International Journal of Basic and Applied Sciences, 14 (4) (2025) 729-736

International Journal of Basic and Applied Sciences

Website: www.sciencepubco.com/index.php/IJBAS
https://doi.org/10.14419/r5ytdw11
Research paper

Effect of Chapter-Wise Performance on Overall Achievement in The Mathematics Subject

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Received: June 22, 2025, Accepted: August 14, 2025, Published: August 27, 2025

Abstract

This study investigates the impact of chapter-wise performance on overall achievement in mathematics among secondary school students. A total of 400 students were surveyed and categorized into two performance groups- Very weak (VW) and Very good (VG) based on their mathematics scores. The main objective of this study is to analyse the relationship between students' performance in individual mathematics chapters and their overall achievement in the subject. A t-test revealed that there is no statistically significant difference between the VW and VG groups ($t = 0.57$, $p>0.05$), which suggests that performance in individual chapters does not vary significantly between extreme achievement groups. However, Pearson's correlation analysis indicated a strong negative relationship between VG scores and VW outcomes ($r = -0.85$, $p = 0.02$), implying that improvements in stronger students may correspond with underperformance in weaker counterparts for certain content areas. Linear regression analysis produced a strong correlation ($R = 0.85$), and the relationship was statistically significant as confirmed by ANOVA ($p = 0.013$). The resulting regression equation, $VW = 57.32 – 1.13.VG$ provides a predictive model for understanding disparities in chapter-level knowledge. These findings can inform targeted instructional strategies and chapter-wise interventions to enhance overall mathematical achievement.

Keywords: *Chapter-Wise Performance; Mathematics Achievement; Student Performance Analysis; Statistical Analysis; Educational Assessment; Performance Gap.*

1. Introduction

For students to excel academically in a given subject, it is important that they possess thorough knowledge across all its chapters.. In all education systems, the mathematics subject has a great role, starting from elementary to higher education. As well as in various competitive examinations. This paper seeks to analyse how students perform in Mathematics based on the NCERT syllabus implemented by the Board of Secondary Education, Assam (SEBA). Under this board, in class X, there are mainly seven branches, namely algebra, geometry, trigonometry, mensuration, coordinate geometry, probability, and statistics. The factors found to have an impact on mathematics performance were learner-related, such as ill-discipline, language barriers, and learner attitudes. Teachers' factors included a lack of pedagogical content knowledge and skill, and a lack of appropriate professional training. High academic performance in a subject is determined by several factors, especially in rural regions. According to a study, the students had a negative attitude toward mathematics. It was also found that an ineffective mathematics curriculum in secondary schools was the reason behind poor performance in the subject. Moreover, many of the primary school teachers lacked the potential and competence to teach mathematics at the primary school levels, and this largely contributed to the lack of interest amongst students[1]. Located in Assam, Baksa is part of the Bodoland Territorial Administrative District (BTAD) and is characterized by a population with generally low levels of formal education. The district is home to a multilingual community, where Bodo, Assamese, Bengali, Nepali, and Santhali are commonly spoken. Among school students, Mathematics is often viewed as one of the most difficult subjects. According to the syllabus pattern and chapters, 2022, the chapters included in the mathematics subject for class X, NCERT are namely algebra, geometry, trigonometry, mensuration, coordinate geometry, probability, and statistics. This study has one research question, which is given below.
Is there a significant relationship between students' performance in individual chapters and their overall performance in the subject?
The analysis further revealed that the univariate effects on calculating and word problem-solving were significant, but the effect on conceptual understanding was insignificant[2]. According to a study, it is revealed that many factors could impact students' performance; however, four main thematic categories were identified: academic, personal, social, and demographic[3]. In addition to this, the health condition is also a major factor that greatly affects the academic performance of a student. The negative health correlates of academic disparities among members of lower-performing groups[4].

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2. Literature review

The primary objective of this study is to analyse the impact of chapter-wise performance on overall achievement in mathematics among 10th standard students in government high schools in Baksa District, Assam. The study aims to determine whether poor performance in specific chapters significantly lowers students' overall subject performance and to identify the statistical relationship between chapter-level mastery and total achievement. In this paper, the performance of a certain group of students of class x, under SEBA, in the mathematics subject in algebra, geometry, trigonometry, mensuration, co-ordinate geometry, probability, and statistics is discussed. The implementation of innovation in curriculum resources in terms of new possibilities for changing students' encounters with mathematics is also closely linked to the development of digital curriculum resources[5]. The concept of learning assessment in academia is not a new one. The topic has attracted considerable attention from the research community, resulting in a substantial body of existing literature. So, the concept of learning assessment is fundamental for the study of human cognitive action. Pedagogical mobility and adjustability develop a positive learning culture to support student performance, school retention, consistency regarding attendance, and a sense of belonging in the learning environment[6]. A study recommends that academicians should hold workshops and seminars for students to develop a stronger self-concept so that they can improve their abilities and lead a successful life in the future[7]. Educational performance is, in most cases, measured numerically, with examination results serving as the primary basis. The study habits is one of the major factors that affect the academic excellence of students. To get excellent performance in a subject, the students should focus on the performance of each of the chapters in the subject. For this, the study habit has a great role. It is considered a key criterion to judge one's total potentialities. Study Habit is the system of behaviour followed by students in the activity of their studies, which helps as a mean of learning[8]. Various methods and techniques are used in evaluation student exam scores. The use of fuzzy logic of the principles of fuzzy logic is more flexible as compared to other methods. "The classical method adheres to a constant mathematical rule; evaluation with fuzzy logic has great flexibility."[9]. Many students do not understand the questions properly. During classroom teaching, teachers do not use mathematics-related teaching and learning materials, and many schools do not have a separate mathematics teacher in the school. One teacher teaches all subjects in a class. Previously, it was a misconception that mathematics is required only for being an Engineer, Mathematician, or Scientist, and hence the subject was treated as difficult by society. The institute administration can take necessary supportive initiatives for poorly-performing students and encourage good-performing students to continue excelling[10], "The school student had a fear psychosis of the subject."[11]. According to some researchers' findings, "we consider mathematics as socially produced knowledge that characterizes the social and imaginary interactions manifested in culture; the multiple explanatory forms of socio-cultural experiences; the ways of reading, understanding, and explaining how human culture constitutes itself and the multiple methods and codes of mathematically reading socio-ocultural realities"[12],. From a study, it is revealed that "Students have many misconceptions in the use of symbols in algebra, which affect their learning and solving algebraic problems."[13]. According to a report of the superintendent of the New York City schools in 1929, more high school pupils failed in mathematics than in any other subject. In a book, it is revealed that, "In one particular school, more than half of the pupils failed in first-term algebra, and failure in high school mathematics as a whole was 26.9 per cent, the next greatest failure being in foreign languages."[14]. The primary challenges students encountered in learning Mathematics, particularly in the key areas discussed, included: language barriers, difficulty in translating verbal problems into mathematical expressions, procedural errors in solving algebraic problems, incorrect application of formulas or theorems, and struggles with understanding algebraic language. There are also some non-mathematical factors that the students faced problems in the mathematics subject. Such as anxiety, overconfidence, carelessness lack of attention. The finding of a paper present that, "With the help of mathematics education, students are developing a high level of mental abilities, such as logical reasoning, Creative thinking, along with effective problem-solving and decision-making abilities, significantly contributes to individual success and societal advancement."[15]. "The student's positive academic perception and feeling like a good student in mathematics class have a positive impact on his or her academic success."[16]. According to a study, it is revealed that "Students dislike Mathematics as they perceive it as a difficult subject."[17]. Nasrin A., in a paper, revealed that, "Mathematics is an integral part of the curriculum in almost all countries of the world."[18]. Mathematics is considered in many fields like physics, engineering and technology, accountancy and statistics, chemistry, etc., as a key subject because it is essential and significant. This study aims to know the performance of the high school students in mathematics. This study underlines how the performance of each chapter in the mathematics subject affects the overall performance of the subject.

The Hypothesis of the Study is explained in the following Table 1:

Table 1: Hypothesis of the Study

Null Hypothesis	Alternative Hypothesis
There is no difference in the mean value between the variables VW and VG.	There is a difference in the mean value between the variables VW and VG.

3. Significance of the study

This study contributes to the field of applied survey statistics by demonstrating the effective use of classical statistical methods on primary data collected through structured questionnaires. The Krejcie and Morgan formula is used to determine an appropriate sample size. The data were collected from government high schools in Baksa District, Assam. The study employed an independent samples t-test, Pearson's correlation, ANOVA, and linear regression to explore relationships among key variables. The significance of this research lies in its practical application of traditional statistical tools precisely applied to real-world data to uncover meaningful patterns and support evidence-based conclusions. By combining sound sampling methods with widely accepted analytical techniques, the study offers a replicable framework for similar research in educational and other social science contexts.

This work provides practical value for both researchers and practitioners pursuing guidance on applying statistical methods in field-based surveys. It strengthens the relevance of classical techniques in modern research settings and promotes the use of statistically valid procedures for informed decision-making. This work contributes to the broader understanding of how quantitative methods can be used effectively outside of controlled research settings, especially in education and similar social sectors. It also encourages the continued use of validated statistical procedures in applied research.

4. Materials and methods

4.1. Research design and sampling

This study aims to examine the academic performance of Class X students in NCERT Mathematics under the SEBA curriculum. The research follows a descriptive design, utilizing freshly gathered primary data. The selection of the Baksa district in Assam as the study area is based on the HSLC examination results of 2022, which indicated that 33.41% of students from this district did not pass the examination. The total population was 13123 from 79 government high schools and higher secondary schools in Baksa district, where 400 sample students were randomly selected from 10 schools. Students were categorized into two performance groups: Very Weak and Very Good, based on their scores.

Due to the small sample size, the study has some limitations. Some students do not have the opportunity to participate in the survey due to the small sample size. If we want to survey as large a sample size as possible, the larger the standard deviation, the less accurate will results, since smaller sample sizes get increasingly representative of the entire population. Such factors may influence the accuracy of the survey, as higher variability often contributes to reduced reliability and the emergence of bias in the results.

In this study, many respondents did not submit their responses during the assigned time. Some students who wanted to participate in the survey did not participate due to a mismatch in the time scheduled.

In this study, based on Krejcie & Morgan (1970), the sample size for the population of 13,123 is 400, at a level of confidence 95% and 5% margin of error, which was determined by the following method:

$$n = \frac{\chi^2 Np(1-p)}{e^2(N-1)+\chi^2 p(1-p)},$$

Where n = sample size
N = population size
e = margin of error = 0.05
χ^2 = chi-square of degree of freedom 1 and confidence 95% = 3.841, and
p indicates the population proportion and is often set to 0.5 by default if the true proportion is unknown.

The questionnaire comprised 7 chapters, each containing 5 items, for a total of 35 items. Responses were measured on a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree). The total score for each student was calculated by summing their responses across all items. Based on these totals, students were categorized into performance groups: VW (Very Weak) for scores between 0 and 30 points, and VG (Very Good) for scores between 60 and 100 points. Scores from 31 to 59 points were considered intermediate and excluded from the extreme group analysis. Reliability of the questionnaire was assessed using Cronbach's alpha to ensure internal consistency.

4.2. Research instruments

The statistical techniques employed were: Independent Samples t-test to compare the means of performance groups, Pearson's Correlation to examine relationships between chapter-wise scores and overall performance, One-Way ANOVA to test the variation in overall achievement across different performance levels, and Linear Regression Analysis to assess the predictive value of chapter-wise scores on overall mathematics achievement.

The methodology implemented in this study comprises the following key stages:

1) Development of a multiple-choice evaluation test covering all chapters of the syllabus.
2) Administration of the questionnaire using structured response sheets to collect data from participants.
3) Compilation and processing of the data obtained through the questionnaire.
4) Statistical analysis of the processed data employing the t-test method to assess significant differences.

This study makes use of a questionnaire to gather data regarding students' academic performance in Mathematics.. A set of questionnaires with multiple-choice questions, including all the chapters of class X NCERT mathematics textbook book is provided to the students to put their responses. Each of the items in the questionnaire is measured on a scale of 5-point Likert scale. Before it is used, the instrument has been tested for validity and reliability. Validation of the questionnaire was performed by educators knowledgeable in the subject to confirm its accuracy and relevance. The set of questionnaires is based on knowing mathematical formulae, application of formulae, understanding numerical problems, and some basic concepts. The validity of the questionnaire sheet included the eligibility of the questions, appropriate concepts, a definite instruction to give the response, and various types of interpretation. After collecting the response sheet, an interview is conducted with the students to relate to their response sheet. Based on students' performance in the response sheet, the performance is categorized into very weak and very good. These criteria are formed by identifying the students' performance in the corresponding response sheet test within the scale from 0 to 10.

SPSS (version 26.0) was employed for the statistical analysis of the data. To highlight the potential relationships between the variables VW and VG, the descriptive statistics were used. Measures of variability indicate how spread out the values in a data set are, including metrics like variance, standard deviation, and standard error. To determine whether the two populations under VW and VG are statistically different from each other, the t-test was used in this study. A linear regression analysis was performed to examine the influence of the variable VG on the variable VW.

5. Results

This study investigated the performance of high school students in the NCERT mathematics textbook in government schools in Baksa District, Assam. Each of the performance in all the branches or portions of the subject, namely algebra, geometry, trigonometry, mensuration, coordinate geometry, probability, and statistics, are determined. When working with quantitative variables, it becomes necessary to group the data into categories to present them in the form of a frequency distribution. The data is grouped into class intervals, the number of which should not be small or very large, and it is recommended that it range from 5 to 20.

Although descriptive statistics is a simple method of summarizing data, it is fundamental and meaningful in statistical analysis, and that can be used as a building block on which further analysis can be based [19]. The performance was categorized based on very weak and

very good. The respondents responded to each variable, and the responses were used to determine the subject performance of the students in government schools. The descriptive statistics of all the branches and the performance are shown in Table 2.

Table 2: Descriptive Statistics of Very Weak and Weak Performances

	N	Mean	Std. Deviation	Std. Error Mean
VW	7	28.44	9.98	3.78
VG	7	24.87	7.39	2.80

Table 2 shows the descriptive statistics of very weak and weak performances of class X students in Baksa district in mathematics subject of the NCERT. It shows that the mean performance of very weak was higher than the very good performance. This result shows that the students' performance in the mathematics subject was very weak.

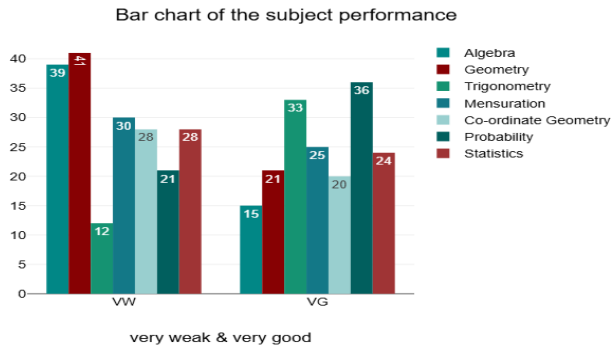

Fig. 1: Chart Shows Subject Performances.

In Figure 1, the chart is a bar chart. The X-axis represents the performance categories- VW(very weak) and VG(very good), Y-axis represents the number of students in each category. The figure illustrates the students' performance in six mathematics topics—Algebra, Geometry, Trigonometry, Mensuration, Coordinate Geometry, Probability, and Statistics—categorized into two groups: Very Weak (VW) and Very Good (VG).In the Very Weak category, the highest weakness is seen in Statistics (40 students) and Algebra (39 students), followed closely by Mensuration (33). Probability (30) and Geometry (28) also show significant weaknesses, while Trigonometry (21) and Coordinate Geometry (12) have comparatively fewer students in this group. In the Very Good category, Coordinate Geometry leads with 36 students performing at a high level, followed by Mensuration (33) and Probability (30). Algebra (25) and Trigonometry (21) have moderate VG performers, while Geometry (20) and Statistics (15) have the lowest performers.

Overall, the chart indicates a clear disparity in performance across topics. Statistics stands out as the weakest area, with the highest proportion of VW students and the lowest VG count. In contrast, Coordinate Geometry shows the strongest performance trend, with the fewest VW students and the highest VG count. This suggests that targeted improvement is most needed in Statistics, Algebra, and Mensuration, while strengths can be leveraged from Coordinate Geometry and Probability. The correlation analysis is shown below in Table 3.

Table 3: Correlation between Very Weak and Very Good Performances

	r	p
VW and VG	-0.85	.022

This correlation analysis in Table 3 shows two sets of values: r (correlation coefficient) and p (p-value), for the relationship between VW and VG. Here, the correlation coefficient value will indicate the strength and direction of the linear relationship between VW and VG. The coefficient -0.85 suggests a very high, negative correlation. So, in this study, the relative reliability or validity of the questionnaire is not high. This means that, generally, as VW increases, VG tends to decrease. Illustrating the basic measurement topics of reliability and validity via Pearson's r correlation coefficient is one method for bridging the instructional gap [20]. In most research, a p-value less than 0.05 is considered statistically significant. Here, the p-value of .022 is less than 0.05, which suggests that the correlation observed (r = -0.85) is unlikely to be due to chance. Therefore, it is confident that there is a statistically significant relationship between VW and VG.

Here, the analysis indicates that there is a statistically significant, very high negative relationship between VW and VG. As VW increases, VG tends to decrease, and this pattern is unlikely to be a result of random chance. The result of the Pearson correlation confirmed that there was a significant correlation between VW and VG, r(5) = -0.85, p = .022. The results for the t-test are shown in Table 4.

Table 4: T-Statistics of Performance of Students with Very Weak and Very Good

	t	df	p	Cohen's d
VW - VG	0.57	6	0.59	0.21

Table 4 presents the results of a paired samples t-test, which is used to compare the means of two related groups to determine if they are statistically different from each other. This is the calculated t-statistic for the test, which in this case is 0.57. A t-statistic is a measure of the difference between the two groups relative to the variation in the data. The positive sign indicates the direction of the difference, suggesting that the mean score for the VW group is higher than the VG group.

The degree of freedom for this test is 6. This value relates to the number of subjects in the study minus the number of groups being compared, in this case, two. It's used to calculate the p-value for a given value of t. Here, the p-value is 0.59, indicating the probability of observing the test results, or more extreme, given that the null hypothesis is true. A p-value of 0.59 means there's a 59.03% chance of obtaining these test results if the null hypothesis were true. Typically, a p-value of less than 0.05 is considered statistically significant, so this result suggests that there is no statistically significant difference between the VW and VG means.

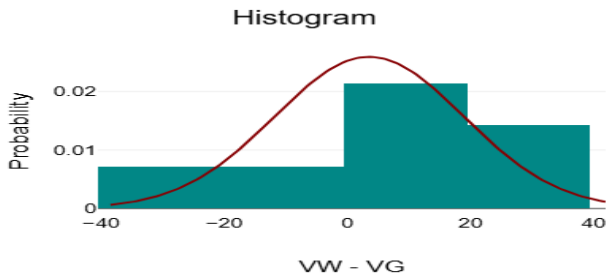

Fig. 2: Histogram of VW and VG.

Figure 2 indicates that the regression model showed that the variable VG explained 68.79% of the variance in the variable VW. The ANOVA test was used to check whether this value was significantly different from zero. Using the present sample, it was found that the effect was significantly different from zero. Using the present sample, it was found that the effect was significantly different from zero, F=11.02, p = .013, R^2 = 0.69. F=11.02, p = .013, R^2 = 0.69.

Figure 2 presents a histogram comparing the distribution of Very Weak (VW) and Very Good (VG) scores for students' mathematics performance. The horizontal axis represents the VW–VG score difference, where negative values indicate higher VW counts and positive values indicate higher VG counts. The vertical axis on the left shows the frequency of occurrences, while the vertical axis on the right represents probability density. The histogram shows a concentration of values around the extremes, with a notable cluster at the negative side (around –40) corresponding to many very weak performances, and another cluster at the positive side (around +40) indicating a significant portion of students with very good performance. The curve overlaid on the histogram represents the probability distribution, which appears to be slightly skewed, suggesting that the performance distribution is not perfectly symmetrical. The accompanying description indicates that the regression model found VG performance explains 68.90% of the variance, meaning VG scores are a strong predictor in the dataset. ANOVA testing confirmed the statistical significance of this relationship. Overall, the figure highlights a polarized performance trend among students, with many falling into either the very weak or very good category, and fewer in the mid-range

The following regression model is obtained:

$$VW = 57.32 - 1.13 \cdot VG$$

Table 5: Linear Regression of the Variable VG on the Variable VW

	Unstandardized Coefficients	Standardized Coefficients				95% confidence interval for B	
Model	A	Beta	Standard error	t	p	lower bound	upper bound
(Constant)	57.32		8.71	6.46	.001	33.91	78.8
VG	-1.12	-0.85	0.34	-3.32	.021	-1.99	-0.25

From Table 5, it is shown that when all independent variables are equal to zero, the value of the variable VW is 57.32 (constant). If the value of the variable VG changes by one unit, the value of the variable VW changes by -1.12.

Table 6: Linear Regression Model for Variable VG on Variable VW

R	R^2	Adjusted R^2	Standard error of the estimate
0.85	0.691	0.64	6.12

In Table 6, a linear regression analysis was performed to examine the influence of the variable VG on the variable VW. Here, R is the correlation between the observed values of the dependent variable VW and the predictions made by the model using the independent variables. This R value of 0.85 indicates a very high positive correlation between the observed values and the prediction made by this model. R^2 is the proportion of the variance in the dependent variable that can be explained by the independent variables in the regression model. This R^2 value of 0.69 means that 68.79% of the variance in your dependent variable is explained by the independent variables in your model. In other words, 68.79% of the change in VW can be predicted from the independent variables. Adjusted R-squared adjusts the R^2 value based on the number of variables in the model and the number of observations. Here, it suggests that after adjusting for the number of predictors, about 63.54% of the variance in the dependent variable is accounted for.

The Standard Error of the Estimate value indicates the average distance that the observed values fall from the regression line. A standard error of 6.12 means that the predicted values are, on average, 6.12 units away from the actual values. Whether this is a small or large error depends on the context and scale of your dependent variable. In summary, the model shows a very high positive relationship between the observed values and the prediction, explains 68.79% of the variance in the dependent variable, but the predictions are on average 6.11 units away from the actual values, which may or may not be significant depending on the context of your data.

Table 7: P-Value in ANOVA

Model	Df	F	P
Regression	1	11.031	.0145

In Table 7, the number of independent variables in our model is 1. With a p-value of .014, which is less than 0.05 but greater than 0.01, the results are statistically significant. This suggests that the null hypothesis can be rejected, indicating that the independent variables (predictors) in your model affect the dependent variable. In summary, ANOVA results indicate that our regression model is statistically significant, suggesting a good fit compared to a model without any predictors. The regression model showed that the variable VG explained 68.79% of the variance in the variable VW. Using the present sample, it was found that the effect was significantly different from zero, F=11.031, p = .0145, R^2 = 0.691.

6. Discussion

Through this study, it is revealed that the performance of students in the mathematics subject is very weak. The t-statistic value for the study is 0.57, and the p-value is 0.59. Here, the p-value is greater than 0.05; therefore, there is no statistically significant difference between

the VW and VG. The correlation coefficient -0.85 suggests a very high, negative correlation. So, in this study, the relative reliability or validity of the questionnaire is not high. This means that, generally, as VW increases, VG tends to decrease. As VW increases, VG tends to decrease, and this pattern is unlikely to be a result of random chance. The result of the Pearson correlation showed that there was a significant correlation between VW and VG, $r(5) = -0.85$, $p = 0.022$.

This study reveals that students' performance in mathematics is generally weak. A t-test was conducted to determine whether there is a significant difference between VW and VG. The result yielded a t-statistic of 0.57 with a p-value of 0.59. Since the p-value is greater than 0.05, we fail to reject the null hypothesis, indicating that there is no statistically significant difference between the means of VW and VG. However, a Pearson correlation analysis showed a different result. The correlation coefficient was $r(5) = -0.85$, with a p-value of 0.022. As this p-value is less than 0.05, we reject the null hypothesis of no correlation. This indicates a strong and statistically significant negative correlation between VW and VG. In other words, as VW increases, VG tends to decrease. This relationship is unlikely to have occurred by chance. Therefore, while the t-test suggests that VW and VG do not differ significantly in their mean values, the correlation analysis indicates that the two variables are strongly and inversely related.

Difficulties encountered by the participants in mathematics were teacher-, content-, and student-based [21]. The challenges that students have in learning mathematics include having trouble recalling information from previous classes, forgetting information easily, and having trouble understanding mathematical ideas [22]. Textbooks impact on teaching and learning as they dictate what will be taught, in what order, and how [23]. The finding of the study also supports the previous findings found by many researchers, which were cited in the present study. So, the effect of the performance of each of the chapter or portions of a particular subject, mathematics, affects the overall performance of the subject, which also supports the previous study [24]. In classrooms all over the world, textbooks are used to support the teaching and learning of mathematics[25]. Understanding and knowing each of the chapters of a subject in every textbook is an important part for the student to get good performance in a subject. School authorities should focus on evaluating students' performance in any subject at any academic institution. it can A study concluded that, "students' own perceptions of mathematics and the teaching method are more prevalent than their parents' help with mathematics."[26]. According to a study, it is revealed that "the mathematics anxiety and test anxiety had a significant impact on mathematics."[27]. In this study, it is revealed that most of the schools in the Baksa district in the above-mentioned year did not focus on chapter performance; instead, they focused on only the overall performance of the subject. The findings of a study suggest that "academic assessment factors relating to students' previous and current academic performance were very important and might help in predicting their academic performance."[28]. Teachers and students need to make conscious decisions when using textbook tasks and should carefully investigate the learning opportunities of tasks rather than relying on the textbook's own descriptors [25]. The textbook is the most used resource in Irish classrooms [23]. Teachers need to experience themselves in different ways to use digital technologies to work on mathematical tasks and to identify the instructional paths for students to internalize the use of digital apps as an instrument to understand the concepts and to pose and formulate mathematical problems [29]. From the regression model, it is also found that if the value of the variable VG changes by one unit, the value of the variable VW changes by -1.12. To address weak chapter performance, targeted tutoring sessions can be organized for struggling students. Digital learning tools such as videos, interactive quizzes, and simulations can make difficult concepts clearer. Peer-assisted learning groups may help students explain and learn from one another. Regular practice tests can monitor progress and identify remaining gaps. Linking these activities to real-world applications will motivate students and show the relevance of the topics learned.

7. Limitations of the study

In this study, the following limitations exist.

1) This study was confined to a sample of 400 secondary school students, which may limit the extent to which the findings can be generalized to broader populations or different educational settings.
2) The categorization of students into "Very Weak" (VW) and "Very Good" (VG) performance groups was based exclusively on mathematics scores. Other influential factors, such as cognitive styles, socio-economic conditions, or learning environments, were not considered.
3) The study was conducted with a total of 400 participants, which provides a substantial dataset for general analysis. However, certain subgroup analyses—such as categorization into VW (Very Weak) and VG (Very Good) groups—resulted in smaller sample sizes within each category. This reduction in subgroup size may affect the statistical power and the generalizability of those specific comparisons. This limitation is acknowledged, and results for such subgroups should be interpreted with caution. The subgroup sizes reflect the actual distribution of performance levels among the participants and are reported transparently in the results tables.
4) The research employed a cross-sectional design, collecting data at a single time point. As a result, it does not account for longitudinal changes in students' academic progress over time.
5) The scope of analysis was restricted to chapter-wise performance and its correlation with overall achievement, potentially overlooking additional variables such as instructional quality, student engagement, or assessment methods.
6) The linear regression model applied in this study presumes a consistent linear relationship between variables, which may not fully represent the nuanced dynamics of student learning and academic achievement.

8. Implication of the study

The findings from this study have the following implications

1) The outcomes of this research highlight the importance of using chapter-specific performance data to inform instruction and support targeted teaching strategies.
2) The results emphasize the value of differentiated instruction to address the diverse learning needs of students performing at both lower and higher ends of the achievement spectrum.
3) By identifying specific chapters where students consistently perform poorly, educators can develop early interventions aimed at improving foundational understanding and overall mathematical performance.
4) The regression model developed in this study may serve as a predictive tool to help educators and administrators identify potential disparities and take proactive measures.
5) These findings suggest that teacher training programs should incorporate strategies for diagnostic assessment and focused remediation, especially in content areas that show wide performance gaps.

6) The observed inverse relationship between strong and weak performers in certain content areas underscores the need for balanced instructional attention, ensuring that improvements in one group do not inadvertently disadvantage another.

9. Conclusion

To compete in most of the competitive examinations across or outside the state, basic concepts of mathematics are very important. In this study, the nature of the evidence is completely established through primary data obtained from students. As a key finding to the research question, as mentioned in this study, it is revealed that the performance of each of the chapters or the portions of a subject affects the overall performance of the subject for the students in the mathematics subject. To obtain good academic performance, each student must have good performance in every subject. From the linear regression model, it can be concluded that if the value of the variable VG changes by one unit, the value of the variable VW changes by -1.12. The variable VG explained 68.79% of the variance in the variable VW.

This study provides empirical evidence on the significance of individual chapter performance in influencing overall mathematics achievement. The results reveal that an increase in very weak performances across chapters is associated with a decline in very good overall achievement. The findings offer valuable insights for educators and curriculum developers, suggesting the need to prioritize chapters with consistently poor performance to improve total subject outcomes.

The future scope of this study may consider: Investigating the effectiveness of targeted interventions on low-performing chapters, conducting similar analyses across different subjects and education levels, incorporating qualitative data (e.g., teacher insights, student feedback) to contextualize quantitative findings, and exploring the influence of socio-demographic factors such as gender, school infrastructure, and instructional quality on chapter-wise and overall performance. The researchers wish to recommend to the head of the institution and the concerned subject teachers to focus on and give importance to each chapter performance to get good or excellent performance in the whole mathematics subject. Also, the researchers hope that this concept of study to determine and investigate other subjects' performance will support future research.

10. Declaration of the statement

The authors declare that the work presented in this research paper is original and has been carried out by us independently. This research has not been published or presented elsewhere in part or in full for the award of any degree, diploma, or other similar titles.

Acknowledgement

The authors would like to express sincere gratitude to the office of the inspector of school, Baksa District, and the authority of the schools for their support, encouragement, facilities, and resources for the study.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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