PACE Strategy

Project Title:

Predicting Student Performance and Risk of Failure using Data Analytics and Machine Learning

PLAN

Stakeholders:

- School Administrators
- Teachers
- Parents

Goals:

- Improve student academic performance
- Reduce dropouts
- Enhance teacher effectiveness
- Improve attendance & engagement

KPIs:

- Avg Exam Score
- Pass Rate %
- Attendance %
- Teacher Effectiveness Index (teacher rating × avg student performance)
- Dropout Risk %
- Disciplinary Incidents per Student

ANALYZE

🔷 Student Performance

- **SQL:**
  - Avg score per grade, subject, gender, parent education, family income.
  - Top/bottom 10% students.

🔷 Attendance

- **SQL:**
  - Attendance % per student, per grade.

- Students with <75% attendance.

🔷 **Teacher Effectiveness**

- **SQL:**
  - Avg student score per teacher.
  - Compare teacher qualification/experience vs outcomes.

🔷 **Activities**

- **SQL:**
  - Participation % in extracurriculars.
  - Compare avg scores of activity participants vs non-participants.

🔷 **Disciplinary Records**

- **SQL:**
  - Count of incidents per student.
  - Compare avg scores of disciplined vs non-disciplined students.

CONSTRUCT

SQL Outputs → Power BI

- Create fact-dimension model (fact tables: attendance, exam_scores, classes; dimension tables: students, teachers, activities, disciplinary_records).

Dashboards in Power BI:

- Student Performance Dashboard
  - KPIs: Avg score, pass rate, subject trends.
  - Heatmap: Subject-wise score distribution.
  - Demographic filters: gender, parental education, income.
- Attendance Dashboard
  - Attendance trends per grade/subject.
  - Scatterplot: Attendance % vs Score.
  - Drill-down: Identify students with chronic absenteeism.
- Teacher Effectiveness Dashboard
  - Teacher leaderboard (rating vs student outcomes).
  - Bubble chart: years of experience vs avg score.
- Activities Dashboard
  - Activity participation trends.

    - Comparison: participants vs non-participants.
- Student Risk Dashboard
    - Flags students at risk (low attendance, low score, high discipline).
    - Integration of Python model predictions.
- Predictive Modeling in Python:
    - Target: Pass/Fail (score ≥ 40 = Pass).
    - Features: attendance %, avg exam score, parental education, family income, activities, teacher rating, discipline.
    - Models: Random Forest, XGBoost, SMOTE
    - Metrics: Accuracy, Precision, Recall, F1, ROC-AUC.
    - Output: Risk probability per student → exported to Power BI.

EXECUTE

- Integrate insights into dashboards.
- Share recommendations:
    - Early intervention program for at-risk students.
    - Extra support for low-performing subjects/teachers.
    - Attendance monitoring system.
    - Encourage activity participation.
    - Targeted counseling for disciplined students.
- Portfolio Packaging:
    - SQL scripts, Power BI dashboards, Python notebook, documentation, insights report.