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AN ANALYSIS OF THE DECLINE OF MATHEMATICS LEARNING IN DEVELOPING COUNTRIES IN THE 21ST CENTURY

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Abstract: This article examines the specific and significant decline in mathematics learning and skills among students in developing countries in the 21st century. He argues that this trend is an essential part of a broader crisis in educational motivation, exacerbated by the unique nature of mathematics as a discipline. This decline is due to the interplay of less recognized relevance in the age of digital calculators, an educational culture that favors memorization over conceptual understanding, and intense cognitive competition with instant gratification digital media. A comparative analysis with the 20th century shows that whereas mathematics was once seen as a direct route to a technical career, today its abstract teaching methods cannot compete with more attractive alternatives. This article builds on the work of [1], [2], and [7] to offer a multifaceted solution focused on educational reform, strategic technology integration, and demonstrating the relevance of mathematical literacy to desired careers in the 21st century.
Keywords: Mathematics Education, Math Anxiety, Developing Countries, 21st Century Skills, Applied Mathematics, Pedagogical Reform, Digital Tools, Rote Learning, Conceptual Understanding, STEM Motivation.

Introduction.

Across the developing world, there is a consistent and worrying trend of a significant decline in student knowledge and interest in learning mathematics. International assessments such as TIMSS (Trends in International Mathematics and Science Research) and PISA (Program for International Student Assessment) consistently show that many developing countries have lower average scores and higher levels of **mathematics anxiety** than developed countries [6]. This article argues that declines in mathematics learning are an acute symptom of a broader 'paradox of abundance', but are exacerbated by factors specific to the field itself. The main argument is that the abstract, rote approach to teaching mathematics that has existed since the 20th century is completely outdated in the 21st century. She now faces the reality of students saturated with digital tools that eliminate the need for manual calculations and entertainment media that undermine their ability to support logical reasoning [7]. Through a comparative analysis with the 20th century, this paper examines the pedagogical, technological, and socio-economic factors that are particularly detrimental to mathematics education and proposes targeted interventions to restore numerical intuition and competency.

I. The XX Century Paradigm: Mathematics as a Gateway to Technical Prestige

In the 20th century, mathematics occupied an undeniably prestigious position in the educational systems of developing countries. It was the basis of career development and was directly linked to the most popular and respected professions.

- **Factor 1: The Utilitarian Value and Clear Career Pathways.** Mathematics was a major subject in the most popular professions such as engineering, medicine, and physical sciences. Success in mathematics was more than just academics. It was an immediate

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prerequisite for admission to polytechnics and medical schools. This created a strong extrinsic motivation to master the subject. This was consistent with a concept of learning that is deeply rooted in the social and cultural context, in this case the context of socio-economic development [8]. The path was linear. Mathematics knowledge → technical training → it was a reliable and honorable job.

- **Factor 2: A World Demanding Manual Numerical Literacy.** Before the digital economy, daily life required stronger manual numerical intuition. From managing a household budget with limited funds to calculating market fluctuations, these ongoing low-cost exercises strengthened basic arithmetic skills. This is consistent with the theory of **situated learning** [5], which posits that learning is a function of the activity, context, and culture in which it takes place. Mathematics was part of the required daily practice.
- **Factor 3: Pedagogical Monoculture and the "Drill and Practice" Model.** Although the dominant educational model of memorization and repeated practice is far from ideal, it has been effective in situations where distractions are limited. The emphasis on procedural mastery, often at the expense of conceptual understanding, has created a generation with strong computer skills. However, this method prioritized speed and accuracy over deep understanding, sowing the seeds of future **mathematical anxiety** [1].

Comparative Analysis: The Shift to the XXI Century

The 21st century has created a perfect storm that has destroyed all the pillars of the 20th century model of mathematics education and hindered deep mathematics learning.

II. The XXI Century Paradox: The Irrelevance of the "How" in an Age of "What"

The modern environment provides tools that make mathematical effort unnecessary while severing the direct link between mathematical effort and tangible rewards.

- **Factor 1: The Erosion of Perceived Relevance and the Calculator in the Pocket.** The proliferation of smartphones has fundamentally changed the value of instruction manual algorithms. Students reasonably question the need for manual calculations, and this phenomenon has been noted by educational researchers, who argue that curricula should evolve beyond computer science and focus on problem solving and conceptual reasoning [4]. When the "how" becomes automated, the "why" becomes vague and alienation occurs.
- **Factor 2: Pedagogy of Fear vs. The Engagement Economy.** The 20th century's rote learning model is responsible for today's severe **math anxiety** and boredom. **[1]** argues that traditional mathematics education creates a "fixed mindset" in which students believe that mathematical ability is innate and cannot be changed. This fear-inducing approach directly competes with the highly glamorous, dopamine-driven world of video games and social media [7]. The patience required for mathematical reasoning is no match for the instant feedback of digital entertainment, which treats mathematics like an arduous task.
- **Factor 3: The Fractured Link to Modern Careers.** While mathematics is critical for fields like data science and AI, this link is not made explicit to students. The path is no longer linear. A student sees a successful app developer but does not see the underlying discrete mathematics or statistical models. The work, **[1]** on **growth mindset** is crucial here; without a mindset that they can learn and apply math, and without clear examples of its application, students perceive the foundational learning as an irrelevant hurdle rather than a gateway.

III. Comparative Case Study: The Trajectory of an Engineering Aspirant

A comparison of a student aiming for a technical career in the late 20th century versus today highlights this shift.

- **XX Century (e.g., 1990s Brazil):** A student wanting to be a civil engineer knew that their entire future hinged on their performance in high-stakes mathematics exams. Their motivation was high because the consequence of failure was clear. They spent countless hours with textbooks and practice problems because these were the only tools available, and the goal was singular and well-defined, a classic example of high-stakes extrinsic motivation.
- **XXI Century (e.g., 2020s Brazil):** A similar student today still faces tough exams. However, they are now bombarded with stories of college graduates who are unemployed, while seeing peers in digital careers that seem to require less advanced math. They may use photo-based math solving apps to shortcut homework, never engaging in the "productive struggle" that **[1]** identifies as essential for brain development and deep learning. The direct link between today's math homework and tomorrow's career is clouded, diluting the motivational drive.

Proposals for Reversing the Decline in Mathematics Learning

Solving the math crisis requires a fundamental reboot of its teaching philosophy, moving from a culture of computation to one of conceptualization and application.

1. Pedagogical Reformation: From "Drill and Kill" to "Explore and Apply."

The core of math education must shift from memorizing procedures to understanding concepts through application.

- **Proposal:** Widespread adoption of **Applied Project-Based Learning (PBL)**. As championed by **[1]** and others, PBL answers the "why" by embedding math in relatable, tangible scenarios. This moves learning from abstract to situated, making it meaningful and combating disengagement.

2. Strategic Technology Integration: From Calculator Replacement to Conceptual Aid.

Technology must be used not as a crutch to avoid thinking, but as a scaffold to enhance understanding.

- **Proposal:** Integrate dynamic geometry software (like GeoGebra) and coding platforms into the curriculum. These tools allow students to explore mathematical relationships visually, transforming math from a static set of rules to a dynamic world of patterns, thus leveraging technology as a cognitive partner [3].

3. Curriculum Modernization: Making the Invisible Links Visible.

The curriculum must explicitly connect mathematical concepts to their powerful modern applications.

- **Proposal:** Develop new modules that demonstrate how algebra is the foundation of computer algorithms and how statistics underpin data science. This directly addresses the "relevance gap" and provides a modern, compelling reason for engaging with mathematics.

4. Teacher Training and Mindset Shift: Combating Math Anxiety.

Teachers are on the frontline. They must be equipped to foster a positive mathematical mindset.

- **Proposal:** Invest in continuous professional development that focuses on **conceptual understanding** and fostering a **growth mindset** (Dweck, 2006). Creating classrooms where mistakes are valued as learning opportunities is crucial to reducing the **math anxiety** that paralyzes so many students.

5. Gamification and Positive Reinforcement.

To compete in the attention economy, mathematics needs a rebrand.

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- **Proposal:** Incorporate elements of **gamification** for achieving learning milestones. Promote participation in math clubs and Olympiads as challenging and rewarding intellectual sports, helping to build a new, positive identity around being a "math person" [1].

Conclusion

The decline in mathematics learning in developing countries is not an inevitable consequence of modernization. This is a direct result of an educational model that has failed to adapt. The fascinating digital world has revealed that the 20th century's emphasis on mechanical computing has been made obsolete by technology and has failed to inspire joy and curiosity. Building teacher reform on research such as [1], [2] provides a clear path forward. The solution lies at a critical tipping point. We have to stop teaching students only to be human calculators and start giving them the ability to think mathematically and solve problems. By demonstrating the immense power and relevance of mathematics in the 21st century and making learning fun and practical, we can reverse this decline and equip the next generation with the foundational knowledge they need to thrive.

References

1. Boaler, J. (2016). Mathematical Mindsets: Unleashing Students' Potential through Creative Math, Inspiring Messages and Innovative Teaching. Jossey-Bass.
2. Dweck, C. S. (2006). Mindset: The New Psychology of Success. Random House.
3. Jonassen, D. H. (2000). Computers as Mindtools for Schools: Engaging Critical Thinking. Prentice Hall.
4. Kaput, J. J. (1992). Technology and mathematics education. In D. A. Grouws (Ed.), Handbook of research on mathematics teaching and learning (pp. 515–556). Macmillan.
5. Lave, J., & Wenger, E. (1991). Situated Learning: Legitimate Peripheral Participation. Cambridge University Press.
6. Mullis, I. V. S., Martin, M. O., Foy, P., Kelly, D. L., & Fishbein, B. (2020). TIMSS 2019 International Results in Mathematics and Science. Boston College, TIMSS & PIRLS International Study Center.