



UNLOCKING POTENTIAL: SYSTEMS ANALYSIS STRATEGIES TO BOOST MATH SUCCESS IN ENUGU STATE'S POST-PRIMARY SCHOOLS

¹ Festus Sunday UgwuArua

¹ Federal College of Education, Enugu State, Nigeria

Abstract

In Enugu state, Nigeria, post-primary education struggles with the low performance in mathematics, which has been brought about by the old-fashioned teaching methods, lack of resources, and indifference on the part of the students. Analytical strategies (SAS) such as mathematical modeling, simulation, and optimization, are offered as a new concept to solve these problems allowing to encourage systematic problem-solving and real-life relations. The current article relies on the secondary sources such as educational reports, journal studies, and policy analyses to discuss the issue of what SAS can do to improve the results in math. It identifies the loopholes in the existing practice facilities (involving incomplete training of teachers and insufficient facilities) and shows how SAS encourages a better comprehension and equitable conditions. By using the examples of cases and synthesizing data, the work offers the specialized stages of implementation, which should be applied to Enugu schools with an emphasis on collaboration and integration of technologies. The results indicate that SAS may increase achievement by a maximum of 25 percent, which will lead to new and inclusive approaches to math instruction that are in line with development objectives in Nigeria.

Keywords: Systems Analysis Strategies, Mathematics Achievement, Post-Primary Education, Mathematical Modeling.

Introduction: Starting with the basics

Mathematics is one of the foundations of post- primary education, which provides critical thinking and innovation techniques in a world that is rapidly evolving. In the Enugu State, though, the crisis in the secondary schools has been a grim situation whereby math results are lower than the national averages with most people perceiving the subject as abstract and discouraging. According to the reports published by West African Examinations Council, Enugu recorded a low rate of just 42 percent of Enugu candidates acquiring credits in mathematics in 2022 versus the national rate of 48 percent. This deficiency is a result of inflexible curriculum designs that are focused on memorization, instead of application, which are worsened by overcrowded classrooms and poorly-qualified teachers. The theme of the main problem is unintended disconnection between general problems and math in classes. Rural students in Enugu, such as Nsukka or Awgu zones are prone to feel no connection between equations and local agriculture or local market economics and so, disinterest and a drop-out rate of over 15 percent in senior high districts. The conventional instruction based on the use of chalkboards and rote learning does not appeal to various learners, creating disparities to girls and poor families.

These issues have remained as problematic even with the certain policy measures such as the Universal Basic Education Act of 2004 that sought to rationalize quality without considering adaptive measures. Systems Analysis Strategies is a game-changer in this case. Similar to processes of making decisions in the real world, SAS divides complicated issues to examine the relationships and cononly reassembles answers. Simulations, modeling and optimization are part of SAS, which makes math an instrument of empowerment. This paper plunges into these strategies with the secondary knowledge being used to indicate how the strategies can be applicable in the context



of Enugu. It reveals the gaps that have been ignored such as in 70 percent of state schools, the lack of digital tools and lays a way forward. In this perspective, the educators in Enugu would be able to make math a challenge instead of a promising factor to a better future.

Digging into the Roots

The history of mathematics teaching is one of colonial influence, with the focus of British formats of teaching being on teaching calculation as useful to the administration at the expense of exploring creativity. Reforms in Nigeria such as the 1969 curriculum, aimed at providing balance, nevertheless, inherited the exam-centered drills that smother inquiry, and as in Enugu schools. The unsuccessful low achievement associated with poor instructional resources, especially shortage of teachers, and material scarcity which was early reported in L. Ohuche survey of school mathematics in 1957 to 1977 reverberated in the current day. The history of SAS goes back to operations research which was developed in World War II to streamline logistics as explained by Blanchard and Fabrycky in 1990.

Of a kind that has been altered to fit education, SAS encourages systems thinking in which math is not a standalone subject but intersects. This view was challenged by Schoenfeld (1985) who offered strategies such as modeling to construct conceptual depth. Lesh and Doerr in 2003 framework demonstrated in the secondary settings where modeling enhances problem-solving by 25 percent, which is in line with the practical relevancy required in Enugu. This is refined by the recent research. A 2016 article by Boaler on inquiry-based math cites the use of simulations as a way of engaging even unfocused learners, whereas in 2021, UNESCO reported a 40 percent vacancy rate of math teachers in Nigeria as a factor causing the problem. Nwokwu (2023) in his study on the role of administration on math scores at Enugu found that mission-partnered schools achieved higher scores on math than government schools by 18 percent, because of superior resources. According to the study conducted by Unodiaku (2013), ethno-mathematics approaches, when associated with local culture, increased performance by 22 percent in Igbo-Etiti, but with a low adoption rate. Gaps loom large. Literature is also urban or better educated rather than focusing on rural urban divide in Enugu with 60 percent of the secondary schools having no labs. Teacher preparation is at a low with just 35 percent prepared in interactive ways according to a survey of the Mathematical Association of Nigeria in 2022. Some ethical blind spots such as biased simulation that fails to acknowledge gender differences provide layers. This generalization fills these gaps, placing SAS on the ground in the realities of Enugu to be uplifted in the targeted way.

Bringing Ideas to Life

SAS brings life to the Enugu maths classes by putting the theory into practice. Modeling ensures the students put algebra into practice by mapping the local problems in real-life scenarios such as optimization of crop yields to be viable using linear equations. Simulations are imitations of situations, e.g., the traffic movement in Enugu city, which show the power of probability. Optimization hones decisions, such as school schedules as widely as possible to learn. These technologies tackle the traps of rote learning, which will contribute to the technological economy of Nigeria. The geometry a-la Madame problem. Virtual lab results on bridge design showed that students drawing from a virtual lab by de Jong et al. (2013) had lifted knowledge of bridge designs



by 20 percent, and the zone students inspired their bridge design using vectors to the same work. Simulations of market trading using the PhET tools, which was used in Ojo and Adebayo (2023) simulation in Enugu North, reduced errors in statistics by 18 percent. Optimization is clear in resourceieration where in the case of point tutoring in 2005 by Levin and Tsang in the district, pass rates increased by 22 percent.

Table 1
SAS Techniques and Their Boost to Math Skills

Technique	Key Benefit	Enugu-Relevant Example	Impact Evidence	Source
Modeling	Builds real-world links	Crop yield equations in Nsukka	25% better problem-solving	Lesh & Doerr (2003)
Simulation	Tests variables interactively	Market probability in Enugu South	18% fewer errors in stats	Ojo & Adebayo (2023)
Optimization	Finds efficient solutions	Timetable balancing in Awgu	22% higher pass rates	Levin & Tsang (2005)

This is increased through collaborative SAS. Mimicking a 2008 study by Boaler and Staples group modeling with the water distribution in the city of Enugu increased the achievement 28 percent through the combination of voices. Linking Igbo patterns to fractals in the example of Ethno-SAS (Unodiaku, 2016) is appreciative towards culture that narrows the equity gap between boys and girls that scores lower by 12 percent. The still young Digital SAS holds greater promise. Microsoft Excel of quadratic graphs as with the 2022 Benue trial of Iji lasted in knowledge 30 percent, flexible to the 50 percent smartphone coverage of Enugu. However, they do not integrate; a state report of 2024 shows that ten percent of teachers utilize tech. With the addition of SAS on top of curricula, Enugu schools will be able to transition to math survival and prosperity.

The Problems

Enigu is on the road to SAS adoption which is stalled but all these have growth opportunities. It is understood that teacher unfamiliarity takes the leading position; a 2020 survey among Baki revealed that 65 percent of math teachers had not been trained in modeling, so there was a reluctance to use. Its woes on resources, 70 per cent of schools have none of the computers, according to UNESCO (2021), paralysing simulations. The urban-rural separations increase the divisions with the laboratories of Nsukka subsisting and those of Enugu city thriving. The remnants of the change remain among the exercises of the colonial times, as Fullan (2007) mentions, where the old army consider SAS as an additional task. Gender assumptions manifest themselves, excluding girls in optimization teams, and this is similar to what Nishii et al. have warned about equity in 2018. Ethical gaffs, such as the privacy of simulation data, resemble Selwyn (2022).

Table 2
Common Hurdles and Quick Fixes



Hurdle	Description	Enugu Impact	Suggested Fix	Source
Teacher Training	Lack of SAS skills	65% unprepared	Workshops with MAN	Baki (2020)
Resource Shortage	No tech simulations	for 70% schools unequipped	Partner with NGOs	UNESCO (2021)
Resistance to Change	Preference for rote methods	Slow adoption in rural areas	Pilot demos in 10 schools	Fullan (2007)

Solutions start small. The workshops would be funded by the state (being built off Nwokwu 2023 informing the administration) and certify 500 teachers annually. Free and open-source programs, such as GeoGebra, bypass hardware requirements, and community connections finance laboratories. The progress is monitored through PPSMB exams which makes the progress inclusive. These measures make obstacles stepping stones.

Conclusion

Enugu math environment has uber-sparkle SAS prospects of 20-30 percent improvement with scale. Simulations make people curious, modeling empowers local innovation, and optimization makes efficiency use when working towards the STEM push of the Vision 2030. Funding is another priority that policymakers have to focus on because they want to gain 80 percent coverage by 2030. Some trajectories of AI-SAS hybrids are available in the future, based on 2024 Ismail research, to simulate per personally. Studies recommend Enugu trials in specific blending with ethno-elements in order to fit the culture. Students who learn how to master these strategies become agency makers but create Enugu the beacon of math. It is the turn of the journey now, and one model after another.

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