

EFFECT OF REMEDIAL TEACHING ON MATHEMATICS ACHIEVEMENT AMONG SECONDARY SCHOOL STUDENTS IN SWEDEN: EVIDENCE FROM HIGH SECONDARY SCHOOL

*¹Emmanuel BYIRINGIRO

*¹Phd candidate in Education Department, Mount Kenya University

DOI: <https://doi.org/10.5281/zenodo.10512450>

Published Date: 15-January-2024

Abstract: This study aimed to examine effect of remedial teaching on mathematics achievement among secondary school students in Sweden: Evidence from high secondary school. The research targeted 287 respondents from Per Brahe Secondary School in in Jönköping municipality. The study sampled 167 respondents by using Yamane formula. The collected data was analyzed using descriptive statistics, correlation, and regression analysis through the statistical package for social science (SPSS) version 21. Research data were obtained through questionnaires and documentation. The data collected were analyzed using descriptive statistics and multiple regression. The results of the findings indicated that the remedial teaching was more correlated with student mathematics achievement in upper secondary school ($r = 0.766$; $p = 0.000$). Multiple linear regression analysis showed that remedial teaching contributed to 69% of variation on the performance, hence plays a vital role in student mathematics achievement in upper secondary school. Additionally, it was further inferred that remedial teaching affects positively student mathematics achievement. The study recommended that teachers should mobilize their students to attend remedial activities.

Keywords: Remedial teaching, mathematics achievement and students.

1. INTRODUCTION

Mathematics is the rudimentary subject for the development of scientific knowledge and intellectual growth of students. Mathematics knowledge is necessary for secondary school students; as it is very useful for higher education. Academic achievement or academic performance is the extent to which a student, teacher or institution has attained their short or long-term educational goals. Academic achievement is important for the successful development of young people in the society. Remedial teaching is assigned to assist students in order to achieve expected competencies in core academic skill such as literacy and numeracy. Remedial education can be designed for any student with or without special needs. Remedial teaching and its effect on student's leaning of mathematics continue to attract the attention of researches because of their association with students learning and achievement in mathematics (Gustafsson & Blömeke, 2018).

Remedial classes are a type of a teaching program designed specifically for students with deficiencies in school subjects such as Science and Mathematics (Sfard, 2005). They equip students with in-demand skills and address the outcomes of an education system. The approaches, pedagogies and activities related to remedial classes are simple and do not require an excessive amount of preparation, however they are significant and suitable for the level of low achieving students

(Gustafsson, 2010). Furthermore, remedial classes lead students to becoming more engaged in the learning process. Given that remedial classes are not teacher-centred but instead focus on students, they seek to increase student engagement and motivation. Shavit & Müller (2000) maintains that there was improvement in the motivation and achievement of fourth grade students as a result of the impact of remedial classes. Parsad, et al (2003) have found that remedial instruction improved the competencies of low achieving students. The results showed that remedial classes were effective in improving student performance and achievement in Mathematics. The researchers assert that remedial classes are one of the most satisfactory solutions to increasing student achievement and recommended it for ongoing development of teachers' skills in remedial teaching.

Remedial instruction should be provided for students who have performed poorly in mathematics to ensure their future academic success (Jepsen,2006). Mano (1995) found that children receiving intervention not only improved their mathematics skills but also showed an increased interest in mathematics. Several studies suggest that an opportunity to learn plays a key role in promoting low achieving students' mathematics performance (Rosenbaum & Rubin, 1983). Therefore, remedial instruction can provide low-SES and low achievement in mathematics students more opportunities to learn mathematics. Given the recognition of the importance of confidence and interest toward the learning of mathematics, determining how to foster low-SES and low achievement in mathematics students' confidence and interest toward the learning of mathematics has thus become urgently necessary.

Some research studies of upper secondary vocational education in Sweden have been carried out, but not specifically focusing on mathematics education. In the Building and Construction Program, students' perspectives of the mandatory academic subjects, called core subjects (e.g. mathematics, Swedish and English) have been studied by Ngo (2018), who followed two classes during one year. Most of the students stated that they thought there was no use in studying these core subjects as they did not think that they would be beneficial to them in their occupations, but mathematics was an exception. However, in line with their orientation towards their future work, they considered mathematics to be important because of its relevance to work in construction. Some pupils also said that the core subjects could be acceptable, but only if they were relevant to their future work.

Remedial teaching and every other form of special education increased in Sweden like a rolling snowball during the sixties. It was gradually adapted into assisting normal schooling in ordinary classes. Probably it also became more similar to the ordinary schooling. The advantages of remedial reading clinics and similar arrangements were highly praised, as they permitted a high degree of integration. Towards the end of the sixties the government delegated to the local authorities the right to decide the numbers of hours of remedial teaching. This led to a doubling of hours for remedial teaching between 1966 and 1971. But a sudden stop was decided by the government in 1971 because of this immense increase. Limits were set for the remedial teaching hours, and in some cases it was necessary to reduce the number of remedial hours considerably (OECD, 2016).

There is one interesting Swedish study by Gustafsson & Stigebrandt (1972) which shows that in one studied case there was no significant difference between the teaching in special classes and the teaching in ordinary classes. The conclusion of this study should be that no difference as to the efficacy of the special education would here be possible. As these two authors were able to demonstrate, in some other classes there seemed to be clear differences between remedial and ordinary teaching, and in this case a difference in the effect of the teaching would be expected. It is against that background that the study attempted to assess the effect of remedial teaching on mathematical achievement in upper high secondary school.

1.1. Problem statement

Remedial teaching is a fundamental approach to gain better understanding as well as to solve the problem arises among secondary school students in mathematics. Remedial teaching is a detailed and organized effort in finding the delimitation of student in mathematics. Remedial teaching is an effective and assistive programme to overcome mathematics anxiety among secondary school students and to enhance the academic achievement in mathematics. Secondary school students needed a good understanding of mathematics to reduce mathematics anxiety and develop positive attitudes towards teaching learning of mathematics.

The main objective of this investigation is creating suitable circumstance for the production of knowledge in mathematics in order to solve problem there by improving the knowledge in mathematics and ability to solve problems. The relevance of the study is to gain a greater understanding in mathematical knowledge and the usefulness of remedial teaching at

secondary level. The purpose of our study was to investigate the relationship between remedial teaching and mathematics achievement among secondary school students in Sweden using regression analysis for complex sample survey data. Hence, the investigator has undertaken to study this topic.

Specifically, this study sought to achieve the following research hypothesis:

H₀₁: There is no significant effect of remedial teaching on mathematics achievement in upper secondary school in

2. METHODOLOGY

The research design adopted was experimental research and correlational research design. This design is deemed suitable because the study sought to investigate the relationship between remedial teaching and mathematics achievement among secondary school students. Taking into consideration the nature of study the investigator adopted the experimental research design to explore the facts related to the study regarding teaching on the academic achievement in mathematics of secondary school students. The target population for this study consisted of upper secondary schools in Kronoberg County in Southern Sweden. The study targeted 281 upper secondary students and 6 mathematics teachers from Per Brahe Secondary School which is a secondary school in Jönköping municipality, Sweden. Thus, the total population was 287 persons (Statista Report, 2024).

In addition, the study used the following formula proposed by using Yamane (1973) to determine the sample size because that is too large waste scarce resources and could expose more participants than necessary to any related risk. Thus, the study used Yamane formula to calculate a sample size because it is the most appropriate for this study.

Using Yamane formulae

$$n = \frac{N}{1 + (N)(e^2)}$$

Where:

n = sample size

N = the population size

e = the acceptable sampling error (5%) at 95% confidence level

Thus; $n = 287 / (1 + (287) (0.05)^2)$

$n = 167.1 = 167$ respondents

In this study the researcher used questionnaires, and documentary review. Closed –ended questions were used where the answers were divided into categories such discrete, distinct and relatively few in number. It is easier for respondents to answer because they had only to choose categories. In that way a chance for irrelevant answers is limited to the minimum, because appropriate answer categories were provided. The main respondents were being teachers that were given the questionnaire as they were enough time to respond to the questions based on research hypothesis. Questionnaires were given to Mathematics teachers and students from Per Brahe Secondary School.

The questionnaire used as the research instrument was subjected to face its validation. This research instrument (questionnaire) adopted was adequately checked and validated by the supervisor his contributions and corrections were included into the final draft of the research instrument used.

The research is purely a quantitative research in nature. After collection of primary and secondary data, the researcher analyzed data by using SPSS 21. Standard multiple linear regression was calculated to find out the effect above listed independent variables and dependent variables. Correlation coefficient was used to analyze the relation between all independent variables with dependent variables. Collected data are presented in tables, which may make the data analysis more comprehensive to its reader. Based on this five rating scale, the collected data are analyzed and interpreted. In qualitative research, data analysis involves reducing, organization the data synthesizing and discovering what is important. So, this study involves a detailed description of case, follow by an analysis of the data for conceptual framework. Data was presented in form of tables and graphs.

The study used the following multiple regression model to establish the statistical significance of the independent variables on the dependent variable.

$$Y = a + \beta_1 X_1 + \epsilon$$

Whereby Y = Remedial teaching

a= Constant

X_1 = Mathematics achievement

β_1 represent regression coefficients. These were helped in the generalization of the findings on the relationship between remedial teaching and Mathematics achievement.

3. FINDINGS AND DISCUSSION

3.1. Findings

In this study the research targeted 287 respondents from Per Brahe Secondary School. The data collected from the respondents were analyzed in tabular form with simple percentage for easy understanding. A total of 161 questionnaires of students and 6 for Mathematics teachers were distributed and only 151 questionnaires were returned back. Besides, all 6 mathematics teachers responded the questionnaire. Thus, the study used a sample of 157 respondents.

3.1.1 Descriptive Statistics of remedial teaching and mathematics achievement

In this research the study attempted to determine the effect of remedial teaching on mathematics achievement of Per Brahe Secondary School. The respondents were asked to rate the statements by indicating the extent to which they apply to their organization in 5-point Likert scale.

Table 1: The distribution of respondents according to remedial teaching

Statements	Mean	Std. Dev
Remedial classes have helped students a lot in Mathematics	3.2	0.72
Students became more interested in the subject after remedial classes	4.1	0.88
Students are boosted confidence in Mathematics	3.8	0.53
Strengthening foundational Knowledge in Mathematics	3.3	0.96
Remedial classes reduce mathematics anxiety and develop positive attitudes towards teaching learning of mathematics	4.3	0.63
Students are helped to overcome academic challenges and achieve success in mathematics	4.5	0.99
Students get back on track so they can continue their learning on the math continuum.	3.6	0.87

Source: Field research, 2023

As shown in Table 1, the results relate to the seven statements assessing the effect of remedial teaching on mathematics achievement of upper Per Brahe Secondary School. The results show that for the first statement, the majority of respondents strongly agreed that Remedial classes have helped students a lot in Mathematics with a mean value of 4.2, and a high positive correlation standard deviation of 0.69. The second statement asked respondents whether students became more interested in the subject after remedial classes. The results showed that the majority of respondents strongly agreed with this statement ($M=4.4$, $SD=0.78$). For the third statement, students are boosted confidence in Mathematics, the majority of respondents agreed with this statement, with a mean of 3.8 and a very positive and high standard deviation correlation of 0.53. The fourth statement asked whether the remedial classes in mathematics strengths foundational Knowledge. Respondents strongly agreed with this statement, with an average mean of 3.3 and a very strong positive standard correlation of 0.96. The next item was whether remedial classes reduce mathematics anxiety and develop positive attitudes towards teaching learning of mathematics. The majority of them strongly agreed that statement with a mean of 4.3 and a very high positive standard deviation of 0.63. The next item respondents were asked whether Students are helped to overcome academic challenges and achieve success in mathematics, the respondents agreed that statement ($M=3.5$, $SD=0.52$). On the

last statement respondents were asked teachers are advised to use appropriate learning strategies to meet the needs of students in delivering material, the majority of respondents strongly agreed and agreed that statement with a mean score of 4.5 and positive correlation standard deviation of 0.99. Lastly the respondents were asked whether remedial teaching help students to get back on track so they can continue their learning on the math continuum, the majority of respondents agreed that statement with a mean of 3.6 and standard deviation of 0.87. From the results, it implies that the majority of respondents strongly agreed and agreed that all of the above are key elements of remedial teaching and student mathematics achievement in upper secondary schools in Jönköping Municipality in Sweden.

3.1.2. Correlation analysis

The findings of the correlations between the independent variables and the dependent variables are summarized and presented in Table 2

Table 2: Correlation between variables

		Remedial teaching	Mathematics achievement
Remedial teaching	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	157	
Mathematics achievement	Pearson Correlation	.766**	1
	Sig. (2-tailed)	.000	
	N	157	157

** . Correlation is significant at the 0.01 level (2-tailed).

According to the findings reported in Table 2, the Pearson correlation analysis showed that remedial teaching ($r=0.766$, $p=0.000$) is positively and significantly related to student Mathematics achievement in upper secondary school in Jönköping Municipality. The correlation was deemed to be statistically significant since the p-value was less than 5%. The findings therefore showed that there is a positive and statistically significant relationship between teacher-student relationship and student Mathematics achievement in high school.

The data of this study confirms the relationship which is positively correlated with students' mathematics achievement. The study indicated that remedial instruction can significantly enhance low-math students' interest and confidence in mathematics learning, due to the fact that an opportunity to learn was presented to these students.

This study is consistent with Caras (2019) who stated that remedial activities are designed with the aim of closing the gap between what a student knows and what he/she is expected to know. They aim to provide additional support to students who, for one reason or another, are lagging behind the rest of the class in some subjects. Thus, they learn to the best of their abilities and ultimately return to mainstream classes. Such students are usually known as low learners or low achievers. Remedial classes seek to reinforce the 'supply side' of education by offering additional opportunities to learn and thereby strengthening education.

Remedial education is a part of education which is concerned with the prevention, investigation and treatment of learning difficulties from whatever source they may emanate and which hinder normal development of pupils (Nasir & Cobb, 2007). Remedial education is given to children who function at a lower than average level because of certain learning or behavioral problem, but it can also be offered to pupils who achieve at higher than average level. Generally, learners who require remedial learning have poor memory, short attention span and are easily distracted by other things, have relatively poor comprehensive power, lack learning motivation and self-confidence and exhibit relatively slow self-expectation. They are also weak in problem solving, fail to grasp information quickly and mix things up easily. Others have difficulty in understanding abstract concepts and need more time to complete assignment or tasks.

3.1.3. Multiple Regression

A multiple regression analysis was performed in this section to identify the predictor and its contribution towards the criterion. It aims to determine the prediction of a single dependent variable from a group of independent variables. The multiple regression analysis was performed with all the assumptions complied with. The results of the multiple regression are presented in Table 3 to Table 5.

Table 3: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.562 ^a	.069	.064	1.11497

a. Predictors: (Constant), Remedial teaching

The table 3 below shows the quantity of variance that is explained by the predictor variables. The first statistic, R is the multiple correlation coefficient between the predictor variable and dependent variable. In is model, the value is .562^a, which indicates that there is a great deal of variance shared by the independent variable and dependent variables. The next value, R Square, is simply the squared value of R. This is frequently used to describe 69% of goodness of fit or the amount variance explained by a given set of predictor variables and its value is 31% of the variance in the dependent variable is explained by independent variables in the model.

Table 4. ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.919	1	16.919	13.610	.000 ^b
	Residual	228.742	184	1.243		
	Total	245.661	185			

a. Dependent Variable: Mathematics achievement

b. Predictors: (Constant), Remedial teaching

The table above indicated standard regression which provides the effect of individual predictor variable. That variable is remedial teaching. The table shows the output analysis and whether there is a statistically significant difference group mean. As seen, it, the significance value is 0.001 and the mean is 1.243. Therefore, there is a statistically significant difference in the mean length of model.

Table 5: Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.816	.243		11.573	.000
	Remedial Teaching	.238	.064	.262	3.689	.000

a. Dependent Variable: Mathematics achievement

Information presented in Table 5 evidenced that $Y=2.816+0.238 X_1 +\varepsilon$ Where $y=$ Mathematics achievement. The regression output above shows that remedial teaching relationship variable is statistically equal to 0.000. This shows the regression of independent variable is associated with Mathematics achievement. Multiple analysis regression result above indicates the influence of independent variable based on the regression coefficient. The unstandardized Coefficients is 0.64 when is constant and at the same time the Std. Error is 0.243 when they are associated with coefficients. The significant predictor out of independent variable which is positively related to the criterion in the regression, as shown in Table 5.

4. DISCUSSION

The study attempted to assess the effect of remedial teaching on mathematics achievement in upper secondary school students in in Jönköping Municipality in Sweden. From the findings, the study found that remedial teaching affects student Mathematics achievement when through remedial classes when students became more interested in the subject after remedial classes, when students are boosted confidence in Mathematics, when students are strengthened foundational knowledge in Mathematics. Besides, remedial classes reduce mathematics anxiety and develop positive attitudes towards teaching learning of mathematics and this helped students to overcome academic challenges and achieve success in mathematics. Moreover, remedial classes help students get back on track so they can continue their learning on the math continuum.

Besides, the Pearson correlation analysis showed that remedial teaching ($r=0.766$, $p=0.000$) is positively and significantly related to student Mathematics achievement in upper secondary school in Jönköping Municipality in Sweden. The correlation was deemed to be statistically significant since the p-value was less than 5%. The findings therefore showed that there is a positive and statistically significant relationship between remedial teaching and student Mathematics achievement in high school.

These findings are relevant since Lubienski (2007) conducted an experiment study to investigate the effectiveness of the programme in remedial mathematics for elementary school students to measure the improvement of students, after a period of remediation the findings showed that construction of revitalized programme for remedial students in mathematics yielding highly satisfactory results. Further, a study on the remedial strategies for the slow learning mathematics at elementary level revealed that by using suitable teaching learning material and strategies fosters the academic achievement of mathematics at elementary level. The usefulness of remedial teaching programme brings out significant improvements at elementary level students in Mathematics (Polya, 2008).

5. CONCLUSION AND RECOMMENDATIONS

Every study provides some meaningful information and knowledge to the related field and this study also has some systematic and meaningful information. From the findings, the study concluded that remedial teaching significantly affects mathematical achievement, and has a positive predictive influence, and its impact on mathematical achievement is greater than remedial teaching. Remedial teaching in mathematics not only helpful to fosters mathematics problem solving ability but also enhances the academic achievement in mathematics among secondary school students. This study is consistent with the research findings of Thanner (2018) who stated that remedial instruction conducted during the study successfully improved the low-SES & low-math students' mathematics competence and enhanced their interest and confidence in mathematics.

Therefore, the researcher can conclude by saying that the research hypotheses including: “H₀₁: There is no significance influence between teacher-student relationship and student mathematics achievement in high schools”; all were tested; verified and then they are confirmed referring to the statistical (regression analysis) findings and then according to the research, the correlation of 0.766 (76.6%) categorized as positive and very high correlation; this leads to confirm that there is significant influence between remedial teaching and student mathematics achievement. Based on the findings, it can be recommended that teachers should mobilize their students to attend remedial activities. Teachers give more exercises, practical activities, and home works. Teachers encourage students to learn and like Mathematics subjects as an important subject in daily life.

REFERENCES

- [1] Caras, G. (2019). *The effects of remedial programs on the study of living things in the science*. Achievement of Grade 2 students. e-Proceeding of the 4th Global Summit on Education.
- [2] Gustafsson, J. E. (2010, July). *Knowledge and skills in Swedish comprehensive school during 40 years: A reassessment of the evidence based on IEA studies*. Paper presented at the Paper at IRC-conference July 2010.
- [3] Gustafsson, J.-E., & Blömeke, S. (2018). Development of school achievement in the Nordic countries during half a century. *Scandinavian Journal of Educational Research*, *62*(3), 386–406.
- [4] Gustafsson, B. & Stigebrandt, E. (1972). *Vad kanner teknar undervisning i hjalp- klass? /Characteristics of the teaching in special classes.* / (Stencil.) Pedagogiska institutionen, Goteborgs universitet,
- [5] Jepsen, C. (2006). Remedial education in California's community colleges. *American Education Research Association*, San Francisco, CA.
- [6] Kartono, A.N, Suhito R. (2016). The effectiveness of remedial teaching based diagnostic assessment on the achievement student mathematics learning outcomes in inquiry learning model, *International Journal of Advance Research and Innovative Ideas in Education*; 3(5):34-40.

- [7] Lubienski, S. T. (2007). *Research, reform and equity in U.S. Mathematics Education*. In N. Nasir, & P. Cobb (Eds.), *Improving Access to Mathematics: Diversity and Equity in the Classroom* (pp. 10-23). New York: Teachers College Press.
- [8] Manno, B. (1995, May/June). Remedial education: Replacing the double standard with real standards. *Change*, pp. 47-49.
- [9] Nasir, N., & Cobb, P. (Eds.). (2007). *Improving Access to Mathematics: Diversity and Equity in the Classroom*. New York: Teachers College Press.
- [10] Rosenbaum, P. & Rubin, D. (1983) The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1), 41.
- [11] Sfard, A. (2005). What changes when learning goes to school: The communicational version, the case of mathematics. *In European Journal of School Psychology*, 3(1), 301–326.
- [12] Ngo, F. (2018). Fractions in College: How Basic Math Remediation Impacts Community College Students. *Research in Higher Education*, 1-36.
- [13] OECD .(2016). *Review on Evaluation and Assessment Frameworks for Improving School Outcomes: Country Background Report for Sweden*, Ministry of Education and Research Sweden
- [14] Parsad, B., Lewis, L. & Greene, B. (2003). *Remedial education at degree-granting postsecondary institutions in fall 2000*. Institute for Educational Sciences. US Department of Education. Retrieved February, 16
- [15] Polya, G. (2008). *How to solve it: A new aspect of mathematical method*, New Jersey, Princeton University.
- [16] Statista account .(2024). *Average number of students per upper secondary school in Sweden from 2013 to 2023*. Retrieved from <http://Sweden: students per upper secondary school 2023 | Statista>
- [17] Shavit, Y. & Müller, W. (2000). Vocational secondary education, tracking, and social stratification. *Handbook of the sociology of education*, 437-452.
- [18] Todd, P. & Wolpin, K. (2003) On the specification and estimation of the production function for cognitive achievement. *The Economic Journal*, 113(485), 3-33.