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# FLIPPED CLASSROOM: AN AVANT-GARDE TEACHING STYLE IN MATHEMATICS FOR GRADE VII LEARNERS

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## ABSTRACT

The objective of our research is to study the impact of the Flipped Classroom model on Grade 7 Learners and changes in performance perspective from students' viewpoint before and after intervention. This research will endeavor to respond to the following question: What effects does Flipped Classroom have on students' Mathematics academic performance? A better understanding of this teaching method is provided in the classroom through experimental model experiments conducted by employing quantitative research. Mean scores were determined for pre- and post-tests and T-tests were used for comparative analysis in the Statistical Program for Social Sciences (SPSS). Results showed a significant increase in testing scores among students, which reflected that this method is effective in developing student self-directed learning. This study was a Mathematics educational initiative, giving rise to the conclusion that using technology in Math education can help maintain student interest in learning by making it more interactive. Engagement in learning environments facilitated by educators who have innovative teaching methods is critical to ensuring that students are not only engaged but also bridging the knowledge gap. Results suggest

that Flipped Classroom strategies were beneficial in improving student comprehension via a learner-centered model, which was effective in enabling students to attain a deeper conceptual understanding of mathematics.

**Keywords:** Flipped Classroom, Secondary Mathematics, Mathematics for Grade 7, Methodology in Math Instruction, Teaching of Mathematics, Interactive Learning in Mathematics

## 1. INTRODUCTION

At its core, math is a concept-based discipline that will help students to continue developing their numeracy and problem-solving skills. It not only helps in solving problems but also contributes a lot to the development of skills for handling practical calculations. In the entire world, mathematics is one of three core subjects and somebody's ability in math partially determines what universities will accept your application. The Common Core approach argues that they are better off learning more and deeper grade by grade so that they can take algebra in eighth grade (Schoenfeld, 2016) as opposed to the historical emphasis on arithmetic for business and only a few teenagers studying high school geometry in addition to algebra (Schoenfeld, 2016).

Number sense is a very important thing that can never be avoided. Teaching such a subject requires mathematics teachers whose level of concentration is as deep as the well gets and with innovative teaching approach. Although extensive research has been done on the subject, colossal strides to reform how mathematics is taught, particularly in Pakistan have hitherto been ignored.

Pakistan also revised its curriculum in the past but implementation issues kept the revision from being effective. As of now, The national curriculum provides five broad standards for mathematics from Grade I to Grade XII:

Numbers and Operations

Algebra

Measurements and Geometry

Information Handling

Cognition and Reasoning

The 2006 National Curriculum stated this outline of standards but also urged for teachers to help develop their students mathematical performance through the skills established by those standards. One of the main points of the curriculum is that students need to develop particular "strands" in order to understand math concepts, reasoning and applications fully. Kilpatrick et al. These were identified by Dzama (2001) as the strands that all mathematics learners should address and by Annika (2016) who opined, schools are well equipped with computers, however teachers find great difficulty in incorporating Information and Communication Technology (ICT) into their lesson.

The five key strands are:

Enlightenment: Grasping basic ideas and their functions.

Procedural Fluency: Carry out procedures flexibly, accurately, efficiently, and appropriately demonstrating deep understanding of... the operations for each of the whole numbers 1ľ9.getWriter Seeta Twice; Pic is in public domain.

Strategic Competence (From the basic to developed skills to solve problem and make decision),

Adaptive Reasoning: Making sense of problems and persevering in solving them, constructing viable arguments, analyzing relationships and connections between concepts, reflecting on mathematical ideas and processes.

Efficient Dissipostion: Fostering positive math mindset and the ability to approach both simple and difficult problems with confidence.

It aims to provide a holistic teaching of mathematics by including these strands, making them more interesting and at the same time challenging. The National Curriculum for 2006 also referred to

the innovative roles that teachers should take, including moving from transmitting mathematics to being more committed with students during the teaching process.

The Single National Curriculum (2020) for Grades I-V also implores teachers to design inquiry learning settings. Consistent with the 2006 National Curriculum, there is an expectation that students are engaged in rich learning experiences to develop their understanding of mathematical concepts. David et al. This was also justified by Schultchen et al. (2019), suggesting the utilization flipped classroom approach for ICT integration in mathematics education and influencing student achievement positively.

Yet in many experiences I carry out with teachers, even when improvements have been made to the curriculum and technology has moved on massively from what was available through most of my schooling in Mexico, very traditional pedagogical habits persist, rooted in memorisation rather than meaning. An earlier study (National Bureau of Economic Research [NBER], 2005–2016) similarly found that the curriculum is a necessary condition for reform, but it has little to no effects on achievement until teachers use it as a part of their professional and instructional improvement process.

Fajet et al. According to Kuntz (2005), there are only two types of teachers: competent and affective. Skilled instructors reveal the proficiency of topic, and they also present it in a way so learners can feel the support of their study. When teachers are able to make a positive affect, this can contribute to students bridging the gap. The study, which was conducted by Yasmin Jahan and Thadeo Anan in 2016, finished that there is a demand for a brand-new as well as inventive manner of teaching mathematics (Jahan & Anan, 2016).

The goal of this work is to encourage the use of technological innova-tions for teaching in mathematics to strengthen the latter and help student perform better on standardized knowledge tests.

Download Now Abstract Research on the Flipped Classroom has been written for numerous studies. Or as Heather (2019) observed, very few studies have actually tested the effects of such reforms. This highlights a discrepancy: the world is being digitalised in all topics whereas mathematics education has not joined this integration. The future of mathematics teaching as a potential new instructional practice that is almost impossible not to happen, the Flipped Classroom, deserves a thorough analysis of what may or not work.

Kilpatrick et al. introduced the problems of outdatedness following old-fashioned teaching methods! Strands of Mathematics by Fosnot (2001) Rather, the problem occurs when conceptual understanding of maths — which should be the fundamentals — are brushed under the carpet and students in higher grades end up pulling their hair out because no attention was paid to core concepts early on. As a result, many students will instead try to memorize problems verbatim without understanding true mathematical concepts. The study of Mutodi and Ngirande (2014) reported that teachers who used productive principles successfully in building the concepts also positively increased learning as indicated by 96.7% of students softly underscoring reduced learning gap.

In fact, the older a student becomes and the further they advance in school, the more likely they are to lose basic math abilities due to longterm passive/experiential teaching. According to Borko et al. In the domestic studies reported in How People Learn (1992), teachers were found as less knowledgeable, with less effective instructional strategies and curriculum materials. Tactile learning starts in early education to develop numeracy, but as students progress through the grades,

hands-on activities may be phased out. Roussouw et al. There is also some evidence to suggest the usefulness of hands-on activities in teaching concepts (Koh & Fraser, 1998) and Piaget's theory of active learning.

Moreover, the extensive use of technology has also enabled students to learn photo and video editing, another useful hands-on life skill. It is in the labs of science and with language where multimedia tools are uniquely within reach, to advance these fields. ICT-enhanced learning is important for creating effective learning environments (Annika, 2016). Strageton (2003), moreover, conveyed that proper use of ICTs can serve as a useful tool in terms of formative feedback. As Protheroe (2007) explained, the use of technology in teaching mathematics not only motivates students but also fosters their ability to solve problems and communicate based on mathematical terms.

Additionally, today, students are increasingly becoming independent learners and their way of learning is far different from a typical classroom setting. But other than for those, few things have changed–including lesson plans. Stols et al. (2016) suggested that students should be shown video-recorded lectures, and their learning modes should be identified so as to enable them to build a framework of their own awareness. In addition, he recommended that students be allowed the liberty to internalize new concepts differently which wass a recepy for success versus more traditional inculcation techniques. Which merges with passage 2, which two passages in accordance of what Pajares(1992) has forwarded that individual learners making sense for themselves produce accurate understanding. Both studies indicate that a video-lecture model indicates part of an active and reflect teaching practice increases outcomes for mathematics.

According to Stols et al. According to Bell (2016) and Pajares (1992), the Flipped Classroom has been established as a promising practice in mathematics. This leads to facilitation of deeper

learning and self-directed study, which incentivizes the increased use of technology in a constructive manner; it therefore represents an increasingly valuable approach to revitalizing math education going forward.

## 1.1. Research Objectives

This research aimed to achieve the following objectives in order to evaluate the impact of the planned intervention and address the identified challenges:

- To explore the effects of the Flipped Classroom on students' performance in Mathematics after the intervention.
- To assess the changes in students' performance in Mathematics during the pre-intervention, mid-intervention, and post-intervention stages of the Flipped Classroom.
- To compare the mean scores of students before and after the intervention to measure its effectiveness.

## 1.2. Research Questions

This research aimed to address key questions that challenge the study and provide valuable insights to address identified gaps:

- What are the effects of the Flipped Classroom on students' performance in Mathematics?
- How does the Flipped Classroom influence changes in students' performance in Mathematics?
- What are the mean scores of students before and after the intervention?

This work could be beneficial to many field of studies and to the structuring of the educational system. We also believe that it can help policy makers in integrating technology with Mathematics pedagogy so as to harness the power of students learning before we lose them into the quagmire of ineffective groups. New modern policies can offer teachers and schools a powerful new weapon

to promote deeper levels of concept understanding in students. It also helps teaching build a stronger linkage with students; if we play the role as a scaffold for student, they can self evaluate their learning process. These methods may inspire students through fun activities that validate their understanding of maths.

For future development, the study can add a great deal to mathematics education too where technologies help to learn problem-solving and learning activities.

Ethical considerations

Table 1 summarizes the ethical issues that were considered before engaging in this study.

- Obtaining school approval
- Securing permission from the ECON section head
- Ensuring student anonymity
- Maintaining confidentiality
- How to conduct the study in a narrow time frame without disturbing the regular course of school.

## 2. LITERATURE REVIEW

It is important to address with students the development of the technology, for which they should attract and participate in learning. Connecting that learning with technology can bridge many of these gaps. Students and Gender Gap Students have become polarized, where girls usually score well then boys in the learning but something interesting happens with mathematics, there girls give way to the students. Literacy is still required to reach every corner and give boys and girls the same chances. We urgently require a tech-savvy way to break these boundaries (Annika, 2016), Hence there arises the need of an effective pedagogy combining learning and ICT in one circle.

Published a meta-analysis on-discussion-med-d-ten-break-et-A_letter_respecting A Letter respecting Then, the study (2021) re-inserted in economic and social causes of suicide predicts that earlier academic achievements influence later ones and may generate a Flynn effect as long as children are exposed to varies i n retest across discipline areas. Annika (2016) actually emphasized that it was hard for teachers to achieve the integration of technology in pedagogy. In addition, the study emphasized Black and William (2009) were eager to suggest that the practice is essential for students in order to learn concept and comprehend instructions. Additionally, proper development of pedagogical skills is an essential requirement for the students to improve their learning which in turn can only be possible through efficient use of ICT in coursework. The study has demonstrated that ICT enhancements in the subject can aid pupils to bridge gaps in their sex-related, accuracy-related and possibly even concept.

Stoles et al. The approach presented in (2016) where students view a video of the delivery of instruction of the subject and construct their own complex web of concept through which they understand is cited with reference. David et al. (2019) expressed that Flipping the Classroom has been described as many of definitions, but one definition is pretty obvious which is “flipped classroom as students systematically complete instructional material before every class (e.g.: by watching a full videotaped lecture) and practice or apply instructional material with guidance to faculty during class (e.g.: by working on problem-solving assignments). It also described with how dramatically the flipped classroom changed their academic, as well. In the opinion of antioxidant, Flipped Classroom actually demand of an extra that is self-learning ability. David et al. Traditional classes have cognitive limitations Showing inadequacy Cognitive load is high When students do not apply instructional conductance to their own learning (Bang et al., 2019). On the other hand,

flipped learning is an application where one will get learned instruction guidance and even it inspires peer to peer learning among students.

Carter et al. Castle et al. (2018) mentioned a university of Nebraska study by Love et al.; They tested flipped classroom which provided to students who weeded another significant numbers from the mid terms (2004). Similarly, the review of flipped classroom as reported by Carter (2018), does not provide enough evidence regarding the exact scale to which Flipped Classroom works in terms of enhancement on students academics as well as Mathematical courses specifically.

According to (David et al., 2019), The Flipped classroom supports students by giving them active, interactive and constructive time to obtain responsibility in applying the instructions by easily reflecting right guidance in right time to reach all required objectives. An instructional design for a proper Flipped Classroom that would lead to the various results other some is not included in this study. Jeffrey et al. The fact that Flipped Classroom actually opened a similar period of time to overcome their misconceptions among students as well as from the results were seen too did not happen) but also created space for them to develop something we would ideally want to complete and enhance novice teachers was determined. Another estimate of the research indicates that maximum 35% of teachers in United States want to learn the models of Flipping Classroom for better grade performances. The flipped classroom provided a course structure modelled upon this framework, with the pre-class delivery of content being implemented using a variety of modes such as recorded videos or virtual PowerPoint presentation through which knowledge was transmitted outside the classroom. Flipped Classroom does its timely work in classroom to allowing teachers to give there best effort graded opportunity tasking them active learning not passive only.

Yes, the technology movement has redefined the education worldwide from books to internet, then online free courses etc. Internet or Online Education: Finally, The biggest contribution in the internet education was done by The MIT and Harvard where they started to offer open courses through their platform Coursera EdX respectively. An explosion which triggered MOOC (Massive Online Open Courses) from other educators, and colleges Universities a better platform to share their knowledge globally (Connie, 2019). Likewise, Connie emphasized that Flipped Classroom method can also be used by teachers in class to facilitate significant learning using this modern technology. The study had pointed out that students have a bigger problems in Asia (instead of worldwide) where they will memorize the facts about what stuff works for them about how to score the full marks in exams rather than application. Which means, they do not get the idea of practical application and when sent out in industry problems in real world, they end up facing disasters and hurdles as compared to students working on practical execution. Students in the future will need to be able solve problems that do not even exist today and there can only size ton when we are capable of integrating the rapidly evolving technology into our pedagogies through various means (Connie, 2019). This research addressed the gaps of existing knowledge regarding the absence of technology integration in Asian classrooms. Since Pakistan is in Asia, thus the research suggested to promote Flipped Classroom Methodology for reaching the target as highlighted, which make students to focus on application of knowledge instead of remembering facts.

## 3. METHODOLOGY

The study used quantitative research design to determine the effect of Flipped Classroom model on Grade 7 students in Mathematics. The research design concentrates on numeric data through measurement pre and post intervention to objectively evaluate student performance. The

effectiveness of the Flipped Classroom was tested by comparing student scores through a pre-test–post-test experimental method to normal teaching methods.

The final point is in line with the principles of Action Research, a methodology based on researcher intervening to resolve an issue of practice occurring within classroom as well. The intervention program was duly planned & the blueprint of measures incorporated, to ameliorate a given problem i.e. students performance in Mathematics on introduction of Flipped Class method. This research seeks to do well in implementing real-world changes while also studying the effects by using this action-oriented methodology.

The study population comprises of Grade 7 students from one school in Karachi, Pakistan. This particular school was chosen as it provided an appropriate setting for delivering the intervention and assessing its effects The study included just two school (grades 7 and 8 were organized into the same building) to help manage data collection and intervention efforts. One section employed the Flipped model for teaching, and the other followed traditional teaching pattern to do a comparison of control group with experimental group.

The sample size was restricted to 18–20 students per section, which made it a viable representation of population with Grade 7 learners of the selected school. This sample size also enabled the researcher to gather and analyze data he had targeted to undertake within the research timeline.

The Flipped Classroom intervention was constructed to change the way teachers and students interact in the classroom. The instructional material (video lectures, tutorials, readings) was organized in an experimental section and made available to students before class. Which also helped them studied main topics in their own time away from the classroom. This time was dedicated to more in depth discussions, problem solving activities and other group exercises that made sure you understood the material on a higher level.

As the control group, The control section as such was taught in typical manner with lectures and instructor-led activities occurring during class time and follow up practice activities assigned for homework.

The intervention was implemented over the course of multiple weeks so students had time to practice and become comfortable with a new way of learning while also providing enough data for comparison.

Data Collection was performed in two main steps; pre-test and post-test.

Pre-Test: A standardized Mathematics test was administered to students of both sections prior to the intervention, in order to evaluate their level of knowledge and understanding about basic mathematical concepts.

Part post-test: After the implementation, both sections took the same test of contents. Test scores obtained from the post-test phase were utilized to evaluate differences in performance and to determine how Flipped Classroom model affected the test results.

In addition, the tests were created to measure whether tutoring students in mathematics summarised during the intervention program and that both sections of the course were measured using equivalent grading criteria.

We referred descriptive statistical method with pre-test and post test data. The use of the T-Test for comparing mean scores for the experimental and control groups pre-and post intervention was principal analysis method. It has allowed to establish if the change in student performance observed were expected or a result of chance. The data analysis was undertaken employing the Statistical Program for Social Sciences (SPSS) so that obtained results are trustworthy and reliable.

The study was a rich and deep study in terms of the impact of the Flipped Classroom model, but the researchers had also some limitations:

With a composite size levitating around 18-20 students per section. This restricts the full generalizability of this study.

This took place in only one school and is not a good representation of the wider educational settings or student populations.

However, the time constraint might result in limiting the duration of intervention and influence the Flipped Classroom model to students' long-term effect on Mathematics outcomes.

While the above-mentioned problems are still valid, this research provides a powerful base when it comes to understanding what benefits can one expect with the implementatio n of Flipped Classroom in Maths teaching. Therefore, future investigations that extended the sample size and study period to corroborate this outcome.

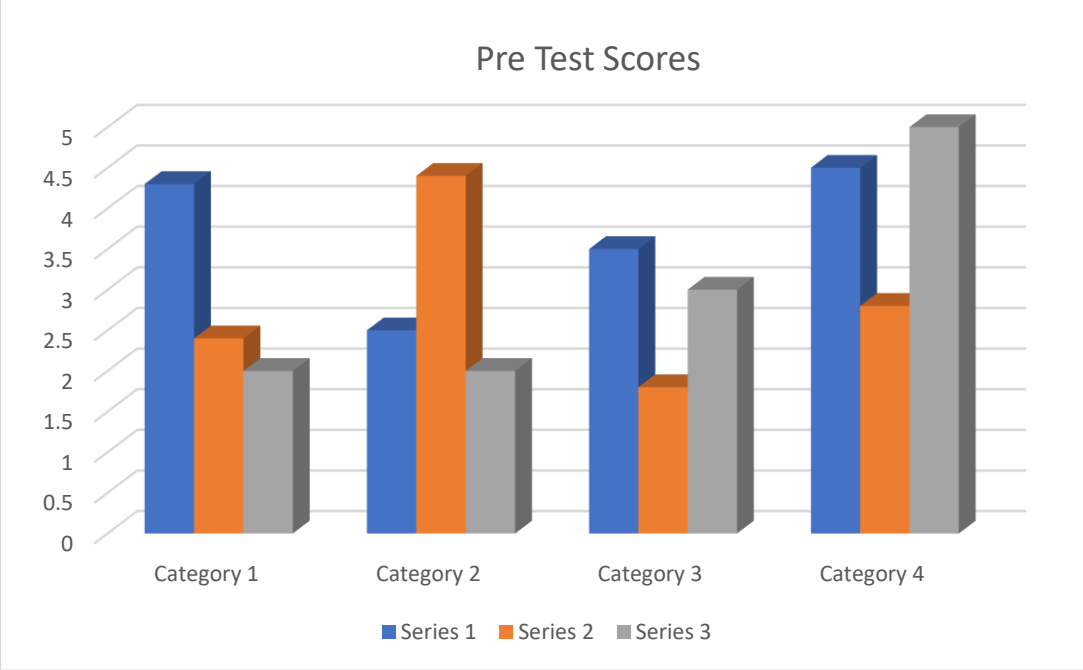
## 4. DATA COLLECTION

The data in this research is collected through pre-test and post-test of the intervention. The pre-test and post-test will be marked according to the scores of each question. The scores were compared of one class with the intervention. The classes were Grade 7 of The Seeds School, with the students' performance on mark.

There was highlighting of the students' inactivity during Mathematics lesson, which often are the results of students' grade fall. The intervention was to introduce a prolific method while also enabling students to achieve a conceptual understanding of something outside the classroom. The Flipped Classroom enabled students to develop their own set of skills and build the concepts accordingly. The data was collected over the period of 1 cycle consisting of two weeks.

Before the intervention, pre-test was administered to assess the prior knowledge level of students on subject. There was a post-test at the end to measure learning progress among them. Our researcher assessed the effectiveness of the difference in scores.

On the other side, we gave the pre-test in the initial stage of intervention that indicates the past learning of students. The design of the study also includes a post-test at the end of the course which serves as an overall final evaluation of how well the intervention works. The pre-test, administered on the first day of the intervention was a 10-item test that is intended to measure students' initial learning in Grade 7 Mathematics.




| | | |
|---|---|---|
| | Abdullah Irfan | 7 B |
| 7 / 10 | Abiha Siddiqui | 7 B |
| 6 / 10 | Anoosha Fahad | 7 B |
| 6 / 10 | Emmad Athar | 7 B |
| 7 / 10 | Hafsa Furqan | 7 B |
| 4 / 10 | Hiba Javed | 7 B |
| 4 / 10 | Javeria Javaid | 7 B |
| 4 / 10 | Maaz Ahmed | 7 B |

| | | |
|---|---|---|
| 4 / 10 | Maaz Fawad | 7 B |
| 2 / 10 | Maham Salman | 7 B |
| 4 / 10 | Manal Binte Asif | 7 B |
| 7 / 10 | Manal Fatima | 7 B |
| 6 / 10 | Mariam Jamal | 7 B |
| 8 / 10 | Marium Khalid | 7 B |
| 3 / 10 | Masoooma Zehra | 7 B |
| 4 / 10 | Muhammad Ayaan | 7 B |
| 7 / 10 | Nashit | 7 B |
| 4 / 10 | Soaleh Muhammad | 7 B |
| 8 / 10 | Syed Hassan Ali | 7 B |
| 5 / 10 | Tahoora Naveed | 7 B |
| 8 / 10 | Warishah Fasih | 7 B |
| 5 / 10 | Yousuf Kazi | 7 B |

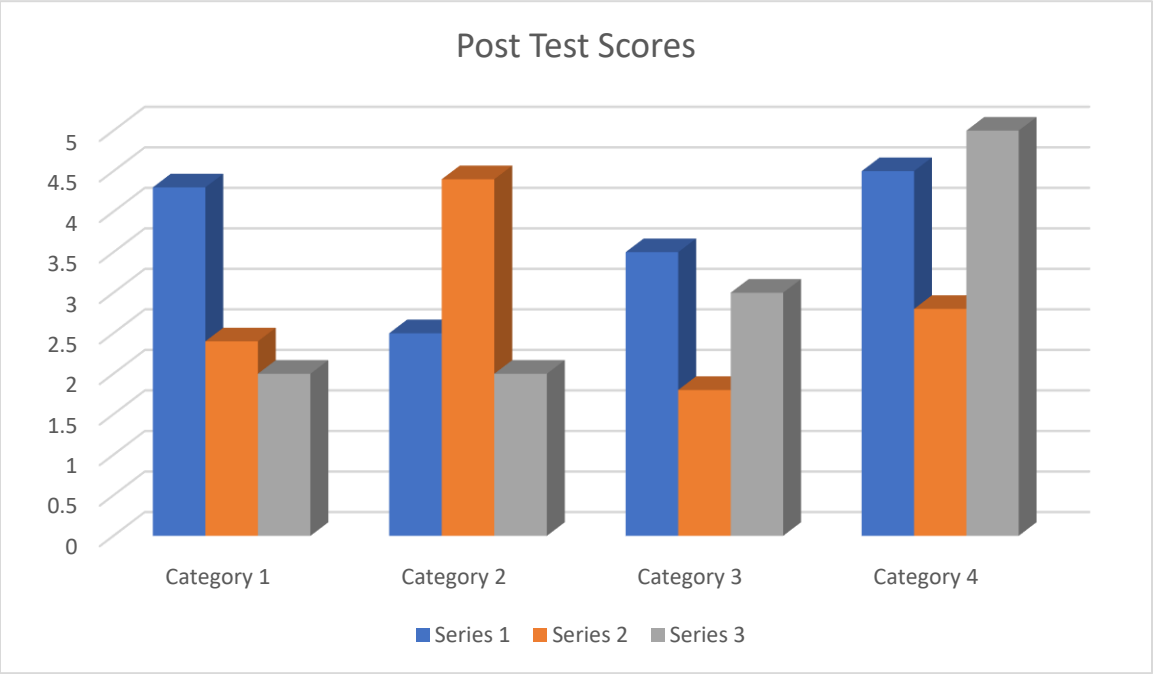
The intervention was designed for student to study at home and then bring their knowledge back to the classroom. The Flipped Classroom Model turns the traditional learning and assessment means to an inverted mode. In a traditional model, students normally receive their new content in class and are evaluated over it using end of chapter type tests or homework. The Flipped Classroom allows students have to deal with the material at home and at school are involved in outcomes.

Starting with the pre-test on the first day of intervention, Grade 7-B students were involved in this study. Later, through MS Teams link a video take of the Percentage conversion was shared with

students and they asked to watch it in homes. The next day, students were given the task of providing their own examples in the class to see what they had learned. These problems were then solved with the same topics that they had read in another similar problem from the syllabus.

During the intervention, students of class 7-B were using video links more effectively to solve text exercises. The teacher worked the action plan, and soon the students followed suit as well… naturally due to their level of engagement in what was best for themselves along with making great progress, in a short period of time You could see that in their board presentations and during solving book problems.

The Flipped Classroom Model and its effects were also post-tested (15 marks) on the last day of the intervention. Test scores were collected which helped present the table mentioned in the following example with the impact of intervention on students performance.




| | | |
|---|---|---|
| | ABDULLAH IRFAN | 7B |
| 8 / 15 | Abiha siddiqui | 7B |

| | | |
|---|---|---|
| 14 / 15 | Anoosha Fahad | 7B |
| 15 / 15 | Emmad Athar | 7B |
| 15 / 15 | Hafsa Furqan. | 7B |
| 8 / 15 | Hiba Javed | 7B |
| 13 / 15 | Javeria javaid | 7B |
| 10 / 15 | Maaz ahmed | 7B |
| 13 / 15 | Maaz Fawad | 7B |
| 10 / 15 | Maham Salman | 7B |
| 11 / 15 | Manal Binte Asif | 7B |
| 15 / 15 | Manal Fatima | 7B |
| 14 / 15 | Mariam Jamal | 7B |
| 15 / 15 | Maryam Khalid | 7B |
| 13 / 15 | Masooma Zehra | 7B |
| 7 / 15 | Muhammad Ayaan | 7B |
| 15 / 15 | Nashit | 7B |
| 15 / 15 | Soaleh muhammad | 7B |
| 15 / 15 | Syed Hassan Ali | 7B |
| 9 / 15 | Tahoora Naveed | 7B |
| 14 / 15 | Warishah fasih | 7B |
| 9 / 15 | Yousuf Kazi | 7B |

## 5. RESULTS AND DISCUSSION

There was no significant change in students' Mathematics scores after participating in a remedial Math course using the Flipped Classroom model. The pre-test and post-test data were compared

using mean scores. Students in the Flipped Classroom participated in a post-test to demonstrate their learning over the intervention period. The data was analyzed using a **T-Test** in **SPSS**, offering a clear insight into the effectiveness of the new methodology. This analysis highlighted the impact of integrating modern approaches into the learning environment provided to students.

**T-Test**

[DataSet0]

**Paired Samples Statistics**

| | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | Pretest Marks | 54.5455 | 22 | 17.65470 | 3.76399 |
| | Post Test Marks | 82.2273 | 22 | 18.63160 | 3.97227 |

A paired sample T-Test was conducted to evaluate whether a statistically significant difference existed between the mean scores of the pre and post-stage intervention. The results of the paired sample T-Test indicated that there was a significant increase in the scores of Mathematical Achievements through the remedial course.

Pre-Test: (M = 54.55, SD = 17.65, N = 22)

Post-Test: (M = 82.23, SD = 18.63, N = 22)

Hence, the researcher rejected the null hypothesis. It is concluded that there is a significant difference pre and post test scores after the remedial measures or the intervention.

Despite these limitations, the study has provided me with new insights that will help improve my instructional practices and allow me to better serve our students. Teacher typically are role models in a certain algebra field, so I have to work hard on making my students realized the benefit of establishing relationships with them. Will ultimately promote more student discussion and involvement in the learning cycle once execution of innovative strategies for planning have been

completed.

I felt that nowadays students can learn digitally faster than in traditional teaching. It allowed me to highlight the hard work the students put into their work, and it showed — they were proud and confident in what they had done.

Teachers cannot afford to allow students to lose focus especially when it comes to new topics in Mathematics. The subject supposedly presents diversity of methodologies but many have been teacher based in nature. This work had indicated the needed of employing attractive and mastery-based approaches to create better reasoned mathematics.

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