Requirements specification for monitoring students process

Dominika Kiejdo, Jan Gniedziejko

1. General description of business process

a. General description:

The process of monitoring students goes as follows: Each student is assigned to the class which counts about 30 students. Classes have different profiles. Each profile has different expanded subjects and the same basics ones. Each course is on a different subject and held by the teacher. Teachers hold their lessons to their courses. On every lesson the teacher checks attendance. During each month the teachers have detailed prescriptions of what their students should know before an exam. They are free to choose which method they want to pass on the knowledge (3 options: mass- the whole class does activities together, individual- everyone does activities by their own, group- they conduct activities in groups). In the first 3 days of every month, instead of classes, students take the monitoring exams. Students need to take the exams from each course they take. The exam is the same for all of the students in every study year. The exams are signed by code, so the teacher grading the exam does not know whose work it is. For each type of exam, there's an answer key. In addition, at the end of each academic year the final exams are conducted from each course (its purpose is to check the knowledge from the whole year).

The increase in the average results from monthly monitoring exams at a level not less than 1% monthly compared to the previous month

The increase in the average students' satisfaction at a level not less than 5% annually compared to the previous academic year

b. Typical questions:

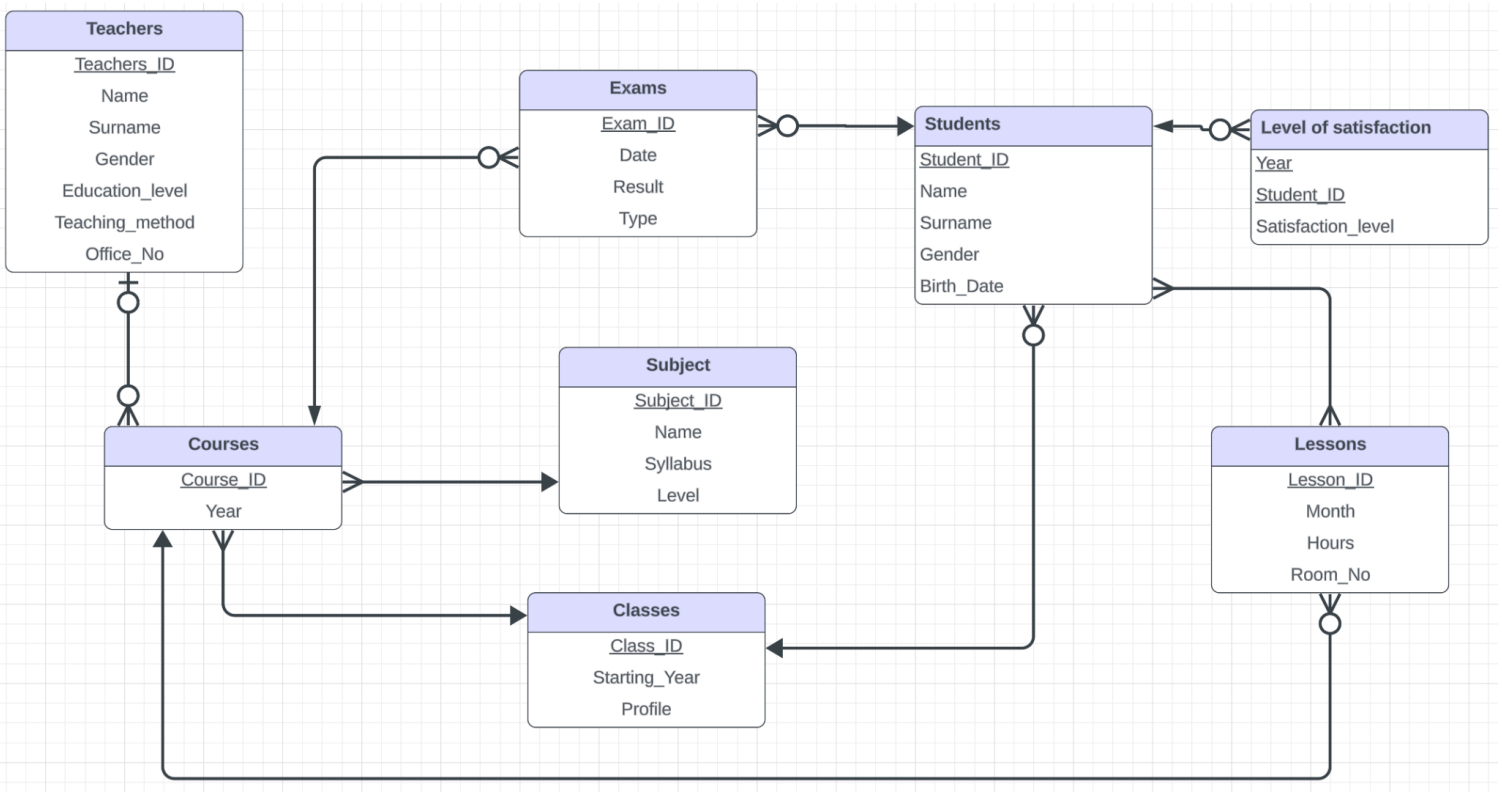
Which student has the best results from all exams carried out this month?
Which student made the biggest progress?
Do better exam results influence the satisfaction's level?
Whose teacher's students have the highest results from a certain subject?
Are exam results correlated to final exam results?
Are bad results on tests(<50%) a result of not attending the classes?
Does the size of class matter in the case of exam results?
Give the average of results for each subject this year
Compare average results this year to average results of previous year
Which teachers have the most satisfied students?

c. Data:

All data are extracted from the high school's system. This system stores info about who is signed to what class, who is conducting classes, attendance of students, results of monitoring exams, and results of matura exams. In addition more precise data about students and teachers are stored in EXCEL sheet

2. Data sources structures

toGAther



Description of Entity Sets and its components

Entity Sets	Attributes	Description	Type
Exams All of the exams that are conducted in the GA high school	**Exam_ID**	**Unique number for each monitoring exam**	**non-null, unique identifier**
	Date	**Year and month in which the exam was conducted**	**Date in format:** YYYY-MM
	Result	**The score obtained by a student on a given exam (in percentage)**	**Non-negative integer** Max value: 100
	Type	**Describes the type of the exam, whether it is final exam or just monitoring exam (that is done every month)**	**One character. Allowed values:** **- F -** Final **- M -** Monitoring (Monthly)

Entity Sets	Attributes	Description	Type
Classes Classes that are conducted for about 30 people and have the same expanded subjects	**Class_ID**	**Unique number for each class**	**non-null, unique identifier.**
	Starting_Year	**Year, when the given class was created**	**Date in format:** YYYY
	Profile	**Describes the academic focus (specialization) of the class** **e.g.:** **Mathematics-Physics**	**String of letters and spaces** Max length: 40
Teachers people that educate students and work in "Gall Anonymous" High School	**Teacher_ID**	**Unique number for each teacher**	**non-null, unique identifier.**
	Name	**Name of the teacher**	**String of letters and spaces** Max length: 30
	Surname	**Surname of the teacher**	**String of letters and spaces** Max length: 40
	Gender	**Gender of the teacher**	**One character. Allowed values:** • **M -** Male • **F -** Female
	Education Level	**Represents the education level obtained by teacher**	**String of letters and spaces** Max length: 40
	Teaching_method	**method of teaching mass(everyones does together), individualized (by themself), group (in groups)**	**One character. Allowed values:** • **M -** mass • **I -** individualized • **G -** group
	Office_No	**The number of the room, where teacher is available in his 'free' time**	**String of digits** Max length: 3
Students teenagers that attend to the "Gall Anonymous" High School	**Student_ID**	**Unique number for each student**	**non-null, unique identifier.**
	Name	**Name of the student**	**String of letters and spaces** Max length: 30
	Surname	**Surname of the student**	**String of letters and spaces** Max length: 40
	Gender	**Gender of the student**	**One character. Allowed values:** • **M -** Male • **F -** Female
	Birth_Date	**Date of birth**	**Date in format:** YYYY-MM-DD

Entity Sets	Attributes	Description	Type
Courses represents one course that is on certain subject teached by specific teacher for given class	**Course_ID**	**the identifier of exact subject that have only one teacher and is for one class,**	**non-null, unique identifier**
	Year	**The year, when this course is conducted**	**Date in format:** YYYY
Subjects represents subjects on a certain level	**Subject_ID**	**Unique number for every subject**	**non-null, unique identifier**
	Name	**name of subject**	**String of letters and spaces** Max length: 40
	Syllabus	**The description of subject**	**FILE (.PDF)**
	Level	**level of difficulty**	**One character. Allowed values:** • **E -** expanded • **B -** basic
Attendance represents the attendance of certain in a month to particular lesson	**hours attended**	**the amount of hours of a lesson**	**Non-negative integer** Max value: 10
Lessons represents lessons conducted from particular subject in one month	**Lesson_ID**	**Unique number for each conducted lesson**	**non-null, unique identifier.**
	Month	**the month during which, the lessons were conducted**	**Date in format:** MM
	Hours	**the amount of hours of a lesson**	**Non-negative integer** Max value: 10
	Room_No	**What kind of medal did the athlete earn?**	**String of digits** Max length: 3
Level of satisfaction represents students' level of satisfaction of attending our school	**Student_ID**	**Student Primary Key**	**non-null, identifier.**
	Year	**The year in which given student rate his satisfaction level**	**Date in format:** YYYY
	Satisfaction _Level	**Level of student's satisfaction**	**Non-negative integer** Max value: 10

RDB:

Exams(Exam_ID, Date, Result, Type, Student REF Students, Course REF Courses)

Students(Student_ID, Name, Surname, Gender, Birth_Date, Class REF Classes)

Teachers(Teacher_ID, Name, Surname, Gender, Education Level, Office_No, Teaching method)

Classes(Class_ID, Starting_Year, Profile)

Lessons(Lesson_ID, Month, Hours, Room_No, Course REF Courses)

Courses(Course_ID, Year, Class REF Classes, Teacher REF Teachers,, Subject REF Subjects)

Subjects(Subject_ID, Name, Syllabus, Level)

Level of satisfaction(Student_ID REF Students, Course REF Courses, Satisfaction Level)

Attendance(Student REF Students, Lesson REF Lessons, hours attended)

Lessons(LM_ID, Month, Course REF Courses, Lessons Conducted, Number of hours)

Attendance(Student REF Students, NumberOfLessons REF Lessons, NumberOfAttendance)

AM Excel

Sheet 1 : If the address or family status changes, the data in the sheet are updated (Information about students in "Gall Anonim" high schools network, each line describes one student, line 1 is a header row):

Column A - student ID (numeric, 0 decimal precision)
Column B - City, Postal code, street, house number (text)
Column C - previous school(text)
Column D - average of middle school exams (numeric)
Column E - average grades from middle school (numeric)
Column F - contact to one legal guardian (phone number)
Column G - contact to second legal guardian (phone number)
Column H - Family status (from: full family, separated family, one parent, no parents)

Sheet 2 :(Information about teachers in"Gall Anonim" high schools network, each line describes one bookstore, line 1 is a header row):

Column A - Teacher ID (numeric, 0 decimal precision)
Column B - the salary (numeric, 0 decimal precision)
Column C - contact address (text)
Column D - phone number (numeric)
Column E - name of university finished (text)
Column F - date of employment (date)

3. Scenarios of analytical problems

What have impact on the exam results?

1. Compare the exam results from each subject from this month to the previous months.
2. What are the results of the overall best-students in the current and the previous month?
3. Identify the profiles that have the overall best and worst exam results.
4. Did the average of final exams compared to results from middle school increased or decreased?
5. Compare classes that had the same subject but with different teachers, did the average results of exams change?
6. Is there a correlation between study hours per month and their exam results?
7. Compare the results in relation to the family status of students.
8. Analyze the correlation between attendance and exam results
9. How does teachers' education level impact student performance?
10. What are the results of exams in relation to the teachers' employment in a school?
11. Which method of teaching is best for a given subject?
12. Does the distance to school have an impact on exam results?
13. Does the ranking of the previous middle school have an impact on exam results?

What is the reason for the change in student satisfaction?

1. Does final grade result in change in satisfaction?
2. Is there any correlation between students’ attendance and satisfaction level?
3. Which classes have the most and the least satisfied students in the past 3 years?
4. Does a year of studying have an impact on average level satisfaction?
5. Is there a change in satisfaction between classes of different profiles?
6. What are the best rated teachers in the current and the previous year?
7. Is there any correlation between students’ satisfaction of the course and the level of education of a teacher that runs it?
8. Does the method of teaching have an impact on the satisfaction level of the teacher?

4. Data needed for analytical problems Analytical problem:

What have impact on the exam results?

1. Compare the exam results from each subject from this month to the previous months:
    - **exam results-** toGAther, table exams, column result where column type of exams=”M”
    - **month -** toGAther, table exams, column Date,
    - **subject-** toGAther, table Subject, Column Subject_ID

2. What are the results of the overall best-students in the current and the previous month?
    - **Student IDs -** toGAther, table students, column Student_ID
    - **month of exams-** toGAther, table exams, column Date,
    - **average of all exams in one month -** toGAther, table exams, Column Result
    - **exam results-** toGAther, table exams, column result where column type of exams=”M”

3. Identify the profiles that have the overall best and worst exam results.

    - **Profiles in school -** toGAther, table classes, column profile
    - **Exam result -** toGAther, table exams, column result

4. Did the average of final exam results compared to middle school final exams increased or decreased?
    - **final exam-** toGAther, table exams, column result where column type of exams=”F”
    - **exam from middle school-** GA exel, Column E

5. Compared to classes that had the same subject but with different teachers, do the average results of exams differ?
    - **exam results-** toGAther, table exams, column result where column type of exams=”M”
    - **teacher-** toGAther, table teacher, column Teacher_ID,
    - **subject-** toGAther, table Subject, Column Subject_ID

6. Is there a correlation between study hours per month and their exam performance for each subject?
    - **exam results-** toGAther, table exams, column result where column type of exams=”M”
    - **hours**- toGAther, table lesson, column hours
    - **month -** toGAther, table exams, column Date
    - **subject-** toGAther, table Subject, Column Subject_ID

7. Compare the average of results in relation to the family status of students.
    - **Student_IDs -** toGAther, table exams, column student_ID
    - **exam results-** toGAther, table exams, column result where column type of exams=”M”
    - **family status-** GA exel, Column I

8. Analyze the correlation between attendance and exam results this month to the previous
    - **exam results-** toGAther, table exams, column result where column type of exams=”M”
    - **month -** toGAther, table exams, column Date
    - **Number of lessons** - toGAther, table lesson, column Lesson_ID
    - **attendance of students -** toGAther, table Attendance, Columns Student and Lesson
    - **Attendance of students -** it is calculated by dividing attendance of students by the number of lessons conducted. We define categories of the attendance rate as following: *High Attendance* - when attendance rate >90% , *Good Attendance* - when attendance rate >75%, *Fair Attendance,* when attendance rate >50%, *Poor Attendance,* when attendance rate <=50%

9. How does teachers' education level impact student performance?
    - **exam results-** toGAther, table exams, column result where column type of exams=”M”
    - **teacher-** toGAther, table teacher, column Teacher_ID,
    - **education_level-** toGAther, table teacher, column education_level

10. Does the length of employment of teacher have impact on the exam result?(compare results from three months and see if results are getting better)
    - **exam results-** toGAther, table exams, column result where column type of exams=”M”
    - **month-** toGAther, table exams, column Date,
    - **teacher-** toGAther, table Teacher, Column Teacher_ID
    - **Date of employment**- GA exel, Column E

11. Which method gives the best result for which subject?
    - **exam results-** toGAther, table exams, column result where column type of exams=”M”
    - **method**- toGAther, table teacher, Column method
    - **subject-** toGAther, table Subject, Column Subject_ID

12. Does the distance to school have an impact on exam results?
    - **exam results-** toGAther, table exams, column result where column type of exams=”M”
    - **distance to school** - there is no such information in high school’s data sources. This information can be obtained by:
        - adding additional column to GA Excel that will contain distance to school for each student
        - distance analysis with the use of Google Maps

13. Does the ranking of the previous middle school have an impact on exam results?
    - **exam results-** toGAther, table exams, column result where column type of exams=”M”
    - **ranking of the middle school -** there is no such information in the high school’s data sources. This information can be obtained by:
        - adding additional column to GA Excel (1st sheet) that will contain ranking of the middle school that given student attended to
        - such information can be obtained from website “waszaedukacja.pl”

What is the reason for the change in student satisfaction?

1. Does final exam grade have an impact on satisfaction?
    - **exam results-** toGAther, table exams, column result where column type of exams=”F”
    - **Satisfaction_Level** - toGAther, table Level of satisfaction, Column Satisfaction_Level
    - **year**- toGAther, table Level of satisfaction, Column Year

2. Is there any correlation between students’ attendance and satisfaction level?
    - **Satisfaction_Level** - toGAther, table Level of satisfaction, Column Satisfaction_Level
    - **Student**- toGAther, table Students, Column Student ID
    - **Number of lessons conducted -** toGAther, table Lessons, Column Lesson_ID
    - **Attendance of students -** toGAther, table Attendance, Columns Student and Lesson

3. Which classes have the most and the least satisfied students in the past 3 years?
    - **Classes** - toGAther, table Level of satisfaction, Column Class_ID
    - **Year of satisfaction level -** toGAther, table Level of satisfaction, Column Year
    - **Satisfaction level -** toGAther, table Level of satisfaction, Column Satisfaction_Level

4. Does a year of studying have an impact on average level satisfaction?
    - **Satisfaction_Level** - toGAther, table Level of satisfaction, Column Satisfaction_Level
    - **Year of satisfaction level -** toGAther, table Level of satisfaction, Column Year
    - **Starting year** -toGAther, table Classes, Column Starting year

5. Is there a change in satisfaction between classes of different profiles?
    - **Satisfaction_Level** - toGAther, table Level of satisfaction, Column Satisfaction_Level
    - **Profile** -toGAther, table Classes, Column profile

6. Is satisfaction level based only on goodness of courses?
    - **Satisfaction_Level** - toGAther, table Level of satisfaction, Column Satisfaction_Level
    - **year**- toGAther, table Level of satisfaction, Column Year
    - **Student_ID**- toGAther, table Students, Column Student ID
    - **Course_goodness**- no such information

7. Is there any correlation between course goodness and the level of education of a teacher that runs it?
    - **teacher-** toGAther, table teacher, column Teacher_ID,
    - **education_level-** we define 4 categories in education levels: Teaching Certification, Bachelor, Master, PhD. The information about it is stored in toGAther, table teacher, column education_level,
    - **Teacher attitude Rate** - no such information

8. Rank methods of teaching from the highest average of course goodness?
    - **teacher-** toGAther, table teacher, column Teacher_ID,
    - **method-** toGAther, table teacher, column education_level
    - **Course_goodness**- no such information

It is not possible to build a BI system to support in solving these analytical problems without introducing additional activities in “Gall Anonymous” high school. We suggest introducing an additional anonymous survey for each student. Such questionnaire should contain at least question like:

- How do you rate the goodness of the course?
- How do you rate the teacher’s attitude towards students?

and it has to be repeated as many times as the number of courses. This questionnaire is added to questionnaire about overall satisfaction level at the end of each academic year, and entered to the excel sheet by appointed employees:

Column A – Class_ID
Column B – Course ID
Column C – Goodness Rate (numeric from 1 to 5)
Column D – Teacher's attitude Rate (numeric from 1 to 5)