



# **School-Absent-Incident Tracker Microsoft Power Bi Solution**



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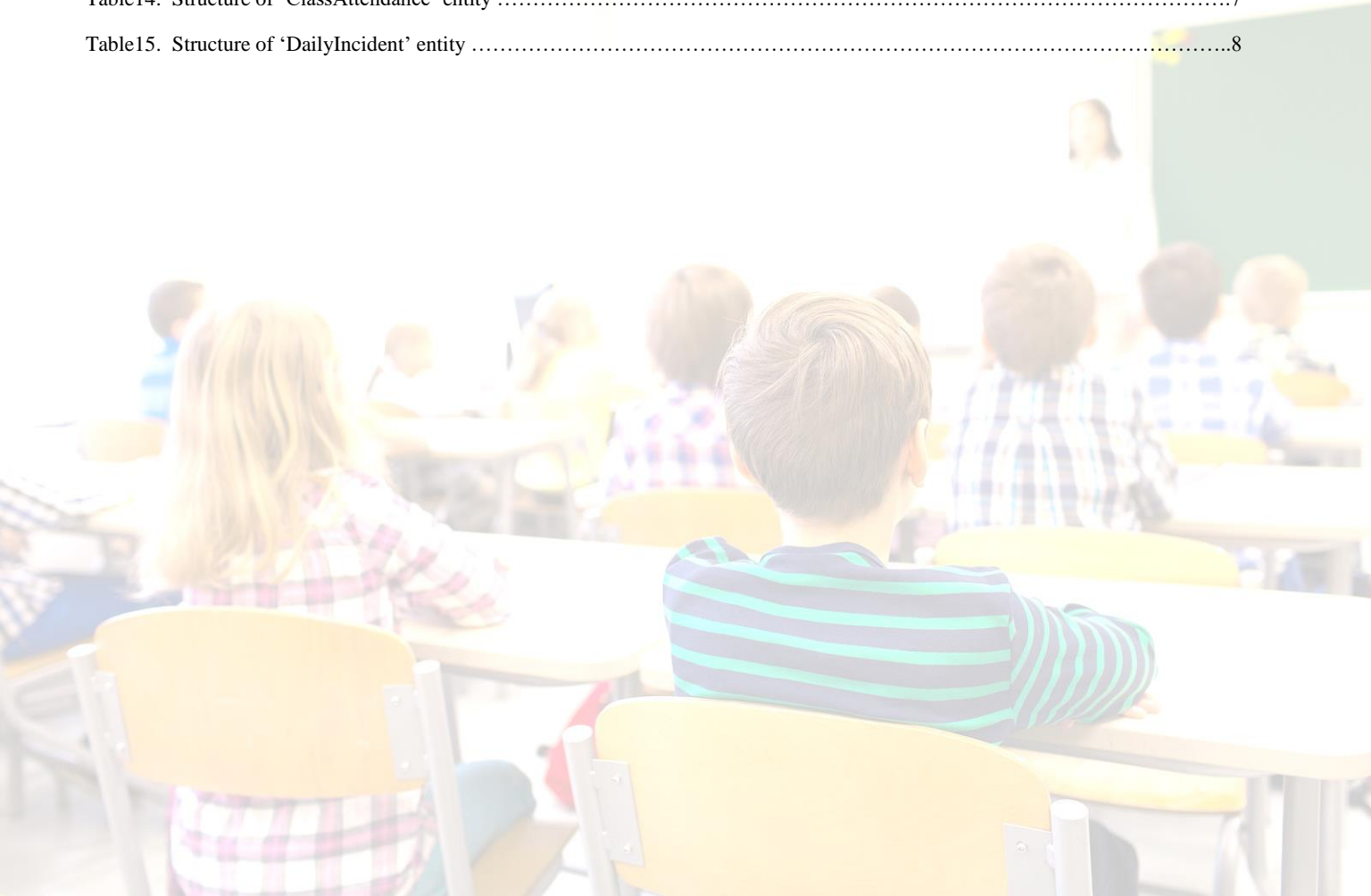
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## 1. Introduction:

In this project, I'm going to develop a data warehouse architecture to provide detailed information about design and implement the K12 Absent and Incident Power BI solution to help the district, district leaders, principals and teachers quickly identify students at risk.

An 'at-risk' student is generally defined as a student who is likely to fail at school. In this context, school failure is typically seen as dropping out of school before high school graduation.

In this model, we consider three main risk factors that most of districts are involved to them. These are included number of **Unexcused Absences**, Number of **Incidents** and **cumulative GPA** relevant to each student.

**DISCLAIMER:** The visuals are based on simulated data. They do not represent real world. The insights are for illustrative and demo purposes only and should not be used as facts or alternative facts.

## 2. Why is Power bi used?

Power BI is a tool used to build interactive reports with multiple visuals and data distributed across different pages. It is a combination of Power Pivot, Power View and Power Query. Power Bi is an easy tool to find insights within an organization's data. Power BI can connect to variety of multiple data sets, transform and clean the data into a data model. It also be able to create charts or graphs to provide visuals of the data and easily deployable Row Level Security.

## 3. Data Dictionary

A data dictionary is a set of files that contains records about objects in the database, such as data ownership, data relationships to other objects, and other data.

The following is a list of all objects (entities) and corresponding columns (Attributes) that must be created prior to deploying the solution.

**Entity Name:** Action

**Description:** A list of Actions that will be taken in the event of some type of incident on campus. Examples of these actions are: Loss of Privileges, Saturday School, Verbal Warning, etc.

**Columns:**

Name	Description
ActionID	Unique Identifier for each Action in the list.
Action	Description of each Action.

Table1. Structure of 'Action' entity

Following table shows ActionID and different possible action that could be considered after each incident occurs.

ActionID	Action
ID	In-school Suspension
ES	Restorative Dialogue
RJ	Restorative Justice
EY	Expelled Remainder Of School/yr
As	Tcher/parent/student Conference
IS	In-school Detention
LD	Lunch Detention
PC	Parent Contact
EL	Expelled Less Than School Year
AC	Behavior/Attendance Contract
VB	Verbal Warning
SF	Suspension 5 Days Or Less
RS	Referral To Social Worker
SM	Suspension More Than Five Days
SS	Saturday School
AP	Admin/Prnt/Gurdn/Stu Conference
RF	Referral To Counseling
DB	Detention Before/after School
LP	Loss of Privileges
IA	In-school Alternative
Cn	Ref Police - No charges filed
EN	Expelled Into Next School Year

Table2. Data Populated of 'Action' entity

**Entity Name:** AttendanceType

**Description:** A list of Attendance Types that correspond to the student's attendance on that day. Examples of these actions are: Absent, Counselor, Office, Field Trip, etc.

**Columns:**

Name	Description
AttendanceTypeID	Unique Identifier for each Attendance Type in the list.
AttendanceType	Description of each Attendance Type.

Table3. Structure of 'AttendanceType' entity



Populate data in AttendanceType table:

AttendanceTypeID	Attendance Type
V	Early Completion
5	Parent Request Opt Out Testing
A	Absent (unexcused)
F	Field Trip
C	Counselor
X	Excused Tardy
I	In School Detention
Q	Went Home Ill
O	Office
W	Weather
6	State or District Testing
N	Nurse/Infirmary
G	Early Release/Parent
H	Timeout to Home
Y	In a Facility
R	Runaway
P	P rearranged
S	Suspended
L	Tutored-District
D	Enrolled in Special Program
M	SPED ONLY in school no IEP Svcs
J	Teacher Excused
E	Excused Absence
T	Tardy (Unexcused)
Pr	Present
K	Social Worker
Z	In Detention Center (SCYSC)

Table4. Data Populated of 'AttendanceType' entity

**Entity Name:** Course

**Description:** A list of Courses that are available at school or district. Examples of these actions are: English, Math, Chemistry, etc.

**Columns:**

Name	Description
CourseID	Unique Identifier for each Course in the list.
CourseName	Description of each Course.
CourseCode	An additional Unique Identifier that is more descriptive than CourseID. Some examples are as follows: EN.ENG1, MT.MATH1, etc...

Table5. Structure of 'Course' entity

**Entity Name:** Incident

**Description:** A list of Incidents. Examples of these actions are: Fighting, Cursing, Theft, etc...

**Columns:**

Name	Description
IncidentID	Unique Identifier for each Incident in the list.
Incident	Description of each Incident.

Table6. Structure of 'Incident' entity

Populated data in 'Incident' entity

IncidentCodeID	Incident
AA1	L1 Unexcused Absences
ALA	L2 Abusive Lang w/Staff
ALP	L1 Abusive Lang/Intim w/Student
APL	L3 Any Act Prohibit by F/S/L Law
ASR	L2 Altering Sch/Classrm Rcrds
AT3	L3 3rd Degree Assault (by adult)
CLM	L1 Classroom Misconduct
CLO	L2 Continual LEVEL I Infraction
CLT	L3 Continual LEVEL II Infraction
CP2	L2 Campus Misconduct
CPM	L1 Campus Misconduct
DEP	L3 Destruction/Sch/Emp Prop
DIS	L1 Dishonesty
DSP	L2 Defacing School Prop
FCD	L2 Fail Complete Disc Assignmt
FIG	L2 Fighting
HA3	L3 Harassment
HAR	L2 Harassment
IDH	L1 Inappropriate Dress/Hygiene
INS	L1 Insubordination
IS2	L2 Insubor/open/persist defiance
L1E	L1 Inappropriate/Prsnl Elect Dev
L2B	L2 Bullying
L2E	L2 Inappropriate/Prsnl Elect Dev
L2P	L2 Phys Mistreatment of Studnt
L2V	L2 Violation of AUA
L3A	L3 P/U of Alcohol
L3D	L3 P/U of Drug Paraphernalia
PSV	L2 P/D/S Sched 4 or 5 substances

PU4	L4 P/U Dangerous Weapon
PUT	L2 P/U of Tobacco/Simulated
PUW	L2 Inadvertent Pos(Stand )Weap
SV2	L2 Serious Violations at School
SV3	L3 Serious Violations at School
THE	L2 Theft
ULC	L2 Unauthorized Leaving Campus
ULM	L3 Unlawful U/P/D/S of Marijuana
UNA	L2 Unexcused Absences/Truancy
UNT	L1 Unexcused Tardiness
WF3	L3 Weapon/Facsimile (Standard)

Table7. Data Populated of 'Incident' entity

**Entity Name:** Involvement

**Description:** A list of Involvements. Examples of these actions are: Accomplice, Victim, Witness, etc.

**Columns:**

Name	Description
InvolvementID	Unique Identifier for each Involvement in the list.
Involvement	Description of each Involvement.

Table8. Structure of 'Involvement' entity

Populate data in 'Involvement' entity

InvolvementCodeID	Involvement
A	Accomplice
W	Witness
V	Victim
P	Perpetrator
N	Not Applicable

Table9. Data Populated of 'Involvement' entity

**Entity Name:** School

**Description:** A list of Schools in District, County, etc.

**Columns:**

Name	Description
SchoolID	Unique Identifier for each School in the list.
SchoolName	Name of Each School.

Table10. Structure of 'School' entity



Populate data in ‘School’ entity

SchoolID	School Name
138	Villa Elementary School
245	Cordova Middle School
351	Sutter High School

Table11. Data Populated of ‘School’ entity

**Entity Name:** Student

**Description:** A list of Students in County, District, School, etc.....

**Columns:**

Name	Description
StudentID	Unique Identifier for each Student in the list.
StudentName	Student first, middle and last name.
Gender	Student Gender (Male, Female)
FederalRaceCategory	Student Race (Asian, Black, White, etc....)
PrimaryLanguage	Student Primary Language (English, Spanish, etc....)
GradeNumber	Student current Grade (1, 2, 3, etc....)
Grade	Student current Grade name (First, Second, Third, etc....)
CumulativeGPA	Student current overall GPA

Table12. Structure of ‘Student’ entity

**Entity Name:** Attendance

**Description:** Each row in this table represents a unique daily attendance record for each student in the school. It will be used to determine whether a student was absent the entire day (Excused or Unexcused)

**Columns:**

Name	Description
SchoolID	Unique Identifier for each School in the list.
AttendanceDate	Date of attendance
StudentID	Unique Identifier for each Student in the list.
NumofPossiblePeriods	How many possible periods in a day.
NumofTardies	Total tardies for a given day
NumofUnexcusedAbsent	Number of unexcused absences for each period
NumExcusedAbsent	Number of excused absences for each period

Table13. Structure of ‘Attendance’ entity

## 2.1 DAX - Data Analysis Expressions

After the data has been successfully loaded into Power BI desktop from respective source, in order to do some calculations or modifications on data, Power BI uses Data Analysis Expressions (DAX).

The Data Analysis Expressions (DAX) language is a formula language for Power Pivot, Power BI Desktop, and Tabular modeling in SQL Server Analysis Services (SSAS), which allows users to define custom calculations in PowerPivot tables (calculated columns) and in Excel PivotTables (measures). DAX includes some of the functions that are used in Excel formulas, and it includes additional functions that are designed to work with relational data and perform dynamic aggregation.

### Measured defined by DAX language in Attendance table:

```
Avg Cum GPA = AVERAGE('Attendance'[Cumulative GPA])
Course Attendance = COUNTROWS('ClassAttendance')
Excused Absences = SUM('Attendance'[ExcusedAllDay])
Student Count = CALCULATE(DISTINCTCOUNT(Student[StudentID]),
CROSSFILTER('Attendance'[StudentID], Student[StudentID], Both))
Tardies = SUM('Attendance'[NumofTardies])
Unexcused Absences = SUM('Attendance'[UnexcusedAllDay])
```

### Object Name: ClassAttendance

**Description:** Each row in this table represents a unique daily attendance record for each student in the school. It will be used to determine whether is a student was absent the entire day (Excused or Unexcused)

### Columns:

Name	Description
Term	Associated term for each row.
AttendanceDate	Date of attendance
StudentID	Unique Identifier for each Student in the list.
SchoolID	Unique Identifier for each School in the list.
CourseID	Unique Identifier for each Course in the list.
AttendTypeID	Unique Identifier for each Attendance Type in the list.

Table14. Structure of 'ClassAttendance' entity

### Entity Name: DailyIncident

**Description:** Each row in this table represents a unique Incident record for each student in the school. It will be used to determine number of incidents at different levels

**Columns:**

Name	Description
SchoolID	Unique Identifier for each School in the list.
IncidentDate	Date of incident
StudentID	Unique Identifier for each Student in the list.
InvolvementID	Unique Identifier for each Involvement in the list.
IncidentID	Unique Identifier for each Incident in the list.
ActionID	Unique Identifier for each Action in the list.

Table15. Structure of 'DailyIncident' entity

**Measured defined by DAX language in Attendance table:**

Total Incidents = COUNTROWS('DailyIncident')

**4. Data Modeling**

Development of a database occurs to shape what will hold the data and how (Data Modeling).

In Data modeling we take the requirements and begin to design a plan.

**3.1 Data Modeling Terminology:**

**Entity** –Structure holding data, Table

**Attribute** –Column label, name, Field

**Tuples** –Rows in a table

**Domain** –Set of valid values for an attribute

**Null** –Absence of ANY value

**Relationship** –How entities relate

**Degree** –How many entities in a relationship

**Cardinality** –Measure of participation

**3.2 Relationships in Data Modeling:**

One to One –Single instance of both entities

One to Many –Single instance and multiple instance of another entity

Many to Many –Many instances of both entities

**Cardinality** is the number of times the entity participates in the relationship

**Cardinality Options:**

Maximum Cardinality –Can't exceed a certain number

Minimum Cardinality –Must be a specific minimum number

Fixed Cardinality –Must always be a specific number

**Entity Relationship Diagram (ERP):**

An entity relationship diagram (ERD) shows the relationships of entity sets stored in a database. By defining the entities, their attributes, and showing the relationships between them, an ER diagram illustrates the logical structure of databases. ER diagrams are used to sketch out the design of a database. Following image shows ER Diagram that indicates relationships between different entities and attributes in the K12 Absent and Incident student information system.

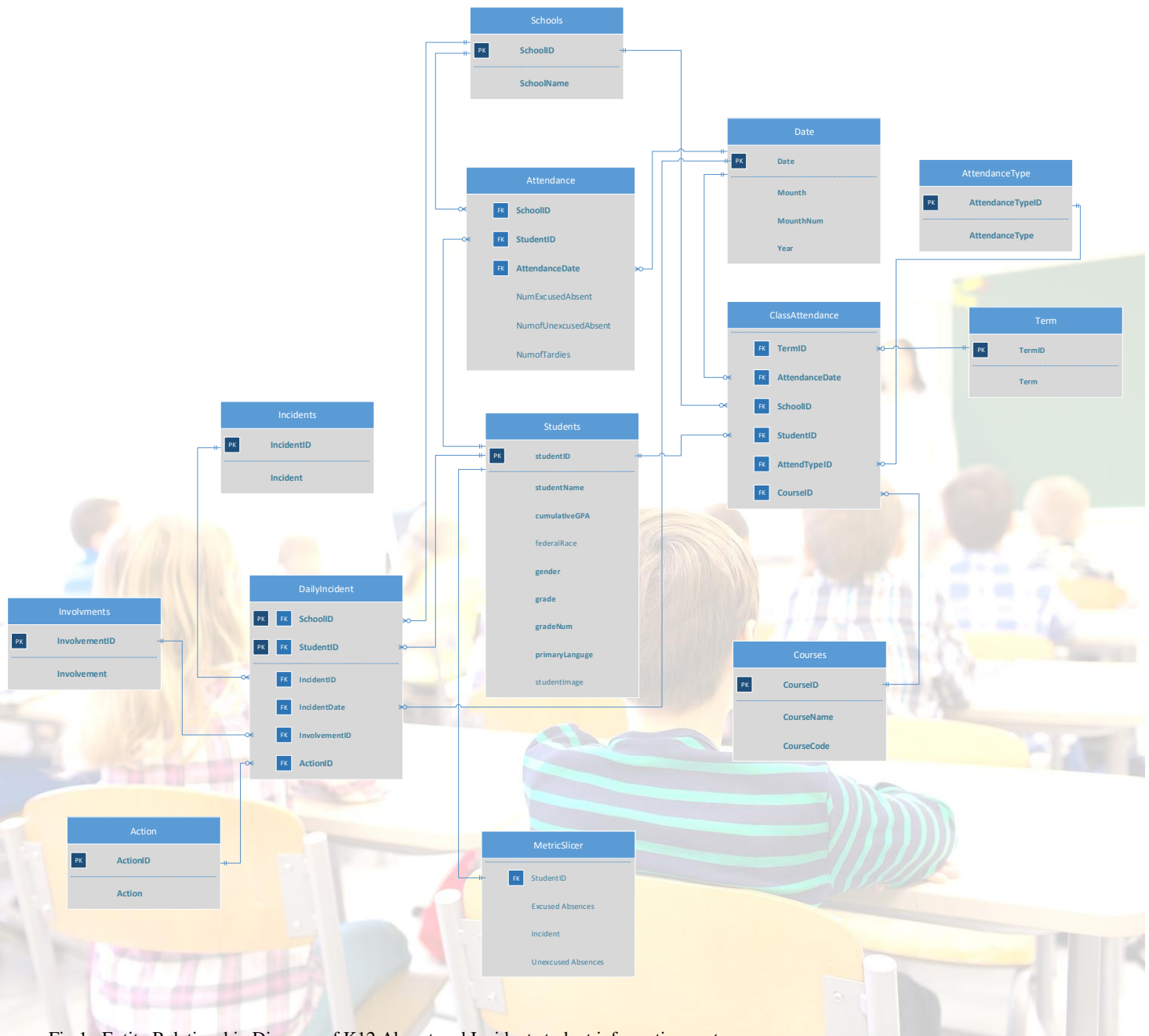


Fig 1. Entity Relationship Diagram of K12 Absent and Incident student information system

## 5. Data view:

Data View helps us inspect, explore, and understand data in our Power BI Desktop model. With Data View, we are looking at our data after it has been loaded into the model.

When we are modeling our data, sometimes we want to see what's actually in a table or column without creating a visual on the report canvas, often right down to the row level. This is especially useful when we are creating measures and calculated columns, or we need to identify a data type or data category.



TABLE: Student (3,032 rows)

StudentID	Student Name	Gender	Federal Race	Primary Language	GradeNum	Grade	CumulativeGPA	StudentImage
40834374	Kirsten Hunt	Female	TwoOrMoreRaces	English	7	07Seventh	3.39	https://demoimageuploader.blob.core.windows.net/students/fem
40834412	Julian Vaughan	Male	TwoOrMoreRaces	English	7	07Seventh	3.26	https://demoimageuploader.blob.core.windows.net/students/mai
40834780	Brooklyn Eddison	Female	TwoOrMoreRaces	English	7	07Seventh	2.00	https://demoimageuploader.blob.core.windows.net/students/fem
40835830	Bob Healy	Male	TwoOrMoreRaces	English	9	09Ninth	1.83	https://demoimageuploader.blob.core.windows.net/students/mai
40835963	Colleen Mason	Female	TwoOrMoreRaces	English	10	10Tenth	4.00	https://demoimageuploader.blob.core.windows.net/students/fem
40836519	Javier Nanton	Male	TwoOrMoreRaces	English	11	11Eleventh	2.86	https://demoimageuploader.blob.core.windows.net/students/mai
40836652	Chester Weston	Male	TwoOrMoreRaces	English	9	09Ninth	2.64	https://demoimageuploader.blob.core.windows.net/students/mai
40837345	Bristol Gilmore	Female	TwoOrMoreRaces	English	7	07Seventh	3.58	https://demoimageuploader.blob.core.windows.net/students/fem
40837386	Alex Pearce	Female	TwoOrMoreRaces	English	6	06Sixth	2.65	https://demoimageuploader.blob.core.windows.net/students/mai
40839072	Jamie Sawyer	Female	TwoOrMoreRaces	English	6	06Sixth	3.68	https://demoimageuploader.blob.core.windows.net/students/fem
40839272	Liam Simpson	Male	TwoOrMoreRaces	English	9	09Ninth	3.17	https://demoimageuploader.blob.core.windows.net/students/mai
40840933	Payton Rowe	Female	TwoOrMoreRaces	English	8	08Eighth	2.85	https://demoimageuploader.blob.core.windows.net/students/fem
40841505	Dakota Barrett	Female	TwoOrMoreRaces	English	7	07Seventh	3.69	https://demoimageuploader.blob.core.windows.net/students/fem
40841777	Deborah May	Female	TwoOrMoreRaces	English	10	10Tenth	2.57	https://demoimageuploader.blob.core.windows.net/students/fem
40841834	Marilyn Andersson	Female	TwoOrMoreRaces	English	6	06Sixth	3.81	https://demoimageuploader.blob.core.windows.net/students/fem
40842454	Ruth Shea	Female	TwoOrMoreRaces	English	6	06Sixth	2.75	https://demoimageuploader.blob.core.windows.net/students/fem
40842581	Elle Clarke	Female	TwoOrMoreRaces	English	6	06Sixth	2.39	https://demoimageuploader.blob.core.windows.net/students/fem
40843849	Lucas Clark	Male	TwoOrMoreRaces	English	12	12Twelfth	2.70	https://demoimageuploader.blob.core.windows.net/students/mai
40843922	Jenna Chapman	Female	TwoOrMoreRaces	English	9	09Ninth	3.11	https://demoimageuploader.blob.core.windows.net/students/fem
40844209	Hannah Tutton	Female	TwoOrMoreRaces	English	9	09Ninth	2.75	https://demoimageuploader.blob.core.windows.net/students/fem
40845271	Phoebe Greenwood	Female	TwoOrMoreRaces	English	6	06Sixth	2.79	https://demoimageuploader.blob.core.windows.net/students/fem
40846505	Lucas Kerr	Male	TwoOrMoreRaces	English	6	06Sixth	1.89	https://demoimageuploader.blob.core.windows.net/students/mai
40850293	Bree Slater	Female	TwoOrMoreRaces	English	9	09Ninth	2.66	https://demoimageuploader.blob.core.windows.net/students/fem
40853681	Mike Neville	Male	TwoOrMoreRaces	English	6	06Sixth	3.96	https://demoimageuploader.blob.core.windows.net/students/mai

Fig 2. Data view of 'Student' entity

TABLE: Attendance (516,862 rows)

SchoolID	AttendanceDate	StudentID	NumofPossiblePeriods	NumofTardies	NumofUnexcusedAbsent	NumofExcusedAbsent	UnexcusedAllDay	ExcusedAllDay	Cumulative
351	Wednesday, April 26, 2017	40890726	6	0	0	0	0	0	0
351	Wednesday, March 8, 2017	40890726	6	0	0	0	0	0	0
351	Friday, March 17, 2017	40890726	6	0	0	0	0	0	0
351	Thursday, April 6, 2017	40890726	6	0	0	0	0	0	0
351	Friday, April 7, 2017	40890726	6	0	0	0	0	0	0
351	Monday, April 10, 2017	40890726	6	0	0	0	0	0	0
351	Tuesday, May 9, 2017	40890726	6	0	0	0	0	0	0
351	Thursday, August 18, 2016	40877957	6	0	0	0	0	0	0
351	Friday, August 19, 2016	40877957	6	0	0	0	0	0	0
351	Monday, August 22, 2016	40877957	6	0	0	0	0	0	0
351	Tuesday, August 23, 2016	40877957	6	0	0	0	0	0	0
351	Wednesday, August 24, 2016	40877957	6	0	0	0	0	0	0
351	Thursday, August 25, 2016	40877957	6	0	0	0	0	0	0
351	Friday, August 26, 2016	40877957	6	0	0	0	0	0	0
351	Wednesday, August 31, 2016	40877957	6	0	0	0	0	0	0
351	Wednesday, September 7, 2016	40877957	6	0	0	0	0	0	0
351	Thursday, September 1, 2016	40877957	6	0	0	0	0	0	0
351	Wednesday, September 14, 2016	40877957	6	0	0	0	0	0	0
351	Thursday, September 15, 2016	40877957	6	0	0	0	0	0	0
351	Tuesday, August 30, 2016	40877957	6	0	0	0	0	0	0
351	Tuesday, September 6, 2016	40877957	6	0	0	0	0	0	0
351	Thursday, September 8, 2016	40877957	6	0	0	0	0	0	0
351	Monday, September 19, 2016	40877957	6	0	0	0	0	0	0
351	Monday, August 29, 2016	40877957	6	0	0	0	0	0	0

Fig 3. Data view of 'Attendance' entity

## 6. Relationship View:

Relationship View shows all of the tables, columns, and relationships in our model. This can be especially helpful when our model has complex relationships between many tables.

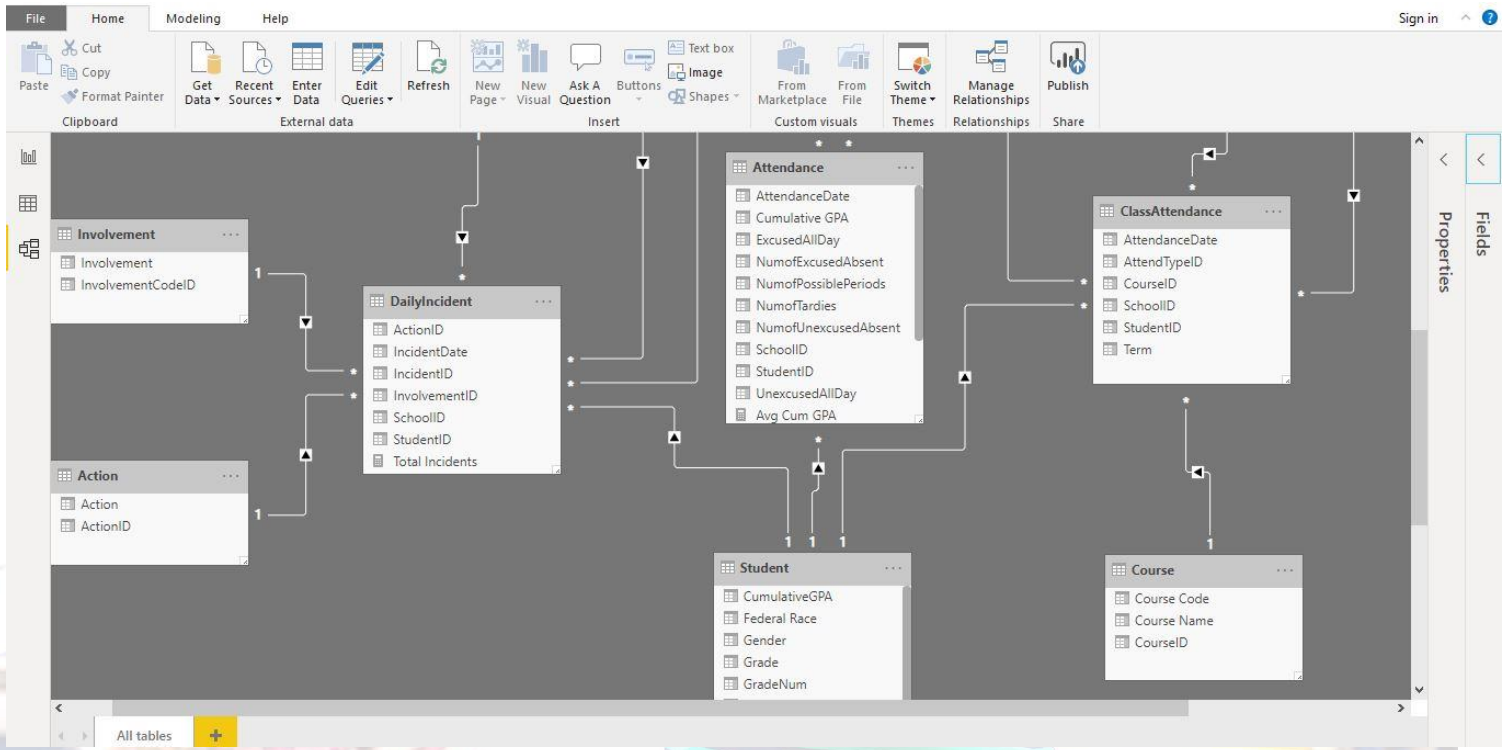


Fig 4. Relationship View of the model

## 7. Data Visualization:

Data visualization refers to the techniques used to communicate data or information by encoding it as visual objects (e.g., points, lines or bars) contained in graphics. The goal is to communicate information clearly and efficiently to users.

The School-Absent-Incident Tracker Power BI report provides a 360-degree view of overall students at risk. Strategic users can use it to quickly check KPIs with respect to different attributes. The interactive visual report provides actionable insights on students at risk by unexcused absence, incident and cumulative GPA factors. Its users can view both high level and detailed analyses of information on a single-screen display. The School-Absent-Incident Tracker Power BI report is a device to data visualization capabilities and technology expertise. Its key features include – Highly effective use of visualization, application of data visualization best practices and highlighting vital information to enable the district, district leaders, principals and teachers quickly identify students at risk and take proper decisions.

These reports contain five pages where respectively included Introduction, District, School, Student and Attendance.

Below, you will find a snapshot of the various level of visualization reports from macro level (High level risk factors information from District and Schools) through micro level (Details information of at risk students).

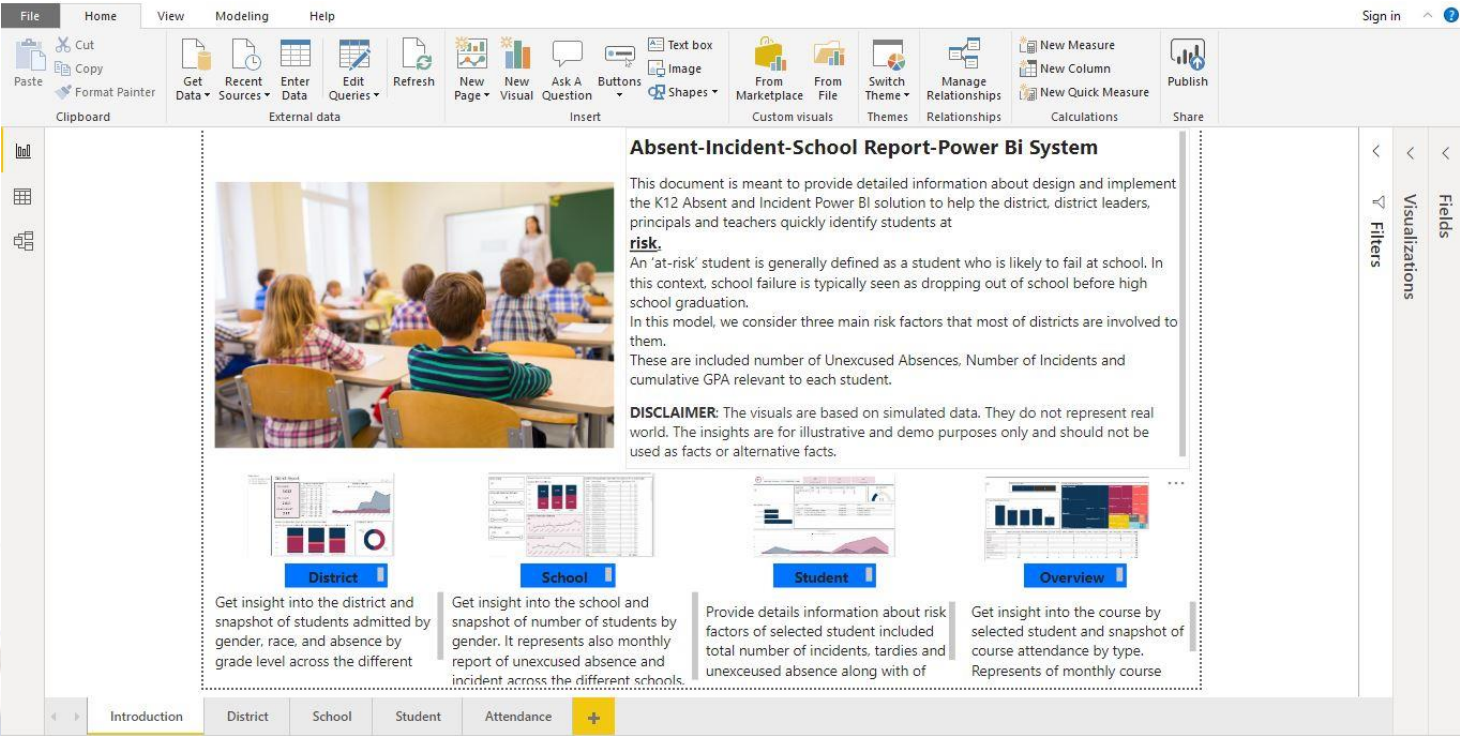


Fig 5. Snapshot of visualization report - Introduction



In the highest level of information we get insight into the district and snapshot of students admitted by gender, race, and absence by grade level across the different schools.

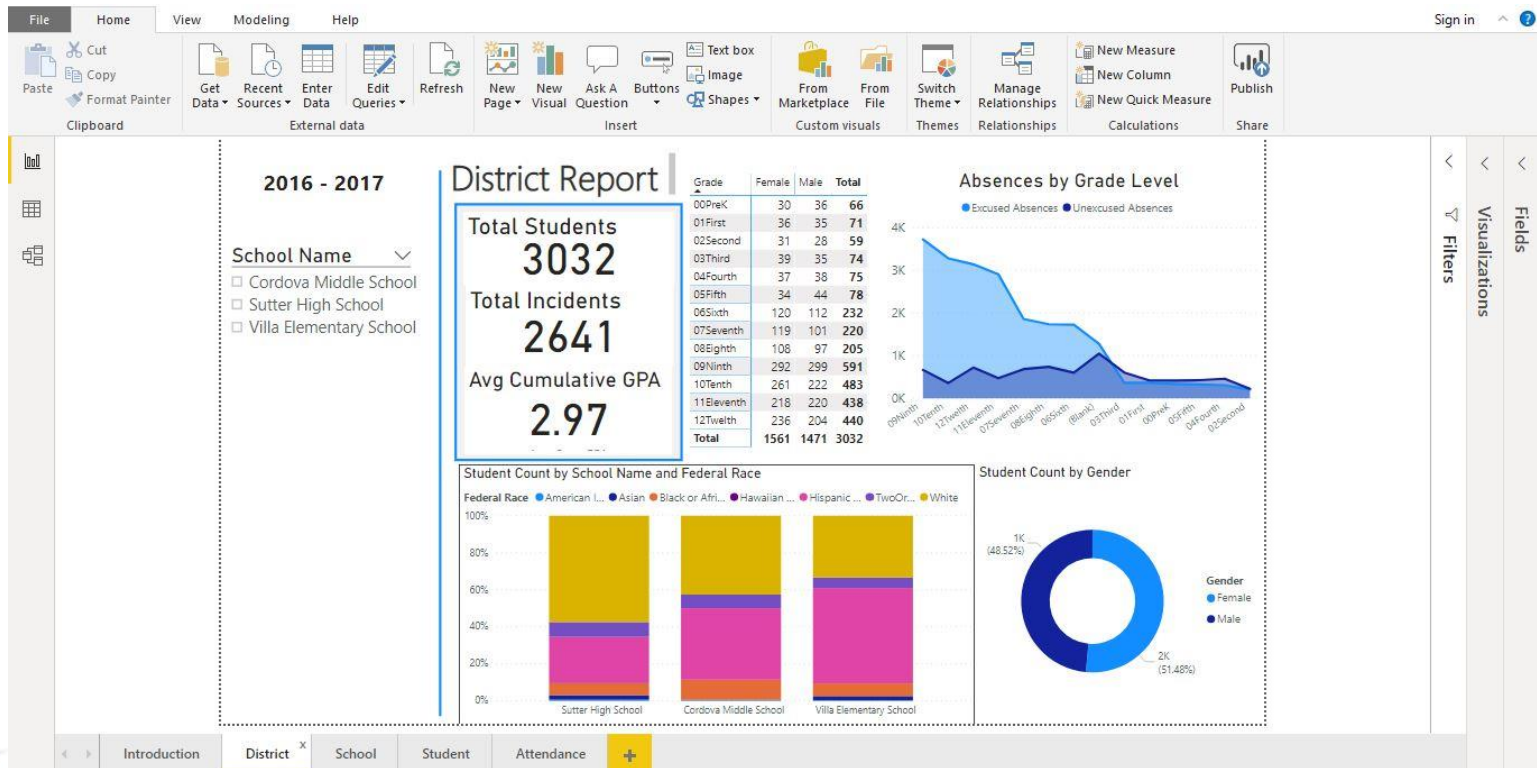


Fig 6. Snapshot of visualization report - District

In the School level report; we get insight into the school and snapshot of number of students by gender. This report represents also monthly report of unexcused absence and incident across the different schools.

The School report page provides a bird's eye view of at risk students, based on Unexcused Absence, Incident and Cumulative GPA factors. Users by applying different slicer, filters, drill down and up, be able to create accurate representation of the students absent and incident reports which can be broken down further on multiple levels.



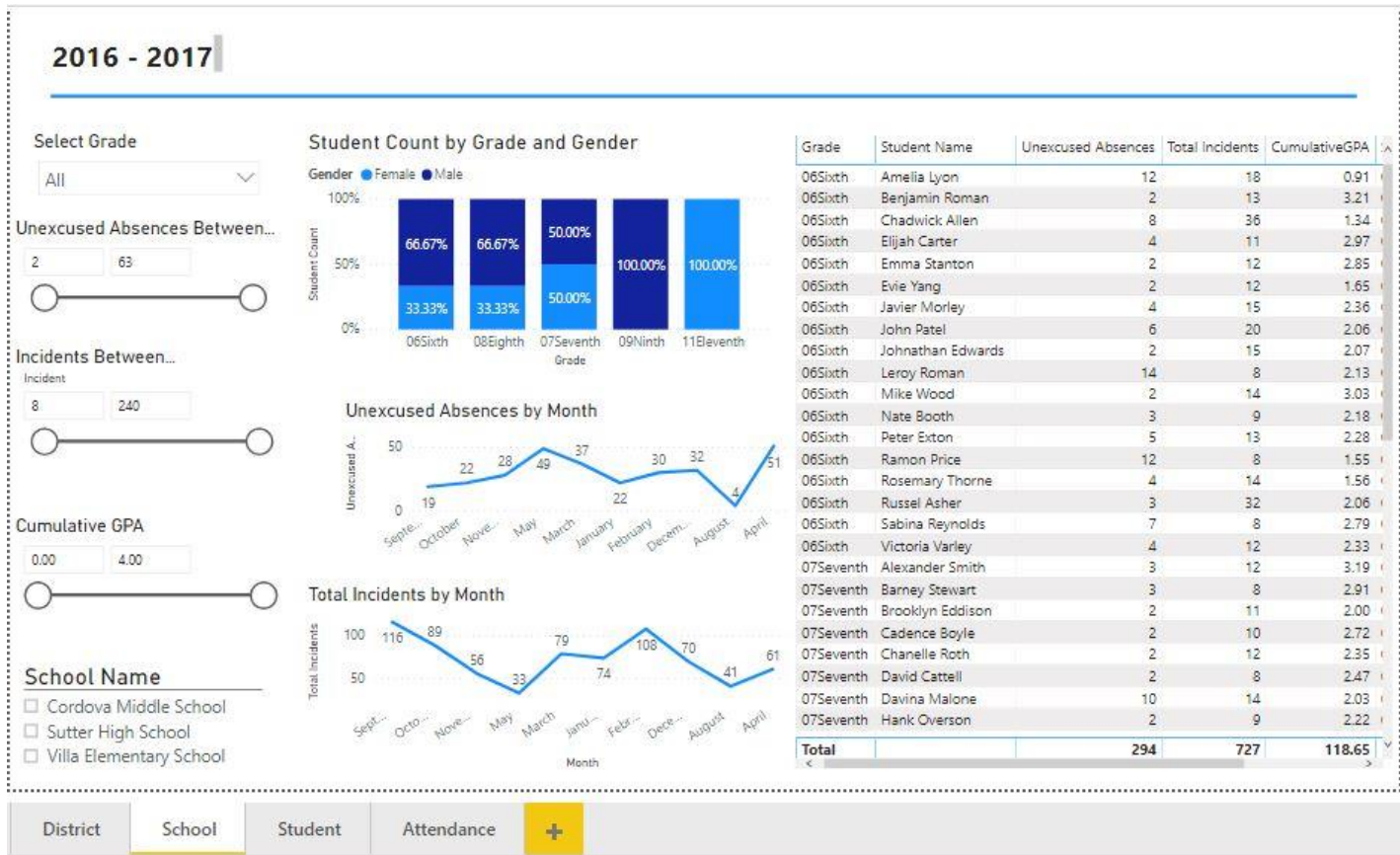


Fig 7. Snapshot of visualization report - School

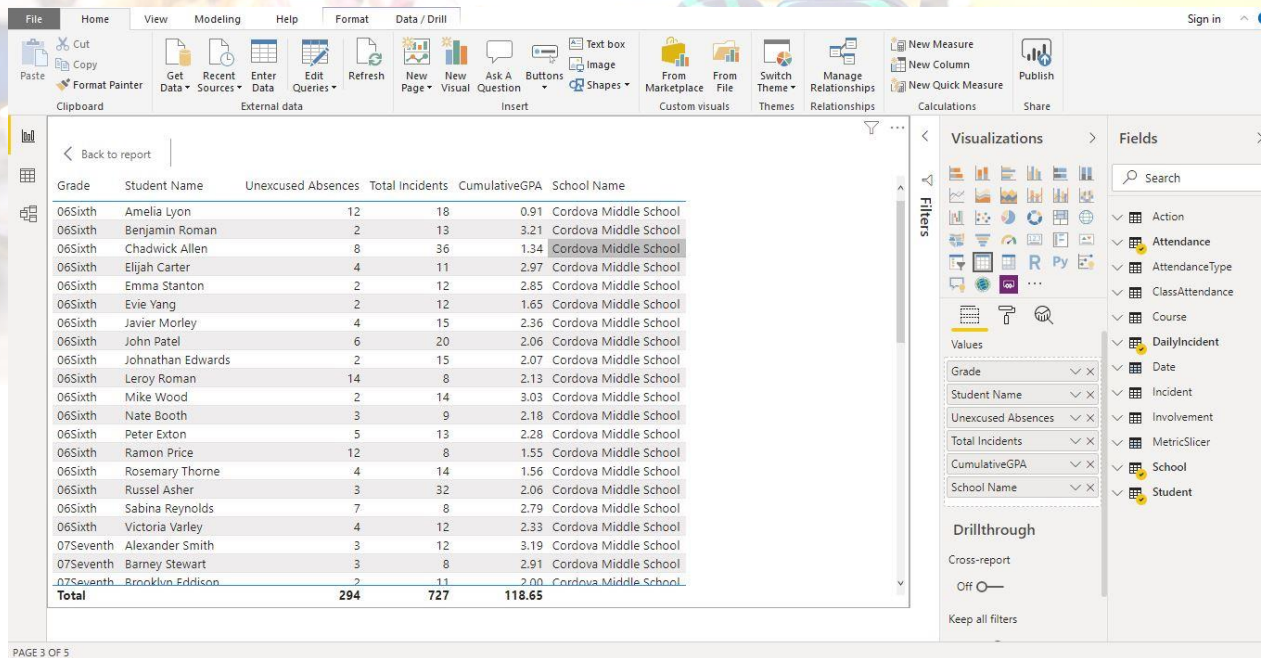
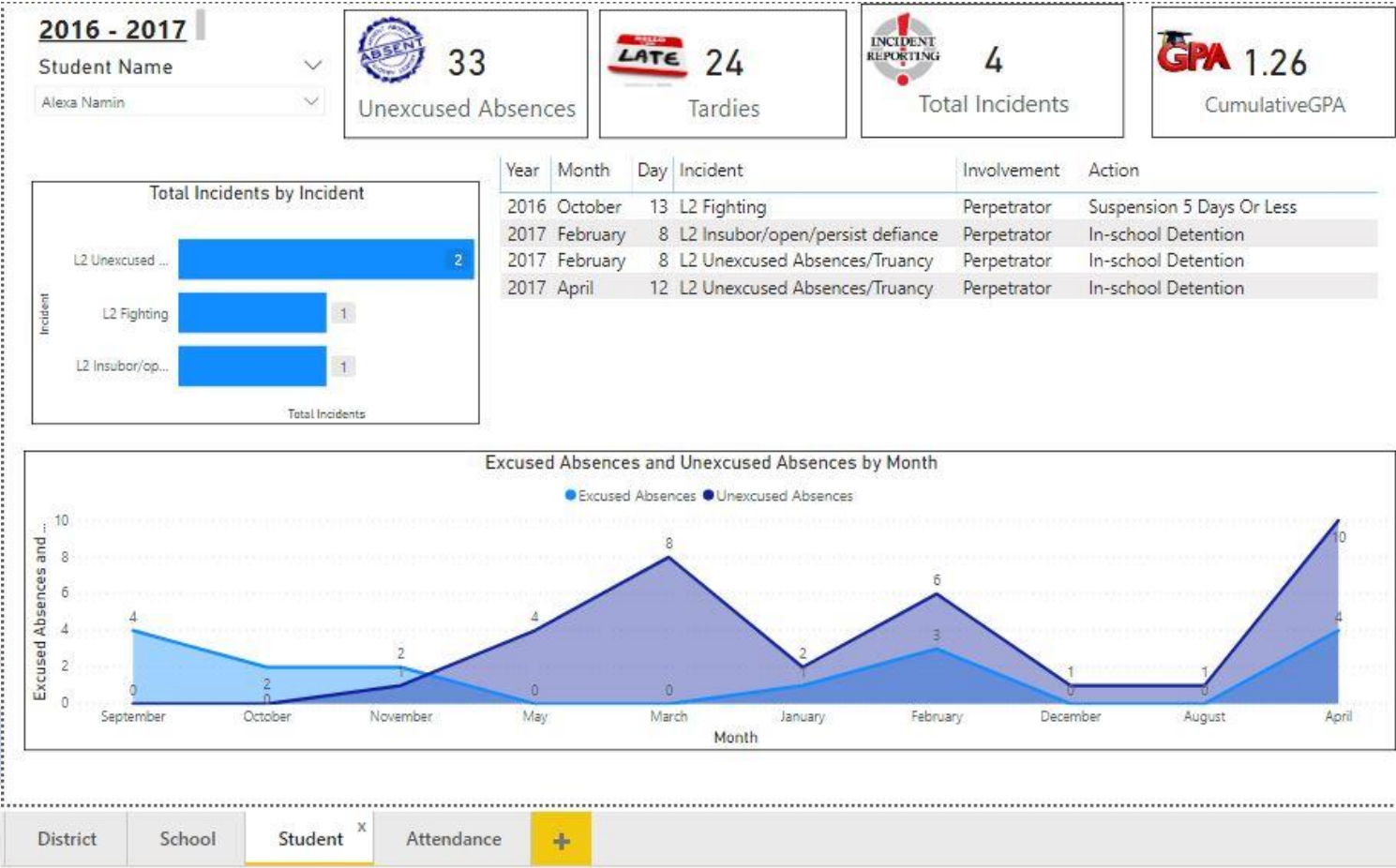


Fig 8. Snapshot of focus on details student visualization report - School

In this level, users can retrieve information of individual student and represent details information based on different risk factors. This report provides detail information about history of incidents relative to student and also compaire Unexcused and Excused absence per month.



The last level of the interactive student reports, get insight into the course by selected student and snapshot of course attendance by type. Represents of monthly individual student course attendance along with details of attendance type provide valuable information about student status.

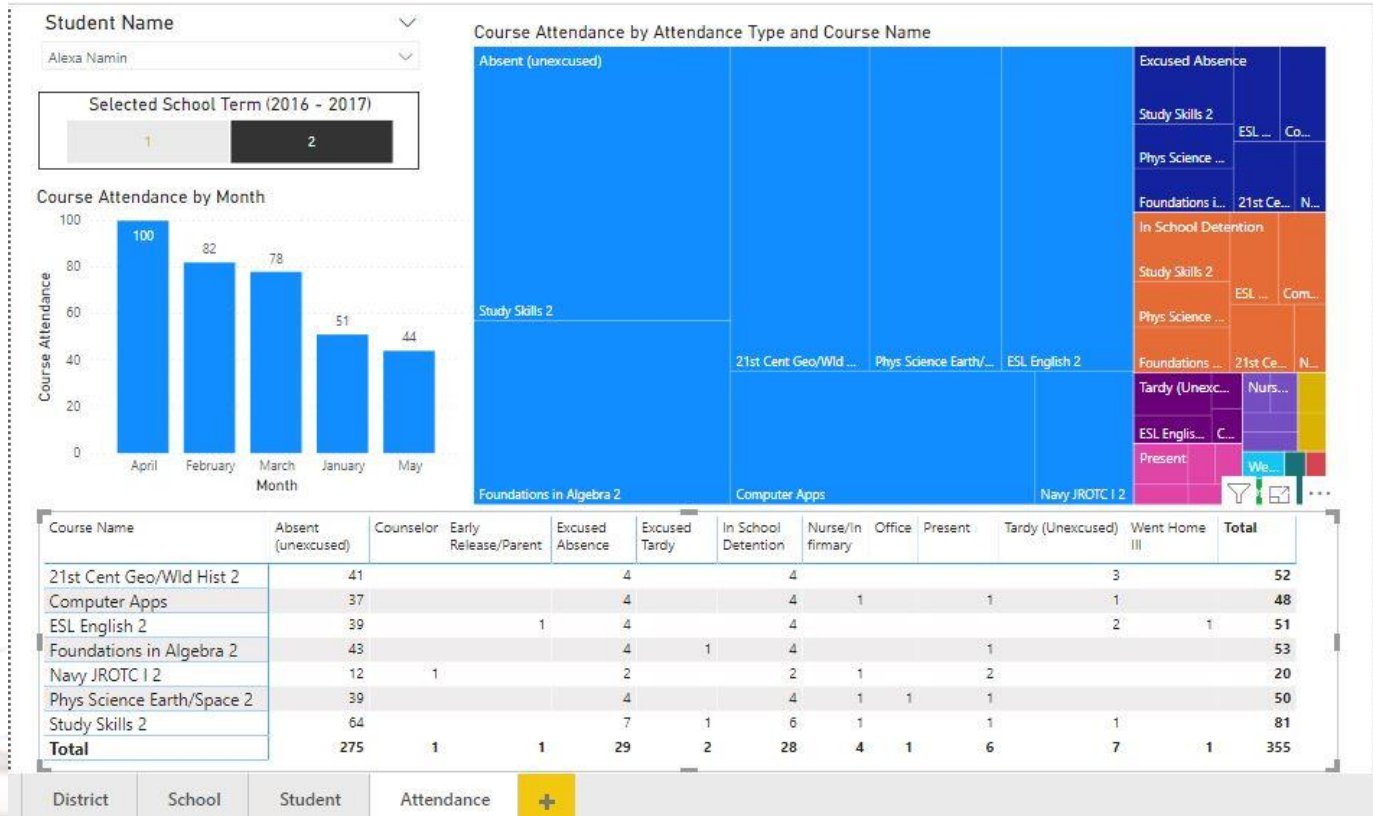


Fig 10. Snapshot of visualization report - Attendance

< Back to report

Course Name	Absent (unexcused)	Counselor	Early Release/Parent	Excused Absence	Excused Tardy	In School Detention	Nurse/In firmary	Office	Present	Tardy (Unexcused)	Went Home Ill	Total
21st Cent Geo/Wld Hist 2	41			4		4				3		52
Computer Apps	37			4		4	1		1	1		48
ESL English 2	39		1	4		4				2	1	51
Foundations in Algebra 2	43			4	1	4			1			53
Navy JROTC I 2	12	1		2		2	1		2			20
Phys Science Earth/Space 2	39			4		4	1	1	1			50
Study Skills 2	64			7	1	6	1		1	1		81
<b>Total</b>	<b>275</b>	<b>1</b>	<b>1</b>	<b>29</b>	<b>2</b>	<b>28</b>	<b>4</b>	<b>1</b>	<b>6</b>	<b>7</b>	<b>1</b>	<b>355</b>

Fig 11. Snapshot of visualization report – Attendance Focus Mode



## 8. Conclusion:

Student At-risk modeling has been proven to transform institutional data into actionable insights that teachers, faculty and staff can all use to monitor and improve results. The primary goal of 'School-Absent-Incident Tracker' is to see student's behavior, and help identify students at risk. This model try to find high value information and apply it to achieving student and campus goals. Student At-risk modeling provides robust data model solution which can help you to access accurate, actionable data that will help monitor student on-track performance. Power bi solution, can help you cleanse, integrate, identify, and analyze data to improve institutional efficiency. Other area of the educational institutions that can monitor and support by Power bi solution are: Enrollment demographics, Grades & assessments, Facilities, Class Performance and Student success forecasting.

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