**DBI202 – LEARNING CENTER MANAGEMENT SYSTEM**

**Lecturer:** DO THI THU NGA

**Class:** AI2003

**Group**: 2

**Authors:**

Le anh duc| HE200666

tran xuan tung | HE200683

tran minh dung | HE200667

nguyen tien dat | HE199203

vu duc minh | HE201162

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# Problem Statement

## Current State

In the development of educational centers, especially foreign language centers, information management has become increasingly complex and requires a lot of accuracy and consistency. However, many centers today are still using manual management methods such as Excel spreadsheets, paper records or separate software that is not integrated with each other. This leads to a series of problems:

* Student information is scattered, difficult to control, and prone to loss or distortion of data such as scores, class schedules, or tuition payment status.
* Scheduling, assigning classes, and coordinating instructors become more complicated as the number of classes and students increases, leading to overlapping hours, empty classrooms, or teacher overload.
* Asynchronous teacher management causes tracking of teaching information, student feedback, or teaching quality to be missed or performed ineffectively.
* Difficulty in updating, organizing courses, curriculum, and accompanying documents.
* Collecting tuition fees and tracking finances largely by hand makes reporting time-consuming, error-prone, and lacking transparency.
* Difficulty in communication between teachers and students, leading to a situation where some students do not receive information.
* Manual systems can’t meet the needs as the center expands new learning programs.
* From these practical issues, building a centralized and effective management system is needed. EducateDB is proposed as a solution to better automate the management process of the center, reduces administrative work, increases data accuracy and improves the experience for both students and staffs in the center.

## Objectives

The main goal of the project is to build a good database system capable of managing the operations of a learning center. We need to:

* Design and implement an database system that supports the management of all important components of the center: students, teachers, classes, courses, schedules, finances.
* Manage student information including data, class schedules, grades, and tuition status.
* Manage teacher information such as personal profiles, teaching schedules, class assignments, and student feedback.
* Organize and manage courses at each level, including curriculum, materials, and entry requirements.
* Automate class placement, teaching assignments, and student progress tracking.
* Record and analyze scores and attendance in a transparent and easy-to-reference manner.
* Manage tuition collection, monitor and report on financial status accurately and promptly.
* Facilitate student reporting, activity reporting and administrative statistics easily for the center's management board.
* Minimize dependence on manual operations, minimizing unnecessary errors.
* Aim to build a scalable system, ready to meet the needs when the center grows in the number of classes, subjects, or new branches in the future.

# Functional Specification

## Table-level Operations

* **Student, teacher**: Has attributes such as id, name, age, and personal account to manage personal information of students/ teachers.
* **course, course\_material**: Manage courses infomation and teaching materials needed for those courses.
* **class, class\_student**: Manage enrollment and data from each student and their class.
* **exam, grade**: Manage information about scores and assignments/tests.
* **payment:** Manage accounting information/ tuition of each student.

## System Operational Logic

### Course and Document Management:

**Description**: The center needs to create and manage a list of English courses (eg IELTS, TOEIC). Each course has detailed information such as description, tuition, and can be updated. Each course comes with specific learning materials (books, videos, audio files).

**In the database:**

* The Course table stores information about each course.
* The Course\_Material table stores the materials, and the course\_id column in this table creates a 1-Many relationship: a Course can have many Course\_Materials.

### Classroom and Teacher Management:

**Description**: To implement a course, the center opens specific classes. Each class is a version of a course, has its own schedule, room, start/end date, and is taught by a teacher. One teacher can teach many different classes.

**In the database:**

* The Teacher table stores their personal information.
* The Class table stores information about classes. The course\_id column associates a class with a Course (1-Many relationship from Course to Class), and the teacher\_id column associates a class with a Teacher (1-Many relationship from Teacher to Class).

### Student Management and Enrollment:

**Description**: Student information management center. Students can register (enroll) in many different classes, and a class can also have many students participating.

**In the database:**

* The Student table stores their personal information.
* The Many-To-Many relationship between Student and Class is resolved using the intermediate table Class\_Student. Each row in this table is an enrollment record, showing which students are enrolled in which classes.

### Examination and Grading Operations:

**Description**: During the course, a class will have tests (midterm, final, quiz). After each exam, each participating student will receive a corresponding score.

**In the database:**

* The Exam table stores exam information and is linked to a Class (1-Many relationship from Class to Exam).
* The Grade table stores scores of each student during a given test. It has a Many-to-1 relationship with both Student and Exam, meaning a score must belong to a specific student and a specific exam.

### Tuition Payment Procedure:

**Description**: Students make tuition payments for the courses they enroll in. The system needs to record these payments, including amount, method, status, and associate the payment with the corresponding student and course.

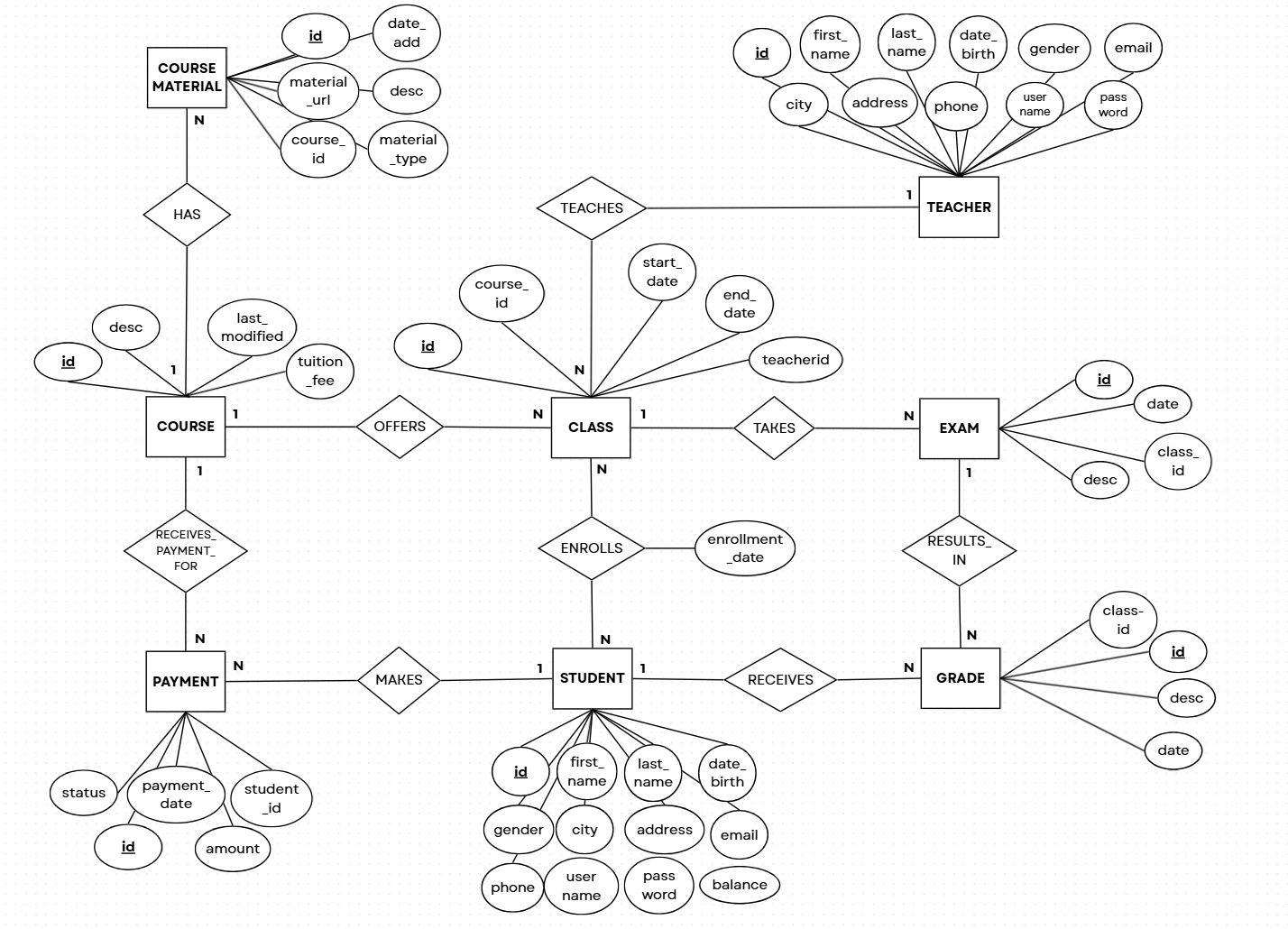
**In the database:**

* The student\_id and course\_id columns in this table create a Many-to-1 relationship with Student and Course, indicating which student paid for which course.

## Attribute Definition

* Teacher: **id (PK)**, first\_name, last\_name, date\_birth, gender, email, phone, address, city, description, user\_name, password
* Student: **id (PK**), first\_name , last\_name), date\_birth, gender, email, phone, address, city, user\_name, password, balance, created\_date
* Course: **id (PK)**, description, last\_modified, tuition\_fee
* Course\_Material: **id (PK)**, **course\_id (FK),** description, material\_type, material\_url, date\_add
* Class: **id (PK)**, start\_date, end\_date, **teacher\_id (FK), course\_id (FK)**, schedule\_info, room\_number
* Class\_Student**: class\_id (PK, FK)**, **student\_id (PK, FK), enrollment**\_date
* Exam: **id (PK)**, date, description, **class\_id (FK)**, exam\_type, duration\_minutes
* Grade: **id (PK)**, value , **student\_id (FK), exam\_id (FK), class\_id (FK)**, date
* Payment: **id (PK)**, payment\_date, amount , status, **student\_id (FK), course\_id (FK)**, payment\_method, notes

# ER model of the system



# Data Dictionary

## Teacher

|  |  |  |  |
| --- | --- | --- | --- |
| **Column Name** | **Data Type** | **Check** | **Key/Index/Constraint** |
| id | Varchar(5) | LIKE 'TE[0-9][0-9][0-9]' | PK, Not null |
| first\_name | Nvarchar(50) |  | Not null |
| last\_name | Nvarchar(50) |  | Not null |
| date\_birth | Date |  |  |
| gender | Nvarchar(3) | IN (N'Nam', N'Nữ') |  |
| e-mail | Varchar(100) | LIKE '%\_@\_\_%.\_\_%' | Unique, Not null |
| phone | Varchar(20) |  |  |
| address | Nvarchar(255) |  |  |
| city | Nvarchar(50) |  |  |
| description | Nvarchar(255) |  |  |
| user\_name | Varchar(50) |  | Unique, Not null |
| password | Varchar(255) |  | Not null |

* **SQL:**

CREATE TABLE Teacher (

id VARCHAR(5) PRIMARY KEY,

first\_name NVARCHAR(50) NOT NULL,

last\_name NVARCHAR(50) NOT NULL,

date\_birth DATE,

gender NVARCHAR(3),

email VARCHAR(100) UNIQUE NOT NULL,

phone VARCHAR(20),

address NVARCHAR(255),

city NVARCHAR(50) DEFAULT N'Hà Nội',

description NVARCHAR(255),

user\_name VARCHAR(50) UNIQUE NOT NULL,

password VARCHAR(255) NOT NULL,

CONSTRAINT CK\_Teacher\_ID CHECK (id LIKE 'TE[0-9][0-9][0-9]'),

CONSTRAINT CK\_Teacher\_Gender CHECK (gender IN (N'Nam', N'Nữ')),

CONSTRAINT CK\_Teacher\_Email CHECK (email LIKE '%\_@\_\_%.\_\_%')

## Student

|  |  |  |  |
| --- | --- | --- | --- |
| **Column Name** | **Data Type** | **Check** | **Key/Index/Constraint** |
| id | Varchar(5) | LIKE 'ST[0-9][0-9][0-9]' | PK, Not null |
| first\_name | Nvarchar(50) |  | Not null |
| last\_name | Nvarchar(50) |  | Not null |
| date\_birth | Date |  |  |
| gender | Nvarchar(3) | IN (N'Nam', N'Nữ') |  |
| e-mail | Varchar(100) | LIKE '%\_@\_\_%.\_\_%' | Unique, Not null |
| phone | Varchar(20) |  |  |
| address | Nvarchar(255) |  |  |
| city | Nvarchar(50) |  |  |
| user\_name | Varchar(50) |  | Unique, Not null |
| password | Varchar(255) |  | Not null |
| balance | Decimal(12,2) | >= 0 |  |
| created\_date | Date |  |  |

* **SQL:**

CREATE TABLE Student (

id VARCHAR(5) PRIMARY KEY,

first\_name NVARCHAR(50) NOT NULL,

last\_name NVARCHAR(50) NOT NULL,

date\_birth DATE,

gender NVARCHAR(3),

email VARCHAR(100) UNIQUE NOT NULL,

phone VARCHAR(20),

address NVARCHAR(255),

city NVARCHAR(50) DEFAULT N'Hà Nội',

user\_name VARCHAR(50) UNIQUE NOT NULL,

password VARCHAR(255) NOT NULL,

balance DECIMAL(12,2),

created\_date DATE,

CONSTRAINT CK\_Student\_ID CHECK (id LIKE 'ST[0-9][0-9][0-9]'),

CONSTRAINT CK\_Student\_Gender CHECK (gender IN (N'Nam', N'Nữ')),

CONSTRAINT CK\_Student\_Email CHECK (email LIKE '%\_@\_\_%.\_\_%'),

CONSTRAINT CK\_Student\_Balance CHECK (balance >= 0))

## Course

|  |  |  |  |
| --- | --- | --- | --- |
| **Column Name** | **Data Type** | **Check** | **Key/Index/Constraint** |
| id | Nvarchar(50) |  | PK, Not null |
| description | Nvarchar(MAX) |  |  |
| last\_modified | Datetime2 |  |  |
| tuition\_fee | Decimal(12,2) | >= 0 |  |

* **SQL:**

CREATE TABLE Course(

id NVARCHAR(50) PRIMARY KEY,

description NVARCHAR(MAX),

last\_modified DATETIME2,

tuition\_fee DECIMAL(12,2),

CONSTRAINT CK\_Course\_TuitionFee CHECK (tuition\_fee >= 0)

);

## Course\_Material

|  |  |  |  |
| --- | --- | --- | --- |
| **Column Name** | **Data Type** | **Check** | **Key/Index/Constraint** |
| id | Varchar(5) | LIKE 'CM[0-9][0-9][0-9]' | PK, Not null |
| course\_id | Nvarchar(50) |  | FK references Course(id), Not null |
| description | Nvarchar(MAX) |  |  |
| material\_type | Nvarchar(50) | IN (N'Sách giáo trình', N'Sách bài tập', N'Tệp âm thanh', N'Video Links', N'Học liệu', N'Sách luyện đề', N'Tài liệu tham khảo') |  |
| material\_url | Varchar(255) |  |  |
| date\_add | Date |  |  |

* **SQL:**

CREATE TABLE Course\_Material (

id VARCHAR(5) PRIMARY KEY,

course\_id NVARCHAR(50) NOT NULL,

description NVARCHAR(MAX),

material\_type NVARCHAR(50),

material\_url VARCHAR(255),

date\_add DATE,

FOREIGN KEY (course\_id) REFERENCES Course(id),

CONSTRAINT CK\_Course\_Material\_ID CHECK (id LIKE 'CM[0-9][0-9][0-9]'),

CONSTRAINT CK\_Course\_Material\_Type CHECK (material\_type IN (N'Sách giáo trình', N'Sách bài tập', N'Sách từ vựng', N'Tệp âm thanh', N'Video Links', N'Học liệu', N'Sách luyện đề', N'Tài liệu tham khảo')));

## Class

|  |  |  |  |
| --- | --- | --- | --- |
| **Column Name** | **Data Type** | **Check** | **Key/Index/Constraint** |
| id | Nvarchar(20) |  | PK, Not null |
| start\_date | Date |  |  |
| end\_date | Date | >= start\_date |  |
| teacher\_id | Varchar(5) |  | FK references Teacher(id) |
| course\_id | Nvarchar(50) |  | FK references Course(id), Not null |
| schedule\_info | Nvarchar(100) |  |  |
| room\_number | Nvarchar(20) | LIKE 'P[1-3][0-9][0-9]' |  |

* **SQL:**

CREATE TABLE Class (

id NVARCHAR(20) PRIMARY KEY,

start\_date DATE,

end\_date DATE,

teacher\_id VARCHAR(5),

course\_id NVARCHAR(50) NOT NULL,

schedule\_info NVARCHAR(100),

room\_number NVARCHAR(20),

FOREIGN KEY (teacher\_id) REFERENCES Teacher(id),

FOREIGN KEY (course\_id) REFERENCES Course(id),

CONSTRAINT CK\_Class\_Dates CHECK (end\_date >= start\_date),

CONSTRAINT CK\_Class\_RoomNumber CHECK (room\_number LIKE 'P[1-3][0-9][0-9]'))

## Class\_Student

|  |  |  |  |
| --- | --- | --- | --- |
| **Column Name** | **Data Type** | **Check** | **Key/Index/Constraint** |
| class\_id | Nvarchar(20) |  | PK, FK references Class(id), Not null |
| student\_id | Varchar(5) |  | PK, FK references Student(id), Not null |
| enrollment\_date | Date |  |  |

* **SQL:**

CREATE TABLE Class\_Student (

class\_id NVARCHAR(20) NOT NULL,

student\_id VARCHAR(5) NOT NULL,

enrollment\_date DATE,

PRIMARY KEY (class\_id, student\_id),

FOREIGN KEY (class\_id) REFERENCES Class(id),

FOREIGN KEY (student\_id) REFERENCES Student(id))

## Exam

|  |  |  |  |
| --- | --- | --- | --- |
| **Column Name** | **Data Type** | **Check** | **Key/Index/Constraint** |
| id | Varchar(5) | LIKE 'EX[0-9][0-9][0-9]' | PK, Not null |
| date | Date |  |  |
| description | Nvarchar(MAX) |  |  |
| class\_id | Nvarchar(20) |  | FK references Class(id), Not null |
| exam\_type | Nvarchar(50) | IN (N'Midterm', N'Final', N'Quiz', N'Mock Test', N'Speaking Test') |  |
| duration\_minutes | Int | > 0 |  |

* **SQL:**

CREATE TABLE Exam (

id VARCHAR(5) PRIMARY KEY,

date DATE,

description NVARCHAR(MAX),

class\_id NVARCHAR(20) NOT NULL,

exam\_type NVARCHAR(50),

duration\_minutes INT,

FOREIGN KEY (class\_id) REFERENCES Class(id),

CONSTRAINT CK\_Exam\_ID CHECK (id LIKE 'EX[0-9][0-9][0-9]'),

CONSTRAINT CK\_Exam\_Type CHECK (exam\_type IN (N'Midterm', N'Final', N'Quiz', N'Mock Test', N'Speaking Test')),

CONSTRAINT CK\_Exam\_Duration CHECK (duration\_minutes > 0))

## Grade

|  |  |  |  |
| --- | --- | --- | --- |
| **Column Name** | **Data Type** | **Check** | **Key/Index/Constraint** |
| id | Varchar(5) | LIKE 'GR[0-9][0-9][0-9]' | PK, Not null |
| value | Decimal(4,2) |  | >= 0.0 AND <= 10.0, PK, Not null |
| student\_id | Varchar(5) |  | FK references Student(id), Not null |
| exam\_id | Varchar(5) |  | FK references Exam(id), Not null |
| class\_id | Nvarchar(20) |  | FK reference Class(id) |
| date | Date |  |  |

* **SQL:**

CREATE TABLE Grade (

id VARCHAR(5) PRIMARY KEY,

value DECIMAL(4,2) NOT NULL,

student\_id VARCHAR(5) NOT NULL,

exam\_id VARCHAR(5) NOT NULL,

class\_id NVARCHAR(20),

date DATE,

FOREIGN KEY (student\_id) REFERENCES Student(id),

FOREIGN KEY (exam\_id) REFERENCES Exam(id),

FOREIGN KEY (class\_id) REFERENCES Class(id),

CONSTRAINT CK\_Grade\_ID CHECK (LIKE id 'GR[0-9][0-9][0-9]'),

CONSTRAINT CK\_Grade\_Value CHECK (value >= 0.00 AND value <= 10.00)

## Payment

|  |  |  |  |
| --- | --- | --- | --- |
| **Column Name** | **Data Type** | **Check** | **Key/Index/Constraint** |
| id | Varchar(5) | LIKE 'PA[0-9][0-9][0-9]' | PK, Not null |
| payment\_date | Date |  |  |
| amount | Decimal(12,2) |  | > 0, Not null |
| status | Nvarchar(20) | IN (N'Success', N'Failed') | Not null |
| student\_id | Varchar(5) |  | FK references Student(id), Not null |
| course\_id | Nvarchar(50) |  | FK references Course(id), Not null |
| payment\_method | Nvarchar(50) | IN (N'Tiền mặt', N'Chuyển khoản', N'Thẻ tín dụng', N'Momo') |  |
| notes | Nvarchar(255) |  |  |

* **SQL:**

CREATE TABLE Payment (

id VARCHAR(5) PRIMARY KEY,

payment\_date DATE,

amount DECIMAL(12,2) NOT NULL,

status NVARCHAR(20) NOT NULL,

student\_id VARCHAR(5) NOT NULL,

course\_id NVARCHAR(50) NOT NULL,

payment\_method NVARCHAR(50),

notes NVARCHAR(255),

FOREIGN KEY (student\_id) REFERENCES Student(id),

FOREIGN KEY (course\_id) REFERENCES Course(id),

CONSTRAINT CK\_Payment\_ID CHECK (id LIKE 'PA[0-9][0-9][0-9]'),

CONSTRAINT CK\_Payment\_Amount CHECK (amount > 0),

CONSTRAINT CK\_Payment\_Status CHECK (status IN (N'Success', N'Failed')),

CONSTRAINT CK\_Payment\_Method CHECK (payment\_method IN (N'Tiền mặt', N'Chuyển khoản', N'Thẻ tín dụng', N'Momo'))

# Physical Implementation

## Views

### V\_Class\_Details

* **Purpose:** To provide an easy-to-read, detailed overview of each class's information.
* **Usecase:** Helps counselors, academic administrators, or teachers quickly look up information about a class without having to write complex JOIN statements between the Class, Course, and Teacher tables. For example, when a student asks about the class "IELTS7S1S23", the staff can simply query this View to immediately know which course the class belongs to, which teacher is in charge, what the schedule and classroom are like.

CREATE VIEW V\_Class\_Details AS

SELECT

cl.id AS ClassID,

cl.schedule\_info AS Schedule,

cl.room\_number AS Room,

co.id AS CourseID,

co.description AS CourseDescription,

t.last\_name + N' ' + t.first\_name AS TeacherFullName

FROM Class cl

JOIN Course co ON cl.course\_id = co.id

LEFT JOIN Teacher t ON cl.teacher\_id = t.id

### V\_Student\_Grades

* **Purpose:** Generate a detailed student score report, combining information from the student, exam, and score.
* **Usecase:** Extremely useful for teachers and academic departments when they need to view or export student transcripts. We query this View to immediately have a clear list including student name, exam name, exam type, exam date and score instead of having to JOIN 3 tables Grade, Student, Exam.

CREATE VIEW V\_Student\_Grades AS

SELECT

s.id AS StudentID,

s.last\_name + N' ' + s.first\_name AS StudentFullName,

e.description AS ExamDescription,

e.exam\_type AS ExamType,

e.date AS ExamDate,

g.value AS GradeValue

FROM Grade g

JOIN Student s ON g.student\_id = s.id

JOIN Exam e ON g.exam\_id = e.id

### V\_Course\_Summary

* **Purpose:** Provide a summary report on the status of each course, including key metrics such as number of classes and number of students.
* **Usecase**: Helps us manage the center to evaluate the effectiveness and popularity of the courses. Based on this View, we can easily answer questions like: "How many classes does the IELTS 7.0+ course have and how many students does it attract?", thereby making business decisions such as opening more classes, adjusting marketing or changing tuition fees.

CREATE VIEW V\_Course\_Summary AS

SELECT

c.id AS CourseID,

c.description AS CourseDescription,

c.tuition\_fee AS TuitionFee,

COUNT(DISTINCT cl.id) AS NumberOfClasses,

COUNT(DISTINCT cs.student\_id) AS TotalEnrollments

FROM Course c

LEFT JOIN Class cl ON c.id = cl.course\_id

LEFT JOIN Class\_Student cs ON cl.id = cs.class\_id

GROUP BY c.id, c.description, c.tuition\_fee

### V\_Student\_Grades

* **Purpose:** To aggregate and display the workload of each teacher.
* **Usecase:** Based on this View, we can quickly know which teachers are teaching multiple classes, which teachers have free schedules, or which teachers are teaching different courses to plan assignments for the next semesters.

CREATE VIEW V\_Teacher\_Workload AS

SELECT

t.id AS TeacherID,

t.last\_name + N' ' + t.first\_name AS TeacherFullName,

ISNULL(COUNT(DISTINCT cl.id), 0) AS AssignedClasses,

ISNULL(COUNT(DISTINCT cl.course\_id), 0) AS DistinctCoursesTaught

FROM Teacher t

LEFT JOIN Class cl ON t.id = cl.teacher\_id

GROUP BY t.id, t.first\_name, t.last\_name

## Triggers/ Procedures/ Functions

### Functions

#### fn\_GetStudentFullName

* **Purpose:** Takes in StudentID and returns the student's full name in "Full Name" format (eg: "Nguyen Van An").
* **Usecase:** Ensure consistency in name display across the system and simplify queries.

CREATE FUNCTION dbo.fn\_GetStudentFullName (@StudentID VARCHAR(5))

RETURNS NVARCHAR(101)

AS

BEGIN

DECLARE @FullName NVARCHAR(101);

SELECT @FullName = last\_name + N' ' + first\_name

FROM Student

WHERE id = @StudentID;

RETURN @FullName;

END

#### fn\_CalculateStudentAge

* **Purpose:** Calculate a person's current age based on their date of birth.
* **Usecase:** Useful when needing to create demographic statistics reports or filter data by age.

CREATE FUNCTION dbo.fn\_CalculateStudentAge (@DateOfBirth DATE)

RETURNS INT

AS

BEGIN

RETURN DATEDIFF(YEAR, @DateOfBirth, GETDATE()) -

CASE WHEN (MONTH(@DateOfBirth) > MONTH(GETDATE())) OR

(MONTH(@DateOfBirth) = MONTH(GETDATE()) AND

DAY(@DateOfBirth) > DAY(GETDATE())) THEN 1 ELSE 0 END;

END

#### Fn\_GetClassesByTeacher

* **Purpose:** Get a detailed list of classes that a particular teacher is teaching.
* **Usecase:** Provide flexible information for teachers and administrators to view and analyze each teacher's class list.

CREATE FUNCTION dbo.fn\_GetClassesByTeacher (@TeacherID VARCHAR(5))

RETURNS TABLE

AS

RETURN

(

SELECT

cl.id AS ClassID,

cl.schedule\_info AS Schedule,

co.description AS CourseDescription

FROM Class cl

JOIN Course co ON cl.course\_id = co.id

WHERE cl.teacher\_id = @TeacherID);

### Procedures

#### usp\_GetStudentEnrollments

* **Purpose:** Get a list of all classes that a particular student is enrolled in.
* **Usecase:** Helps student portal or counselors quickly look up a student's class schedule.

CREATE PROCEDURE usp\_GetStudentEnrollments @StudentID VARCHAR(5)

AS

BEGIN

SELECT ClassID, Schedule, CourseDescription, TeacherFullName

FROM V\_Class\_Details

WHERE ClassID IN (SELECT class\_id FROM Class\_Student

WHERE student\_id = @StudentID);

END

#### usp\_UpdateStudentBalance

* **Purpose:** To provide a secure way to fund student accounts.
* **Usecase:** Assist accounting staff in managing student balances, ensuring accuracy in financial transactions.

CREATE PROCEDURE usp\_UpdateStudentBalance

@StudentID VARCHAR(5),

@AmountToAdd DECIMAL(12,2)

AS

BEGIN

DECLARE @NewBalance DECIMAL(12,2);

IF NOT EXISTS (SELECT 1 FROM Student WHERE id = @StudentID)

BEGIN

PRINT N'Lỗi: Không tìm thấy sinh viên với ID ' + @StudentID;

RETURN;

END

UPDATE Student SET balance = ISNULL(balance, 0) + @AmountToAdd WHERE id = @StudentID;

SELECT @NewBalance = balance FROM Student WHERE id = @StudentID;

PRINT N'Đã cập nhật số dư cho sinh viên ' + @StudentID + N'. Số dư mới: ' + CAST(@NewBalance AS VARCHAR);

END

#### usp\_ProcessCoursePayment

* **Purpose:** Encapsulate the entire complex business logic of paying tuition for a course.
* **Practical Operations:** Very important for the finance department, helping to process payment transactions consistently, check balances and record transaction status.

CREATE PROCEDURE usp\_ProcessCoursePayment

@PaymentID VARCHAR(5), @StudentID VARCHAR(5), @CourseID NVARCHAR(50),

@PaymentAmount DECIMAL(12,2), @PaymentMethod NVARCHAR(50) = NULL, @TransactionNotes NVARCHAR(255) = NULL

AS

BEGIN

DECLARE @StudentBalance DECIMAL(12,2), @CourseTuition DECIMAL(12,2), @PaymentStatus NVARCHAR(20);

DECLARE @CurrentPaymentDate DATE = GETDATE();

SELECT @StudentBalance = ISNULL(balance, 0) FROM Student WHERE id = @StudentID;

SELECT @CourseTuition = tuition\_fee FROM Course WHERE id = @CourseID;

IF @StudentBalance IS NULL OR @CourseTuition IS NULL

BEGIN

SET @PaymentStatus = N'Failed'; SET @TransactionNotes = ISNULL(@TransactionNotes + N'; ', N'') + N'Lỗi: Sinh viên hoặc Khóa học không hợp lệ.';

INSERT INTO Payment (id, payment\_date, amount, status, student\_id, course\_id, payment\_method, notes) VALUES (@PaymentID, @CurrentPaymentDate, @PaymentAmount, @PaymentStatus, @StudentID, @CourseID, @PaymentMethod, @TransactionNotes);

PRINT N'Thanh toán thất bại: Sinh viên hoặc Khóa học không hợp lệ.'; RETURN;

END

IF @PaymentAmount = @CourseTuition AND @StudentBalance >= @PaymentAmount

BEGIN

SET @PaymentStatus = N'Success'; UPDATE Student SET balance = balance - @PaymentAmount WHERE id = @StudentID;

SET @TransactionNotes = ISNULL(@TransactionNotes + N'; ', N'') + N'Thanh toán thành công. Số dư đã cập nhật.';

END

ELSE IF @StudentBalance < @PaymentAmount

BEGIN

SET @PaymentStatus = N'Failed'; SET @TransactionNotes = ISNULL(@TransactionNotes + N'; ', N'') + N'Lý do: Số dư không đủ.';

END

ELSE

BEGIN

SET @PaymentStatus = N'Failed'; SET @TransactionNotes = ISNULL(@TransactionNotes + N'; ', N'') + N'Lý do: Số tiền thanh toán không khớp học phí.';

END

INSERT INTO Payment (id, payment\_date, amount, status, student\_id, course\_id, payment\_method, notes)

VALUES (@PaymentID, @CurrentPaymentDate, @PaymentAmount, @PaymentStatus, @StudentID, @CourseID, @PaymentMethod, @TransactionNotes);

PRINT N'Thanh toán ' + @PaymentID + N' cho sinh viên ' + @StudentID + N' - Trạng thái: ' + @PaymentStatus;

END

### Triggers

#### trg\_UpdateCourseLastModified

* **Activation table:** Course\_Material
* **Purpose:** Automatically update a course's last\_modified field whenever any information about that course's documents is changed.
* **Practical Operations:** Helps the system always have a trace of the last update related to a course, supporting management and testing.

CREATE TRIGGER trg\_UpdateCourseLastModified ON Course\_Material

AFTER UPDATE

AS

BEGIN

SET NOCOUNT ON;

UPDATE Course SET last\_modified = GETDATE()

WHERE id IN (SELECT course\_id FROM inserted);

END

#### trg\_PreventStudentDeletionWithBalance

* **Activation table:** Student
* **Purpose:** Prevent deletion of a student if their account still has funds (balance > 0).
* **Practical Operations:** Ensure financial integrity and avoid loss of important data when the account has a balance.

CREATE TRIGGER trg\_PreventStudentDeletionWithBalance ON Student

INSTEAD OF DELETE

AS

BEGIN

SET NOCOUNT ON;

DECLARE @StudentIDToDelete VARCHAR(5), @StudentBalance DECIMAL(12,2);

SELECT @StudentIDToDelete = id, @StudentBalance = balance FROM deleted;

IF @StudentBalance > 0

BEGIN

PRINT N'Hành động bị hủy: Không thể xóa sinh viên ' + @StudentIDToDelete + N' vì họ vẫn còn số dư trong tài khoản.';

RETURN;

END

ELSE

BEGIN

DELETE FROM Student WHERE id = @StudentIDToDelete;

END

END

GO

#### trg\_LogStudent (Creation, Update, Deletion)

* **Activation table:** Student
* **Purpose:** Automatically record important actions (create, update, delete) on student data into a separate AuditLog table.
* **Practical Operations:** Create a basic auditing mechanism, helping administrators track important student data changes.

CREATE TRIGGER trg\_LogStudentCreation ON Student

AFTER INSERT

AS

BEGIN

SET NOCOUNT ON;

INSERT INTO AuditLog (TableName, RecordID, ActionType, ChangeDetails)

SELECT 'Student', i.id, 'INSERT', 'A new student was created: ' + i.last\_name + N' ' + i.first\_name

FROM inserted i;

END

GO

CREATE TRIGGER trg\_LogStudentUpdate ON Student

AFTER UPDATE

AS

BEGIN

SET NOCOUNT ON;

DECLARE @details NVARCHAR(MAX) = N'';

IF UPDATE(email)

SELECT @details = @details + 'Email changed from "' + d.email + '" to "' + i.email + '". '

FROM inserted i JOIN deleted d ON i.id = d.id;

IF UPDATE(phone)

SELECT @details = @details + 'Phone changed from "' + ISNULL(d.phone, 'NULL') + '" to "' + ISNULL(i.phone, 'NULL') + '". '

FROM inserted i JOIN deleted d ON i.id = d.id;

IF UPDATE(balance)

SELECT @details = @details + 'Balance changed from ' + CAST(ISNULL(d.balance, 0) AS VARCHAR) + ' to ' + CAST(ISNULL(i.balance, 0) AS VARCHAR) + '. '

FROM inserted i JOIN deleted d ON i.id = d.id;

IF @details <> ''

BEGIN

INSERT INTO AuditLog (TableName, RecordID, ActionType, ChangeDetails)

SELECT 'Student', id, 'UPDATE', @details

FROM inserted;

END

END

GO

CREATE TRIGGER trg\_LogStudentDeletion ON Student

AFTER DELETE

AS

BEGIN

SET NOCOUNT ON;

INSERT INTO AuditLog (TableName, RecordID, ActionType, ChangeDetails)

SELECT 'Student', d.id, 'DELETE', 'Student record deleted. Name: ' + d.last\_name + N' ' + d.first\_name + N', Email: ' + d.email

FROM deleted;

END

GO

## SQL Queries

### Find students who have paid but have not been placed in a class.

* **Requirement:** List students who have successfully paid for a course but have not been enrolled in any classes of that course.

SELECT

s.id AS StudentID,

dbo.fn\_GetStudentFullName(s.id) AS StudentFullName,

p.course\_id AS Unenrolled\_Paid\_Course

FROM Payment p

JOIN Student s ON p.student\_id = s.id

WHERE p.status = 'Success' AND NOT EXISTS (

SELECT 1 FROM Class\_Student cs JOIN Class cl ON cs.class\_id = cl.id

WHERE cs.student\_id = p.student\_id AND cl.course\_id = p.course\_id);

### Find classes with the same teacher.

* **Requirement:** Make a list of pairs of different classes taught by the same teacher. The report should display TeacherFullName, ClassID\_1, and ClassID\_2.

SELECT

t.last\_name + N' ' + t.first\_name AS TeacherFullName,

c1.id AS ClassID\_1,

c2.id AS ClassID\_2

FROM Class c1

JOIN Class c2 ON c1.teacher\_id = c2.teacher\_id

JOIN Teacher t ON c1.teacher\_id = t.id

WHERE c1.id < c2.id AND c1.teacher\_id IS NOT NULL;

### Reports student performance in a specific course.

* **Requirement:** For the course 'IELTS\_70', generate a report that displays the name of each enrolled student, their average score, highest score, and lowest score across all exams taken in this course.

WITH StudentGradesInCourse AS (

SELECT cs.student\_id, g.value

FROM Class\_Student cs

JOIN Class cl ON cs.class\_id = cl.id

JOIN Exam e ON cl.id = e.class\_id

JOIN Grade g ON e.id = g.exam\_id AND cs.student\_id = g.student\_id

WHERE cl.course\_id = N'IELTS\_70')

SELECT s.last\_name + N' ' + s.first\_name AS StudentFullName,

AVG(sg.value) AS AverageScore, MAX(sg.value) AS HighestScore, MIN(sg.value) AS LowestScore

FROM StudentGradesInCourse sg

JOIN Student s ON sg.student\_id = s.id

GROUP BY s.id, s.first\_name, s.last\_name ORDER BY AverageScore DESC

### Top 2 classes with the highest and lowest average scores.

* **Requirement:** Create a report with two parts: Top 2 classes with the highest average student scores and Top 2 classes with the lowest average student scores.

WITH Average AS (SELECT

cl.id AS ClassID, co.description AS CourseDescription, t.last\_name + N' ' + t.first\_name AS TeacherFullName,

AVG(g.value) AS AverageGrade

FROM Grade g

JOIN Exam e ON g.exam\_id = e.id JOIN Class cl ON e.class\_id = cl.id

JOIN Course co ON cl.course\_id = co.id LEFT JOIN Teacher t ON cl.teacher\_id = t.id

GROUP BY cl.id, co.description, t.last\_name, t.first\_name)

, A AS (SELECT TOP 2 \* FROM Average ORDER BY AverageGrade DESC)

, B AS (SELECT TOP 2 \* FROM Average ORDER BY AverageGrade)

SELECT \* FROM A UNION ALL SELECT \* FROM B ORDER BY AverageGrade

# Conclusion

* The EducateDB project is a solution to modernize the management process at tutoring and learning centers, especially languages center. Through the design and construction of an integrated database system, the project has solved many problems that still exist in traditional management methods such as data errors, schedule duplication, difficulties in financial management and communication.
* The system not only supports the effective management of students, teachers, courses, schedules, documents, exams and tuition fees, but also aims for automation, scalability and user-friendliness. The project contributes to improving the center's operational efficiency, reducing administrative workload and improving the learner experience.
* In the future, EducateDB can continue to be developed to integrate more advanced functions such as online learning, teaching quality assessment, or connection with other learning platforms, better meeting management and training needs in the digital age.