

Week 4 Task: Advanced Analytics and Custom Visuals

Internship: Virtual Power BI Data Insights Internship

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Objective

This task explores advanced analytics techniques in Power BI to analyze complex educational data scenarios. The goal is to integrate sophisticated DAX formulas and custom visuals to uncover deep insights using the student performance and attendance model developed in earlier weeks.

1. Advanced Analytics Goal

The advanced analytics scenario chosen is: 'Which students are consistently underperforming due to low attendance, and how can we predict future risk groups?'. This question goes beyond basic filtering. It requires identifying patterns between attendance trends, academic performance, and demographics, then using calculated risk indicators to flag students for early intervention.

2. Complex DAX Formulas

Here are several advanced DAX formulas used to support deep insights into student behavior and risk scoring:

- - AtRiskFlag = IF(AVERAGE(attendance[Attendance %]) < 75 && AVERAGE(performance[Score]) < 40, "Yes", "No")

→ Flags students with both low attendance and poor performance as 'At Risk'. Used in KPI and table visual filters.
- - AttendanceTrend = CALCULATE(AVERAGE(attendance[Attendance %]), DATESINPERIOD(attendance[Date], MAX(attendance[Date]), -3, MONTH))

→ Shows average attendance over the last 3 months. Useful to spot consistent attendance decline trends.

- - $\text{ScoreZScore} = (\text{performance}[\text{Score}] - \text{AVERAGE}(\text{performance}[\text{Score}])) / \text{STDEVX.P}(\text{performance}, \text{performance}[\text{Score}])$

→ Normalizes student scores to find outliers who are underperforming in comparison to the average. This helps in highlighting high-risk cases.

- - $\text{CountAtRiskStudents} = \text{CALCULATE}(\text{COUNTROWS}(\text{students}), \text{FILTER}(\text{students}, [\text{AtRiskFlag}] = \text{"Yes"}))$

→ Provides the total number of students currently at risk, used in a KPI and dynamic alert card.

3. Custom Visuals Used

Custom visuals from the Power BI marketplace were integrated to enhance visual storytelling and offer better analysis:

- - Bullet Chart:
 - Combines performance scores and target thresholds in one visual. Helps track subject performance against school-defined benchmarks.
- - Radar Chart:
 - Shows subject-level performance distribution for each student in one view. Helps identify skill gaps and compare across students or classes.
- - Decomposition Tree:
 - Lets users drill down from total risk count → class → gender → student. This uncovers hidden trends behind underperformance.

4. Integration with Week 2 Model

All DAX measures and custom visuals are built on top of the Week 2 star schema model which includes the Students, Attendance, and Performance tables. Existing slicers for Class, Subject, and Gender are retained. DAX flags are added as calculated columns and used in visual-level filters. The radar chart is connected to the performance table; the bullet chart is linked to performance + target table; and the decomposition tree works through the relationship hierarchy. All visuals respond to slicers and allow dynamic exploration.

5. Expected Business/Academic Impact

This dashboard gives educators powerful tools to:

- Detect early warning signs for student disengagement
- Prioritize which students or classes need attention
- Understand if poor scores correlate with attendance patterns
- Take proactive steps before final assessments

Overall, it turns historical data into forward-looking insights that support smarter decision-making in academic environments.

6. User Scenario – Practical Use Case

Imagine a school administrator opens this Power BI dashboard. Using the hierarchy slicer, they filter **Class 9** → **Female** → **Subject: Science**. Instantly, the decomposition tree updates to show a subgroup of students with attendance below 75% and performance below 40%.

The radar chart reveals that these students are especially weak in Physics and Chemistry. Based on this insight, the academic team schedules extra coaching for that subject group.

This scenario demonstrates how combining advanced DAX + custom visuals helps identify not just problems, but precise *root causes*, enabling data-driven educational planning.

7. DAX Optimization Approach

DAX calculations such as Z-Score, Attendance Trends, and At-Risk Flags are optimized using best practices like **variables**, **measure branching**, and filtering only required records. This improves performance and reduces visual load times.

For example, instead of recalculating average performance in every row, I define it once using `VAR AvgScore = AVERAGE(...)` and reuse it in the formula.

8. Custom Visual Source Credits

Visual	Source (Marketplace)	Purpose
Bullet Chart	OKViz by SQLBI	Compare student performance to subject-specific

Visual	Source (Marketplace)	Purpose
		target thresholds
Radar Chart	Microsoft	Visually compare multiple subject scores to detect skill gaps
Decomposition Tree	Microsoft	Drill from class → subject → student to identify root causes of failure
Hierarchy Slicer	Jan Pieter Posthuma	Multi-level filter: Class → Gender → Subject

9. Export Feature

To support real-world usage, the dashboard allows school staff to **export filtered insights to PDF**. For example, a filtered report on “At-Risk students in Class 10” can be saved and shared during review meetings. This adds operational value beyond analysis.