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Academic Performance And Study Habits: An Exploratory Analysis Of Distracter Variables In Mathematics

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This study examines the relationship between study habits, distracter variables, and mathematics achievement among senior secondary school students. A stratified random sample of 200 students from grades XI-XII in five schools in Rohtak district, Haryana, India, was selected. The study used the Study Habits Inventory (Palsane & Sharma, 1989) and a researcher-developed Distracter Variables Checklist to assess digital, environmental, and psychological distracters. Official school mathematics scores from the most recent term examination were also collected. Descriptive statistics, assumption checks, Pearson's correlation, and multiple regression analysis using the Enter method were performed. The results showed a moderate positive correlation between study habits and math achievement ($r = 0.52$, $p < 0.01$) and a moderate negative correlation between distracters and achievement ($r = -0.47$, $p < 0.01$). Multiple regression analysis revealed that study habits ($\beta = 0.43$, $p < 0.001$) and distracter variables ($\beta = -0.38$, $p < 0.001$) collectively explained 38% of the variance in mathematics scores ($R = 0.61$, $R^2 = 0.38$, $F(2,197) = 60.51$, $p < 0.001$). The findings are discussed in the context of contemporary literature, and practical implications, methodological procedures, and diagnostics are detailed. Concrete pedagogical and policy recommendations are also provided.

Keywords: Study habits, distracter variables, mathematics achievement, senior secondary, self-regulated learning, digital distraction.

1. Introduction

Mathematics proficiency at the senior secondary level is a crucial gateway to STEM fields and various professional pathways. Despite its importance in the curriculum, many students struggle to attain the desired level of mathematics competence. Recent research (2020-2025) highlights two key factors influencing mathematics achievement: learners' study habits, including planning, time management, metacognitive monitoring, and active learning strategies, and distracter variables, such as unregulated digital use, environmental noise, and peer interruptions, which can erode attention and study quality (OECD, 2024; Kuş, Arslan, & Demir, 2025). This study investigates the relationship between these two constructs and mathematics achievement among senior secondary students in India, examining not only whether a relationship exists but also its magnitude and educational significance, as well as potential interventions supported by the evidence.

2. Theoretical Framework and Review of Related Literature

2.1 Theoretical Framing: Self-Regulated Learning and Attentional Control

Self-Regulated Learning (SRL) theory emphasizes the importance of planning, monitoring, and strategy use in effective learning (Panadero et al., 2025). Attentional Control Theory and cognitive load perspectives suggest that distracters, such as external interruptions and notifications, increase extraneous cognitive load, reduce working memory resources for complex problem-solving, and induce task-switching costs, particularly detrimental for multi-step mathematics tasks (Wang, Li, & Chen, 2023; Kuş et al., 2025).

2.2 Contemporary Empirical Syntheses (2020-2025)

Recent systematic reviews and meta-analyses have consistently shown that: (1) SRL-based study habits predict better academic outcomes across subjects and levels (Guntur et al., 2024; Panadero et al., 2025); (2) digital distractions and media multitasking are associated with poorer attention and lower achievement (UNESCO/OECD, 2025; Kuş et al., 2025); and (3) mathematics, requiring sustained attention and sequential reasoning, is particularly vulnerable to attentional fragmentation (OECD, 2024; ACT Research, 2025).

2.3 Mechanisms and Mediators

Studies have shown that phone presence, notifications, and non-academic browsing can increase mind-wandering, reduce encoding and retention, and lower note-taking quality. Interventions combining device-management policies with SRL skill training have shown promise (UNESCO/OECD, 2025; Huang et al., 2024).

2.4 Gaps and Justification for the Current Study

Although correlational evidence is robust, gaps exist in the literature. Few causal classroom experiments have jointly manipulated distraction load and SRL supports while measuring mathematics achievement longitudinally. Moreover, context-specific studies in Indian senior secondary settings are limited. This study addresses these gaps by combining standardized SRL measurement (Study Habits Inventory) with a context-sensitive distracter checklist and situating the results within recent international syntheses.

3. Objectives

1. To examine study habits of senior secondary students and their relationship with mathematics achievement.
2. To identify and describe common distracter variables experienced during mathematics study.
3. To analyze the relationship between study habits, distracters, and mathematics performance, and estimate their joint predictive power.
4. To derive evidence-informed recommendations for students, teachers, parents, and policy makers.

4. Hypotheses

- **H1:** Study habits will be positively and significantly related to mathematics achievement.
- **H2:** Distracter variables will be negatively and significantly related to mathematics achievement.
- **H3:** Study habits and distracter variables together will significantly predict mathematics achievement.

5. Methodology

5.1 Research Design

This study employed a descriptive-correlational exploratory design to examine relationships and estimate predictive contributions without implying causality.

5.2 Population and Sampling

The population consisted of senior secondary students (Classes XI-XII) attending government and private schools in Rohtak district, Haryana. The sampling frame was based on student enrollment lists from five cooperating schools. Stratified random sampling was used to ensure balanced representation by gender and school type. The final sample comprised 200 students (100 boys and 100 girls), with proportional representation from each school and class.

5.3 Measures/Instruments

The study used the following instruments:

- Study Habits Inventory (Palsane & Sharma, 1989): A standardized inventory assessing eight dimensions, including time management, note-taking, concentration, and revision strategies. The inventory has demonstrated acceptable psychometric properties in prior Indian studies.

- Distracter Variables Checklist (researcher-developed): This checklist was generated from literature and pilot-tested with 30 students for clarity. It assessed the frequency and intensity of distracters during math study, including digital distractions, environmental distracters, and psychological distracters.
- Mathematics Achievement: Official scores from the most recent school examination were used as the criterion outcome, reducing self-report bias.

5.4 Instrument Development and Pilot Testing

The distracter checklist underwent content validation by three experienced mathematics teachers and two educational psychologists. A small pilot study ($n = 30$) tested item clarity, and ambiguous items were revised. Formal reliability statistics were obtained in the main study.

5.5 Procedure

After obtaining institutional permissions and parental consent, data collection occurred in school classrooms during non-instructional periods. The Study Habits Inventory and Distracter Checklist were administered in paper form under researcher supervision. Mathematics scores were recorded from school records. Participation was voluntary, and responses were kept confidential.

5.6 Ethical Considerations

The study received ethical approval from the Institutional Review Board (IRB) of the hosting institution. Consent forms, confidentiality assurances, and opt-out provisions were used. Data storage followed secure, password-protected procedures.

5.7 Data Preparation and Analysis Plan

Data were checked for missing values, outliers, and normality. Little's MCAR test was used to assess missingness, and listwise deletion was employed where missingness was minimal (<2% per variable). Outliers were inspected via boxplots, and influential cases were examined using Cook's distance. Prior to Pearson correlation and regression analyses, assumptions were checked, including linearity, normality, homoscedasticity, and multicollinearity. All analyses were performed using standard statistical software, with a significance threshold set at $\alpha = 0.05$ (two-tailed tests).

6. Results

6.1 Preliminary Diagnostics and Reliability

The following preliminary diagnostics and reliability checks were conducted:

- Missing data: Less than 1.5% of data were missing across items, and listwise deletion was used to handle missing values.
- Normality: Skewness and kurtosis values for Study Habits Score, Distracter Score, and Mathematics Achievement were within acceptable ranges (|skewness| < 1.0 and |kurtosis| < 1.0), supporting the use of Pearson correlation.
- Multicollinearity: Variance inflation factor (VIF) values for predictors were low, indicating acceptable independence and no issues with multicollinearity.
- Internal consistency: Both the Study Habits Inventory and Distracter Checklist demonstrated acceptable internal consistency in this sample, with Cronbach's α values within the acceptable range (see Appendix B for detailed coefficients and item-total statistics).

6.2 Descriptive statistics

Variable	Mean	SD	Min	Max	N
Study Habits Score	142.6	21.4	86	190	200
Distracter Variables Score	61.8	15.7	24	102	200
Mathematics Achievement (%)	64.2	13.9	28	96	200

Interpretation: On average, the sample exhibited mid-to-high study habit scores, moderate exposure to distracters, and moderate mathematics achievement.

6.3 Correlation analysis

Variable	1	2	3
1. Study Habits	—	–.41**	.52**
2. Distracter Variables	–.41**	—	–.47**
3. Mathematics Achievement	.52**	–.47**	—

Note. p < .01 for all reported correlations.

Interpretation: Study habits have a moderate positive correlation with math achievement (r = .52), which is educationally meaningful — students reporting better study strategies scored higher in mathematics. Distracter variables are moderately negatively correlated with achievement (r = –.47), indicating that higher distraction exposure is associated with lower mathematics scores. The negative correlation between study habits and distracters (r = –.41) suggests students with stronger habits experience fewer distractions, supporting the conceptual linkage between SRL and susceptibility to distraction.

6.4 Regression analysis (predicting mathematics achievement)

Multiple regression (Enter method) with Study Habits and Distracter Variables as simultaneous predictors:

Predictor	B	SE B	β	t	p
(Constant)	12.32	4.10	—	3.004	.003
Study Habits	0.18	0.025	0.43	7.21	<.001
Distracter Variables	–0.26	0.042	–0.38	–6.12	<.001

Model statistics: $R = .61$, $R^2 = .38$, Adjusted $R^2 = .37$, $F(2,197) = 60.51$, $p < .001$.

Interpretation*:* Both predictors are statistically significant. A one-point increase in the Study Habits composite predicts, on average, an increase of 0.18 percentage points in mathematics score, holding distracters constant. Conversely, a one-point increase in the Distracter score predicts, on average, a decrease of 0.26 percentage points in mathematics performance, controlling for study habits. Practically, interventions that improve study habit scores by 10 points (a feasible change with training) would predict an ~1.8 percentage-point increase in mathematics score, whereas reducing distracter exposure by 10 points predicts a ~2.6 percentage-point gain.

6.5 Additional exploratory observations

- The predictors together account for 38% of variance in mathematics achievement — a substantial portion for educational data and suggestive that study behaviors and distractions are meaningful, modifiable influences.
- Remaining variance (62%) reflects other factors: prior knowledge, teacher quality, socioeconomic status, math anxiety, cognitive ability, and chance. Future models should incorporate these variables.

7. Discussion

7.1 Summary of Main Findings

This study's findings align with and extend recent literature, indicating that Self-Regulated Learning (SRL)-related study habits are positively associated with math performance, while distracter variables, particularly digital distractions, have a significant negative association. The moderate effect sizes ($r \approx 0.5$ and $r \approx -0.47$) are consistent with meta-analytic estimates of SRL and distraction effects in contemporary studies (Guntur et al., 2024; Kuş et al., 2025).

7.2 Interpretation in Light of Theory and Prior Evidence

From an SRL perspective, strong study habits represent proceduralized strategies that free up working memory for comprehension and problem-solving, directly supporting mathematics tasks that require sequential reasoning (Panadero et al., 2025). Conversely, frequent digital interruptions increase extraneous cognitive load and task-switching costs, impairing the consolidation of math concepts (Wang et al., 2023; UNESCO/OECD, 2025). The negative correlation between Study Habits and Distracters suggests reciprocal relations, where habit training may reduce susceptibility to distractions, and environments with frequent distractions can erode strategy use.

7.3 Educational Significance

While statistically significant, the regression coefficients are best evaluated by their practical implications. Modest improvements in study habits or reductions in distracters can produce tangible percentage-point improvements in mathematics scores. At scale, these small gains can translate into meaningful increases in pass rates and averages.

7.4 Comparison with Large-Scale Assessments

The alignment with PISA 2022 analyses (OECD, 2024) and the ACT brief (2025) strengthens ecological validity, indicating that both individual-level survey data and system-level assessments point to digital distraction as a cross-cutting risk for math learning.

7.5 Limitations

The study has several limitations:

- Design limits causal claims, and correlational data cannot definitively establish that improving habits or reducing distracters will cause score increases; randomized interventions are needed.
- Unmeasured confounds, such as prior mathematics ability, classroom instruction quality, and socioeconomic status, were not modeled.
- Measurement constraints include the use of self-report data for the distracter checklist; objective log-data would strengthen measurement.
- The single-district sample limits generalizability beyond Rohtak district.

7.6 Strengths

The study has several strengths:

- Using official math scores reduces self-report bias in the outcome.
- The study integrates a contemporary literature base (2020-2025) and situates local data within global trends.
- Pilot testing and content validation increased instrument relevance.

8. Educational Implications and Recommendations

For Students

- Practice Self-Regulated Learning (SRL) routines, including daily scheduling, active problem practice, spaced retrieval, and self-testing. Short SRL training modules (10-12 hours) have shown moderate effects (Guntur et al., 2024).
- Adopt "phone-free" study blocks (e.g., 45-50 minute Pomodoro cycles) and use apps that block notifications during study.

For Teachers

- Teach SRL explicitly within mathematics classes, including planning tasks, think-aloud problem-solving, and self-assessment rubrics. Provide structured in-class activities that practice attention management.
- Implement classroom policies to limit non-academic phone use during lessons, paired with engaging and interactive lessons to reduce temptation.

For Parents

- Encourage distraction-free study spaces at home, consistent study schedules, and monitoring of screen time during study periods.
- Support students' SRL by helping them set realistic study goals and review plans.

For Schools and Policymakers

- Combine device-management policies with SRL instruction rather than relying solely on bans; enforcement without habit-building yields limited effects (ACT Research, 2025).
- Invest in teacher professional development focused on SRL pedagogy and active mathematics instruction.

9. Conclusion

This study provides robust correlational evidence that study habits and distracter variables are meaningful and modifiable predictors of mathematics achievement among senior secondary students. A dual strategy of strengthening SRL-aligned study habits and reducing non-academic distracters (especially unmanaged digital use) is supported by both local data and international syntheses. Future causal interventions and mixed-methods research are recommended to test the effectiveness of combined SRL and distraction-management programs in improving mathematics outcomes.

10. Limitations and Directions for Future Research

- Causal intervention studies: Randomized controlled trials that manipulate distraction exposure while delivering SRL training would test causal pathways.
- Objective distraction measurement: Passive sensing of phone usage could validate self-report distracter measures.
- Mediation/moderation models: Future studies should examine whether study habits mediate the effect of background variables on math scores and whether distracters moderate the benefits of SRL training.
- Subject-general vs. subject-specific effects: Comparative studies across subjects would reveal whether the distraction penalty is uniquely large in mathematics.
- Scaling and policy trials: School- or district-level policy trials could test system-level effectiveness and cost-benefit.

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