A STUDY OF THE ABILITY OF LEARNERS TO APPLY MATHEMATICS TO SOLVE REAL LIFE PROBLEMS

PRESENTED BY(III B. Sc Students):

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INTRODUCTION TO THE PROJECT

In today's world, math goes beyond the classroom. Our mission: Analyze how students perform in real-life math applications. This study combines tests and interviews to explore students' problem-solving abilities. We also dive into teachers' perceptions of math's real-life applications. Get ready for an in-depth look at math like never before

CHAPTER 1

PRELIMINARIES

OBJECTIVES OF THE STUDY

- **OBJECTIVE 1:** "DESIGNING A RELEVANT TEST" - Crafting a math test for real-life application.
- **OBJECTIVE 2:** "REAL-LIFE MATH PROFICIENCY" - Assessing students' ability to use math practically.
- **OBJECTIVE 3:** "STUDENTS’ PERSPECTIVES" - Understanding how students view math in daily life.
- **OBJECTIVE 4:** "TEACHERS’ INSIGHTS" - Exploring teachers' opinions on math's real-world applications.

METHOD OF THE STUDY

- FRAMEWORK DEVELOPMENT:
- TEST DEVELOPMENT
- TEACHER PERCEPTION SCALE
- EXPERT VALIDATION
- SAMPLING AND DATA COLLECTION
- DATA ANALYSIS

POPULATION OF THE STUDY

- Students: Class **10 students** in schools under the directorate of education, G.N.C.T. Of Delhi.
- Teachers: Trained graduate teachers (TGTs) in mathematics teaching in these schools.

SAMPLE OF THE STUDY

- For students: 250 students from 10 schools, with a response rate of 86%(N=215).
- For teachers: 43 teachers from 10 schools, with a 93% response rate.(N= 40)

TOOLS USED FOR THE STUDY

1. **CONCEPTUAL FRAMEWORK:** Designed to define key parameters for mathematics achievement test items measuring real-life problem-solving ability.
2. **MATHEMATICS ACHIEVEMENT TEST:** Developed for assessing students' real-life math application skills.
3. **SEMI-STRUCTURED INTERVIEWS:** Employed to understand students' perspectives on math's real-world use.
4. **TEACHER PERCEPTION SCALE:** Utilized to gauge teachers' views on math's practical applications.

STATISTICAL TOOLS USED FOR THE STUDY

- **DESCRIPTIVE STATISTICS:**
  - Mean and standard deviation for student scores and Teachers' view

- **HYPOTHESIS TESTING:** Employing parametric tests for group mean comparisons
  - **INDEPENDENT SAMPLE T-TEST:** Analyzing group differences(2 Groups)
  - **ONE WAY ANOVA:** Exploring variability among multiple groups

MEAN

It signifies the average score in the math achievement test for students or the perception scale for teachers in our study.

$$\bar{x} = \sum_{i=1}^{n} x_i$$

Where,

$\bar{x}$ represents the mean

x_i Represents individual score or perception

N is the total number of data points

STANDARD DEVIATION

. It signifies how much individual data points deviate from the mean.

Offers insights into the variability of student scores or teacher perceptions in our analysis.

$$\text{Standard deviation } (\sigma) = \sqrt{\frac{\sigma(x - \bar{x})^2}{n}}$$

Where,

σ represents the standard deviation

¯is the mean

n is the total number of data points

INDEPENDENT SAMPLE T- TEST

- Evaluates significant differences between the means of two independent groups.
- In our project, used to compare mean scores of students in the mathematics achievement test based on different demographic factors and their impact on performance.
- Also employed to analyze mean scores in the perception scale among different demographic groups.

$$T = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

- where, $\bar{x}_1$ and $\bar{x}_2$ are the sample means,

  s_1 and s_2 are the sample standard deviations,

  n_1 and n_2 are the sample sizes

Helps assess if observed differences are statistically significant.

ONE-WAY ANOVA

- Analyzes if significant differences exist among means of three or more independent groups.
- Tests equality of means within multiple groups.
- Relevant in our project for assessing differences in mean scores or perceptions among various student or teacher groups.

$$\mathbf{F} = \frac{\boldsymbol{between\text{-}group\ variance}}{\boldsymbol{within\text{-}group\ variance}}.$$

Where between-group variance represents the variation between group means,

within-group variance represents the variation within each group.

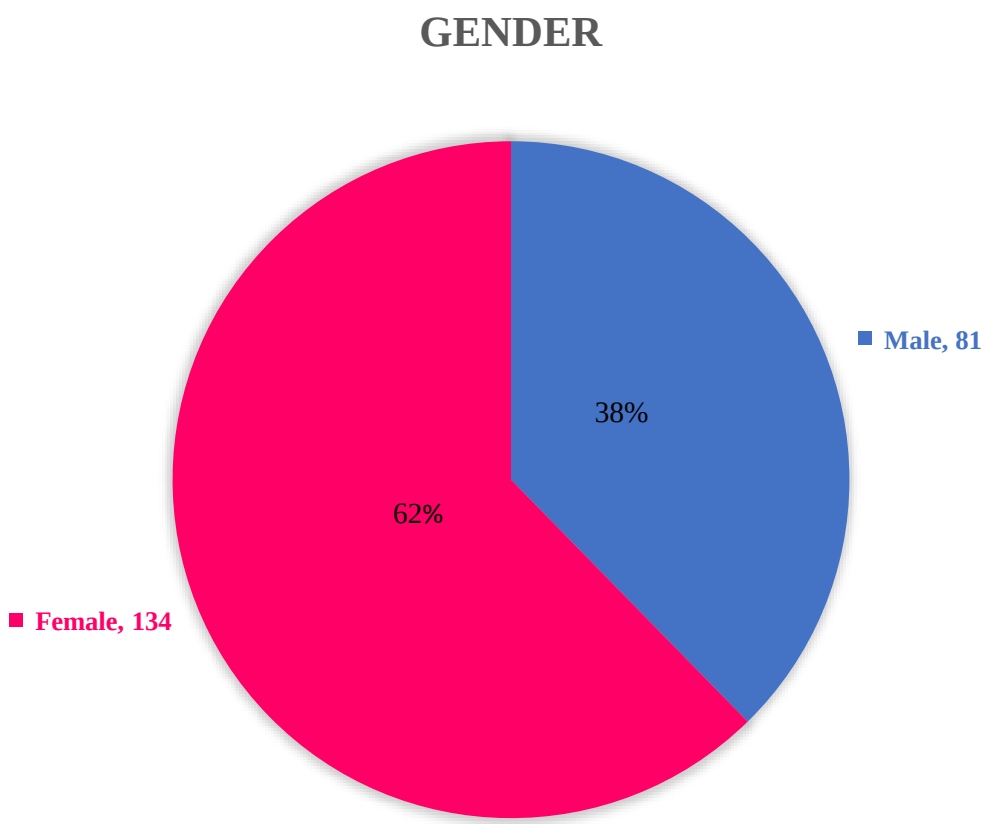
Determines statistical significance of differences

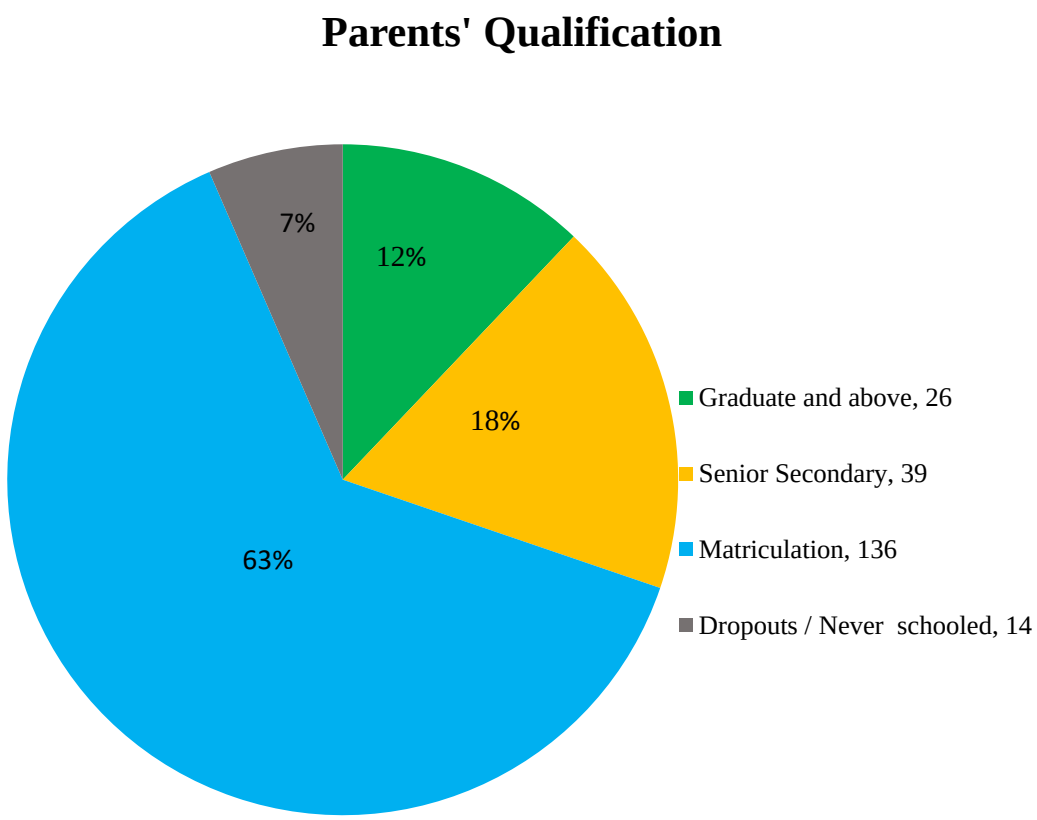
- Chapter 2 will provide an in-depth exploration of the methodology we used in our study. It will give you a detailed understanding of how we collected, analysed, and interpreted the data.

CHAPTER 2

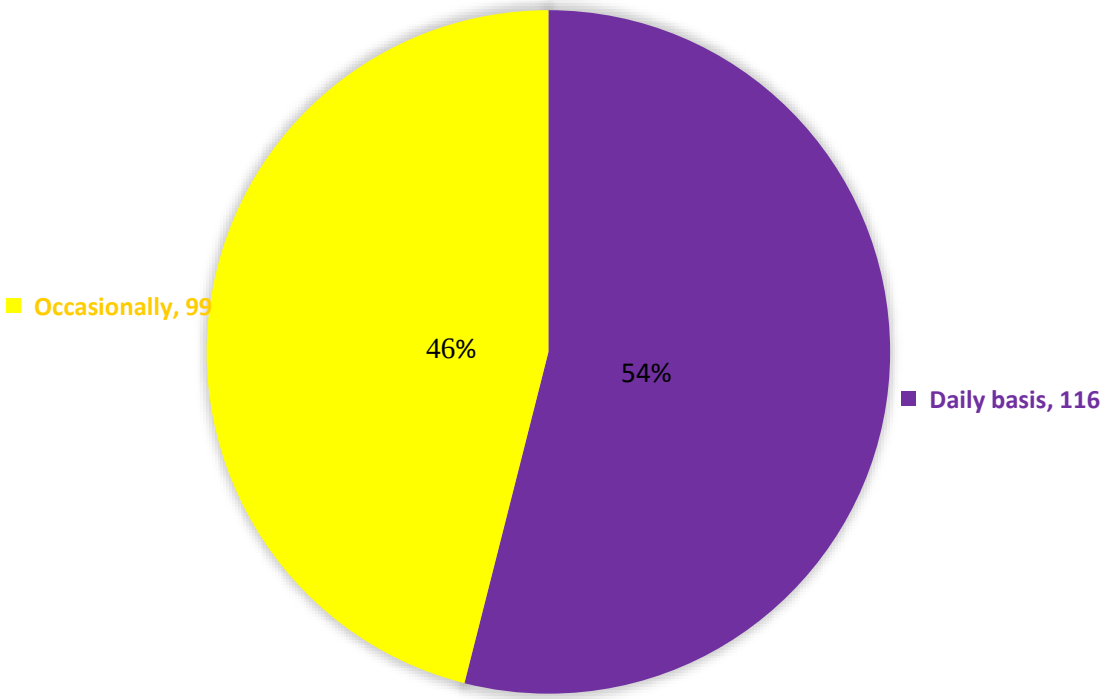
FRAMEWORK AND STUDENT ABILITIES

DEMOGRAPHIC DISTRIBUTION OF STUDENTS

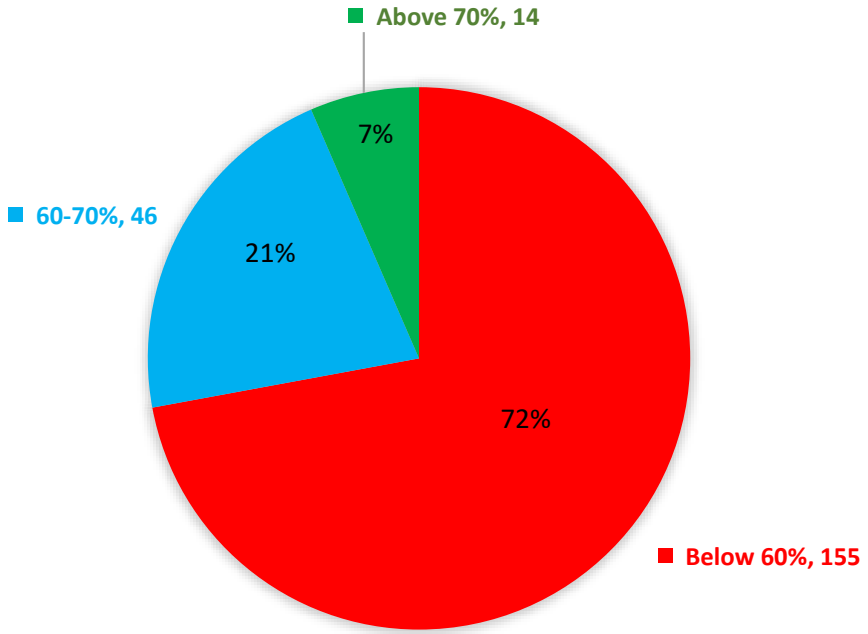




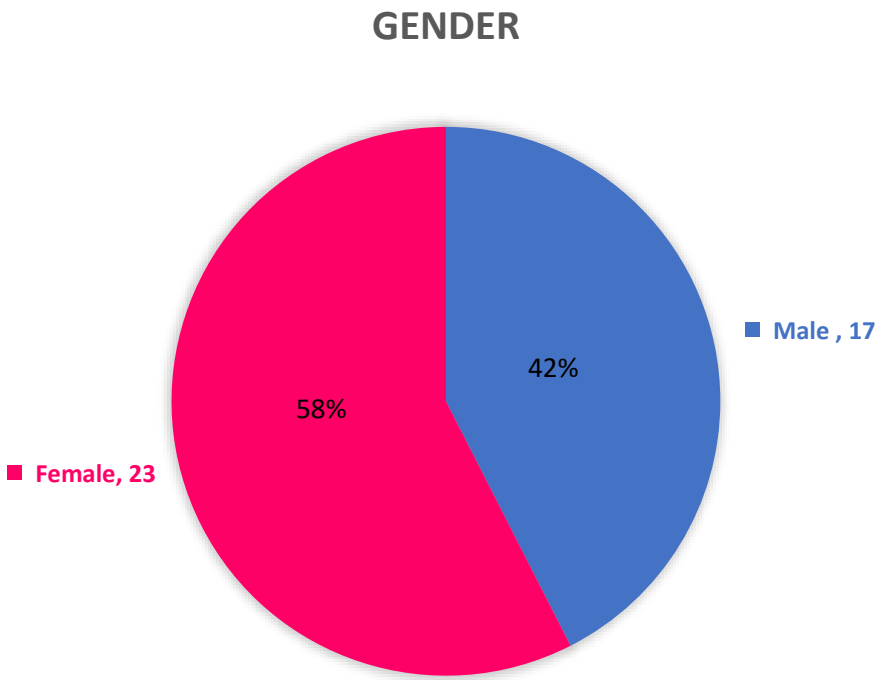
FREQUENCY OF ASSIGNMENT / HOMEWORKS

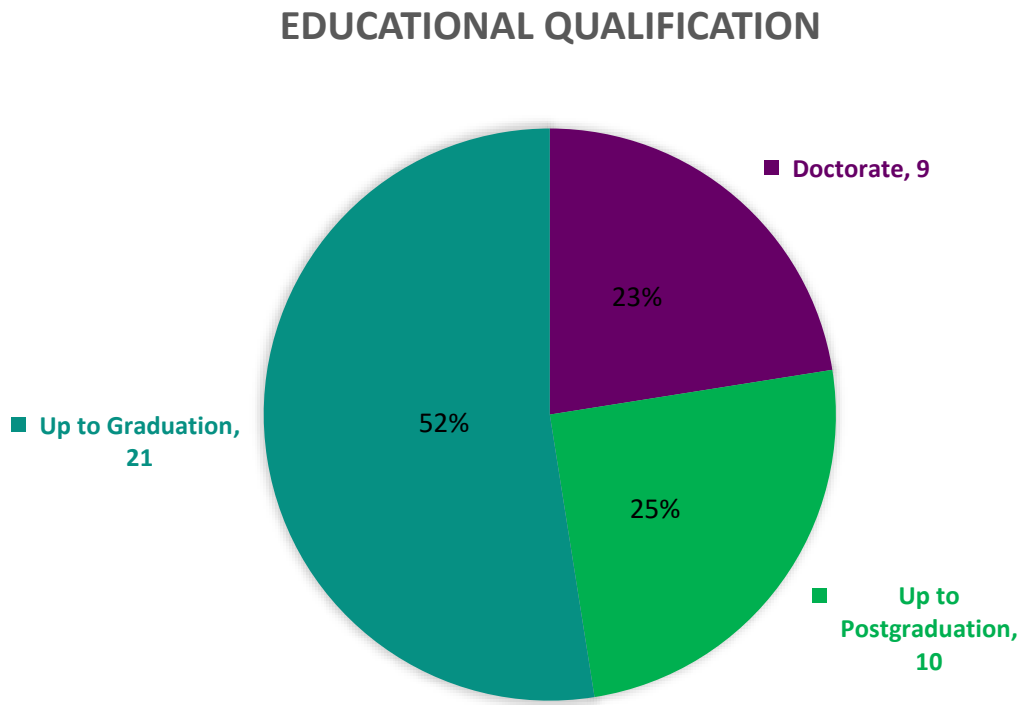


MARKS SCORED IN THE LAST EXAMINATION

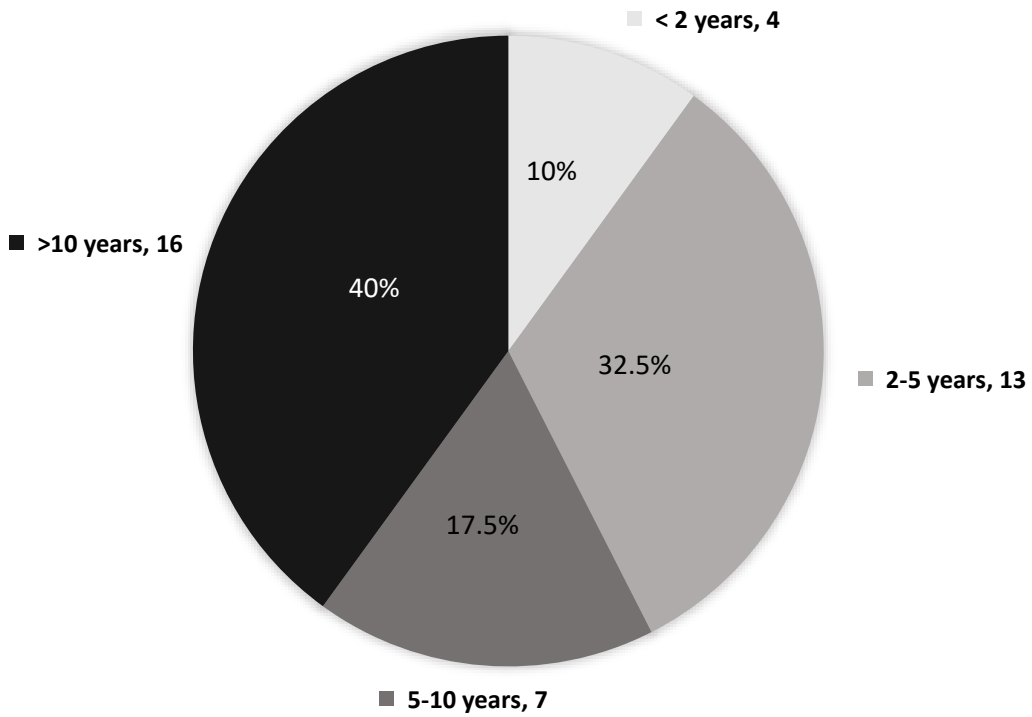


DEMOGRAPHIC DISTRIBUTION OF TEACHERS

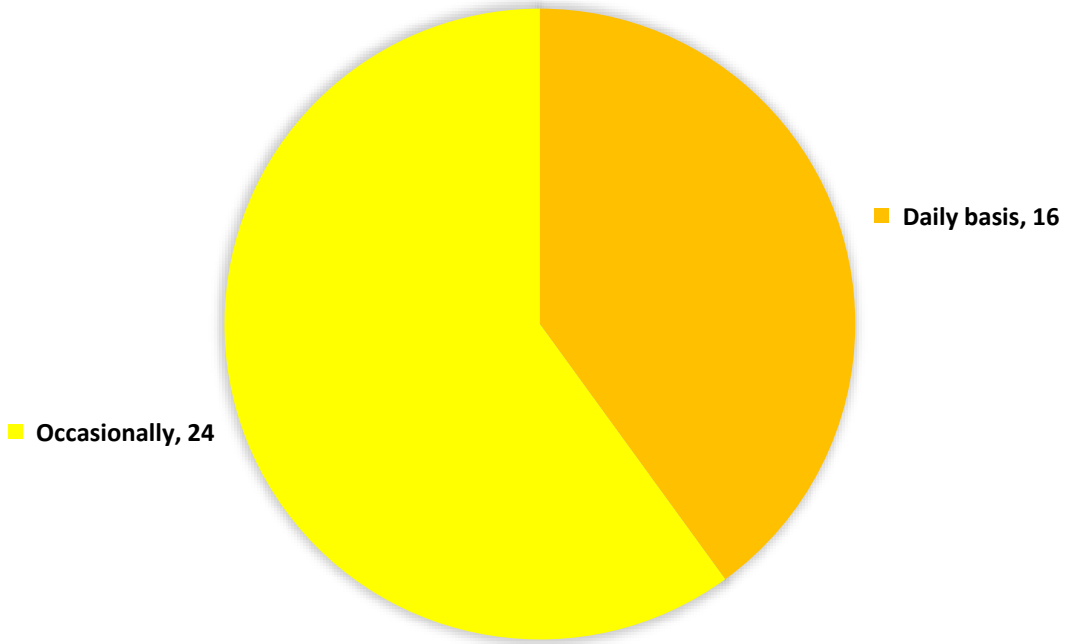




NUMBER OF ACTIVE YEARS OF SERVICE



FREQENCY OF HOMEWORK / ASSIGNMENTS GIVEN



ANALYSIS AND INTERPRETATION OF DATA

DATA ANALYSIS APPROACH

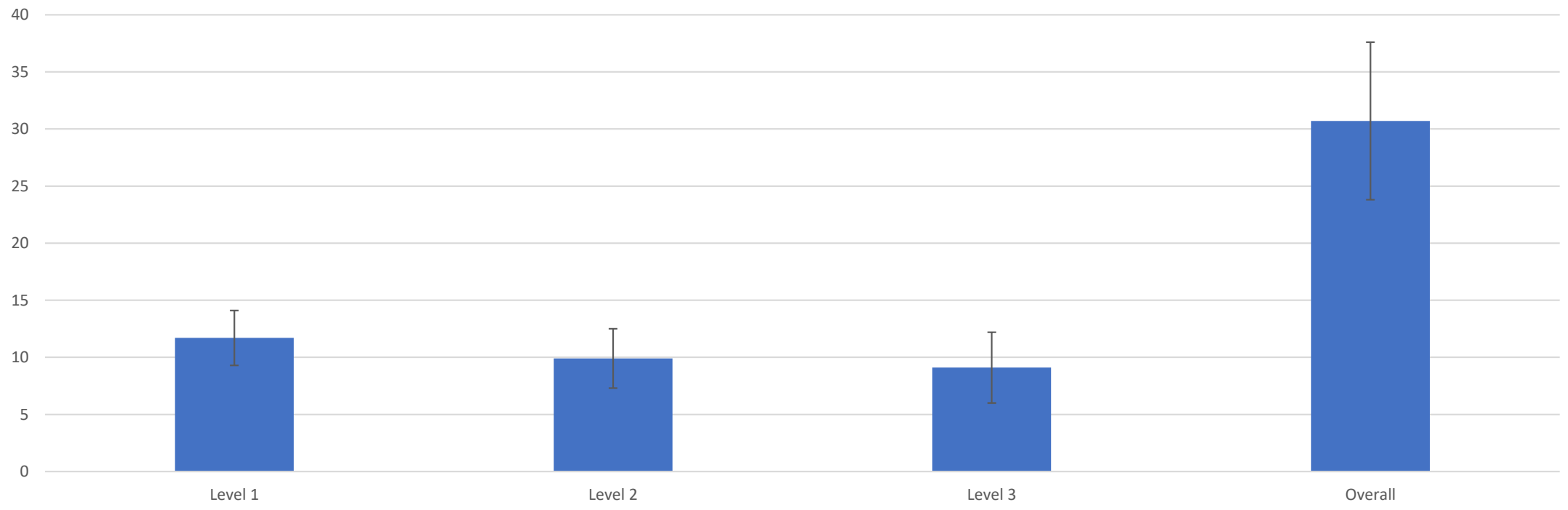
1. **STUDENT SCORES:** Mean and standard deviation used to assess real-life math application skills.
2. **TEACHER PERCEPTIONS:** Mean and standard deviation employed to evaluate their views on math's practical applications.
3. **STATISTICAL TESTS:** Parametric tests, such as t-tests and ANOVA, examined mean differences among groups.

OBJECTIVE 1: "DESIGNING A RELEVANT TEST" - Crafting a math test for real-life application.

- ✓PISA 1999 framework: oecd's "measuring student knowledge and skills" guideline.
- ✓Math literacy: understanding math's real-world role and constructive application.
- ✓Competency levels: students' achievement is classified into three levels.
  - **LEVEL 1: BASICS AND FUNDAMENTAL MATH CONCEPTS.**
  - **LEVEL 2: PROBLEM-SOLVING AND PRACTICAL APPLICATIONS.**
  - **LEVEL 3: ADVANCED THINKING AND REAL-LIFE MATH USE.**

Framework for assessing real-life mathematics competency

Objective 2: "Real-Life Math Proficiency" - Assessing students' ability to use math practically.



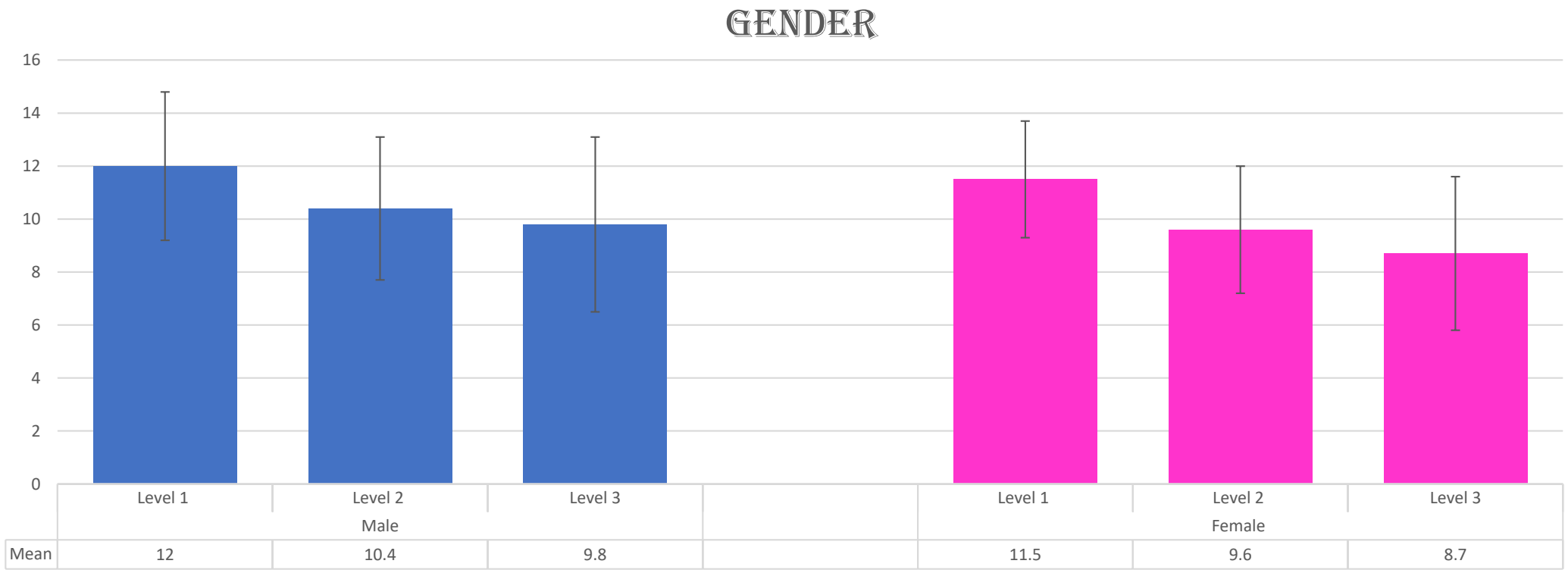
DEMOGRAPHIC FACTORS AFFECTING STUDENTS' APPLICATION OF MATHEMATICS TO REAL-LIFE PROBLEMS(OVERALL PERFORMANCE)

Variable		N	% Total	Mean	SD
Gender	Male	81	38	32.2	**7.6**
	Female	134	62	29.6	**6.2**
Parents Qualification	Graduate and above	26	12	31.1	**7.4**
	Senior Secondary	39	18	32.7	**6.9**
	Matriculation	136	63	29.7	**6.7**
	Dropped out before matriculationor never went to school	**14**	**07**	**32.3**	**6.1**

VARIABLE		N	% Total	MEAN	S.D
Frequency of Assignmentsor Homework	Almost on a daily basis	116	54	35.7	**5.0**
	Occasionally in an irregularmanner	99	46	24.6	**2.4**
Marks Scored in the lastExamination	Below 60 percent in the lastmathematics examination	155	72	29.9	**6.4**
	Between 60 and 70 percent in thelast mathematics examination	46	21	30.1	**6.8**
	More than 70 percent in the last mathematics examination.	**14**	**07**	**38.9**	**7.3**

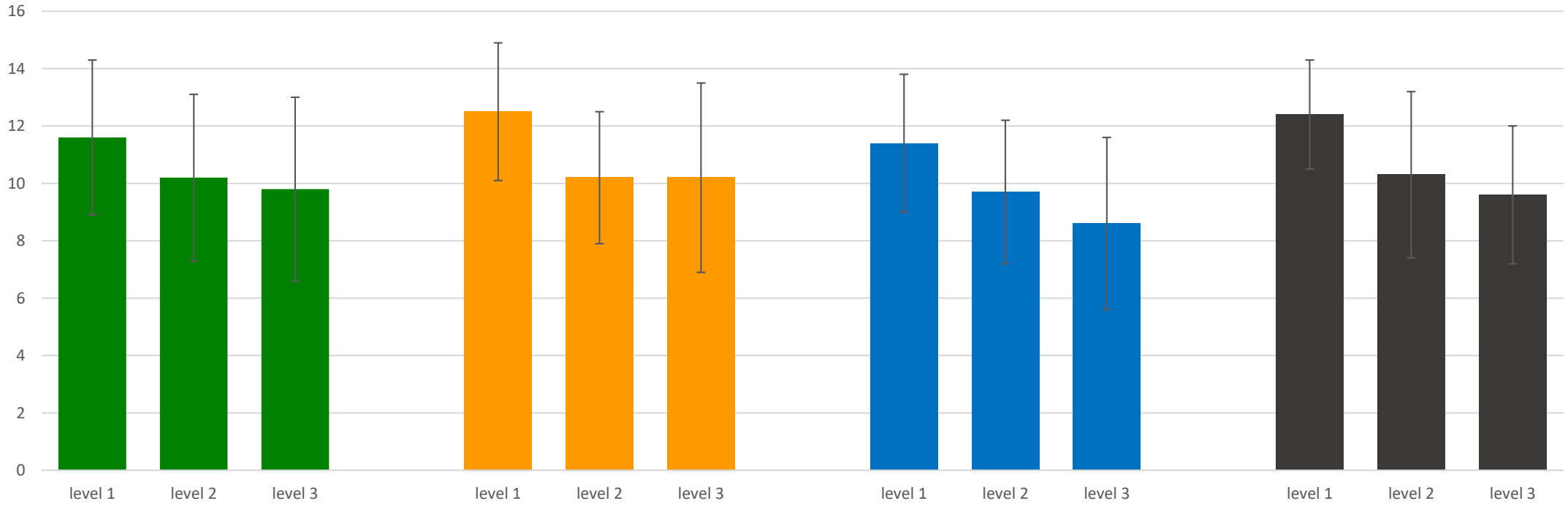
- **Gender differences:** male students (38% of the sample) scored higher (32.2, S.D 7.6) than females (62% of the sample) with a score of 29.6 (S.D 6.2). Male scores were above the sample average, but more varied.
- **Parental qualifications**: surprisingly, students with less-educated parents outperformed those with more educated parents, suggesting a weak correlation.
- **Homework frequency**: daily assignments (54% of the sample) led to higher scores (35.7, S.D 5.0) compared to occasional assignments.
- **Previous math exam performance**: students scoring above 70% (7% of the sample) had the highest competency scores (38.9, S.D 7.3). Those scoring 60-70% (21%) and below 60% (72%) had lower averages.
- **Competency levels**: level 1, focused on reproduction, definitions, and computations, had the highest scores. Levels 2 and 3 showed lower scores but similar variation.

DEMOGRAPHIC FACTORS AFFECTING STUDENTS' APPLICATION OF MATHEMATICS TO REAL-LIFE PROBLEMS(LEVEL-WISE PERFORMANCE)

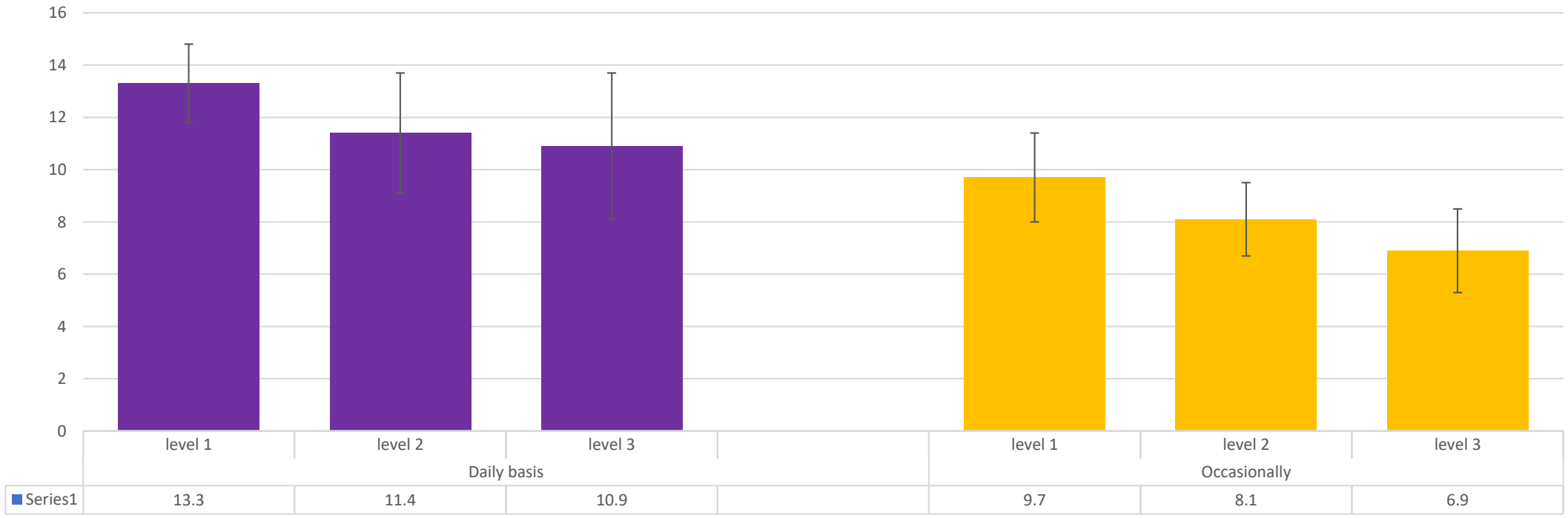


	Male				Female		
	Level 1	Level 2	Level 3		Level 1	Level 2	Level 3
Mean	12	10.4	9.8		11.5	9.6	8.7

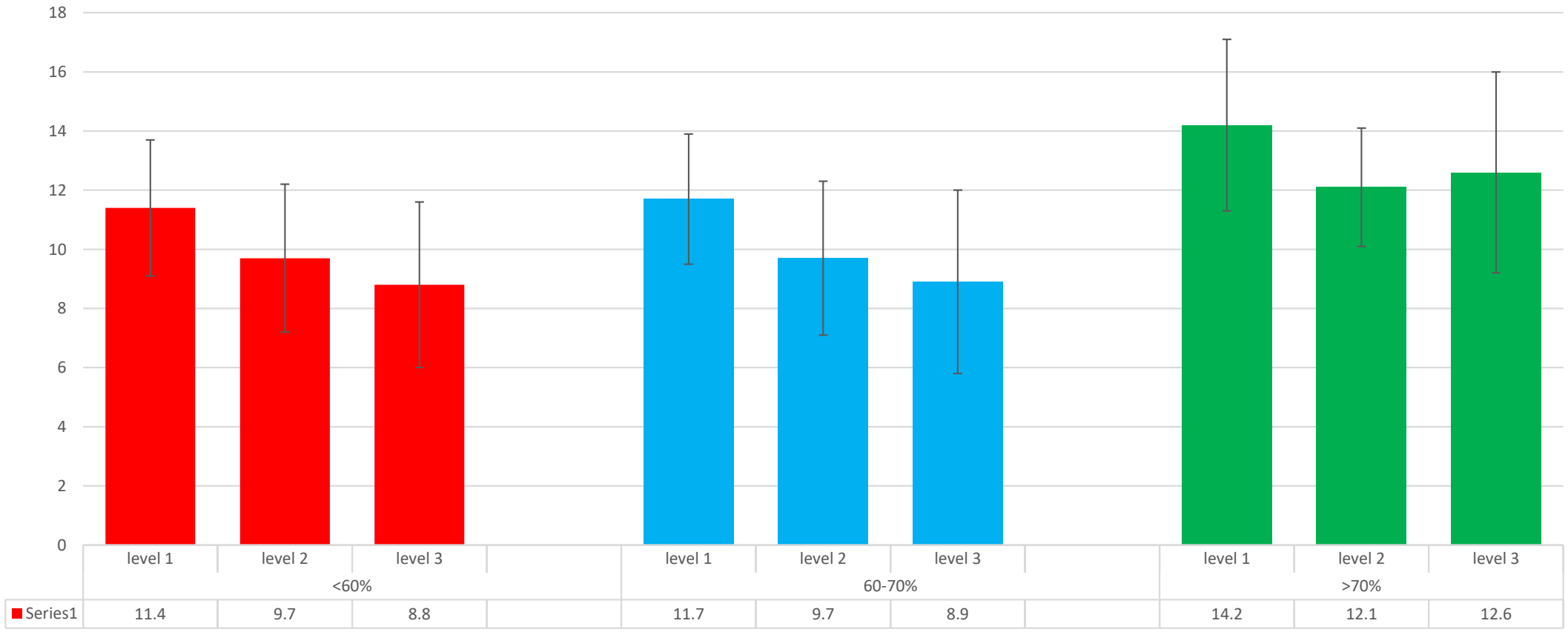
DEMOGRAPHIC FACTOR – PARENTS' QUALIFICATION



DEMOGRAPHIC FACTOR – HOMEWORK FREQUENCY



DEMOGRAPHIC FACTOR – MARKS SCORED IN THE LAST EXAMINATION



In summary, students' real-life mathematical problem-solving abilities vary across demographic profiles and competency levels. These variations drive the need for a detailed analysis of their significance. The upcoming chapters explores **four** subobjectives,

Subobjective 2.1:Effect of Gender
Subobjective 2.2:Effect of Parents Qualification
Subobjective 2.3:Effect of Homework Frequency
Subobjective 2.4:Effect of Marks scored in last Examination

each evaluating the influence of specific demographic factors on students' mathematical skills. We employ statistical tests to assess mean differences among diverse groups within competency levels

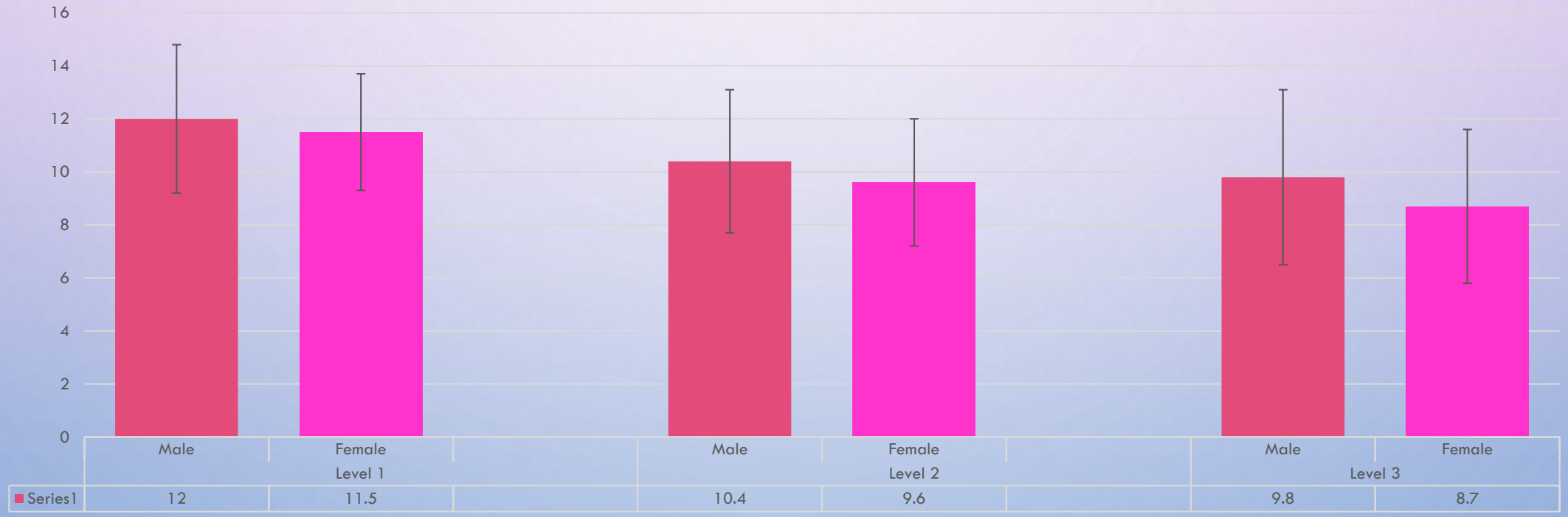
Chapter 3 consists of Subobjective 2.1 and 2.2

CHAPTER 3

IN-DEPTH STUDENT ANALYSIS PART-1

SUBOBJECTIVE 2.1:EFFECT OF GENDER

LEVEL WISE MATHEMATICS ACHIEVEMENT TEST SCORE ACCORDING TO GENDER



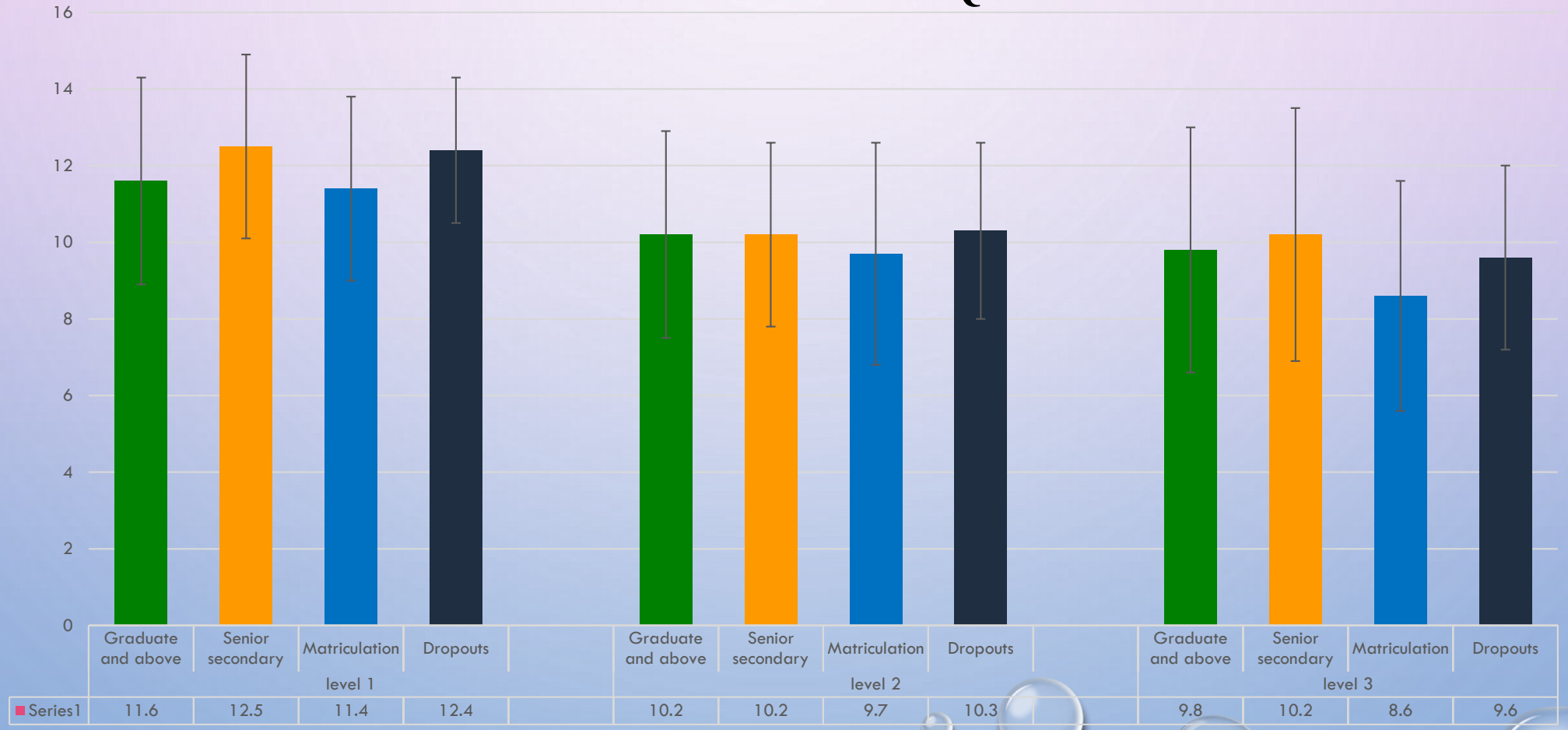
SUMMARY OF T-TEST OF MATHEMATICS ACHIEVEMENT SCORE ACCORDING TO GENDER (N=215)

Achievement Level	Gender	Sample Size (n)	Mean	Std. Dev.	DF	t-value	P-value	Level of Sig.	t crit.	Signif.
Level 1	Male	81	12.0	2.8	213	1.62	0.11	0.05	1.97	NS
	Female	134	11.4	2.2						
Level 2	Male	81	10.4	2.7	213	2.56	0.01	0.05	1.97	S
	Female	134	9.5	2.4						
Level 3	Male	81	9.8	3.3	213	2.82	0.01	0.05	1.97	S
	Female	134	8.6	2,9						
Overall Achievement	Male	81	32.2	7.6	213	2.73	0.01	0.05	1.97	S

The data suggests that male students exhibited a higher aptitude for applying mathematics to real-world problems compared to their female counterparts.

SUBOBJECTIVE 2.2: Effect of Parents' Qualification

LEVEL WISE MATHEMATICS ACHIEVEMENT TEST SCORE A QUALIFICATION ACCORDING TO PARENTS' QUALIFICATION.



SUMMARY OF ONE-WAY ANOVA OF MATHEMATICS ACHIEVEMENT TEST SCORE ACCORDING TO PARENTS QUALIFICATIONS

Competency Level	Source	Sum of Squares	DF	Mean Squares	F	P-Value	F Critical	Significance
Level 1	Between Groups	44.1	3	14.7	2.6	0.06	2.65	NS
	Within Groups	1221.9	211	5.8				
	Total	1266.0	214					
Level 2	Between Groups	14.8	3	4.5	0.76	0.5	2.65	NS
	Within Groups	1397.0	211	6.6				
	Total	1411.8	214					
Level 3	Between Groups	94.7	3	31.6	3.4	0.02	2.65	S
	Within Groups	1979.5	211	9.3				
	Total	2074.1	214					

Overall Competency Level	Between Groups	331.5	3	110.5	2.35	0.07	2.65	NS
	Within Groups	9976.3	211	47.1				
	Total	10307.8	214					

Level 1 and Level 2: Parents' qualifications show minimal impact on basic math skills.
Level 3: Students with parents up to Senior Secondary perform better due to guidance and exposure.
Higher qualified parents might unintentionally limit independent thinking in children's math learning.

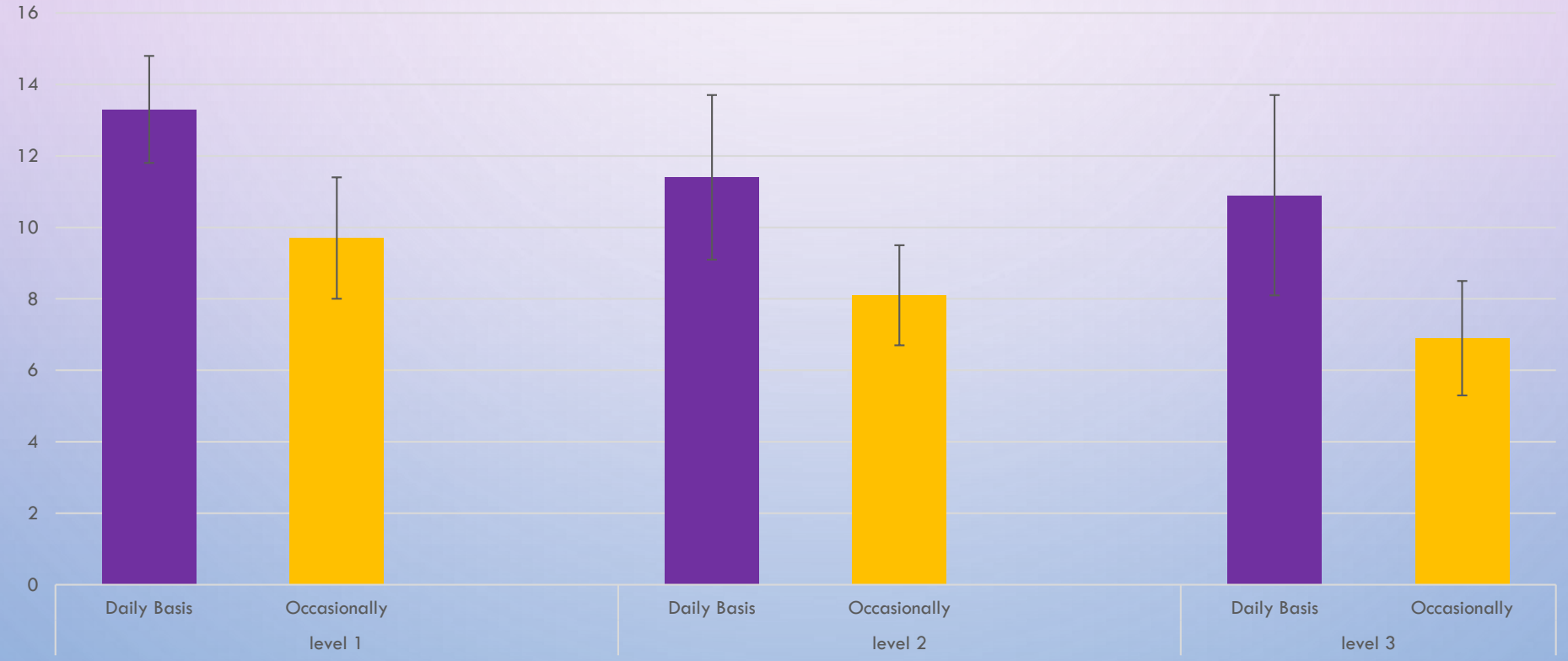
Chapter 4 consists of Subobjective 2.3 and 2.4

CHAPTER 4

IN-DEPTH STUDENT ANALYSIS PART-2

SUBOBJECTIVE 2.3:EFFECT OF HOMEWORK FREQUENCY

LEVEL WISE MATHEMATICS ACHIEVEMENT TEST SCORE ACCORDING TO FREQUENCY OF ASSIGNMENTS OR HOMEWORK



SUMMARY OF T-TEST ON ACHIEVEMENT LEVELS ACCORDING TO FREQUENCY OF ASSIGNMENTS OR HOMEWORK

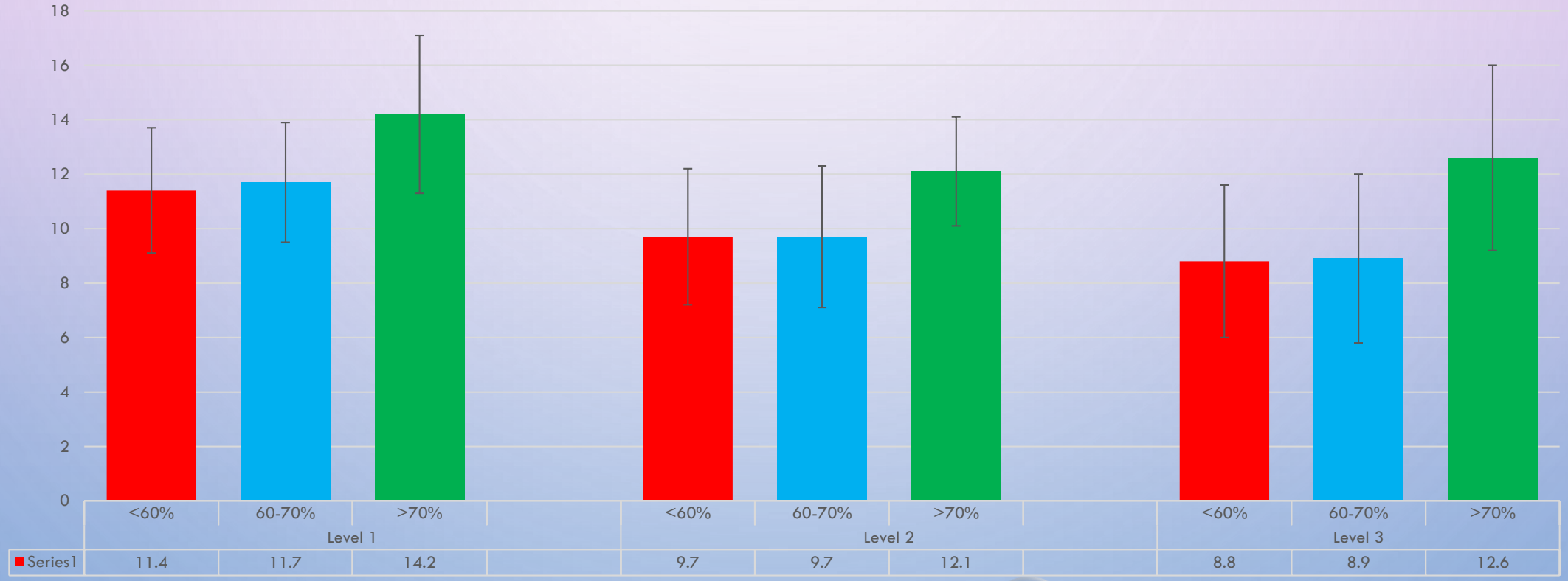
Achievement Level	Frequency of Assignments or Homework	Sample Size (n)	Mean	Std. Dev.	DF	tvalue	P-value	Level of Sig.	T crit.	Signif.
Level 1	Almost on a daily basis	116	13.3	1.5	213	12.7	6.82E-28	0.05	1.97	S
	Occasionally in an irregular manner	99	9.7	1.7						
Level 2	Almost on a daily basis	116	11.4	2.3	213	16.4	9.41E-40	0.05	1.97	S
	Occasionally in an irregular manner	99	8.1	1.4						
Level 3	Almost on a daily basis	116	10.9	2.8	213	12.25	1.82E-26	0.05	1.97	S
	Occasionally in an irregular manner	99	6.9	1.6						

Overall Achievement	Almost on a daily basis	116	35.7	5.0	213	20.1	4.56E-51	0.05	1.97	S
	Occasionally in an irregular manner	99	24.6	2.4						

These results suggest that the frequency of homework and assignments plays a crucial role in students' mathematics competency levels. More assignments and homework are associated with higher competency in all levels and an increased ability to apply mathematics to real-life problems. On the other hand, insufficient homework and assignments may hinder students' mathematical thinking and growth, potentially limiting their competency development.

SUBOBJECTIVE 2.4:EFFECT OF MARKS SCORED IN THE LAST EXAMINATION

MATHEMATICS ACHIEVEMENT TEST SCORE ACCORDING TO MARKS SCORED IN THE LAST EXAMINATION



SUMMARY OF ONE-WAY ANOVA ON ACHIEVEMENT IN DIFFERENT COMPETENCY LEVELS ACCORDING TO MARK

Competency level	Source	Sum Of Sq.	Df	Mean sq.	F	p-value	F crit.	Signif.
Level 1	Between groups	101.83	2	50.92	9.43	1.2E-04	3.04	S
	Within groups	1145.3	212	5.4				
	Total	1247.1	214					
Level 2	Between groups	73.82	2	36.91	5.87	0.03	3.04	S
	Within groups	1333.42	212	6.29				
	Total	1407.24	214					
Level 3	Between groups	192.39	2	96.2	11.1	2.55E-05	3.04	S
	Within groups	1833.83	212	8.7				
	Total	2026.2	214					

Overall competency level	Between groups	1048.78	2	524.39	12.24	9.29E-06	3.04	S
	Within groups	9047.71	212	42.83				
	Total	10128.5	214					

This analysis supports the conclusion that the percentage of marks obtained in the last examination correlates with students' abilities in different levels of mathematics competency. Students who achieved more than 70 percent in their last mathematics examination outperformed their peers in level 1, 2, and 3 tasks, showcasing stronger mathematical competency. The results indicate a direct relationship between students' average mathematics competency scores and their last examination performance, affirming that classroom mathematics competency plays a crucial role in their ability to apply mathematics to real-life problems.

CHAPTER 5

UNLOCKING STUDENTS' PERSPECTIVE

OBJECTIVE 3: "STUDENT PERSPECTIVES" - Understanding how students view math in daily life.

THEME 1: Mathematics in every sphere of life

THEME 2: Integration of mathematics in real life

THEME 3: Interest in mathematics

THEME 4: Opting mathematics in higher classes

THEME 5: Teachers' ability to transform the mathematical ability in real life problems

THEME 6: Improvement in mathematics content, pedagogy and mode of assessment

CHAPTER 6

TEACHERS' INSIGHTS

OBJECTIVE 4: "TEACHERS' INSIGHTS" .

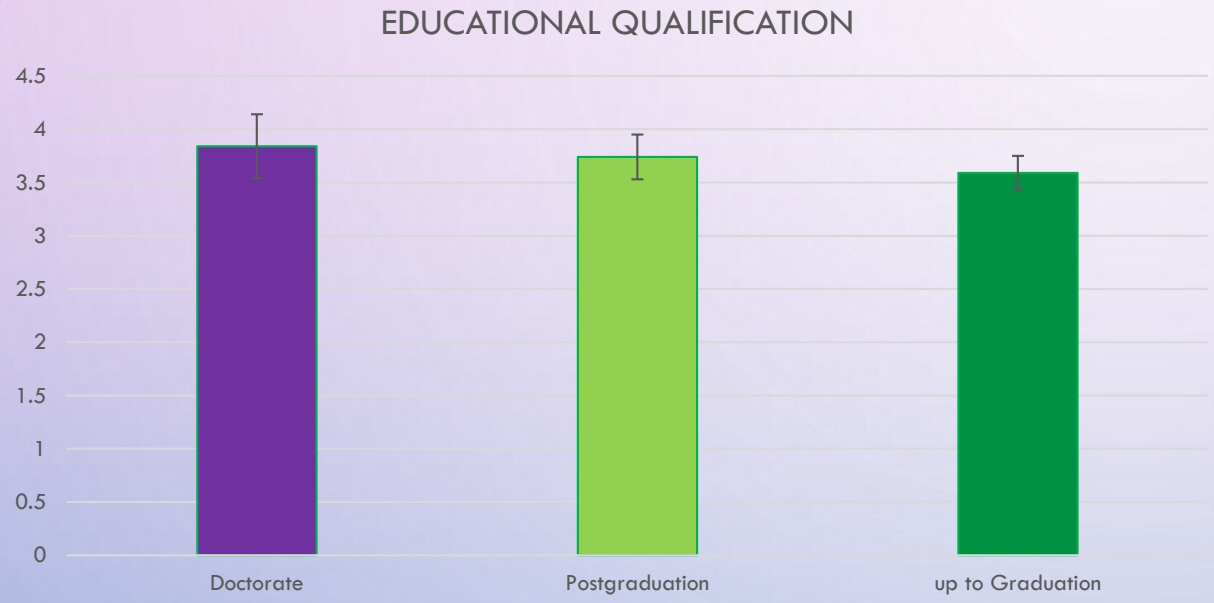
These results indicate that both male and female teachers have overall average perception scores that do not significantly differ.

Consequently, the data provides evidence supporting the conclusion that the perception of teachers regarding the application of mathematics to real-life problems is not influenced by their gender

Summary of t-test of Perception of Teachers According to Gender

Perception Level	Gender	Sample Size (n)	Mean	Std. Dev.σ	DF	tvalue	Pvalue	Level of Sig. (α)	t critical	Sig.
Overall Perception Level	Male	17	3.67	0.26	38	2.01	0.06	0.05	2.05	NS
	female	23	3.78	0.24						

SUMMARY OF ONE WAY ANOVA OF PERCEPTION OF TEACHERS ACCORDING TO EDUCATIONAL QUALIFICATION

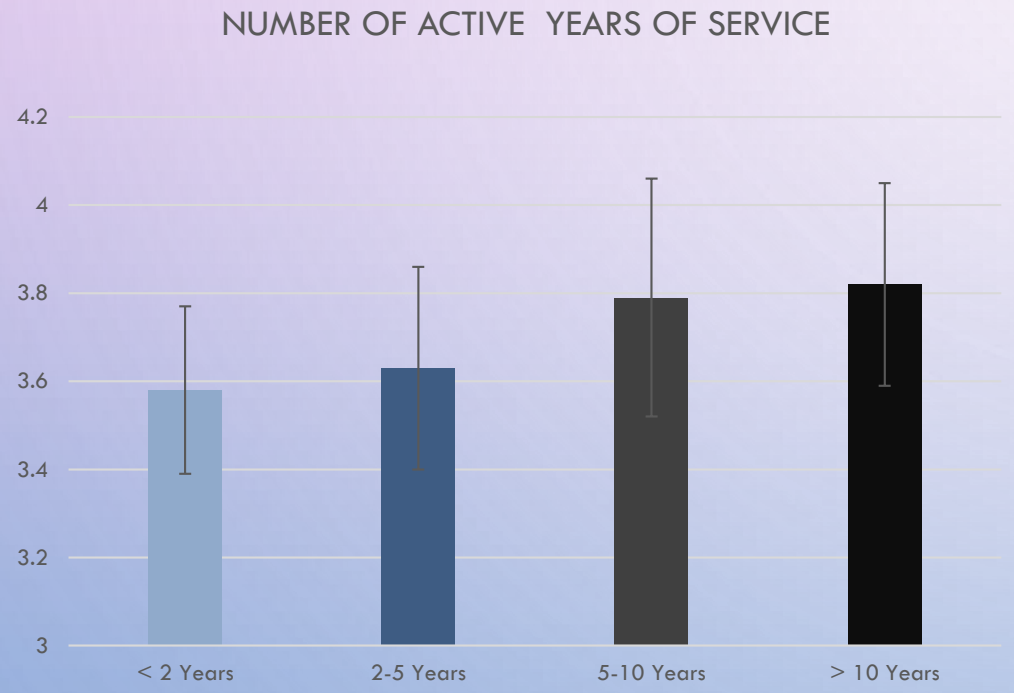


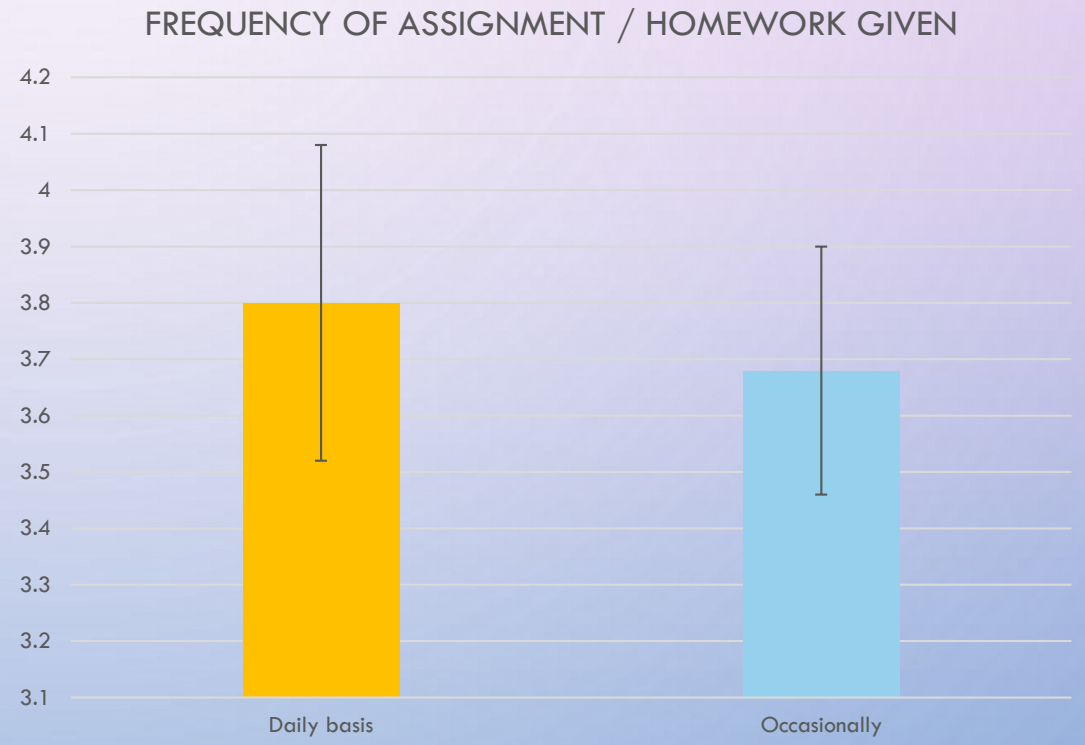
The average perception score of groups of teachers with different qualification and differed and to test the significance of the difference, ANOVA was employed.

More qualified teachers tend to have more favourable perception towards application of mathematics in solving real life problems.

Perception Level	Source	Sum of Squares	DF	Mean Squares	F	P-Value	F-Critical	Significance
Overall Perception Level	Between Groups	0.87	2	0.43	8.11	0.0006	3.26	S
	Within Groups	4.13	37	0.05				
	Total	5.0	39					

MEAN AND STANDARD DEVIATION FOR ACTIVE YEARS AND FREQUENCY OF ASSIGNMENT / HOMEWORK GIVEN





SUMMARY OF ONE WAY ANOVA OF PERCEPTION OF TEACHERS ACCORDING TO NUMBER OF ACTIVE YEARS OF SERVICE

Perception Level	Source	Sum of Squares	DF	Mean Squares	F	P-Value	F-Critical	Significance
Overall Perception Level	Between Groups	0.76	3	0.25	4.57	0.0053	2.88	S
	Within Groups	4.23	36	0.06				
	Total	5.0	39					

The basis of the obtained value of test statistic F that there is a significant difference in overall perception of teachers on the basis of active period of service.

More specifically, results obtained indicate that teachers with lesser period of active service have significantly less favourable perception towards application of mathematics in real life problems.

SUMMARY OF T-TEST OF PERCEPTION OF TEACHERS ACCORDING TO FREQUENCY OF HOMEWORK OR ASSIGNMENTS

Perception Level	Frequency of Homework or assignments given	Sample Size (n)	Mean	Std. Dev.σ	DF	tvalue	Pvalue	Level of Sig. (α)	t critical	Sig.
Overall Perception Level	On a daily basis	1	3.80	0.28	38	2.06	0.04	0.05	2.025	S
	Occasionally in an irregular Manner	24	3.68	0.22						

The basis of the obtained value of test statistic t that there is a significant difference in the overall perception of teachers on the basis of frequencies of homework or assignments given to students.

Teachers who give frequent homework and assignments tend to have more favourable perception about application of mathematics in real life problems than the teachers who give homework and assignment occasionally in an irregular manner.

CONCLUSION

Student Gender: Male students show higher real-world math application aptitude.

Parental Qualifications: Level 3 math competency is influenced by parents' education, especially up to Matriculation.

Homework & Assignments: Regular homework positively impacts math competency at all levels.

Prior Exam Performance: Higher scores in previous exams correlate with better performance in all competency levels.

Teacher's Influence: Teachers' perceptions are positively affected by their qualifications and assigning frequent homework.

Key Influencing Factors: Classroom environment, curriculum, teaching methods, and student interest are crucial for practical math application.

Thank You