Optimizing for Outcomes:

Education Investment Strategy Proposal

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Fazecas, James
Wang, Yuxiao
Williams, Kyasha
Yudanin, Michael

Summer MGMT 59000: AI-Assisted Big Data Analytics in the Cloud
Final Project: Strategic Analytics & AI-Driven Insights: Option C
Group: Data Ninjas 3

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Problem & Approach: The Business Challenge

➔ A $50M non-profit is seeking investment opportunities that will **maximize educational impact**

- Where to invest?
- What to invest in?
- How to measure success?

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Team Methodology

- ➔ Analyze a global dataset of educational outcomes to find the most impactful investment opportunities
  - ◆ We used PISA datasets of impacting factors and educational outcomes for 2015, 2018, and 2022

    Programme for International Student Assessment (PISA) measures 15-year-olds' ability to use their reading, mathematics and science knowledge and skills to meet real-life challenges.
  - ◆ After combining different datasets and cleaning up the data, we built, trained, and evaluated Machine Learning models to find the factors that impact educational outcomes the most
  - ◆ Then, we analyzed the factors from the perspective of -
    - Financial Performance Analyst
    - Custom/Market Analyst
    - Operational Excellence Analyst
    - Risk Analyst
  - ◆ Finally, we suggested an investment strategy, with an implementation framework and KPIs

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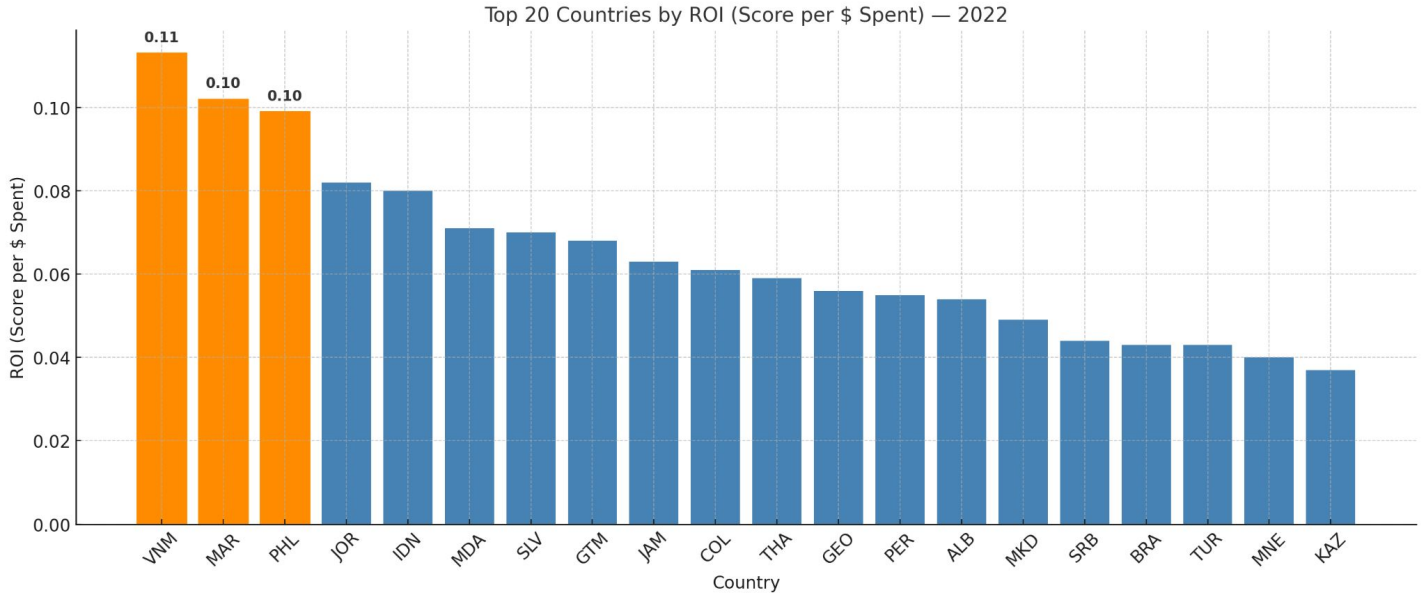
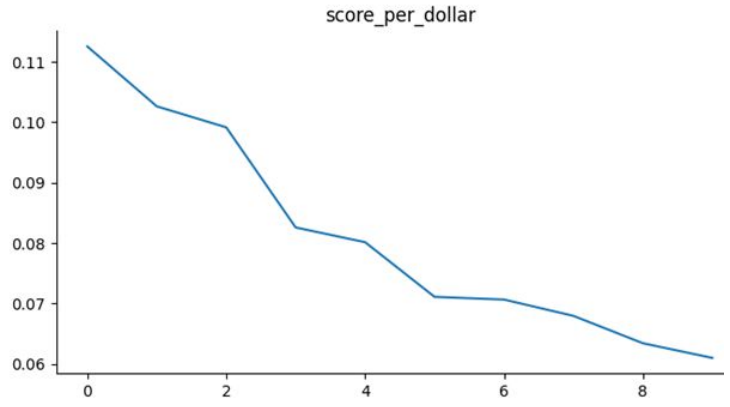
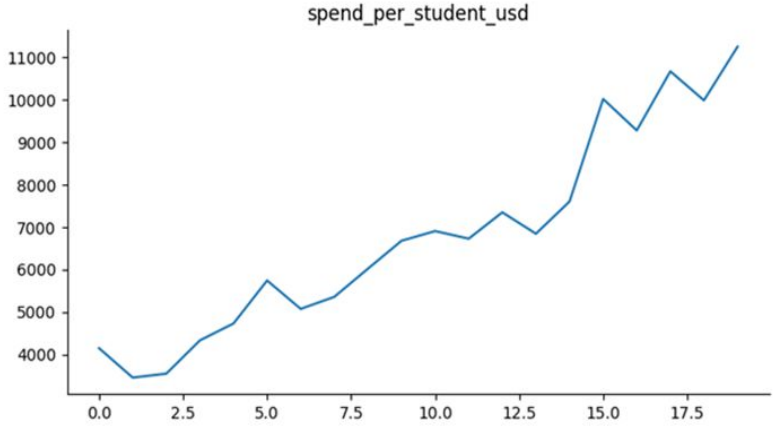
Financial Performance Analyst

James Fazecas







Key Findings:

- **As spending per student ↑, the return on investment (score per dollar) ↓**
- High-spend nations like the US (>$11K per student) show low ROI (~0.062).
- Diminishing returns: spending ↑ 200% only yields ~20–30% score gain.
- Efficiency > budget size: ROI leaders win by smarter allocation.

Conflict & Resolution

- Conflict: Rising per-student spend reduces ROI, creating inefficiency.
- Resolution: Redirect capital to cost-efficient, high-performing regions and apply ROI-based KPIs.

Top 3 Strategic Recommendations

1. **Target Efficiency Leaders**
   a. Prioritize countries with high ROI at lower spend (e.g., Vietnam, Morocco, Philippines).
   b. Use them as benchmarks for best practices
2. **Reallocate Instead of Increasing Spend**
   a. Shift budgets from low ROI regions (where spend is rising but efficiency falls) toward proven high-yield areas.
   b. Example: If spend rises from $5,000 → $10,000 per student, but ROI falls from 0.11 → 0.07, redirect funds to high-impact programs.
3. **Tie Funding to ROI-Driven KPIs**
   a. Measure “Score Improvement per $1,000 spent” as a central metric.
   b. Stop blanket budget growth and instead tie investment directly to measurable learning outcomes.

Expected Impact

- 15–20% improvement in global ROI (by reallocating wasted spend).
- Higher scores per dollar, sustaining outcomes while keeping budgets controlled.
- Long-term scalability: growth only where ROI justifies expansion.

Strategic Focus:

- Optimize spend efficiency, not maximize spend levels.
- Benchmark ROI leaders to replicate success models.
- Institutionalize ROI metrics in decision-making.

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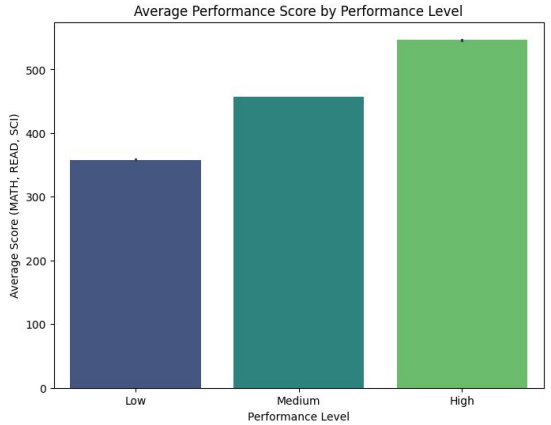
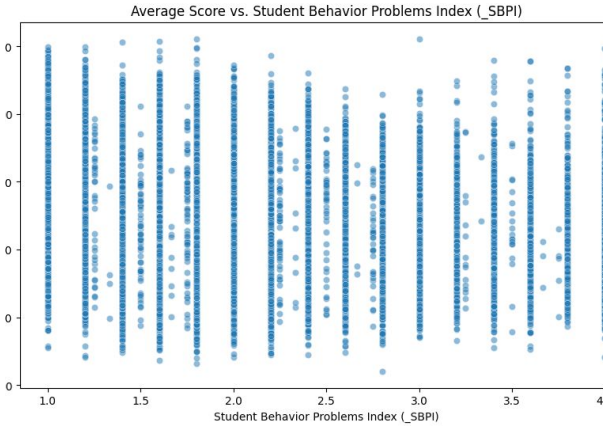
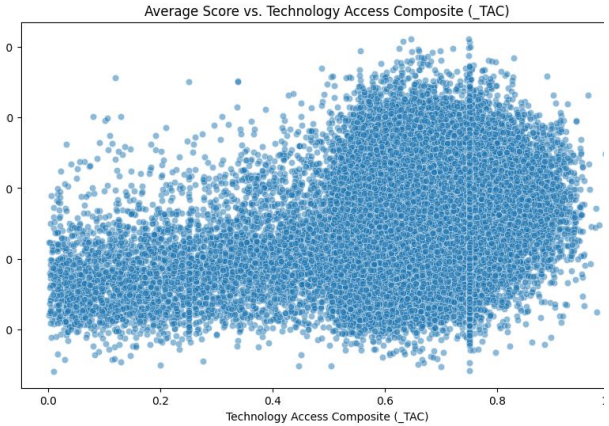
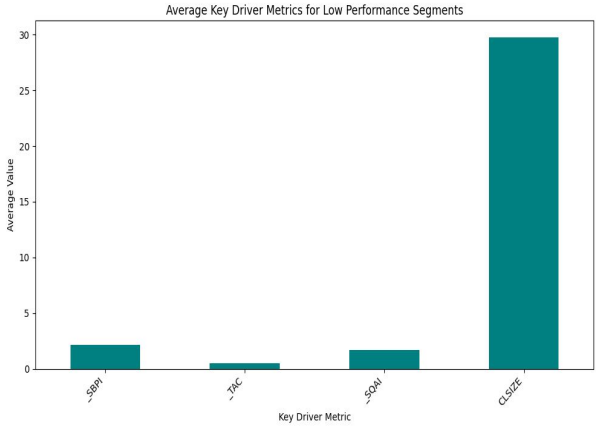
Customer/Market Analyst

Kyasha Williams









Key Findings Academic performance is influenced by technology access (TAC), school quality assurance (SQAI), student behavior problems (SBPI), and class size (CLSIZE). Low-performing segments face the most challenges across these drivers and represent the greatest opportunity for impact.

Conflict & Resolution The main challenge is allocating a limited $50M budget across multiple significant needs. Resolution involves prioritizing based on the strength of each driver's correlation with performance, its prevalence in target regions, and the cost-effectiveness of interventions.

Top 3 Strategic Recommendations

- Improve student behavior by funding truancy reduction and discipline support programs.
- Expand technology access through devices, internet connectivity, and teacher training.
- Strengthen school quality assurance by investing in mentoring, leadership development, and data systems.

Expected Impact Improved academic performance in math, reading, and science. More supportive and effective learning environments. Greater equity in education across underserved regions. Sustainable improvements through local capacity building. Demonstrated impact that can attract future funding and partnerships.

Strategic Focus Target low-performing segments with the highest need and potential. Align investments with validated performance drivers. Apply data-driven, adaptive strategies to ensure long-term success.

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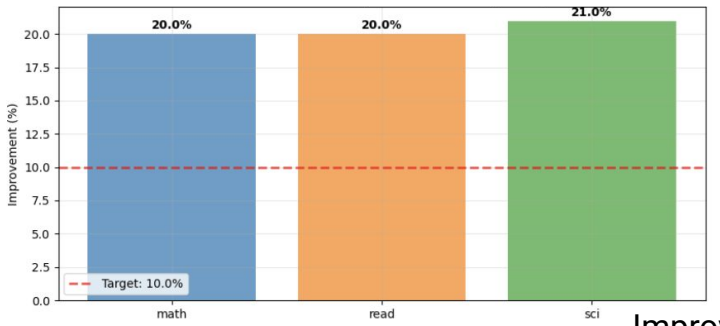
Operational Excellence Analyst

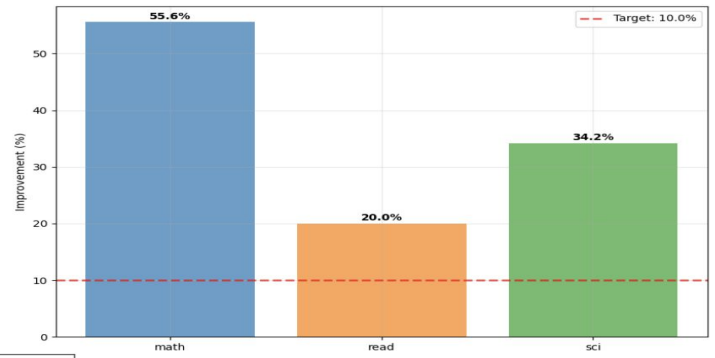
Michael Yudanin

Predicted Score Improvement by Subject

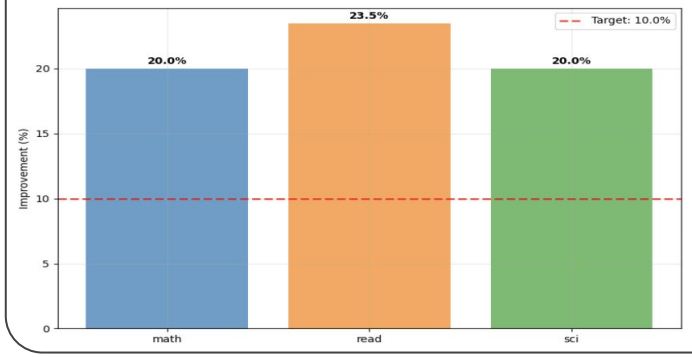
Computers with Internet and Data Projectors



Improving Student-Teacher Ratio



Extracurricular Activities



That was a surprise, even though some researchers had said that.

Key Findings

1. Educational outcomes in math, reading, and science are influenced the most by:
   a. Tech: availability of computers with Internet access and data projectors
   b. Student/teacher ratio
   c. Extracurricular activities, most notably - band/orchestra/choir at school
   d. Truancy

Top 3 Strategic Recommendations

That was no surprise…

- Prioritize investment in:
  - Providing computers with Internet access and data projectors
  - Hiring teachers
  - Sponsoring band/orchestra/choir
- For the biggest return on investment, focus on lower-budget-per-student countries
  - Rwanda, India, Kenya, Philippines, and Peru
- Use clear quantitative KPIs
  - Number of students impacted
  - Additional teachers hired
  - Math, reading, and science PISA scores in years to come

Operational considerations

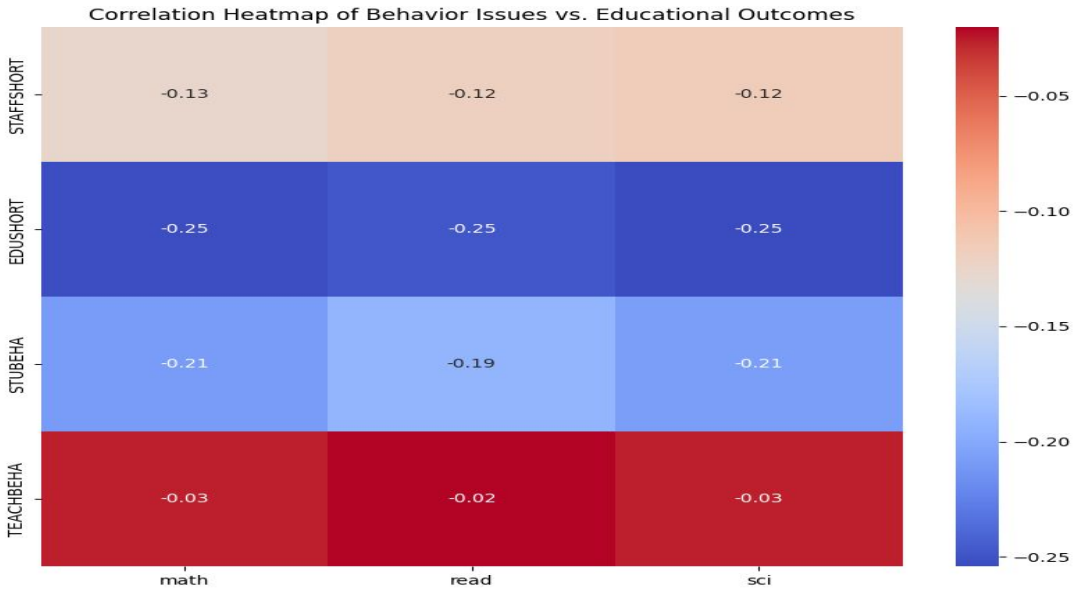
- Tech, hiring teachers, and sponsoring bands is operationally easier than reducing truancy
- Collaborate closely with local educational NGOs
- Calculate the Total Cost of Ownership for all tech investment

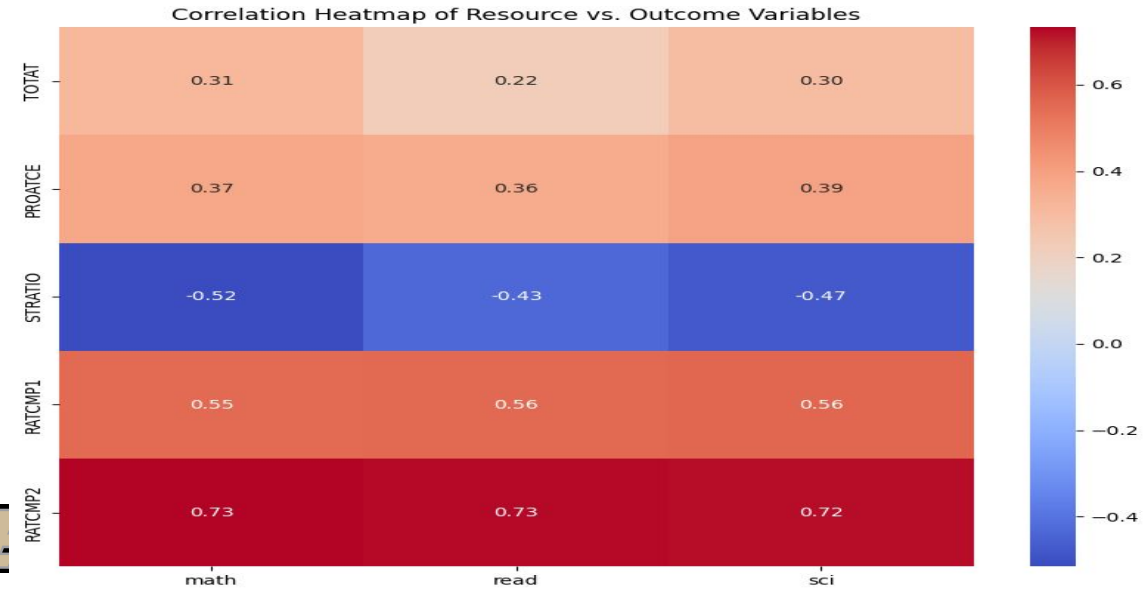
Expected Impact in five years is:

- 650,000+ students directly impacted
- 2,314 additional teachers in the system
- 1,580 schools upgraded with technology
- 25:1 average student-teacher ratio achieved
- 85% digital literacy rate in target schools

Risk Analyst

Yuxiao Wang





Key Findings

- Teacher and student behavior issues (STAFFSHORT, EDUSHORT, STUBEHA, TEACHBEHA) are negatively correlated with student performance. EDUSHORT (Education Shortage) showed the strongest negative correlation, while TEACHBEHA (Teacher Behavior Issues) showed the weakest.

Top 3 Strategic Recommendations

- Focus strategic investments on improving technology access and physical resources in schools, as these show a statistically significant positive impact on educational outcomes.
- Prioritize initiatives aimed at reducing education shortages and addressing student behavior issues, as these have the strongest negative correlations with student performance.
- Equip teachers with enhanced skills in classroom management, de-escalation techniques, and strategies for supporting students with diverse behavioral needs

Expected Impact

- Reduce disruptive behavior and create a more conducive learning environment, mitigating the risk of poor educational outcomes.

Strategic Focus

- Enhance Early Warning Systems for At-Risk Students: Given the negative correlation between student behavior issues and academic performance, implement robust early warning systems that identify students exhibiting behavioral problems or academic disengagement. This allows for timely intervention and support, mitigating the risk of academic failure and negative long-term outcomes.

Strategic Recommendations

1. Invest in Tech

- Specifically, buy and maintain computers with Internet access and data projectors. Take into consideration not only purchasing price but also the cost of ownership.
- Cost Breakdown:
  - Basic Educational Laptop/Tablet: $250-350 per unit
  - Annual Internet Costs per School: $360-$518/year
  - Maintenance & Support (Annual): $100 per device/year
- Implementation Capacity:
  - Total devices: ~67,000 computers across all countries
  - Schools reached: ~670 schools (100 devices per school average)
  - Students impacted: ~201,000 students (300 students per school)
  - 3-year operational budget: $6.7M for maintenance and internet
  - 5-year sustainability: $13.4M total operational costs

We have numbers for projectors too

Rwanda
$12.0M Investment
Computers: 13,400 **Teachers:** 460
Projectors: 1,820 **Schools:** 320
Students: 156,000 **Priority:** Top Choice

India
$15.0M Investment
Computers: 16,750 **Teachers:** 973
Projectors: 2,275 **Schools:** 400
Students: 195,000 **Priority:** High Volume

Kenya
$10.0M Investment
Computers: 11,200 **Teachers:** 265
Projectors: 1,520 **Schools:** 260
Students: 130,000 **Priority:** Strong NGOs

Philippines
$8.0M Investment
Computers: 8,960 **Teachers:** 486
Projectors: 1,216 **Schools:** 200
Students: 104,000 **Priority:** Innovation Hub

Peru
$5.0M Investment
Computers: 5,600 **Teachers:** 225
Projectors: 760 **Schools:** 120
Students: 65,000 **Priority:** Regional Base

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Strategic Recommendations

2. Hire more teachers

- This area is expected to bring about the highest improve in Math
- Annual teacher salary cost: $3,600 - $15,600
- 5-year commitment:
  - India: 973 teachers, 5,865 total teacher-years
  - Kenya: 265 teachers, 1,325 total teacher-years
  - Philippines: 486 teachers, 2,430 total teacher-years
  - Peru: 225 teachers, 1,125 total teacher-years
  - Rwanda: 365
- Total Impact:
  - 2,314 additional teachers hired across all countries
  - Ratio improvement: From 40:1 to 25:1 average
  - Students impacted: ~463,000 students over 5 years

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Strategic Recommendations

3. Focus on highest-impact countries

- Focusing on countries with lower educational budget can being higher ROI in terms of improving outcomes. Specifically, we suggest focusing on Rwanda, India, Kenya, Philippines, and Peru.
- Collaborate closely with educational NGOs and governments:

Rwanda (Top Priority)

- Educate! - Skills-based education reform; Rwanda-one4one - Education access for vulnerable children, etc.
- **Government Program:** Smart Classroom Initiative (2019-2025)
- **Partnership Opportunity:** 90% government co-funding available

India (High Volume Potential)

- Teach for India - Teacher training and placement, Pratham - Educational innovation at scale, etc.
- **Government Program:** Digital India Initiative & Samagra Shiksha
- **Partnership Opportunity:** 75% state government matching funds

Kenya (Strong NGO Ecosystem)

- Asante Africa Foundation - Rural education empowerment, Bridge International Academies - Technology-enabled learning, etc.
- **Government Program:** Digital Literacy Programme (DLP)
- **Partnership Opportunity:** 60% government infrastructure support

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Call for Action

Phase 1: Foundation

Months 1-6

Partnership Development

- Sign MOUs with top 3 countries (Rwanda, India, Kenya)
- Establish procurement agreements with local suppliers
- Complete baseline assessments in 50 pilot schools

Pilot Program Design

- Deploy 5,000 computers across 50 schools
- Hire 100 additional teachers in high-need areas
- Install 500 projectors in selected classrooms
- Launch 10 music programs

Phase 2: Scaled Deployment

Months 7-18

Infrastructure Rollout

- Complete 70% of computer deployment (47,000 units)
- Achieve 60% of teacher hiring targets (1,400 teachers)
- Install 6,400 projectors (70% of target)
- Expand music programs to 140 schools

Capacity Building

- Train 5,000 teachers in digital literacy
- Establish 25 regional training centers
- Create sustainability plans with local partners

Phase 3: Optimization

Months 19-24

Performance Optimization

- Complete remaining deployments
- Achieve target student-teacher ratios
- Document and replicate best practices
- Begin transition to local management

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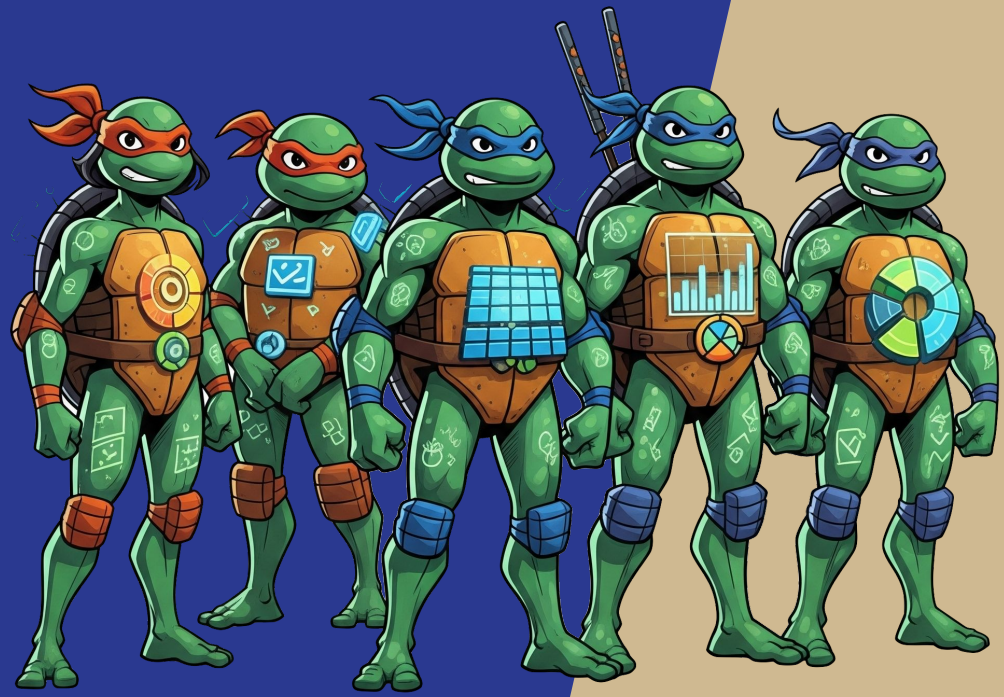
Thank You!



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