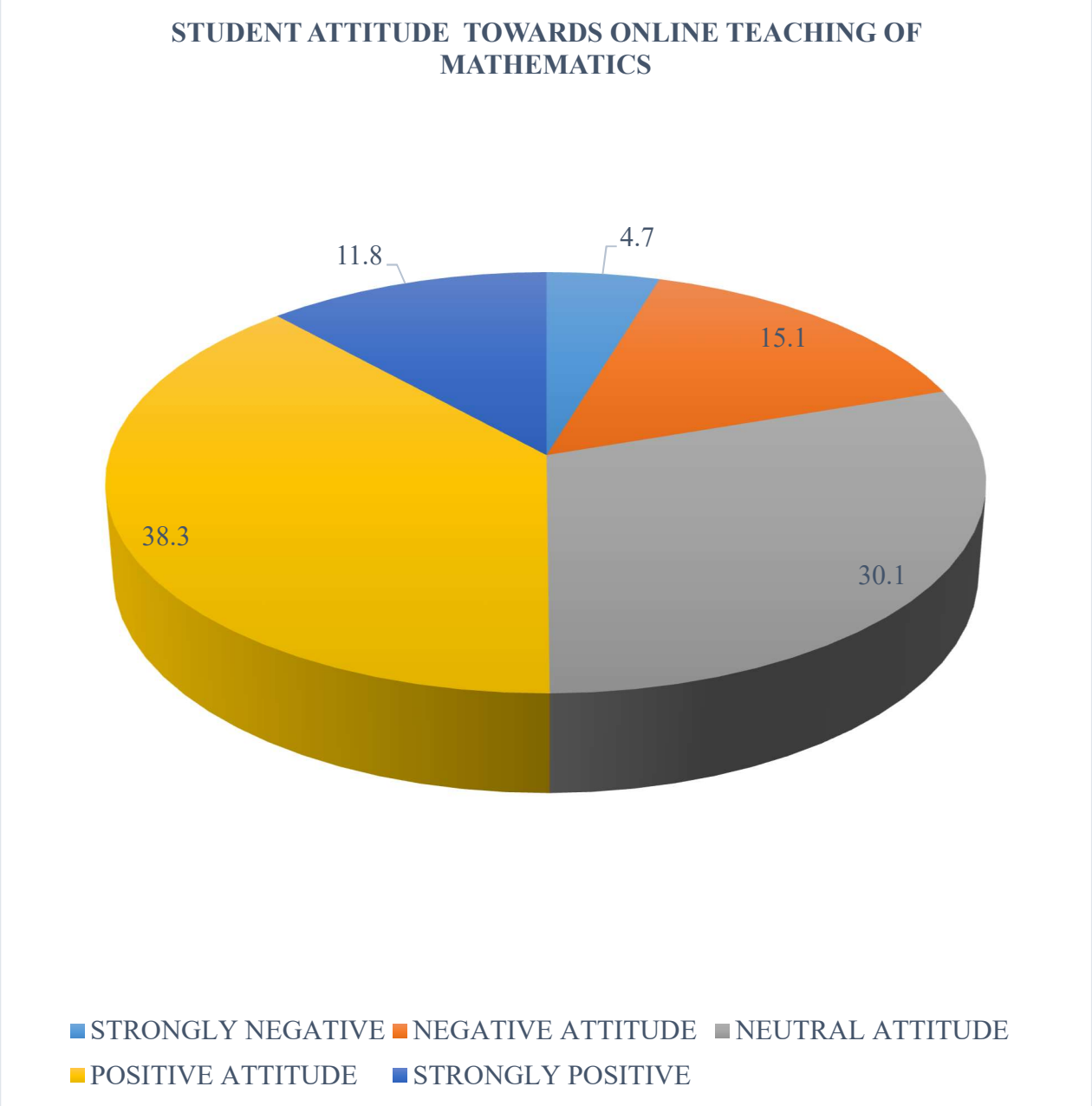
STUDENT ATTITUDE TOWARDS ONLINE TEACHING OF MATHEMATICS			
N	**MEAN**	**STANDARD DEVIATION**	**VARIANCE**
120	50.63	7.32	53.56

TABLE - XIV
PERCENTAGE ANALYSIS

DOMAIN	FREQUENCY	%
STRONGLY NEGATIVE	6	4.7
NEGATIVE ATTITUDE	18	15.1
NEUTRAL ATTITUDE	36	30.1
POSITIVE ATTITUDE	46	38.3
STRONGLY POSITIVE	14	11.8

DISCUSSION

The below pie chart shows the percentage of level of Attitude of Students towards online learning of mathematics. It is clear from the data that 38.3% of the students have positive attitude towards online learning of mathematics and 11.8% of the students have strongly positive attitude towards online learning of mathematics. Only about 19.8% of students have negative and strongly negative attitude towards online learning of mathematics. This shows that most of the students feel comfortable in learning mathematics in online mode.


STUDENT ATTITUDE TOWARDS ONLINE TEACHING OF MATHEMATICS
4.7
15.1
30.1
38.3
11.8
STRONGLY NEGATIVE
NEGATIVE ATTITUDE
NEUTRAL ATTITUDE
POSITIVE ATTITUDE
STRONGLY POSITIVE

GRAPH 10

TABLE - XV
ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS PREPARATION FOR ONLINE TEACHING OF MATHEMATICS

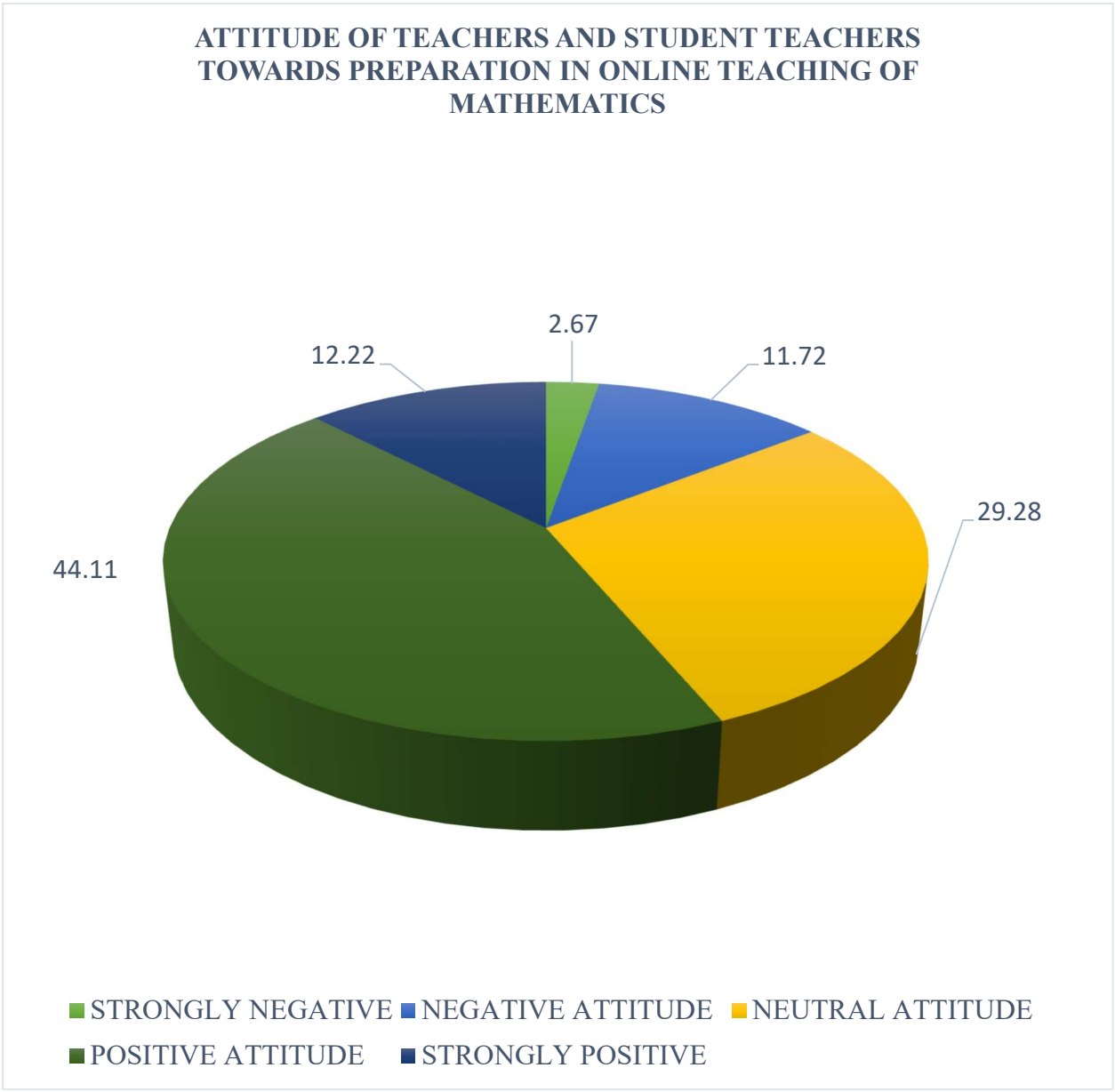
ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS PREPARATION FOR ONLINE TEACHING OF MATHEMATICS			
N	**MEAN**	**STANDARD DEVIATION**	**VARIANCE**
120	52.73	7.98	63.71

TABLE - XVI
PERCENTAGE ANALYSIS

DOMAIN	FREQUENCY	%
STRONGLY NEGATIVE	3	2.67
NEGATIVE ATTITUDE	14	11.72
NEUTRAL ATTITUDE	35	29.28
POSITIVE ATTITUDE	53	44.11
STRONGLY POSITIVE	15	12.22

DISCUSSION

The below pie chart shows the percentage of level of Attitude of Teachers and Student Teachers towards preparation of online teaching of Mathematics. It is clear from the data that 44.11% and 12.22% of the mathematics teachers have positive attitude and strongly positive attitude towards preparation of online teaching for mathematics. Only about 14.39% of teachers have negative and strongly negative attitude towards preparation of online teaching for mathematics. This shows that most of the teachers feel comfortable in preparation for online mathematics classes.


ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS PREPARATION IN ONLINE TEACHING OF MATHEMATICS
2.67
11.72
29.28
44.11
12.22
STRONGLY NEGATIVE
NEGATIVE ATTITUDE
NEUTRAL ATTITUDE
POSITIVE ATTITUDE
STRONGLY POSITIVE

GRAPH 11

TABLE - XVII
ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS PRESENTATION IN ONLINE TEACHING OF MATHEMATICS

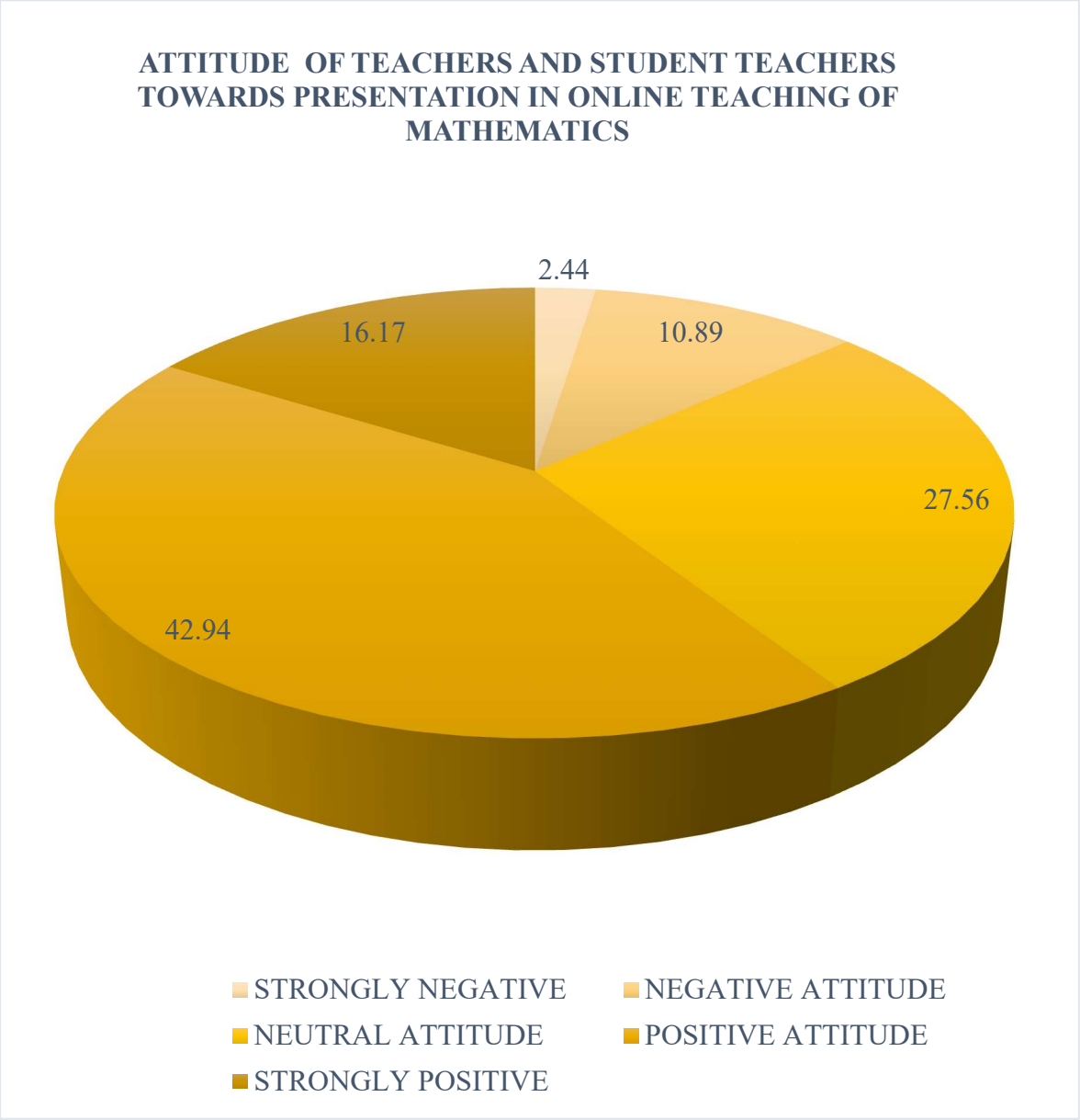
ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS PRESENTATION OF ONLINE TEACHING OF MATHEMATICS			
N	**MEAN**	**STANDARD DEVIATION**	**VARIANCE**
120	53.93	7.67	58.76

TABLE - XVIII
PERCENTAGE ANALYSIS

DOMAIN	FREQUENCY	%
STRONGLY NEGATIVE	3	2.44
NEGATIVE ATTITUDE	13	10.89
NEUTRAL ATTITUDE	33	27.56
POSITIVE ATTITUDE	52	42.94
STRONGLY POSITIVE	19	16.17

DISCUSSION

The below pie chart shows the percentage of level of Attitude of Teachers and Student Teachers towards presentation of online teaching of mathematics. It is clear from the data that 42.94% and 16.17% of the teachers have positive attitude and strongly positive attitude towards presentation of online teaching for mathematics. Only about 13.23% of teachers have negative and strongly negative attitude towards presentation of online teaching for mathematics. This shows that most of the teachers feel comfortable in presenting online mathematics classes.


ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS PRESENTATION IN ONLINE TEACHING OF MATHEMATICS
2.44
10.89
27.56
42.94
16.17
STRONGLY NEGATIVE
NEGATIVE ATTITUDE
NEUTRAL ATTITUDE
POSITIVE ATTITUDE
STRONGLY POSITIVE

GRAPH 12

TABLE - XIX
ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS EVALUATION OF ONLINE EXAMINATIONS IN MATHEMATICS

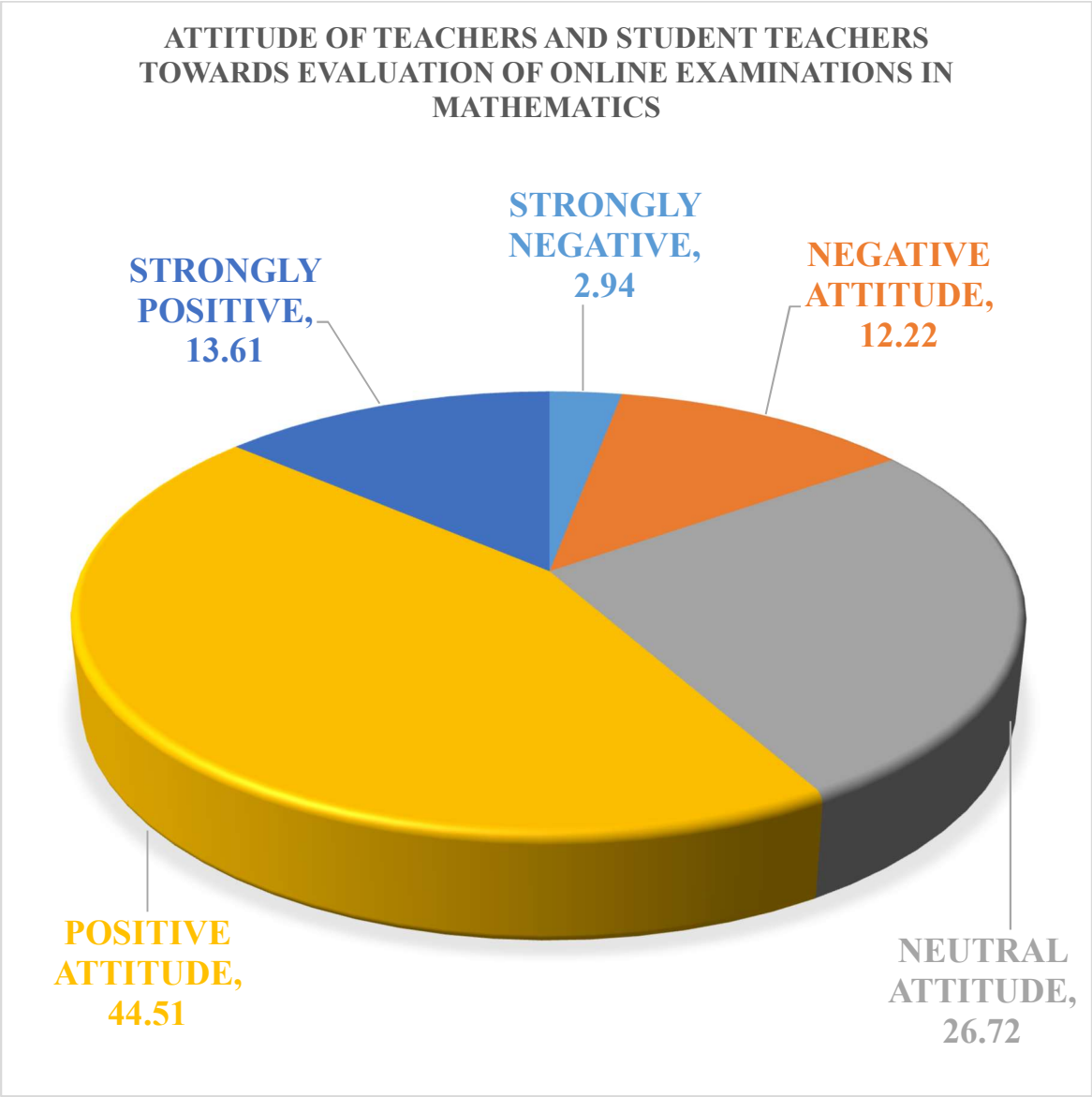
ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS EVALUATION OF ONLINE EXAMINATIONS IN MATHEMATICS			
N	**MEAN**	**STANDARD DEVIATION**	**VARIANCE**
120	53.04	8.3	69

TABLE - XX
PERCENTAGE ANALYSIS

DOMAIN	FREQUENCY	%
STRONGLY NEGATIVE	4	2.94
NEGATIVE ATTITUDE	15	12.22
NEUTRAL ATTITUDE	32	26.72
POSITIVE ATTITUDE	53	44.51
STRONGLY POSITIVE	16	13.61

DISCUSSION

The below pie chart shows the percentage of level of Attitude of Teachers and Student Teachers towards evaluation of online examinations in mathematics. It is clear from the data that 44.51% and 13.61% of the mathematics teachers have positive attitude and strongly positive attitude towards evaluation of online examinations in mathematics. Only about 15.16% of teachers have negative and strongly negative attitude towards evaluation of online examinations in mathematics. This shows that most of the teachers feel comfortable in evaluating mathematics examinations in online mode.


ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS EVALUATION OF ONLINE EXAMINATIONS IN MATHEMATICS
STRONGLY NEGATIVE, 2.94
NEGATIVE ATTITUDE, 12.22
STRONGLY POSITIVE, 13.61
POSITIVE ATTITUDE, 44.51
NEUTRAL ATTITUDE, 26.72

GRAPH 13

4.3 CONCLUSION

The analysis of the data shows the values for the required domains. Through this data, we can easily interpret our requirements. The analysis is the most important chapter as it gives out the answers for all the questions in the project. In this chapter we have analyzed the data gathered and have concluded the findings in the chapter 5.

CHAPTER V
SUMMARY AND CONCLUSION

5.1 INTRODUCTION

The summary and conclusion section is the widely used part of the research report because it review all the information that has been presented in its previous section. This chapter contains an overview of its conclusions based on findings, recommendations and suggestions for further research in this field. For the present study, the investigator selected 120 mathematics teachers and student teachers.

5.2 RESTATEMENT OF THE STUDY

The present study is entitled as "**ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS**".

5.3 MAJOR FINDINGS OF THE STUDY

120 samples of prospective mathematics teachers and mathematics teachers are taken for the present study. The major findings are

i. There is no significant difference in the Attitude of Teachers and Student Teachers with respect to their age towards online teaching of mathematics.

ii. There exist significant difference in the Attitude of Teachers and Student Teachers with respect to their marital status towards online teaching of mathematics. Unmarried teachers show more positive attitude towards online teaching of mathematics than the married Teachers.

iii. There is no significant difference in the Attitude of Teachers and Student Teachers with respect to their qualification towards online teaching of mathematics.

iv. There is no significant difference in the Attitude of Teachers and Student Teachers towards online teaching of mathematics.

v. There is no significant difference in the Attitude of Teachers and Student Teachers with respect to locality towards online teaching of mathematics.

vi. There is significant difference in the Attitude of Teachers and Student Teachers with respect to their family income towards online teaching of mathematics. Teachers with high family income have more positive attitude towards online teaching of mathematics.

vii. The Teachers and Student Teachers have positive attitude towards teaching mathematics in online mode.

viii. On teacher's perspective, students have positive attitude towards learning mathematics in online mode.

ix. The Teachers and Student Teachers have positive attitude in the preparation for online mathematics classes.

x. The Teachers and Student Teachers have positive attitude in the presentation of online mathematics classes.

xi. The Teachers and Student Teachers have positive attitude in the evaluation of mathematics examination in online mode.

5.4 RECOMMENDATIONS

Based on the results of the study the following recommendations are given by the investigator.

- Mathematics teachers and student teachers should be given special training to improve their teaching skills in online mode.

- In all the colleges of education, student teachers should be exposed to create digital contents in mathematics.
- All the schools and educational institutions must provide the required guidelines to students to use the technology and learn effectively.
- To become a successful teacher, they should have subject knowledge along with the idea to use technological skills to teach the subject effectively.
- Upgrading latest information and technology will help teachers serve globally.

5.5 SUGGESTIONS FOR FURTHER RESEARCH

The present study has been focused on analyzing the attitude of mathematics teachers towards online teaching. The present investigation has directed to the following suggestions for further research.

- The study can be extended by increasing the number of samples
- The study can be conducted after creating some applications to teach mathematics easily in online mode
- The study can be conducted separately for male and female prospective teachers
- The study can be conducted for the teachers and student teachers of other Institutions apart from Avinashilingam Institute
- The research can also be taken for a longer time duration to compare the results of performance of students after giving some online teaching techniques to teachers

5.6 CONCLUSION

It is evident from the study that there is no much significant difference in the positive and negative attitudes of mathematics teachers towards online teaching. Though there is a negative attitude towards online teaching among teachers, over experience they tend to learn to teach effectively in online mode. When students learn in online mode, many teachers feel that they could retain the information for a longer period.

Hence, it is important for us to upgrade ourselves to teach mathematics to children in online platforms, which gives anywhere-anytime access to students. Online teaching–learning methods have been the only choice for the educational development of students all over the world due to this pandemic. It has also marked its significant importance in the next generation learning. So, let us learn various skills that would help us be the future inspiring teachers of the society.

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APPENDIX A

PERSONAL DATA SHEET

1. Name

2. Age
   (a) 20 – 30 years (b) above 30 years

3. Marital Status
   (a) Married (b) Unmarried

4. Qualification
   (a) UG (b) PG

5. Subject Specialization
   (a) Mathematics (b) others

6. Occupation
   (a) Student teacher (b) Teacher

7. Teaching experience
   (a) 0-3 years (b) above 3 years

8. Name of the Institute studying/working

9. Family Income

10. Locality
    (a) Rural (b) Urban

APPENDIX B

ATTITUDE OF TEACHERS AND STUDENT TEACHERS TOWARDS ONLINE TEACHING OF MATHEMATICS

1) I have personalized ICT resources to teach mathematics in online mode.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

2) Online teaching of mathematics is easy and flexible.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

3) It is easy to maintain classroom environment during mathematics classes in online mode.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

4) It is practically difficult to monitor every student individually during online mathematics classes.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

5) It is easy to prepare e-content using different tools to teach mathematics in online classes.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

6) It takes more time and effort to prepare mathematical content for online classes.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

7) Due to online classes, the digital competence of mathematics teachers in teaching is improved.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

8) It is easy to complete the portions of mathematics in given time in online mode.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

9) It is difficult to find online materials for mathematics in other languages.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

10) It is difficult for mathematics teachers to maintain class discipline during online classes.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

11) It is interesting to use various tools to teach mathematics in online classes.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

12) It is difficult to repeat mathematics classes due to split classes.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

13) I feel disturbances during online mathematics classes as students are at home.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

14) Online teaching of mathematics is hectic and gives health issues.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

15) Online teaching of mathematics is sufficient for the students on all aspects.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

16) Online teaching of mathematics is effective among children.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

17) Students are interested to learn mathematics in online classes.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

18) Students attend all the mathematics classes on time.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

19) Students are not able to follow the instructions of the mathematics teacher easily in online classes.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

20) It is difficult to understand the psychological status of the children during online mathematics classes.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

21) It is easy to communicate with the students regarding mathematics in online classes.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

22) Students concentrate in mathematics for a longer period in online classes.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

23) It is easy to motivate children towards learning mathematics in online classes.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

24) Children face difficulties in understanding the mathematical concept clearly.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

25) Technical components and internet connection are not reliable all the time during online mathematics classes.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

26) The parents also administer the mathematical classes in online mode.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

27) Peer communication during mathematics period is productive in online classes.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

28) Students do other personal works during mathematics classes in online mode.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

29) Students might miss the teaching continuity as recalling mathematics is difficult in online classes.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

30) Students copy mathematics assignments from internet sources.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

31) The preparation for online mathematics classes takes more time.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

32) It is easy to prepare the teaching aids in mathematics for online classes.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

33) All the teaching aids are prepared digitally for mathematics classes in online mode.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

34) Mathematics contents are easily taken from other resources in internet.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

35) I use various online tools to prepare for mathematics classes in online teaching.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

36) Instructional materials take more time to prepare in other languages (Tamil) for mathematics.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

37) Teaching aids prepared digitally to teach mathematics can be used many times for various classes.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

38) Mathematics teachers need more training and guidance towards preparation for online classes.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

39) Pictorial concepts in mathematics are easy to be taught in online mode.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

40) Preparing creative e-content in mathematics topics is a challenge for teachers in online classes.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

41) It is difficult to use and explain mathematical symbols in online classes.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

42) It takes more effort to plan for student activities in an online mathematics class.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

43) It is easy to prepare mathematics lesson plan digitally.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

44) It is difficult to prepare teaching aids for mathematical theories digitally.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

45) Online teaching of mathematics improves the cognitive domain of the students.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

46) Time limit is not sufficient to complete mathematics portions in online classes.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

47) The student's written work is reduced drastically when teaching mathematics in online classes.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

48) There exist no strong relationship between student and teacher in online mathematics classes.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

49) It is difficult to bring in more student participation in online mathematics classes.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

50) Online teaching improves the teaching competencies of the mathematics teacher.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

51) Online streaming quality disturbs the effectiveness of the mathematics class.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

52) The students are able to adapt to learning mathematics through online technology.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

53) Teaching of certain topics or theories in mathematics is vague in online mode.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

54) It is easy to get workshops or expert suggestions for mathematics classes in online mode.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

55) It is easy to control, monitor and maintain classroom environment to teach mathematics in online mode.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

56) Teaching of mathematics feels incomplete without using chalk and board.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

57) Online teaching facilitates mathematics teachers to make students understand the abstract concepts clearly.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

58) Students could not spend more time to attend mathematics online classes due to ICT complexities.
(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

59) Students can access and refer the notes shared by the mathematics teachers any number of time.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

60) Online mathematics classes effectively deliver the application of various concepts to students easily.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

61) Book back exercises and example questions in mathematics cannot be used to assess students as they tend to copy easily.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

62) Online assessment and evaluation is easy for mathematics teachers.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

63) Students tend to do malpractices during mathematics assessment.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

64) Most of the online mathematics assessment is objective in nature.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

65) It is easy to keep record of the student's academic development in mathematics in online assessment.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

66) Students feel difficulty to complete the mathematics assessment in limited time.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

67) Online evaluation of mathematics is more reliable in nature.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

68) Peer evaluation and review can be done easily in online evaluation of mathematics.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

69) It is difficult to examine and validate the diagrammatic questions like graphs and geometry for mathematics teachers.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

70) Online forums are helpful in evaluating the students' level of understanding mathematics easily.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

71) Not all the mathematical skills of the students are assessed in online evaluation.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

72) Online evaluation tools are very helpful in assessment process of mathematics answer scripts.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

73) Online evaluation does not provide valuable feedback to the mathematical teachers on their teaching.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

74) Class tests cannot be given often to check the achievement level of students in mathematics.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree

75) It is difficult for mathematics teachers to plan for remedial teaching relying on online assessment results.

(a) Strongly Agree (b) Agree (c) Neutral (d) Disagree (e) Strongly Disagree