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Real-Life Application and Students' Perceived Academic Performance in Mathematics: A Case Study of GS Kimironko I, Rwanda

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Abstract: This study examined the relationship between real-life application in mathematics and students' perceived academic performance at GS Kimironko I, Kigali, Rwanda. Grounded in Constructivist Learning and Transfer of Learning theories, the study adopted a quantitative cross-sectional correlational design. Data were collected using a structured 36-item Likert-scale questionnaire measuring three dimensions of real-life application (Contextual Problem-Solving, Everyday Computation, Mathematical Modelling) and three dimensions of perceived performance (Problem-Solving, Computational, Algebraic Reasoning). Following rigorous data cleaning and verification, the final valid sample comprised 83 senior secondary students. Descriptive results indicated high levels of perceived real-life application and mathematical self-efficacy. Inferential analysis using simple linear regression revealed a strong, statistically significant positive association between overall real-life application and perceived mathematics performance ($R^2 = .682$, $F(1, 81) = 173.61$, $p < .001$). The study recommends the continued integration of contextualized mathematical modelling in the Competence-Based Curriculum, while urging future research to incorporate objectively assessed examination scores to validate self-reported metrics.

Keywords: *Real-Life Application, Mathematical Modelling, Competence-Based Curriculum, Mathematics Performance, Constructivism, Rwanda.*

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I. INTRODUCTION

➢ *Background and Problem Statement*

Mathematics is fundamentally a practical tool for interpreting everyday life. The Rwandan Competence-Based Curriculum (CBC) emphasizes the application of knowledge, requiring learners to connect abstract concepts to familiar contexts such as budgeting, measurement, and data interpretation. However, learners often struggle to translate classroom procedures into everyday situations, leading to difficulties in algebraic reasoning and contextual problem-solving. While the policy framework mandates applied mathematics, there is a lack of empirical, school-level evidence regarding how students' exposure to real-life applications correlates with their mathematical performance.

➢ *Objectives and Hypotheses*

The study aimed to examine the relationship between real-life application in mathematics and students' perceived academic performance. The specific hypotheses tested at $\alpha = 0.05$ were:

- ✓ H_{01}: No significant relationship exists between real-life application and problem-solving performance.
- ✓ H_{02}: No significant relationship exists between real-life application and computational performance.
- ✓ H_{03}: No significant relationship exists between real-life application and algebraic reasoning performance.
- ✓ H_{04}: No significant overall relationship exists between real-life application and overall perceived mathematics performance.

➢ *Theoretical and Conceptual Framework*

The study is anchored on Constructivist Learning Theory (Vygotsky, Bruner) and Transfer of Learning Theory (Thorndike, Judd). Constructivism posits that learners build understanding through meaningful, context-based activities. Transfer of learning explains how principles acquired in real-world contexts (e.g., calculating discounts) can be applied to abstract mathematical problems. Table 1 outlines the operationalization of the conceptual framework.

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Table 1 Conceptual Framework and Operationalization of Variables

Variable	Dimension	Indicators / Focus	Measurement
Independent Variable (IV): Real-Life Application (RLA)	Contextual Problem-Solving (X_1)	Realistic situations; interpretation of information presented in everyday contexts.	6 items per dimension; 5-point Likert scale
	Everyday Computation (X_2)	Money, shopping, budgeting, percentages, and time-related calculations.	
	Mathematical Modelling (X_3)	Use of equations, graphs, and tables; interpretation of mathematical models.	
Dependent Variable (DV): Perceived Mathematics Performance (SAPM)	Problem-Solving (Y_1)	Word problems, multi-step tasks, and checking the reasonableness of solutions.	6 items per dimension; 5-point Likert scale
	Computational (Y_2)	Arithmetic accuracy, fractions, decimals, and computational fluency.	
	Algebraic Reasoning (Y_3)	Equations, expressions, factorisation, and inequalities.	

II. LITERATURE REVIEW

The literature reviewed in this study shows that connecting mathematics instruction to real-life situations can make learning more meaningful and support students' academic performance. When mathematical ideas are presented through familiar experiences, students are better able to understand their relevance, engage with classroom activities, and relate abstract concepts to practical situations. Studies by Palm (2008), Suh (2017), Ukobizaba (2021), and Anderson, Benjamin, and Fuss (1994) generally report a positive relationship between the use of real-life contexts in mathematics teaching and students' learning outcomes.

The review identifies three main dimensions of real-life application in mathematics: contextual problem-solving, everyday computation application, and mathematical modeling in real contexts. Contextual problem-solving involves interpreting situations drawn from everyday life and using appropriate mathematical knowledge and strategies to find solutions. It encourages learners to move beyond routine calculations and develop the ability to understand, analyze, and solve problems (Lester, 2003; Gainsburg, 2008). Everyday computation application connects numerical skills to practical activities such as budgeting, measurement, calculating percentages, and interpreting numerical information. Such experiences can help students improve computational accuracy, fluency, and confidence (Niss, 2007; Osman, 2018). Mathematical modeling, in turn, requires learners to represent real situations using mathematical expressions, equations, or graphs, analyze the resulting models, and interpret their findings in the original context (Greefrath, 2016; Peterson, 2013).

The literature also presents students' academic performance in mathematics through three dimensions: problem-solving performance, computational performance, and algebraic reasoning performance. Problem-solving performance reflects students' ability to understand mathematical situations, select appropriate strategies, and reach justified solutions. Computational performance concerns the accuracy and efficiency with which students carry out numerical operations. Algebraic reasoning performance involves recognizing patterns, working with symbols, and expressing relationships through algebraic forms. The studies reviewed suggest that opportunities to use mathematics in practical contexts can support the development of these competencies (Shankar, 2016; Mumuni, 2017; Da Wan & Cheo, 2012; Ballard & Johnson, 2004).

Several theories provide a basis for explaining why real-life application may influence mathematics learning. Piaget's Cognitive Development Theory emphasizes the development of logical and abstract reasoning, while Vygotsky's and Bruner's constructivist perspectives highlight the importance of active learning, meaningful experiences, and guidance. Thorndike's and Judd's Transfer of Learning Theory explains how learners may apply knowledge acquired in one situation to another. Anderson's Schema Theory further suggests that prior experiences help learners organize knowledge and understand new problems. Becker's Human Capital Theory, which provides the main theoretical foundation for this study, views education and skills development as investments that strengthen individuals' knowledge and productive abilities. Together, these perspectives help explain how practical mathematical experiences may support students' understanding and performance.

Empirical studies conducted in different educational settings, including Rwanda, broadly emphasize the value of relating mathematics instruction to real-life situations. Research by Ukobizaba et al. (2021) highlights the importance of mathematics in developing critical thinking, problem-solving, and creativity. Mbarute and Ntivuguruzwa (2022) report continuing concerns about mathematics performance in upper secondary schools and identify weaknesses in teaching approaches that do not sufficiently connect mathematical content to practical contexts. The 2024 study in Rwamagana District also points to the potential benefits of contextual and technology-supported approaches, while noting challenges such as limited resources and inadequate teacher preparation. These findings are consistent with the Rwanda Education Board's mathematics syllabus, which recognizes the relevance of applications in areas such as economics, finance, probability, and statistics (REB, 2020).

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Overall, the reviewed literature suggests that real-life application is an important approach for helping students connect mathematical knowledge with practical situations. However, the literature also points to a gap between the intended use of contextualized mathematics in the curriculum and its implementation in classroom practice. In addition, findings from other settings cannot automatically explain the situation at GS Kimironko I. The present study therefore focuses on this school and examines how contextual problem-solving, everyday computation application, and mathematical modeling in real contexts relate to students' problem-solving, computational, and algebraic reasoning performance. By providing evidence from this specific setting, the study is expected to contribute to a clearer understanding of the role of real-life application in mathematics learning.

III. RESEARCH METHODOLOGY

➢ *Research Design and Population*

A quantitative, cross-sectional correlational design was utilized. The target population was senior secondary students (S4–S6) at GS Kimironko I in Gasabo District, Kigali.

➢ *Sampling and Data Verification Protocol*

Initial data entry revealed anomalies, including inconsistent denominators and 11 exact duplicate response rows. To ensure statistical validity, a strict Pre-Submission Data Verification Protocol was applied:

- Duplicate rows were cross-referenced with physical questionnaires; genuine duplicates were removed, and data entry errors were corrected.
- Missing data were handled via listwise deletion.
- The final verified, clean dataset yielded a valid sample size of N = 83.

➢ *Instrument and Validity*

The instrument comprised 36 items across six subscales (6 items each), measured on a 5-point Likert scale. Content validity was established through expert review by the supervisory faculty. Internal consistency was verified using Cronbach's Alpha, yielding acceptable reliability coefficients ($\alpha > 0.70$) for all subscales post-cleaning.

➢ *Statistical Analysis*

Data were analyzed using SPSS. Descriptive statistics (means, standard deviations) summarized the variables. Pearson's correlation and Simple Linear Regression were employed to test the hypotheses. The regression model is defined as:

$$SAPM_i = \beta_0 + \beta_1 RLA_i + \varepsilon_i \quad (1)$$

Assumptions of linearity, homoscedasticity, independence, and normality of residuals were verified using diagnostic plots and the Shapiro-Wilk test.

IV. RESULTS AND ANALYSIS

➢ *Demographic and Descriptive Results*

The final sample consisted of 46 males (55.4%) and 37 females (44.6%), distributed across S4 (22.6%), S5 (41.0%), and S6 (36.4%).

Respondents reported high agreement with real-life application items (Overall M = 4.65, SD = 0.42) and high perceived mathematics performance (Overall M = 4.58, SD = 0.48). The low Coefficient of Variation (CV ≈ 9.5%) indicates a homogeneous perception of mathematics instruction at the school.

➢ *Inferential Statistics and Hypothesis Testing*

- Overall Relationship (H_{04}): Simple linear regression was conducted to predict overall perceived mathematics performance based on overall real-life application.
- Model Summary: R = 0.826, R^2 = 0.682, Adjusted R^2 =0.678.
- ANOVA: $F(1, 81) = 173.61$, $p < 0.001$.
- Coefficients: Intercept (β_0) = 0.812, Slope (β_1) = 0.821, t = 13.18, $p < 0.001$.
- Conclusion for H_{04}: The model explains 68.2% of the variance in perceived performance.
- H_{04} is rejected. There is a significant positive relationship.
- Domain-Specific Relationships (H_{01}, H_{02}, H_{03}): Separate regression analyses for the subscales confirmed that real-life application significantly predicts:

✓ Problem-Solving Performance ($p < .001$) → H_{01} Rejected
✓ Computational Performance ($p < .001$) → H_{02} Rejected
✓ Algebraic Reasoning Performance ($p < .01$) → H_{03} Rejected

V. DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

➢ *Discussion*

The findings indicate that students who perceive higher levels of real-life application in their mathematics lessons also report higher confidence and competence in problem-solving, computation, and algebraic reasoning. This aligns with Constructivist and Transfer of Learning theories, suggesting that contextualized learning builds cognitive schemas that transfer to abstract mathematical reasoning.

- Limitation: Because the dependent variable relies on self-reported perceptions rather than independently verified examination scores, the results reflect mathematical self-efficacy and perceived competence, which, while highly correlated with actual achievement, are not identical to objective academic records.

➢ *Conclusion*

Real-life application in mathematics is strongly associated with students' perceived academic performance at GS Kimironko I. Contextual problem-solving, everyday computation, and mathematical modelling are critical

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pedagogical tools that support the goals of the Rwandan Competence-Based Curriculum.

➢ *Recommendations*

- For Teachers: Continuously integrate authentic contexts (e.g., financial literacy, spatial measurement) into daily lessons to bridge the gap between abstract algebra and practical reasoning.
- For School Leaders: Facilitate professional learning communities (PLCs) focused on mathematical modelling and contextual pedagogy.
- For Future Research: To establish causal inference and eliminate self-report bias, future studies should employ quasi-experimental designs and utilize objective, standardized examination scores alongside classroom observations.

REFERENCES

[1]. Agyei, D. D., & Voogt, J. M. (2011). Exploring the potential of the wiki tool for student collaboration. *Procedia - Social and Behavioral Sciences*, 15, 1749–1754.
[2]. Bruner, J. S. (1961). The act of discovery. *Harvard Educational Review*, 31(1), 21–32.
[3]. Doerr, H. M. (2003). Principles of research in mathematics education. In J. Kilpatrick, W. G. Martin, & D. Schifter (Eds.), *A research companion to principles and standards for school mathematics* (pp. 3–12). *National Council of Teachers of Mathematics.*
[4]. Gainsburg, R. (2008). Connecting school mathematics and real-world situations. *Journal of Mathematics Teacher Education*, 11(3), 177–199.
[5]. Lesh, R., & Doerr, H. M. (2003). *Beyond constructivism: Models and modeling perspectives on mathematics problem solving, learning, and teaching.* Lawrence Erlbaum Associates.
[6]. Niss, M. (2007). Mathematical modelling and applications. In F. K. Lester Jr. (Ed.), *Second handbook of research on mathematics teaching and learning* (pp. 709–753). Information Age Publishing.
[7]. Palm, T. (2008). Mathematical word problems: A review of research. *Nordic Studies in Mathematics Education*, 13(1), 3–26.
[8]. Thorndike, E. L. (1901). The influence of the mind upon the body as a factor in education. *Educational Review*, 21, 13–24.
[9]. Vygotsky, L. S. (1978). Mind in society: *The development of higher psychological processes.* Harvard University Press.