

SMART EDUCATION TRACKER IN SOUTH SUDANESE SCHOOLS

Project Context

In South Sudan's school systems, tracking student progress and holding educators accountable is often limited by lack of infrastructure, inconsistent data collection, and minimal communication between schools, parents, and the government. Much like hidden processes in wildlife monitoring, student learning outcomes are often invisible until final exams or dropout events occur—when it may already be too late to intervene.

By leveraging a Smart Education Tracker (SET), school administrators, teachers, and parents can monitor student performance using observable academic signals (like grades, attendance, or engagement) to infer the true academic status of a student. This allows early intervention, more accurate reporting, and a stronger culture of accountability and support.

1. Observations

The Smart Education Tracker uses measurable educational indicators such as:

- Term grades in core subjects like Math, English, and Science
- Attendance records and punctuality
- Drop in performance trends across multiple terms
- Teacher assessments and comments
- Parent follow-up reports or feedback
- Gender and school-level disaggregation

Each reporting period (e.g., per term) forms a time step that generates observable data, which can help infer a student's true academic state (e.g., progressing well, struggling silently, or at risk of dropping out).

2. Type of Problem

This is an inference and monitoring problem in a partially observable system, where the actual student academic status is not directly measurable without consistent observation.

We do not always directly see when a student is disengaged, struggling, or unsupported. Therefore, the problem is defined as:

- State Estimation (Decoding): Inferring the most likely academic state (e.g., “on track”, “struggling”, “at risk”) based on grades, attendance, and teacher feedback
- Learning (Training): Continuously adjusting the system's thresholds and weights for what indicators suggest certain academic states

3. Data and Assumptions

a. Known Values at Start:

- Historical grade reports
- Attendance logs per term
- Teacher inputs
- Number of potential student states (e.g., “On Track”, “Needs Support”, “At Risk”)

b. Unknown Values to Be Learned:

- Transition probabilities (e.g., probability a student moves from “On Track” to “At Risk”)

- Emission probabilities (e.g., likelihood of seeing a drop in scores given that a student is “Struggling”)
- Initial state distribution (e.g., assuming most students begin in “On Track”)

4. Parameter Updates (Learning Over Time)

During implementation, the Smart Education Tracker can update internal assumptions and thresholds by analyzing patterns:

- **Transition Probabilities:**
Likelihood that a student progresses from one academic state to another between terms (e.g., “On Track” → “Needs Support”)
- **Emission Probabilities:**
Likelihood of observing specific performance indicators (like declining scores or increased absenteeism) based on a student’s hidden academic state
- **Initial State Distribution:**
The assumed academic status of students at the start of the school year or upon enrolment

Conclusion

The Smart Education Tracker provides a powerful framework for turning fragmented academic records into predictive insights about student well-being and performance. Just like Hidden Markov Models can uncover hidden wildlife patterns from sensor data, SET helps uncover student learning trajectories from indirect observations—allowing teachers, administrators, and parents to act before failure or dropout occurs.

By implementing SET, South Sudanese schools can make smarter, data-informed decisions that improve student retention, promote academic equity, and build a more transparent and accountable education system.