# CS 353
# DATABASE SYSTEMS
# PROJECT DESIGN REPORT
# GROUP 36

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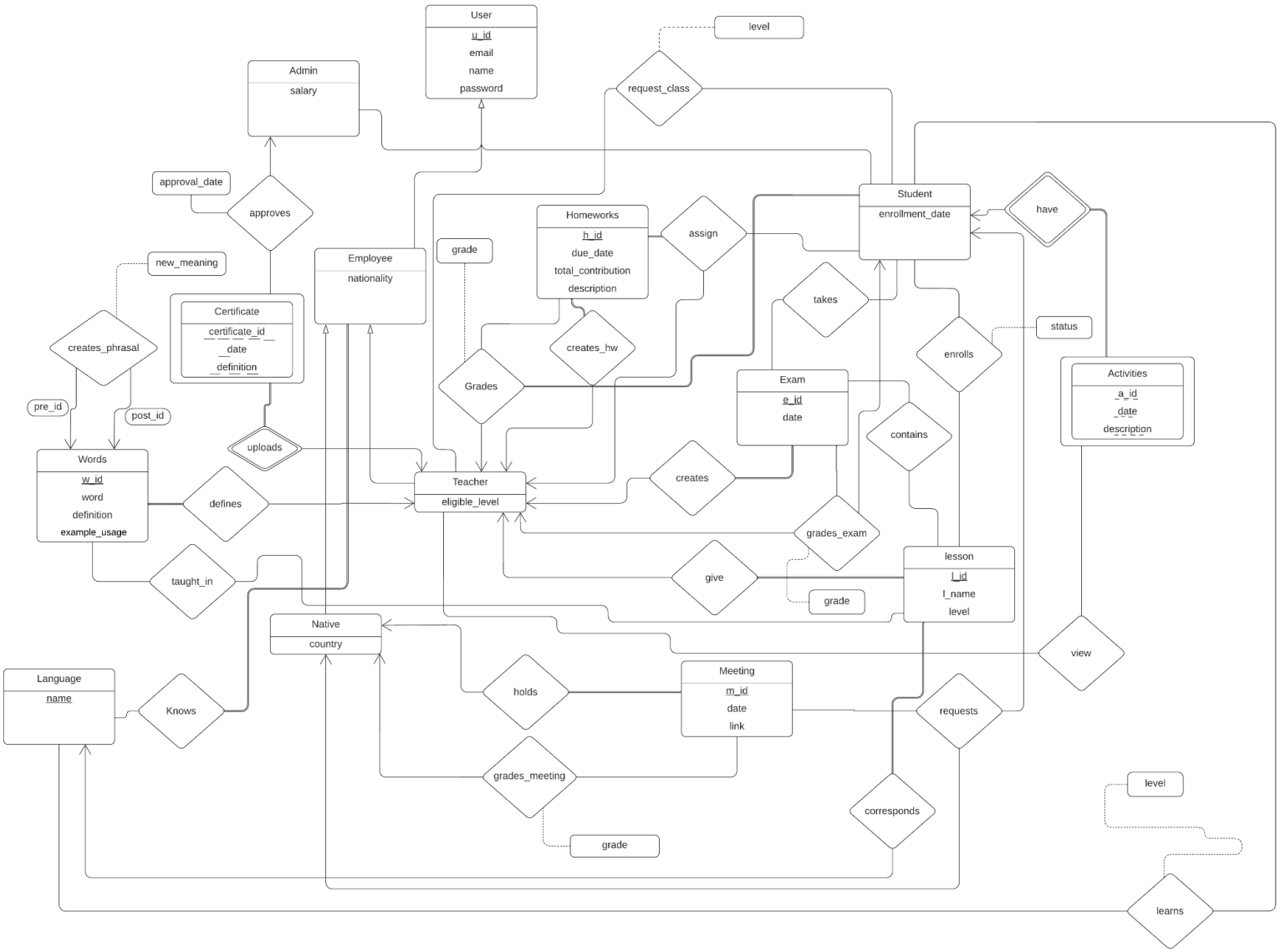
# 1. Revised E/R Diagram



- Language attribute is removed from lesson and employee; instead, a relation called Language is created.
- A three-way relation is created between student, teacher and homework. Now our model successfully implies the function of the teacher which is assigning homework to a specific student.
- A three-way relation is created between student, native and meeting. Now our model successfully implies the function of the student which is requesting a meeting from a specific native speaker.
- Primary key in the user has changed to an u_id instead of email.
- Name and id attributes in student, employee, and admin now moved to the user
- Level attribute of the student removed since we added a new association between language and student as "learns"
- Nationality attribute added to the employee and country attribute added to the Native so that our Native relation is not empty right now.
- Status attribute added to the enroll, so that we can keep track of which lesson request is approved and which are not.
- Create homework relation is created between homework and teacher

# 2. Table Schemas

## 2.1 User

**Relational Model**
User(<u>u_id</u>, email, name, password)

**Primary Key**
u_id

**Candidate Key**
u_id

**Functional Dependencies**
u_id → email, name, password

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE User(
        u_id CHAR(8) NOT NULL,
        email VARCHAR(32) NOT NULL,
        name VARCHAR(32) NOT NULL,
        password VARCHAR(32) NOT NULL,
        PRIMARY KEY(u_id)) ENGINE = INNODB;
```

## 2.2 Admin

**Relational Model**

Admin(u_id, salary)
**u_id is foreign key to User.**

**Candidate Keys**
u_id

**Functional Dependencies:**
u_id→ salary

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE Admin (
        u_id CHAR(8) PRIMARY KEY,
        salary FLOAT,
        FOREIGN KEY(u_id) REFERENCES User(u_id) ON UPDATE CASCADE
ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.3 Employee

**Relational Model**

Employee(u_id, nationality)
**u_id is a foreign key to user**

**Candidate Keys**
u_id

**Primary Key**
u_id

**Functional Dependencies:**
u_id → nationality

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE Employee (
        u_id CHAR(8) PRIMARY KEY,
        nationality VARCHAR(32) NOT NULL,
        FOREIGN KEY(u_id) REFERENCES User(u_id) ON UPDATE CASCADE
ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.4 Student

**Relational Model**

Student(u_id, enrollment_date)
**Email is foreign key to User.**

**Candidate Keys**
u_id

**Primary Key**
u_id

**Functional Dependencies:**
u_id → enrollment_date

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE Student (
        u_id CHAR(8),
        enrollment_date DATE NOT NULL,
        PRIMARY KEY(u_id),
        FOREIGN KEY(u_id) REFERENCES User(u_id) ON UPDATE CASCADE
ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.5 Native

**Relational Model**

Native(u_id, country)
**u_id is foreign key to User.**

**Candidate Keys**
u_id

**Primary Key**
u_id

**Functional Dependencies:**
u_id → country

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE Native (
        u_id CHAR(8),
        nationality VARCHAR(32) NOT NULL,
        PRIMARY KEY(u_id),
        FOREIGN KEY(u_id) REFERENCES User(u_id) ON UPDATE CASCADE
ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.6 Teacher

**Relational Model**

Teacher(u_id, eligible_level)
**u_id is foreign key to Employee.**

**Candidate Keys**
u_id

**Primary Key**
u_id

**Functional Dependencies:**
u_id → eligible_level

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE Teacher (
        u_id CHAR(8) PRIMARY KEY,
        eligible_level VARCHAR(32) NOT NULL,
        FOREIGN KEY(u_id) REFERENCES Employee(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.7 request_class

**Relational Model**

request_class(t_id, s_id, level)
**t_id foreign is key to Teacher(u_id).**
**s_id foreign key to Student(u_id).**

**Candidate Keys**
t_id, s_id

**Primary Key**
t_id, s_id

**Functional Dependencies:**
t_id, s_id → level

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE request_class (
        t_id CHAR(8),
        s_id CHAR(8),
        level VARCHAR(32) NOT NULL,
        PRIMARY KEY(t_id,s_id),
        FOREIGN KEY(t_id) REFERENCES Teacher(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(s_id) REFERENCES Student(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.8 Homeworks

**Relational Model**

Homeworks(h_id, due_date, total_contribution, description)

**Candidate Keys**
h_id

**Primary Key**
h_id

**Functional Dependencies:**
h_id → due_date, total_contribution, description

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE Homeworks (
        h_id CHAR(8),
        description VARCHAR(32),
        due_date VARCHAR(32) NOT NULL,
        total_contribution INT NOT NULL,
        PRIMARY KEY(h_id)) ENGINE=INNODB;
```

## 2.9 creates_hw

**Relational Model**

creates_hw(h_id, u_id)
**u_id foreign is key to User.**
**h_id is foreign key to Homeworks.**

**Candidate Keys**
h_id, u_id
**Primary Key**
h_id, u_id

**Functional Dependencies:**
There is no functional dependency.

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE creates_hw (
        h_id CHAR(8) NOT NULL,
        u_id CHAR(8) NOT NULL,
        PRIMARY KEY(h_id, u_id),
        FOREIGN KEY(u_id) REFERENCES Teacher(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(h_id) REFERENCES Homeworks(h_id) ON UPDATE
CASCADE ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.10 assign

**Relational Model**

assign(t_id, s_id, h_id)
**t_id is foreign key to Teacher(u_id).**
**s_id is foreign key to Student(u_id)**
**h_id is foreign key to Homeworks.**

**Candidate Keys**
t_id, s_id, h_id
**Primary Key**
t_id, s_id, h_id

**Functional Dependencies:**
There is no functional dependency.

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE assign (
        t_id CHAR(8),
        s_id CHAR(8),
        h_id CHAR(8),
        PRIMARY KEY(t_id, s_id, h_id),
        FOREIGN KEY(t_id) REFERENCES Teacher(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(s_id) REFERENCES Student(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(h_id) REFERENCES Homeworks(h_id) ON UPDATE
CASCADE ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.11 Grades

**Relational Model**

Grades(t_id, s_id, h_id, grade)
**t_id is foreign key to Teacher(u_id).**
**s_id is foreign key to Student(u_id).**
**h_id is foreign key to Homeworks.**

**Candidate Keys**
t_id, s_id, h_id
**Primary Key**
t_id, s_id, h_id

**Functional Dependencies:**
t_id, s_id, h_id→ t_id, s_id, h_id, grade

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE Grades (
        t_id CHAR(8) NOT NULL,
        s_id CHAR(8) NOT NULL,
        h_id CHAR(8) NOT NULL,
        grade INT NOT NULL,
        PRIMARY KEY(t_id, s_id, h_id),
        FOREIGN KEY(t_id) REFERENCES Teacher(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(s_id) REFERENCES Student(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(h_id) REFERENCES Homeworks(h_id) ON UPDATE
CASCADE ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.12 Exam

**Relational Model**

Exam(e_id,date)

**Candidate Keys**
e_id

**Primary Key**
e_id

**Functional Dependencies:**
e_id → date

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE Exam (
        e_id CHAR(8),
        date DATE NOT NULL,
        PRIMARY KEY(e_id)) ENGINE=INNODB;
```

## 2.13 Takes

**Relational Model**

Takes( e_id,us_id)
**e_id is foreign key to Exam.**
**u_id is foreign key to Student.**

**Candidate Keys**
e_id, u_id
**Primary Key**
e_id, u_id

**Functional Dependencies:**
There is no functional dependency.

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE Takes (
        e_id CHAR(8) NOT NULL,
        s_id CHAR(8),
        PRIMARY KEY(e_id, s_id),
        FOREIGN KEY(e_id) REFERENCES Exam(e_id) ON UPDATE CASCADE
ON DELETE RESTRICT,
        FOREIGN KEY(email) REFERENCES Student(u_is) ON UPDATE
CASCADE ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.14 creates

**Relational Model**

creates(e_id, u_id)
**e_id is foreign key to Exam.**
**u_id is foreign key to Teacher.**

**Candidate Keys**
e_id, u_id
**Primary Key**
e_id, u_id

**Functional Dependencies:**
There is no functional dependency.

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE creates (
        e_id CHAR(8) NOT NULL,
        u_id CHAR(8) NOT NULL,
        PRIMARY KEY(e_id,u_id),
        FOREIGN KEY(e_id) REFERENCES Exam(e_id) ON UPDATE CASCADE
ON DELETE RESTRICT,
        FOREIGN KEY(u_id) REFERENCES Teacher(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.15 grades_exam

**Relational Model**

grades_exam(t_id, s_id e_id, grade)
**t_id is foreign key to Teacher(u_id).**
**s_id is foreign key to Student(u_id).**
**e_id is foreign key to Exam.**

**Candidate Keys**
t_id, s_id e_id
**Primary Key**
t_id, s_id e_id

**Functional Dependencies:**
t_id, s_id e_id → grade

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE grades_exam (
        t_id VARCHAR(32) NOT NULL,
        s_id CHAR(8) NOT NULL,
        e_id CHAR(8) NOT NULL,
        grade INT NOT NULL,
        PRIMARY KEY(t_id, s_id e_id),
        FOREIGN KEY(t_id) REFERENCES Teacher(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(s_id) REFERENCES Student(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(e_id) REFERENCES Exam(e_id) ON UPDATE CASCADE
ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.16 lesson

**Relational Model**

lesson(<u>l_id,</u> l_name, level)

**Candidate Keys**
l_id

**Primary Key**
l_id

**Functional Dependencies:**
l_id → l_name, level

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE lesson (
        l_id CHAR(8),
        l_name VARCHAR(32)  NOT NULL,
        level VARCHAR(32) NOT NULL,
        PRIMARY KEY(l_id)) ENGINE=INNODB;
```

## 2.17 give

**Relational Model**

give(u_id, l_id)
**u_id is foreign key to Teacher.**
**l_id is foreign key to lesson.**

**Candidate Keys**
u_id, l_id
**Primary Key**
u_id, l_id

**Functional Dependencies:**
There are no functional dependencies.

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE give (
        u_id VARCHAR(32) NOT NULL,
        l_id CHAR(8) NOT NULL,
        PRIMARY KEY(u_id, l_id),
        FOREIGN KEY(u_id) REFERENCES Teacher(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(l_id) REFERENCES lesson(l_id) ON UPDATE CASCADE
ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.18 contains

**Relational Model**

contains(e_id, l_id)
**e_id is foreign key to Exam.**
**l_id is foreign key to lesson.**

**Candidate Keys**
e_id, l_id
**Primary Key**
e_id, l_id

**Functional Dependencies:**
There are no functional dependencies.

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE contains (
        e_id CHAR(8) NOT NULL,
        l_id CHAR(8) NOT NULL,
        PRIMARY KEY(e_id, l_id),
        FOREIGN KEY(e_id) REFERENCES Exam(e_id) ON UPDATE CASCADE
ON DELETE RESTRICT,
        FOREIGN KEY(l_id) REFERENCES lesson(l_id) ON UPDATE CASCADE
ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.19 enrolls

**Relational Model**

enrolls(u_id, l_id, status)
**u_id is foreign key to Student.**
**l_id is foreign key to lesson.**

**Candidate Keys**
u_id, l_id
**Primary Key**
u_id, l_id

**Functional Dependencies:**
u_id, l_id → status

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE enrolls (
        u_id CHAR(8) NOT NULL,
        l_id CHAR(8) NOT NULL,
        status VARCHAR(32),
        PRIMARY KEY(u_id, l_id),
        FOREIGN KEY(u_id) REFERENCES Student(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(l_id) REFERENCES lesson(l_id) ON UPDATE CASCADE
ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.20 Meeting

**Relational Model**

Meeting(m_id, date, link)

**Candidate Keys**
m_id, date

**Primary Key**
m_id

**Functional Dependencies:**
m_id →date, link

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE Meeting (
        m_id CHAR(8) NOT NULL,
        date DATE  NOT NULL,
        link VARCHAR(32)  NOT NULL,
        PRIMARY KEY(m_id)) ENGINE=INNODB;
```

## 2.21 requests

**Relational Model**

requests(m_id, s_id, n_id)
**m_id is foreign key to Meeting.**
**s_id is foreign key to Student(u_id).**
**n_id is foreign key to Native(u_id).**

**Candidate Keys**
m_id, s_id, n_id
**Primary Key**
m_id, s_id, n_id

**Functional Dependencies:**
There are no functional dependencies.

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE requests (
        m_id CHAR(8) NOT NULL,
        s_id CHAR(8) NOT NULL,
        n_id CHAR(8) NOT NULL,
        PRIMARY KEY(m_id, s_id, n_id),
        FOREIGN KEY(m_id) REFERENCES Meeting(m_id) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(s_id) REFERENCES Student(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(n_id) REFERENCES Native(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.22 holds

**Relational Model**

holds(u_id, m_id)
**u_id is foreign key to Native.**
**m_id is foreign key to Meeting.**

**Candidate Keys**
u_id, m_id
**Primary Key**
u_id, m_id

**Functional Dependencies:**
There are no functional dependencies.

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE holds (
        u_id CHAR(8),
        m_id CHAR(8),
        PRIMARY KEY(u_id, m_id),
        FOREIGN KEY(u_id) REFERENCES Native(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(m_id) REFERENCES Meeting(m_id) ON UPDATE
CASCADE ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.23 grades_meeting

**Relational Model**

grades_meeting(u_id, m_id, grade)
**u_id is foreign key to Native.**
**m_id is foreign key to Meeting.**

**Candidate Keys**
u_id, m_id
**Primary Key**
u_id, m_id

**Functional Dependencies:**
u_id, m_id → grade

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE grades_meeting (
        u_id CHAR(8),
        m_id CHAR(8),
        grade FLOAT,
        PRIMARY KEY(u_id, m_id),
        FOREIGN KEY(u_id) REFERENCES Native(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(m_id) REFERENCES Meeting(m_id) ON UPDATE
CASCADE ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.24 Words

**Relational Model**

Words(w_id, word, definition, example_usage)

**Candidate Keys**
w_id

**Primary Key**
w_id

**Functional Dependencies:**
There is no functional dependency.

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE Words (
        w_id CHAR(8) NOT NULL,
        word VARCHAR(32)  NOT NULL,
        definition VARCHAR(32)  NOT NULL,
        example_usage VARCHAR(32)  NOT NULL,
        PRIMARY KEY(w_id)) ENGINE=INNODB;
```

## 2.25 taught_in

**Relational Model**

taught_in(w_id, l_id)
**w_id is foreign key to Words.**
**l_id is foreign key to lesson.**

**Candidate Keys**
w_id, l_id
**Primary Key**
w_id, l_id

**Functional Dependencies:**
There is no functional dependency.

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE taught_in (
        w_id CHAR(8) NOT NULL,
        l_id CHAR(8) NOT NULL,
        PRIMARY KEY(w_id, l_id),
        FOREIGN KEY(w_id) REFERENCES Words(w_id) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(l_id) REFERENCES lesson(l_id) ON UPDATE CASCADE
ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.26 defines

**Relational Model**

defines(u_id, w_id)
**u_id is foreign key to User.**
**w_id is foreign key to Words.**

**Candidate Keys**
u_id, w_id
**Primary Key**
u_id, w_id

**Functional Dependencies:**
There is no functional dependency.

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE defines (
        u_id VARCHAR(32) NOT NULL,
        w_id CHAR(8) NOT NULL,
        PRIMARY KEY(u_id  w_id),
        FOREIGN KEY(u_id) REFERENCES Teacher(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(w_id) REFERENCES Words(w_id) ON UPDATE
CASCADE ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.27 creates_phrasal

**Relational Model**

creates_phrasal(pre_id, post_id, new_meaning)
**pre_id is foreign key to Words(w_id).**
**post_id is foreign key to Words(w_id).**

**Candidate Keys**
pre_id,post_id
**Primary Key**
pre_id,post_id

**Functional Dependencies:**
pre_id,post_id → new_meaning

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE creates_phrasal (
        pre_id CHAR(8) NOT NULL,
        post_id CHAR(8) NOT NULL,
        new_meaning VARCHAR(32) NOT NULL,
        PRIMARY KEY(pre_id, post_id),
        FOREIGN KEY(pre_id) REFERENCES Words(w_id) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(post_id) REFERENCES Words(w_id) ON UPDATE
CASCADE ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.28 Certificate

**Relational Model**

Certificate(<u>certificicate_id, date, definition, u_id</u>)

**Candidate Keys**
certificicate_id, date, definition, u_id

**Primary Key**
certificicate_id, date, definition, u_id

**Functional Dependencies:**
There is no functional dependency.

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE Certificate (
        certificate_id CHAR(8) NOT NULL,
        date DATE  NOT NULL,
        definition VARCHAR(32)  NOT NULL,
        u_id CHAR(8) NOT NULL,
        PRIMARY KEY(certificicate_id, date, definition, u_id),
        FOREIGN KEY(u_id) REFERENCES Teacher(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.29 approves

**Relational Model**

approves(certificicate_id, date, definition, u_id, approval_date)
**certificate_id is foreign key to Certificate.**
**date is foreign key to Certificate.**
**definition is foreign key to Certificate.**
**u_id is foreign key to Admin.**

**Candidate Keys**
certificicate_id, date, definition, u_id
**Primary Key**
certificicate_id, date, definition, u_id

**Functional Dependencies:**
certificicate_id, date, definition, u_id →approval_date

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE approves(
        u_id CHAR(8) NOT NULL,
        certificicate_id CHAR(8) NOT NULL,
        date DATE NOT NULL,
        definition VARCHAR(32) NOT NULL,
        PRIMARY KEY(certificicate_id, date, definition, u_id),
        FOREIGN KEY(certificicate_id, date, definition) REFERENCES
Certificate(certificicate_id, date, definition) ON UPDATE CASCADE ON DELETE
RESTRICT,
        FOREIGN KEY(u_id) REFERENCES Admin(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT,) ENGINE=INNODB;
```

## 2.30 Activities

**Relational Model**

Activities(a_id, date, description, s_id)
**s_id is foreign key to Student(u_id)**

**Candidate Keys**
a_id, date, description, s_id

**Primary Key**
a_id, date, description, s_id

**Functional Dependencies:**
There is no functional dependency.

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE Activities (
        a_id CHAR(8) NOT NULL,
        date DATE  NOT NULL,
        description VARCHAR(32)  NOT NULL,
        s_id CHAR(8) NOT NULL,
        PRIMARY KEY(a_id, date, description, s_id),
        FOREIGN KEY(s_id) REFERENCES Student(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.31 view

**Relational Model**

view(a_id, date, description, s_id, t_id)
**a_id is foreign key to Activities.**
**date is foreign key to Activities.**
**description is foreign key to Activities.**
**s_id is foreign key to Activities.**
**t_id is foreign key to Teacher(u_id)**

**Candidate Keys**
a_id, date, description, s_id, t_id
**Primary Key**
a_id, date, description, s_id, t_id

**Functional Dependencies:**
There is no functional dependency.

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE view(
        t_id CHAR(8) NOT NULL,
        a_id CHAR(8) NOT NULL,
        date DATE NOT NULL,
        description VARCHAR(32) NOT NULL,
        s_id CHAR(8) NOT NULL,
        PRIMARY KEY(a_id, date, description, s_id, t_id),
        FOREIGN KEY(a_id, date, description,s_id) REFERENCES Activity(a_id,
date, description, s_id) ON UPDATE CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(t_id) REFERENCES Teacher(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.32 corresponds

**Relational Model**

corresponds(lesson_id,name)
**lesson_id is foreign key to lesson(l_id)**
**name is foreign key to Language(name)**

**Candidate Keys**
lesson_id,name
**Primary Key**
lesson_id,name

**Functional Dependencies:**
There is no functional dependency.

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE corresponds(
        lesson_id CHAR(8) NOT NULL,
        name CHAR(8) NOT NULL,
        PRIMARY KEY(lesson_id,name),
        FOREIGN KEY(lesson_id) REFERENCES lesson(l_id) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(name) REFERENCES Language(name) ON UPDATE
CASCADE ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.33 language

**Relational Model**

Language(<u>name</u>)

**Candidate Keys**
l_id
**Primary Key**
l_id

**Functional Dependencies:**
l_id→ name

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE language(
        name  VARCHAR(32) NOT NULL,
        PRIMARY KEY(name)) ENGINE=INNODB;
```

## 2.34 learns

**Relational Model**

learns(s_id, name, level)
**name is foreign key to language(l_id)**
**s_id is foreign key to student(u_id)**

**Candidate Keys**
s_id, name
**Primary Key**
s_id, name

**Functional Dependencies:**
s_id, name → level

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE learns(
        name CHAR(8) NOT NULL,
        s_id CHAR(8) NOT NULL,
        PRIMARY KEY(name, s_id),
        FOREIGN KEY(name) REFERENCES Language(name) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(s_id) REFERENCES Student(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT) ENGINE=INNODB;
```

## 2.35 knows

**Relational Model**

learns(name, u_id)
**name is foreign key to Language(name)**
**u_id is foreign key to Employee(u_id)**

**Candidate Keys**
name, u_id
**Primary Key**
name, u_id

**Functional Dependencies:**
There is no functional dependency.

**Normal Form**
BCNF

**Table Declaration**

```
CREATE TABLE knows(
        name CHAR(8) NOT NULL,
        u_id CHAR(8) NOT NULL,
        PRIMARY KEY(name, u_id),
        FOREIGN KEY(name) REFERENCES Language(name) ON UPDATE
CASCADE ON DELETE RESTRICT,
        FOREIGN KEY(u_id) REFERENCES Employee(u_id) ON UPDATE
CASCADE ON DELETE RESTRICT) ENGINE=INNODB;
```

# 3. FUNCTIONAL COMPONENTS

## 3.1. Algorithms

### 3.1.1 Class creation and enrollment related algorithms

Students will search for language class based on his/her level and the language that s/he wants. Students can not enroll in a class higher than his/her level in the corresponding language. Admin will view some general information about the system. Many students can use this system and many students can choose the same language and they can take the same lesson. It should be restricted that the same email cannot sign up again. (For uniqueness)

### 3.1.2 Logical Requirements

Logical errors should be eliminated. Our program has a date attribute and they are separated into two. One of them should take the current time of day to tell us what is the starting point of this attribute. The other one will be determined for later. Students will understand how much time they have. This kind of date should be checked for the date should be later than the current time. Moreover, enrollment dates for students should be the earliest date rather than activity, homework or exam dates. Some certificate dates can be later or earliest.

## 3.2 Data Structures

Alphabetic, numeric and date types make up our system. Numeric types are INT and FLOAT. For strings, CHAR and VARCHAR types are used. CHAR is generally used for ID's and VARCHAR is used for long strings and these strings are not predetermined. Finally, we used the DATE type for the relevant date information.

## 3.3 Use Cases

### 3.3.1 Teacher

**-Create Account:** A teacher can create accounts with a name, password and email. Also, the user type should be selected as a teacher. The email should be unique for every user.

**-Login:** A teacher can login with their emails and passwords. When a teacher login successfully, the system can be used. Lesson, Homework, Exam, Grading, Dictionary and Profile pages will be active.

**-View Course Request:** Teachers can see students' requests to join a particular lesson. Students' names will be shown and which course they want. Teachers can accept the requests any time. Also, teachers can create lessons by choosing language and level.

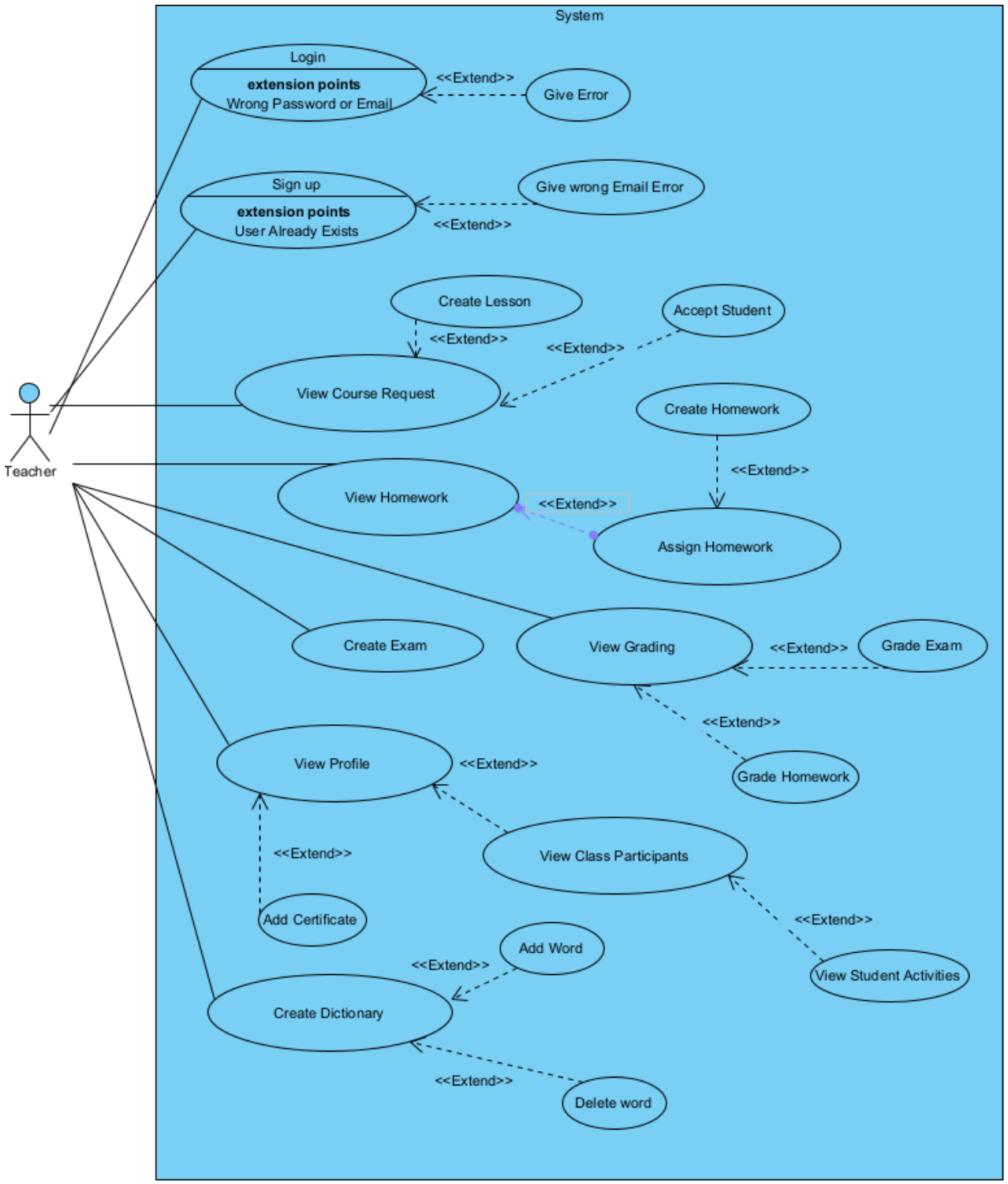
**-View Homework:** Teachers can see the information of the students from the student list and the desired student can be assigned homework.While the homework is given to the student, the date and description of the homework can be seen by the teachers. Teachers can also create another homework by entering new information.

**-Create Exam:** Teachers can create exams by choosing a date.

**-View Grading:** Teachers can grade students' homework or exams and the grades are given can be viewed as a list.

**-View Profile:** Teachers can add certificates and see the certificate they added on their profile page. In addition, they can see the number of participants in the courses they give and the activity of the desired student can be viewed.

**-Create Dictionary:** Teachers can see the words they add according to the selected lesson. New words can be added by entering a word,  an explanation and an example and the desired word can be removed.


System
Login
extension points
Wrong Password or Email
<<Extend>>
Give Error
Sign up
extension points
User Already Exists
Give wrong Email Error
<<Extend>>
Create Lesson
Accept Student
<<Extend>>
<<Extend>>
View Course Request
Create Homework
Teacher
<<Extend>>
View Homework
<<Extend>>
Assign Homework
Create Exam
View Grading
<<Extend>>
Grade Exam
<<Extend>>
View Profile
<<Extend>>
Grade Homework
<<Extend>>
View Class Participants
Add Certificate
<<Extend>>
Add Word
<<Extend>>
View Student Activities
Create Dictionary
<<Extend>>
Delete word

### 3.3.2 Student

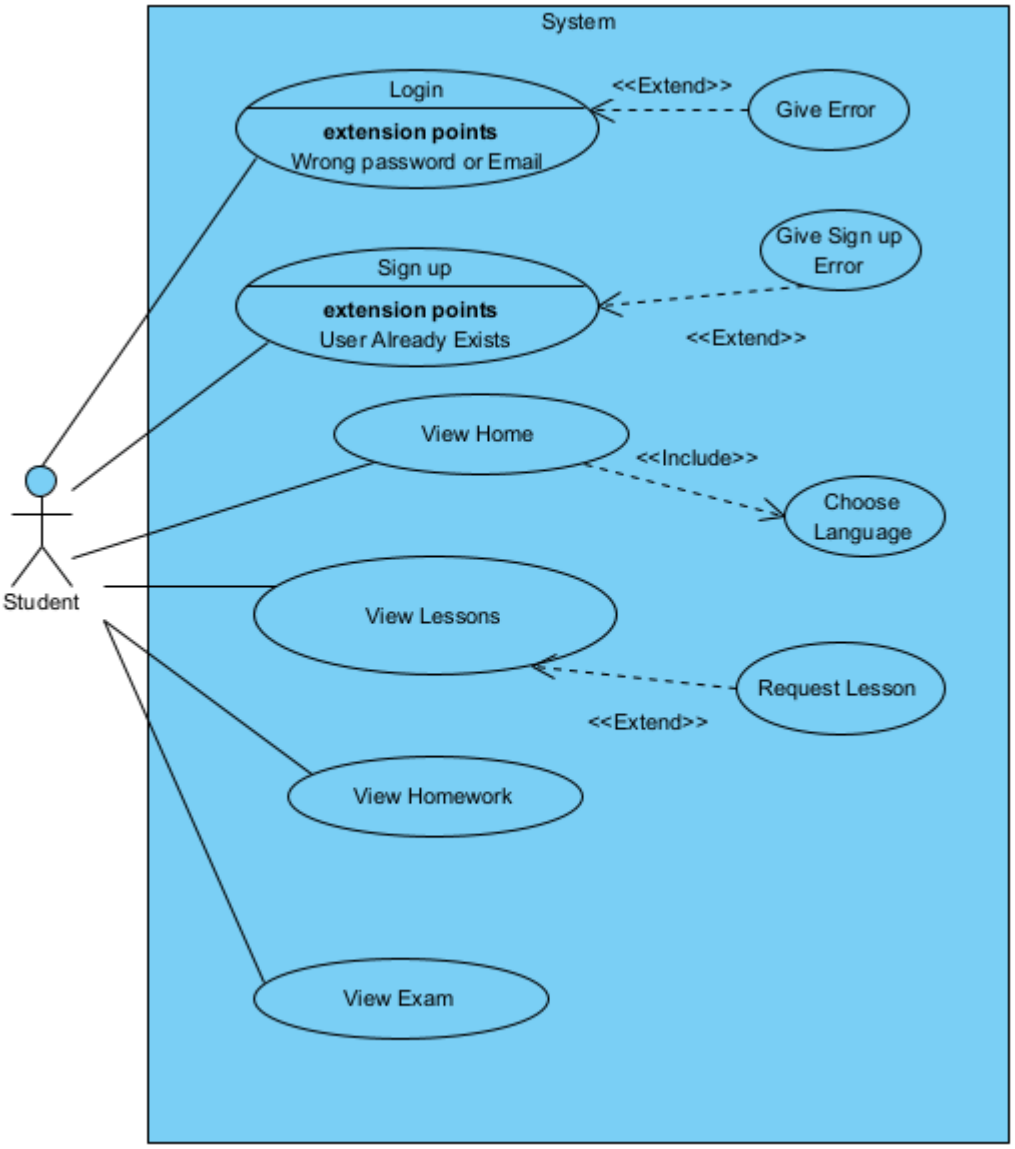
**-Create Account:** Student can create accounts with a name, password and email. Also, the user type should be selected as a student. The email should be unique for every user.

**-Login:** Students can login with their emails and passwords. When students login successfully, they have to choose language in order to use the system. After choosing a language  Lesson, Homework, Exam, Meeting and Profile pages will be active.

**-View Lesson:** Students can send enrollment requests by choosing a language, level, and teacher and see the status of their requests.

**-View Homework:** Students can see the names of the given homework, the deadline, the total contribution and the grade,

**-View Exam:** The results, dates and grades of the exams taken by the students can be seen.



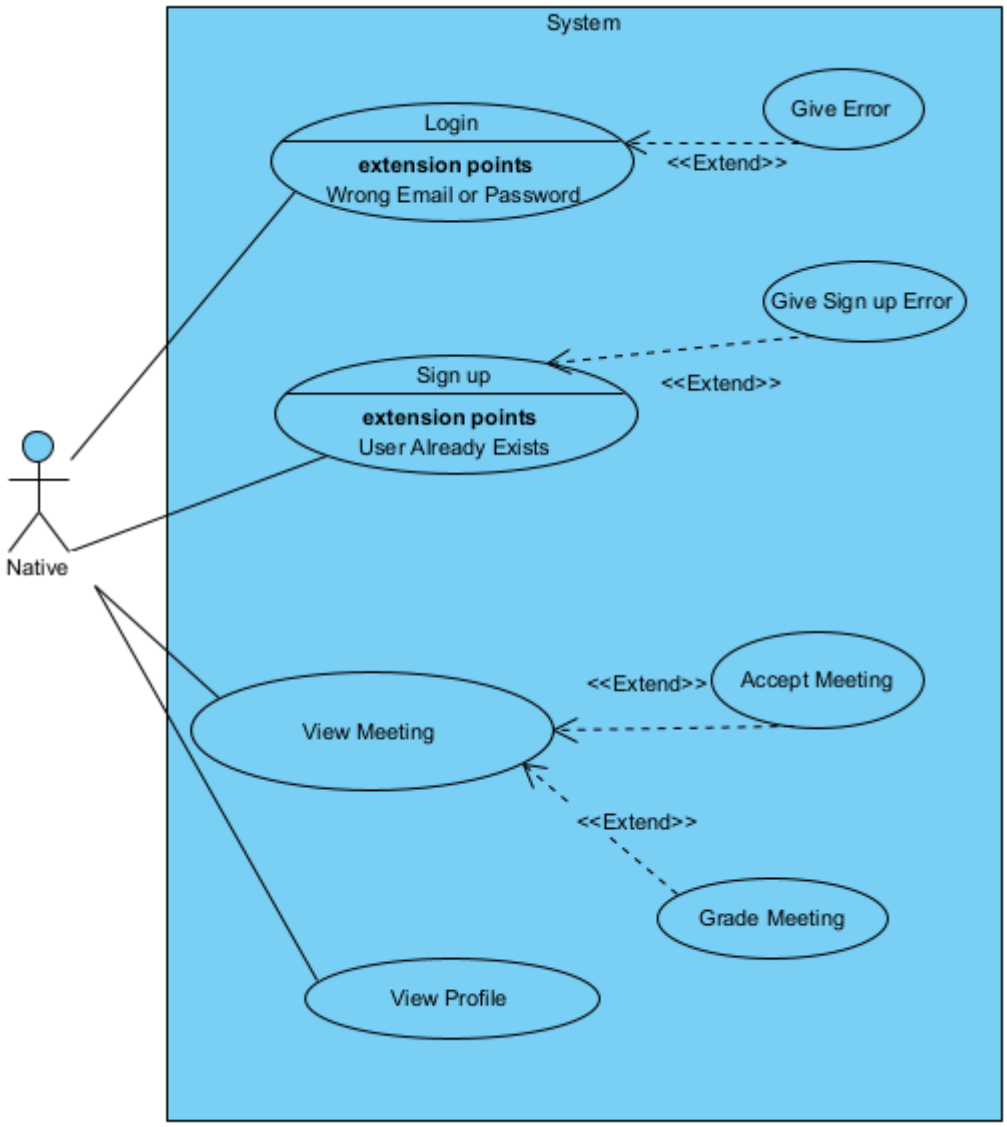

### 3.3.3 Native

**-Create Account:** Natives can create accounts with a name, password and email. Also, the user type should be selected as a native. The email should be unique for every user.

**-Login:** Natives can login with their emails and passwords. When Natives login successfully, they can use the system Meeting and Profile pages will be active.

**-View Meeting:** Natives can see and accept meeting requests from students. They can give grades to the meeting after the meeting.

**-View Profile:** Natives can see their profiles that including the nationality and country of the native



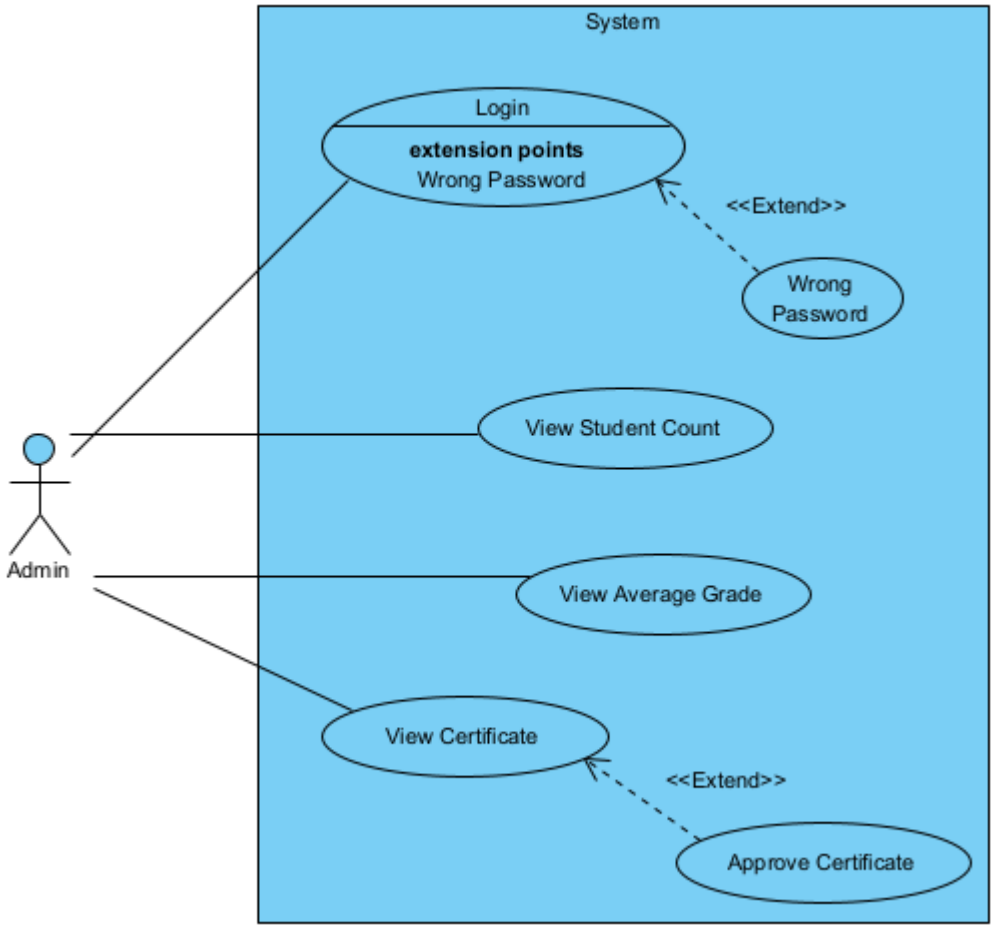

### 3.3.4 Admin

**-Login:** Admins can login with their emails and passwords. When admins login successfully, they can use the system Lesson and Certificate pages will be active.

**-View Student Count:** Admins can see the language of the lessons taught by the teachers and the number of students from the list of teachers.

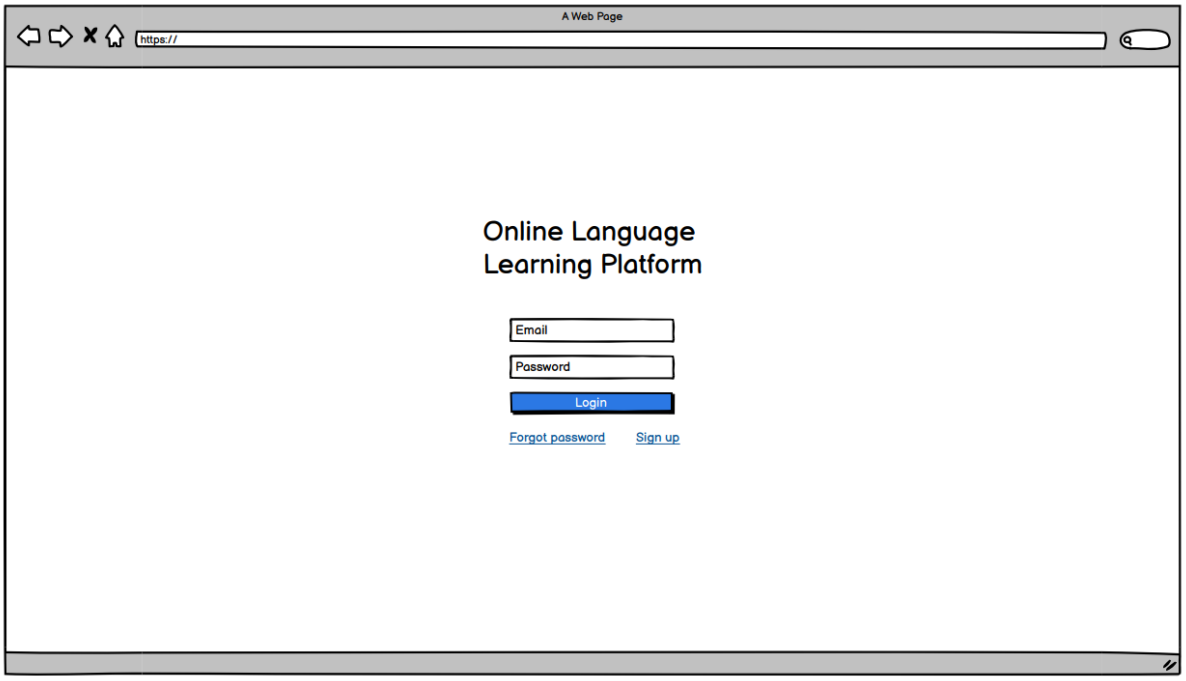
**-View Average Grade:** From the list of teachers, admins can see the average grade in the courses of the lessons taught by the teachers.

**-View Certificate:** Admins can check and accept the certificates that are added by teachers, and when they approve the certificate the approval date can be seen.



# 4. THE USER INTERFACE DESIGN AND CORRESPONDING SQL STATEMENTS

## 1) LOGIN PAGE




**INPUTS**

@email, @password

**PROCESS**

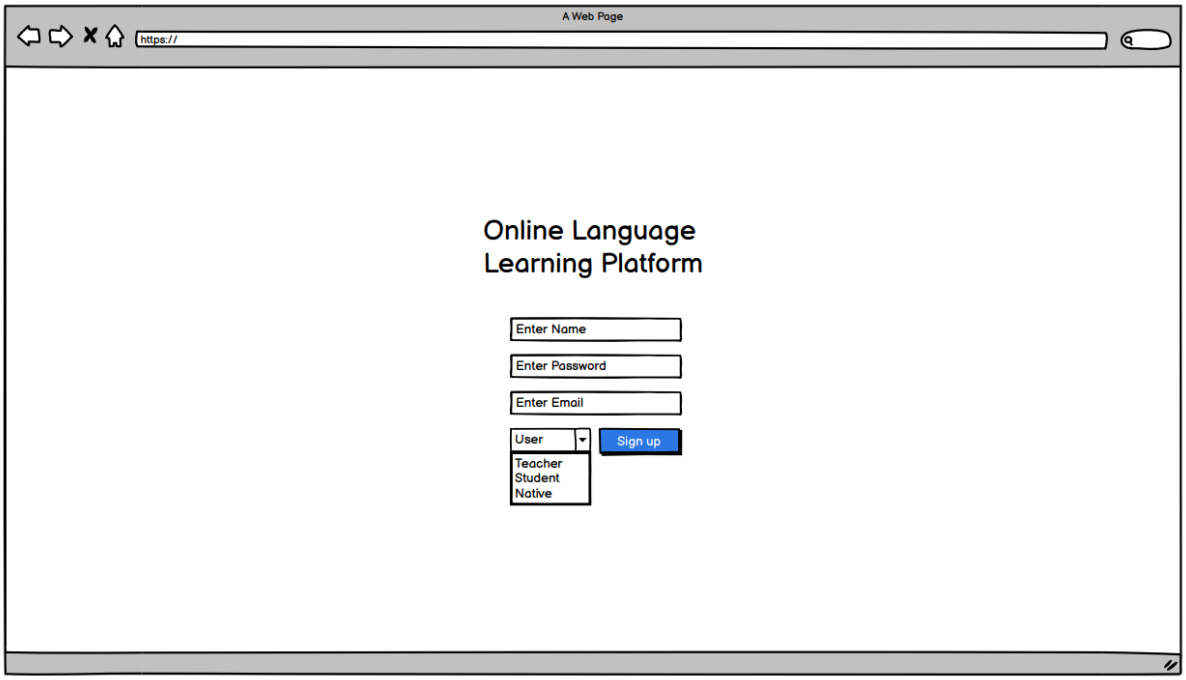
This page is for users that have accounts on the system. Users that do not have an account should go to the “sign up” page. Users will login the system with their email and password. After login to the system, the user will reach the home page. Admins, students, employees ( natives and teachers ) can use this page to login.

**SQL QUERY**

For login button,

```
SELECT u_id, email, password
FROM User
Where email = @email AND password = @password;
```

## 2) SIGN UP PAGE




**INPUTS**

@name, @password, @email

**PROCESS**

In this page, users should enter valid email and password because they will use them for login. User should specify his/her user type. They will be seperated with this information as Student, Teacher or Native.

**SQL QUERY**

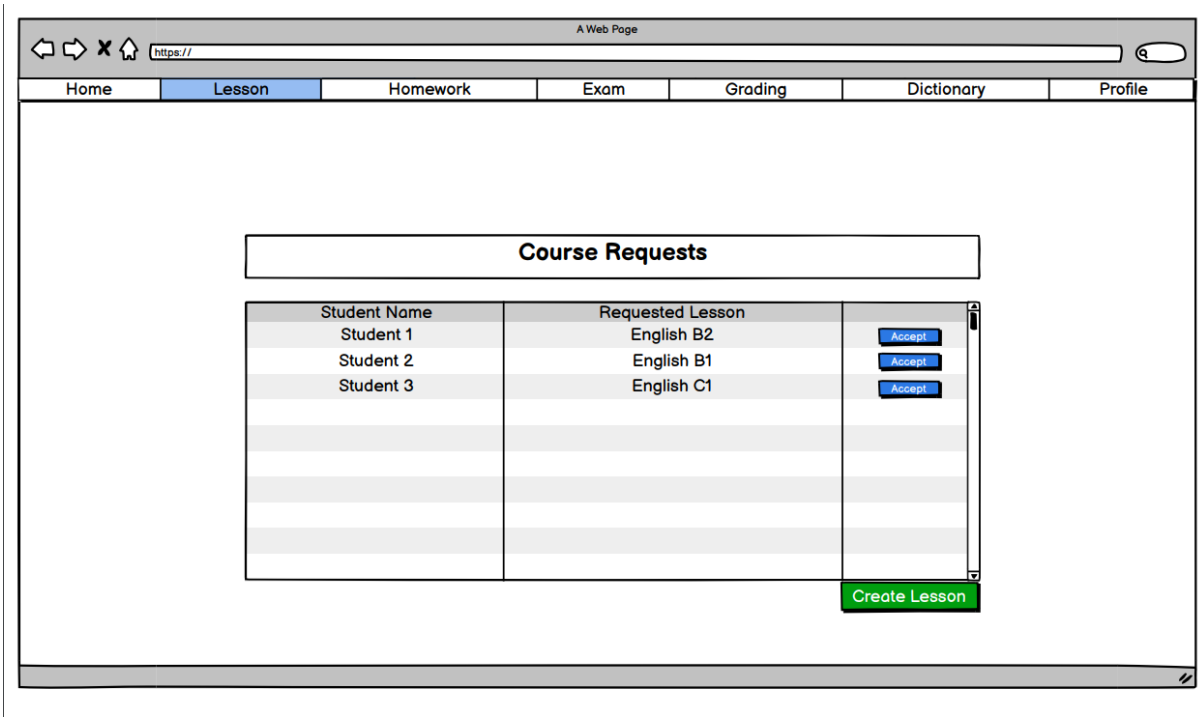
**When Signup button pressed, if Student is selected,**
INSERT INTO Student(u_id, email, name, password, enrollment_date)
VALUES(u_id, @email, @name, @password, enrollment_date)

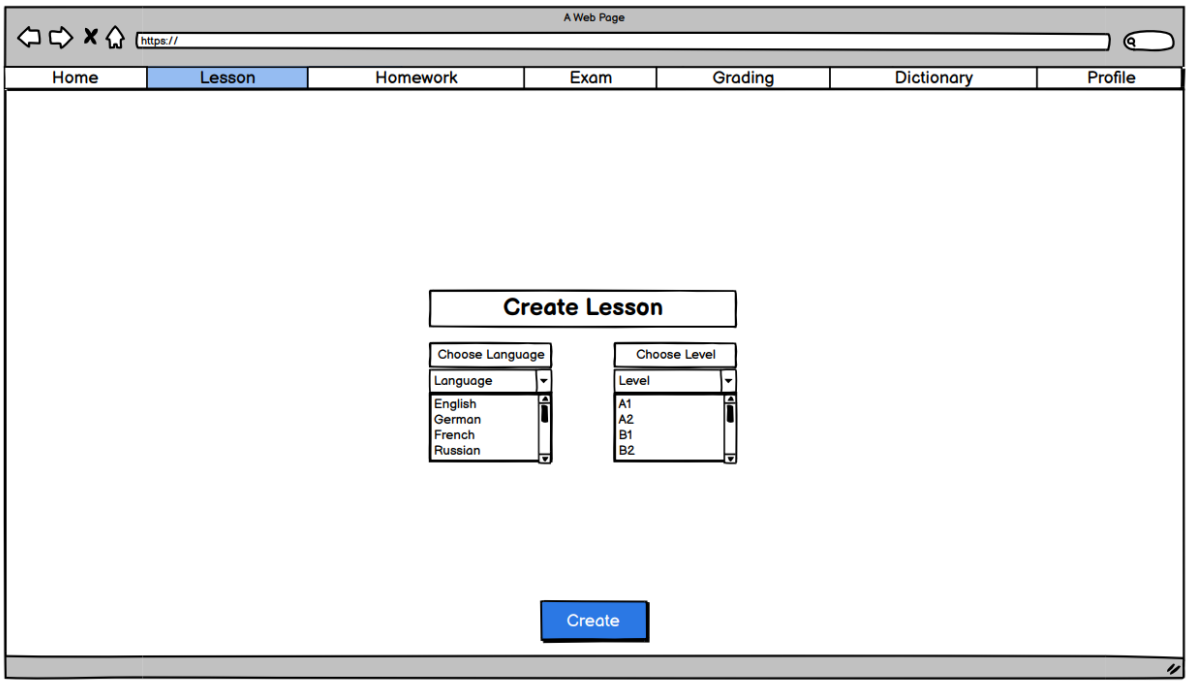
**When Signup button pressed, if Teacher is selected,**
INSERT INTO Teacher(u_id, email, name, password, nationality, eligible_level)
VALUES(u_id, @email, @name, @password, nationality, eligible_level)

**When Signup button pressed, if Native is selected,**
INSERT INTO Native(u_id, email, name, password, nationality, country)

VALUES(u_id, @email, @name, @password, nationality, country)

## 3) LESSON PAGE FOR TEACHER




**INPUTS**

@new_lan
@new_level

**PROCESS**

On this page, teachers can see lesson requests. The lesson name, and student's name can be seen.
On accept button corresponding student will be added to the course
Also teachers can add new lesson associated with them

**SQL QUERY**

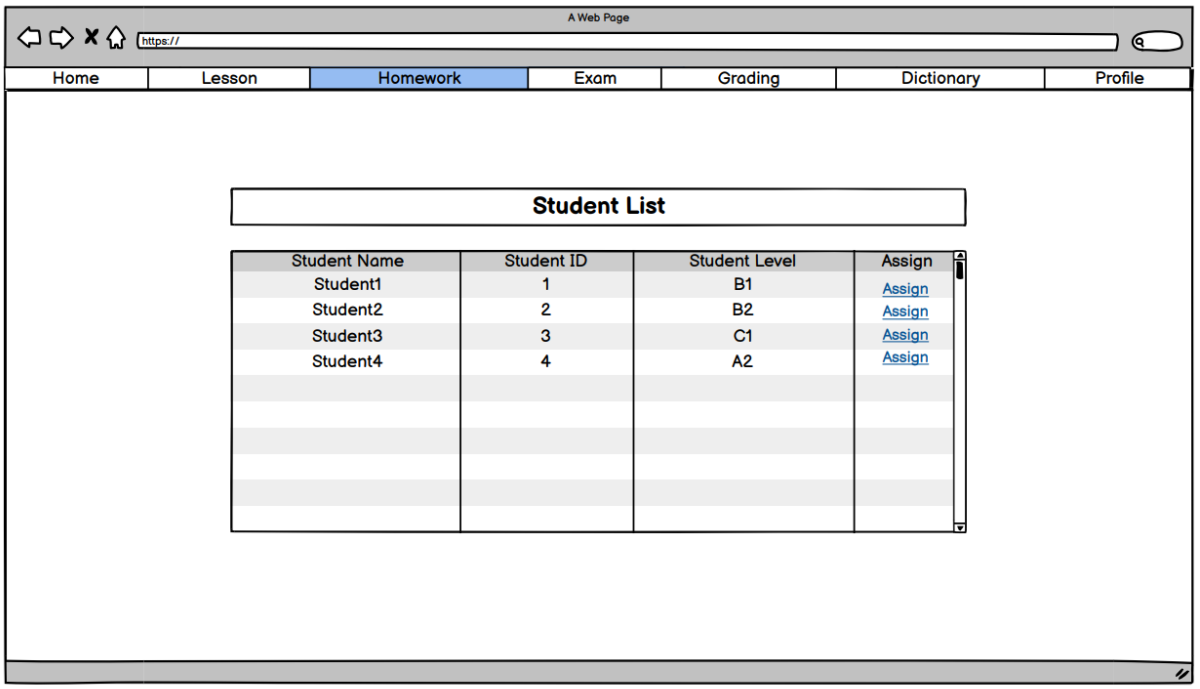
```
SELECT u.name, l.l_name
FROM Student s, User u, lesson l, enrolls e
Where e.status = waiting AND s.u_id=u.u_id AND e.u_id = s.u_id AND
        l.l_id = e.l_id

UPDATE enrolls e
SET status = "approved"
WHERE e.u_id = @u_id AND e.l_id = @l_id

INSERT INTO lesson(l_id, l_name, level)
VALUES(@l_id, @new_lan, @new_level)


INSERT INTO corresponds(lesson_id, language_id)
VALUES(@lesson_id, @language_id)
```

## 4) HOMEWORK PAGE FOR TEACHER



**INPUTS**

-

**PROCESS**

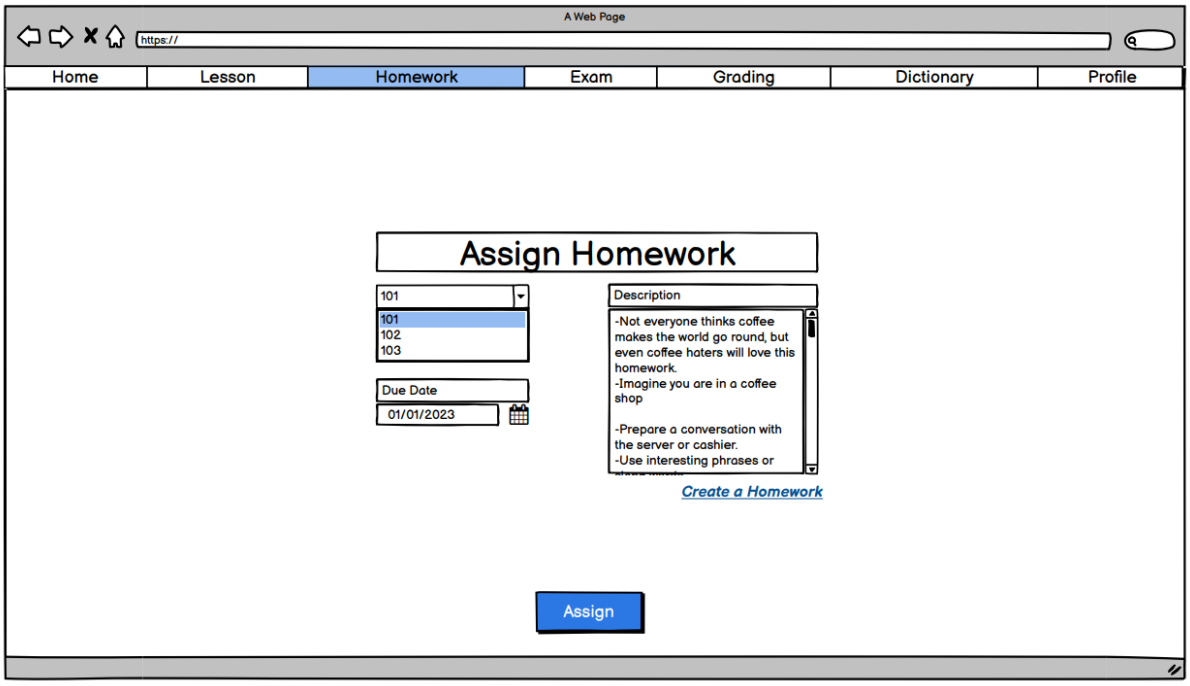
On this page, teachers can see students' information such as student name, student ID, student level. Teachers can assign homeworks in this page by pressing the “Add” button. When they press the “Add” button, they will reach the “Assign Homework” page.

**SQL QUERY**

```
SELECT S.name, S.u_id, req.level
FROM Student S, request_class req
WHERE S.u_id = req.u_id AND req.t_id = @u_id;

SELECT s.name, s.u_id, learns.level
FROM enrolls e, Student s, lesson l, give g, learns
WHERE s.u_id = e.u_is AND e.l_id = l.l_id AND l.l_id = g.l_id AND
        learns.u_id = s.u_id AND learns.name = @language AND
        g.u_id = @u_id;
```

## 5) ASSIGN HOMEWORK PAGE FOR TEACHER



**INPUTS**

@h_id

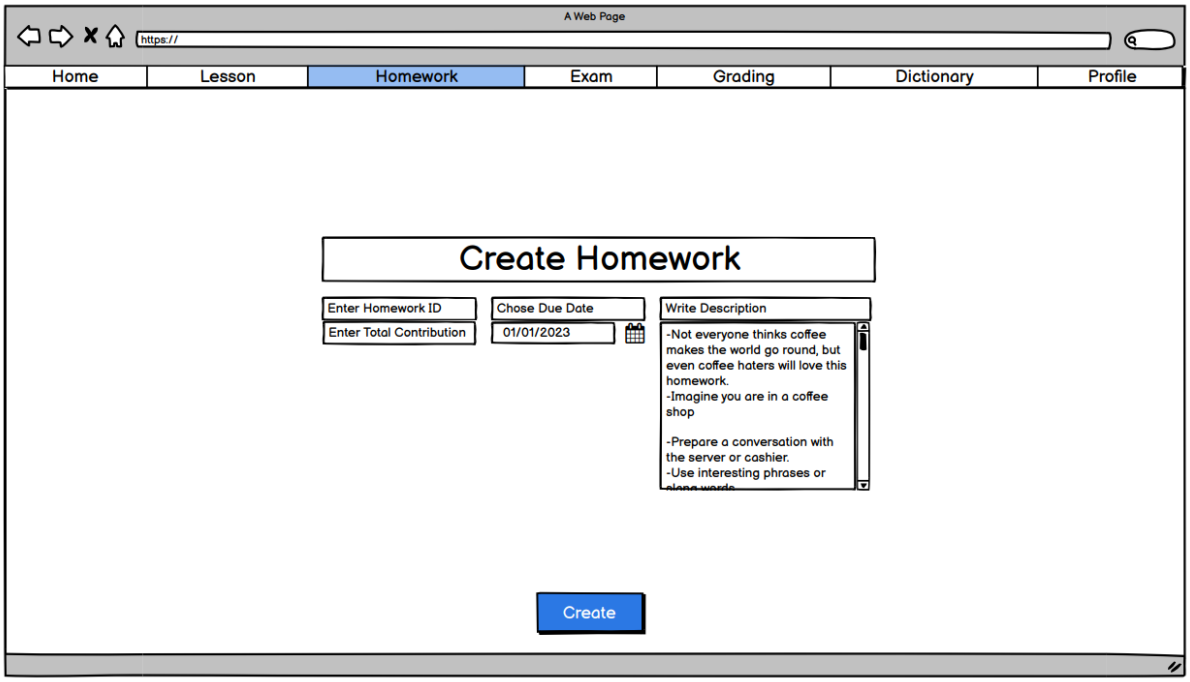
**PROCESS**

On this page, teachers can assign homework to students. In description part, explanation of the homework will be shown. Teachers will choose the ID of homework, they will see the due date for homework and total contribution. When they press the “Assign” button, information will be stored in the database. After pressing the “Create homework” button, teachers will reach the create homework page.

**SQL QUERY**

**When assign button is pressed**
INSERT INTO assign(h_id, s_id)
VALUES (@h_id, @s_id, @u_id)

## 6) CREATE HOMEWORK PAGE FOR TEACHER




**INPUTS**

@h_id, @due_date, @total_contribution, @description

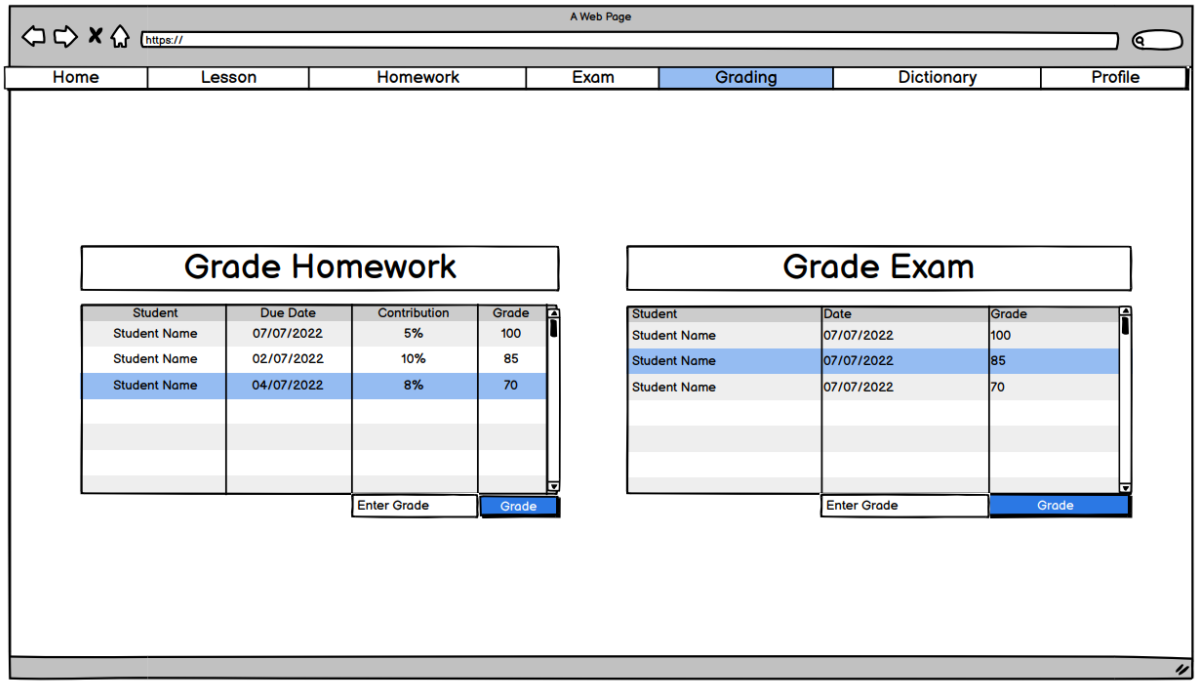
**PROCESS**

On this page, teachers can create homework for students. In the description part, teachers explain the homework that they want to create. Teachers will enter the ID of homework, a due date for homework and enter total contribution to assign the homework. When they press the “Done” button, information will be stored in the database.

**SQL QUERY**

**When Done button pressed,**
INSERT INTO Homework(h_id, due_date, total_contribution, description)
VALUES(@h_id, @due_date, @total_contribution, @description)

## 7) GRADE PAGE FOR TEACHER




**INPUTS**

@grade_exam, @grade_homework

**PROCESS**

On this page teacher can see the students who have assigned homeworks, and can give grades to the students

**SQL QUERY**

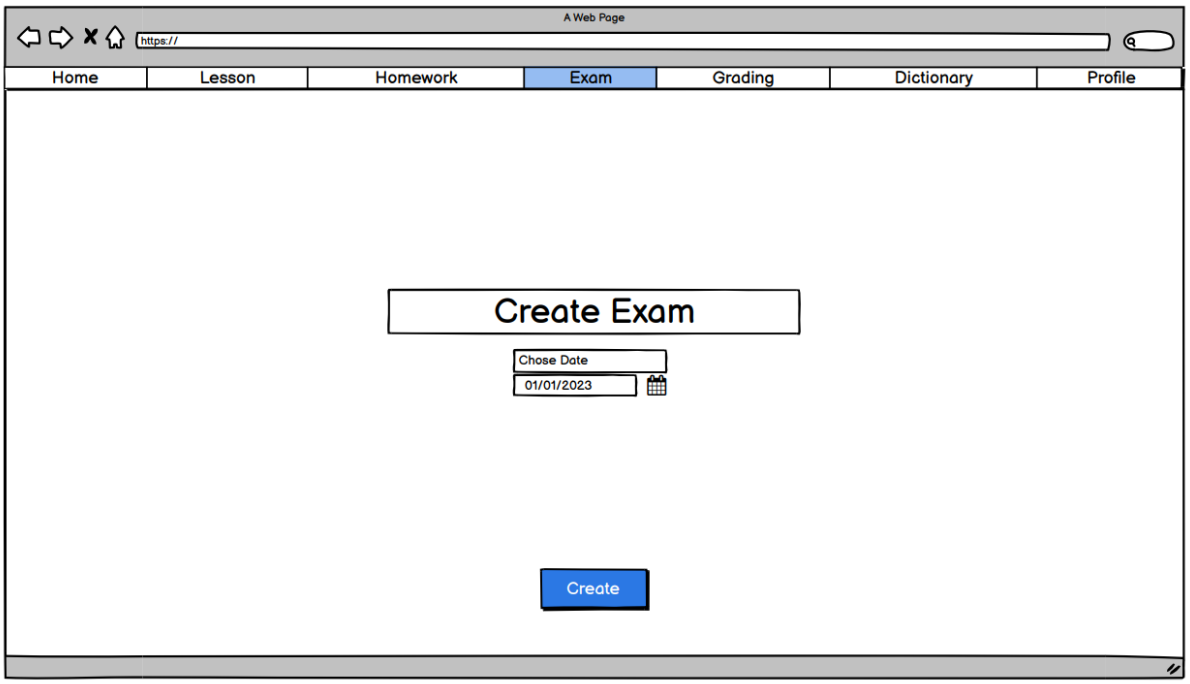
SELECT s.name, h.due_date, h.total_contribution, g.grade
FROM Student s, Teacher t, Grades g, Homeworks h
WHERE g.h_id = h.h_id and g.t_id = t.u_id and g. s_id = s.u_id

**When Grade_homework button pressed,**
INSERT INTO grades(t_id,s_id, h_id, grade)
VALUES(@t_id, @s_id, @h_id, @grade)

SELECT s.name, e.date, g.grade
FROM Student s, Teacher t, Grades_exam g, exam e
WHERE g.e_id = e.e_id and g.t_id = t.u_id and g. s_id = s.u_id

**When Grade_exam button pressed,**
INSERT INTO grades_exam(t_id,s_id, e_id, grade)
VALUES(@t_id, @s_id, @e_id, @grade)

## 8) CREATE EXAM PAGE FOR TEACHER




**INPUTS**

@date

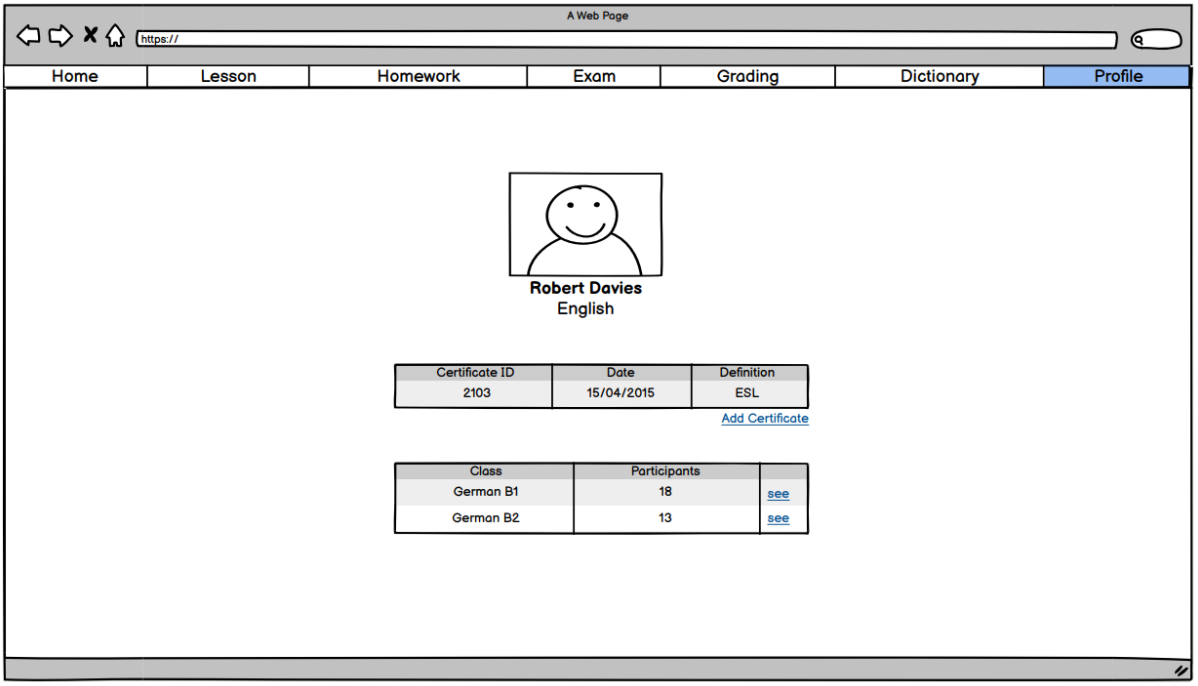
**PROCESS**

On this page teacher can see the students who have assigned homeworks, and can give grades to the students

**SQL QUERY**

**When Create button pressed,**
INSERT INTO Exam(date)
VALUES(@date)

## 9) TEACHER PROFILE PAGE




**INPUTS**

-

**PROCESS**

On this page, teachers can see their profile. This profile will include information about the teacher. Teacher can see his/her classes' information such as class name and participant count. The teacher can see his/her certificate(s). With clicking the "Upload a Certificate" button, s/he can upload his/her new certificate. When pressing the "see" button, the teacher can reach the lesson information page related to the chosen lesson. Moreover, the teacher can also see his/her profile picture and his/her name.

**SQL QUERY**

**For teacher's name,**

```
SELECT t.name
FROM Teacher t
WHERE t.u_id = @u_id;
```

**For certificate,**

```
SELECT c.certificate_id, c.date, c.definition,
FROM Certificate c, Teacher t
WHERE c.u_id = t.u_id
```

**For class information,**

```
SELECT l.l_id,  count( *)
FROM lesson l, give g
WHERE l.u_id = t.u_id AND t.u_id = @u_id
GROUP BY (l.l_id)
```

## 10) ADD CERTIFICATE PAGE FOR TEACHER


**INPUTS**

@id, @date, @def

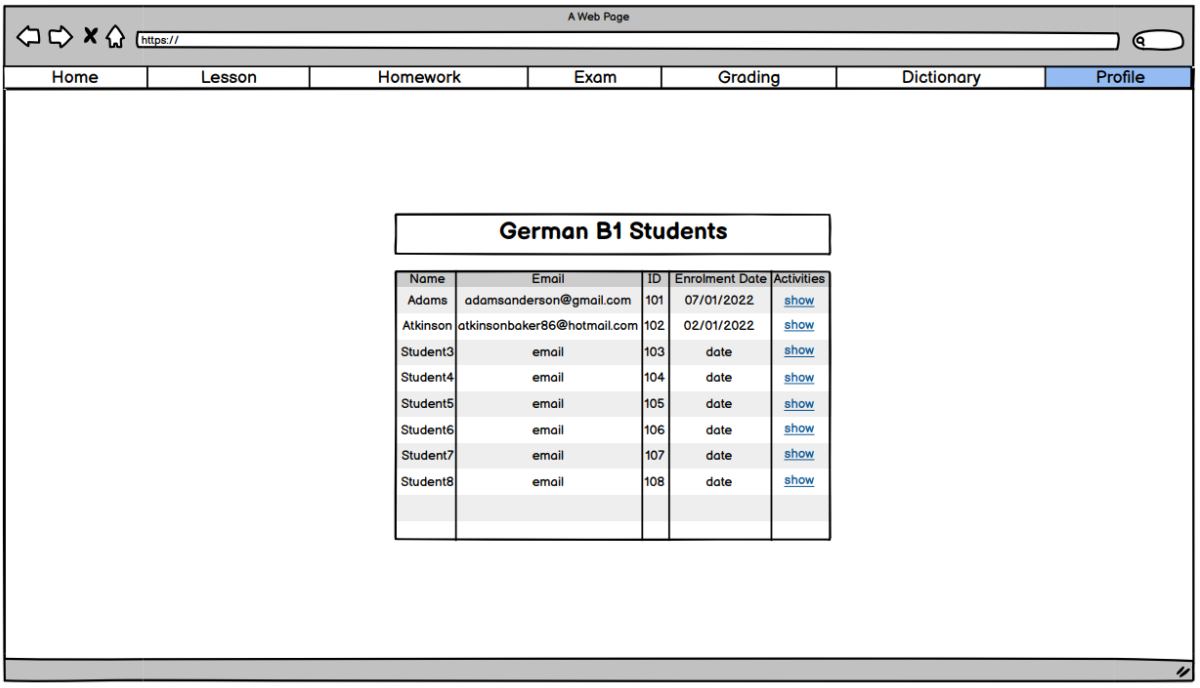
**PROCESS**

On this page teacher can add new certificate to their profile

**SQL QUERY**

**When Add button pressed,**
INSERT INTO Certificate(certificate_id,date, definition)
VALUES(@id, @date, @def, @u_id)

## 11) CLASS PAGE FOR TEACHER




**INPUTS**

-

**PROCESS**

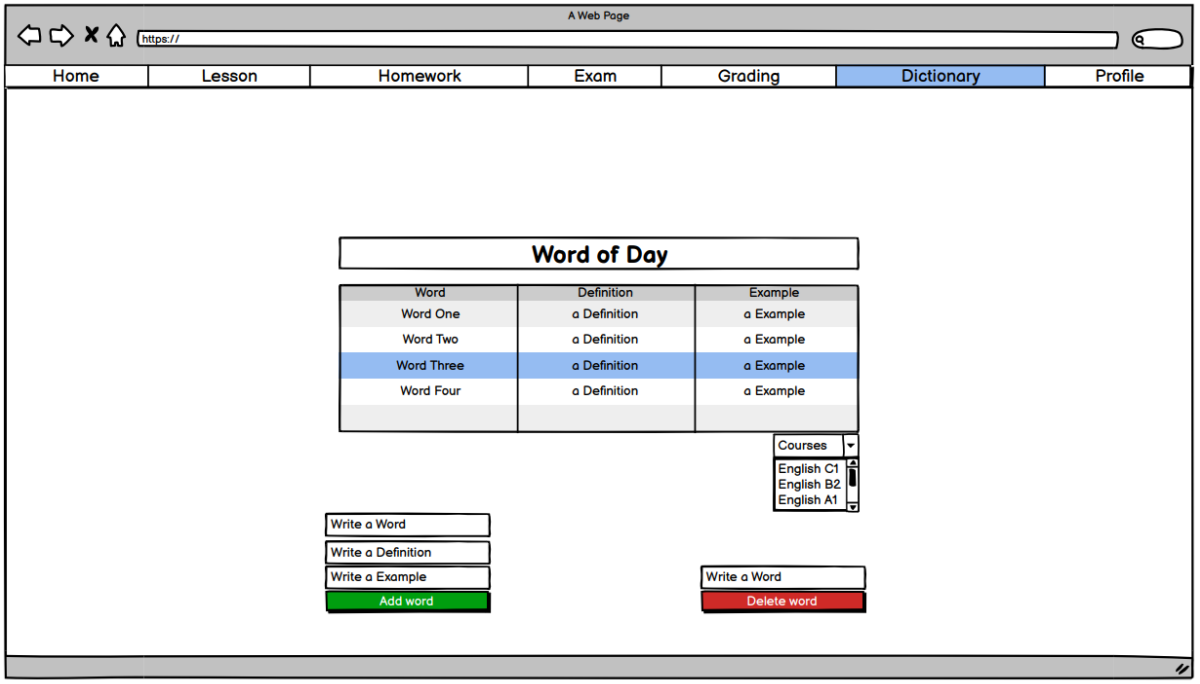
On this page, teachers can see all student information in her/his class. Teacher will get his/her students' name, email, ID and enrollment date. When "show" button is pressed, they will reach activities.

**SQL QUERY**

**For class page,**

```
SELECT s.name, s.email, s.u_id, s.enrollment_date
FROM Student s, enrolls, e
WHERE s.u_id = e.u_id AND e.l_id = @l_id
```

## 12) DICTIONARY PAGE FOR TEACHER




**INPUTS**

@lesson, @new_word, @new_def, @new_example, @del_word

**PROCESS**

On this page, teachers can arrange “Word of day” related to each course by choosing the lesson. They can add a new word with pressing the “Add word” button. Moreover, they can delete the word that is selected.

**SQL QUERY**

**For dictionary page**

SELECT w.word, w.definition, w.example_usage
FROM Words w, taught_in t, lesson l, defines d
WHERE w.w_id = t.w_id AND t.l_id = l.l_id AND d.w_id = w.d_id AND d.u_id = @u_id

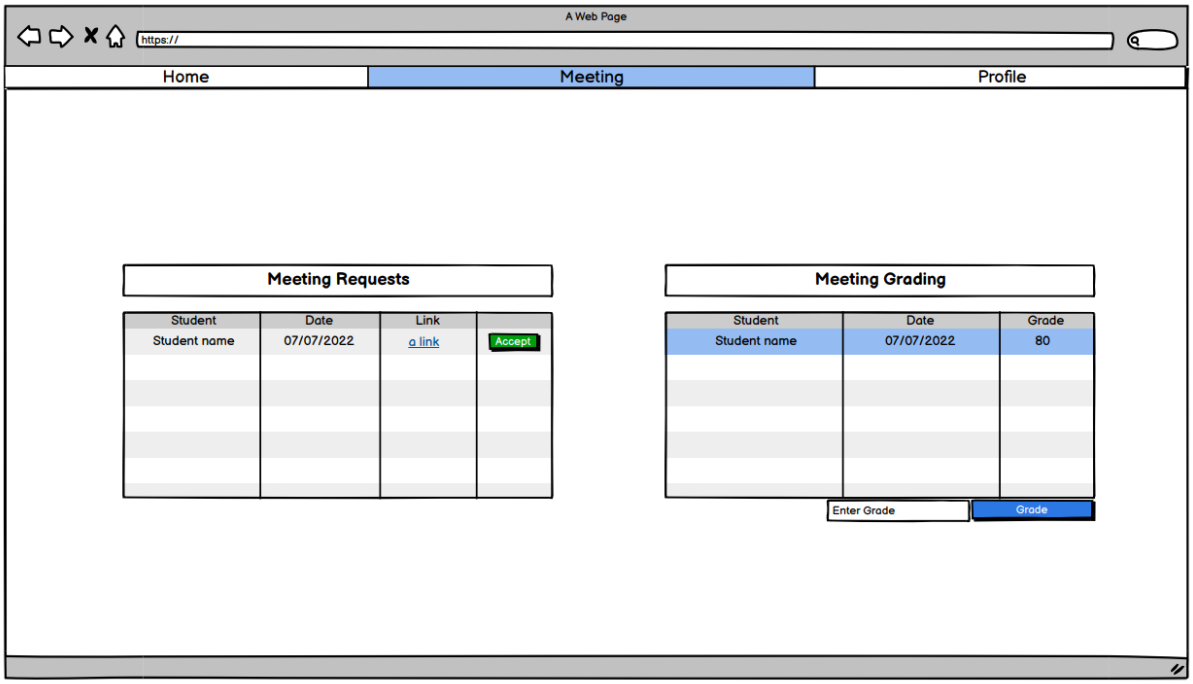
**Inserting a word**

INSERT INTO Words WHERE words.word = @del_word

**Deleting a word**

DELETE FROM Words
VALUES(@new_word, @new_def, @new_example)

## 13) MEETING PAGE FOR NATIVES




**INPUTS**

@grade, @link

**PROCESS**

On this page, Native users can see meeting requests from students, students' name, date and the meeting link. When they click the "accept" button, they will go to the meeting. Moreover, after meeting Native users can grade with pressing the "Grade" button. Natives can also see the students' name, date, the meeting link and grade in the grading table.

**SQL QUERY**

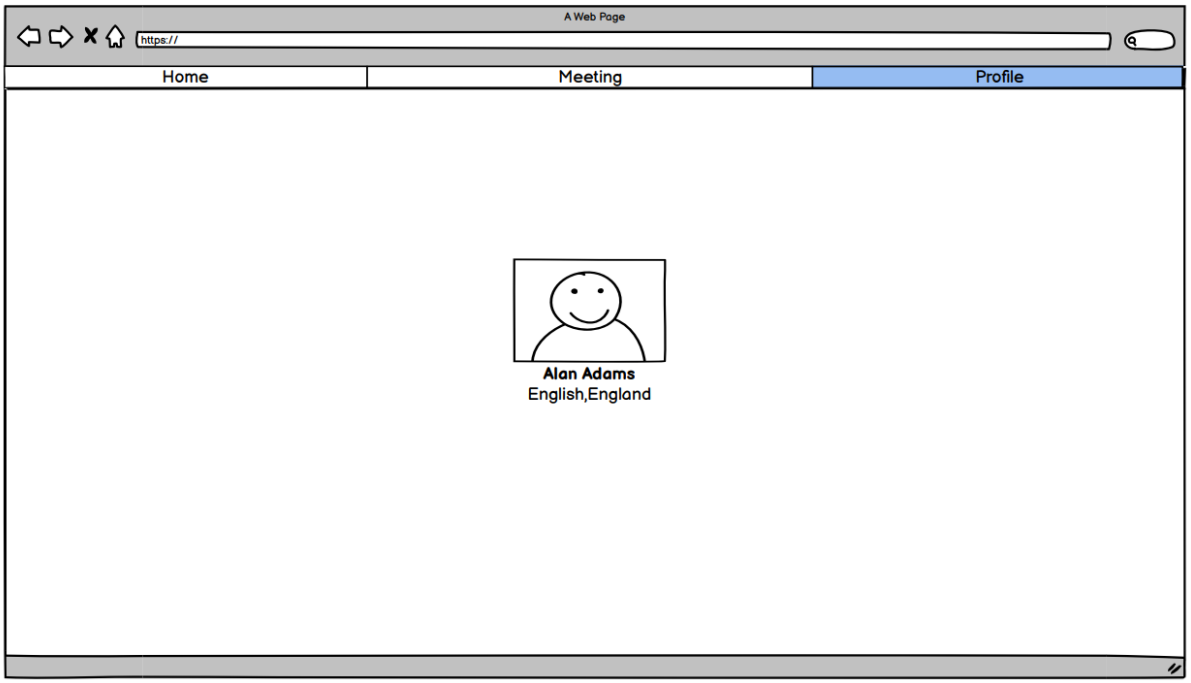
**For grading table,**

```
SELECT s.name, m.date, g.grade
FROM Student s, request r, Meeting m, Native n, grades_meeting g
WHERE s.s_id = r.s_id AND n.n_id = r.n_id AND m.m_id = r.m_id
AND g.m_id = m.m_id AND g.n_id = n.n_id
```

**For request table,**

```
SELECT s.name, m.date,m.link
FROM Student s, request r, Meeting m, Native n
WHERE s.s_id = r.s_id AND n.n_id = r.n_id AND m.m_id = r.m_id
```

## 14) PROFILE PAGE FOR NATIVES



**INPUTS**

-

**PROCESS**

On this page, users can see their profile picture, their name and their country.

**SQL QUERY**

```
SELECT n.name, n.country
FROM Native n, Native na
WHERE n.n_id = na.n_id
```

## 15) HOME PAGE FOR STUDENT

**INPUTS**

@language

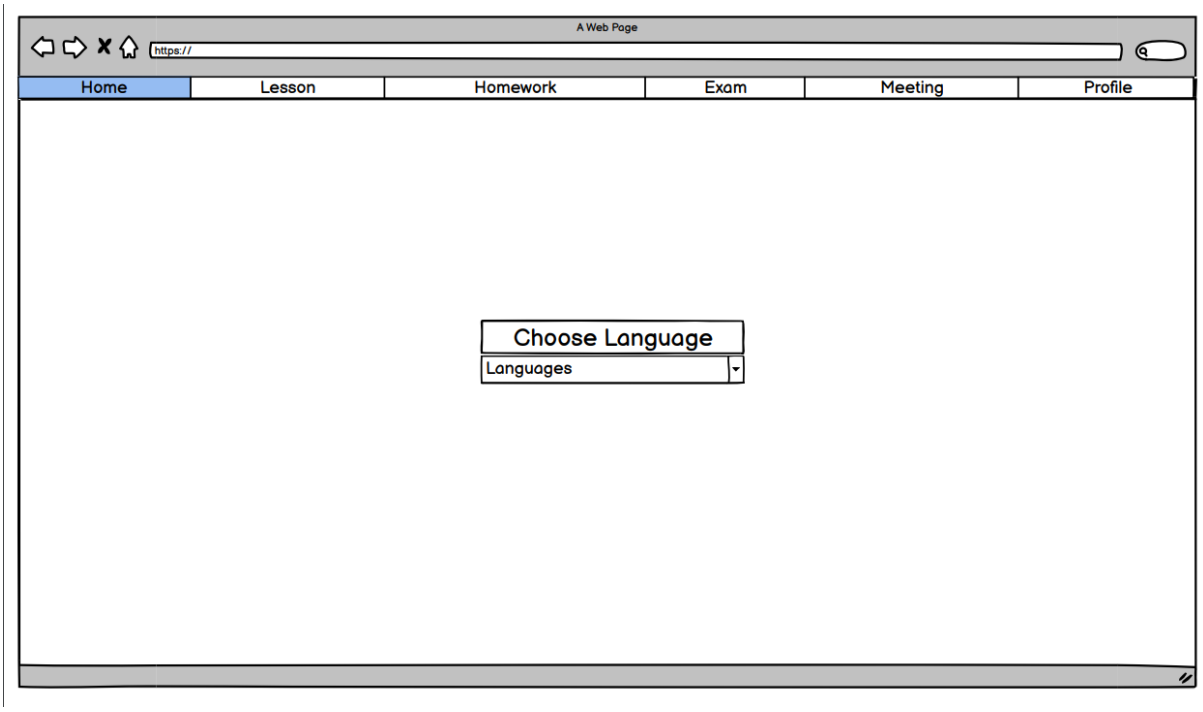
**PROCESS**

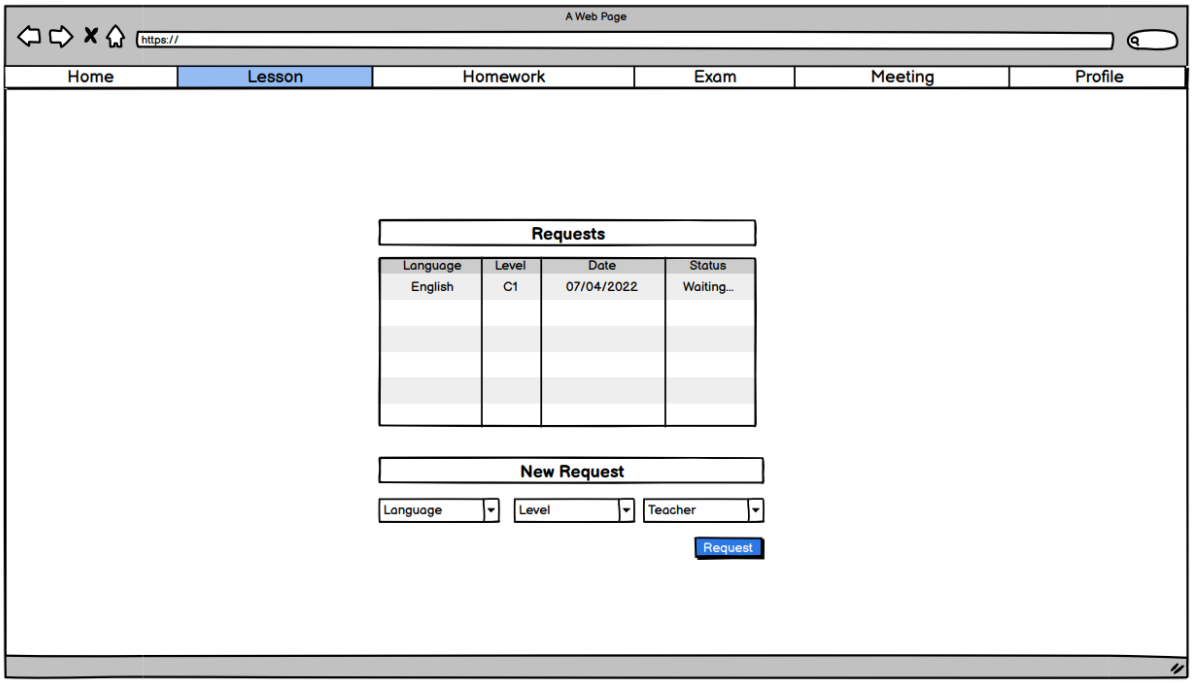
On this page, Student users should choose the language that they want to learn. After they choose the language they can move to the other pages.

**SQL QUERY**

```
SELECT DISTINCT name
FROM Language
```

## 16) LESSON PAGE FOR STUDENT




**INPUTS**

@language
@level
@t.name

**PROCESS**

On this page, Student users can create new lesson requests by choosing a language, his/her level, and a teacher. After pressing the “request” button, the request will be stored in the database. Students can see their requests and their status on the request table.

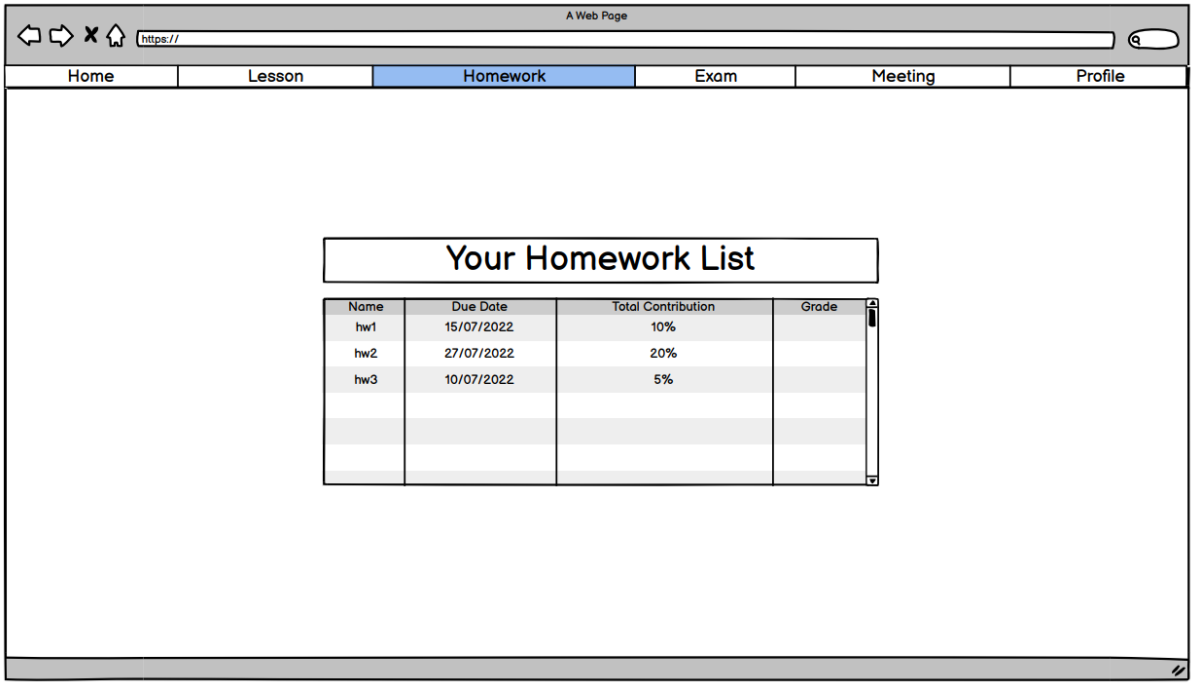
**SQL QUERY**

**For request table**

SELECT l.name, le.level, s.enrollment_date, e.status
FROM Language l, learns le, Student s, enrolls e, lesson les
WHERE l.name = le.name AND s.s_id= le.s_id AND s.s_id = e.s_id AND les.l_id = e.l_id

**For new request**
SELECT l.name, le.level, t.name
FROM Language l, learns le, Teacher t

## 17) HOMEWORK PAGE FOR STUDENT



**INPUTS**

-

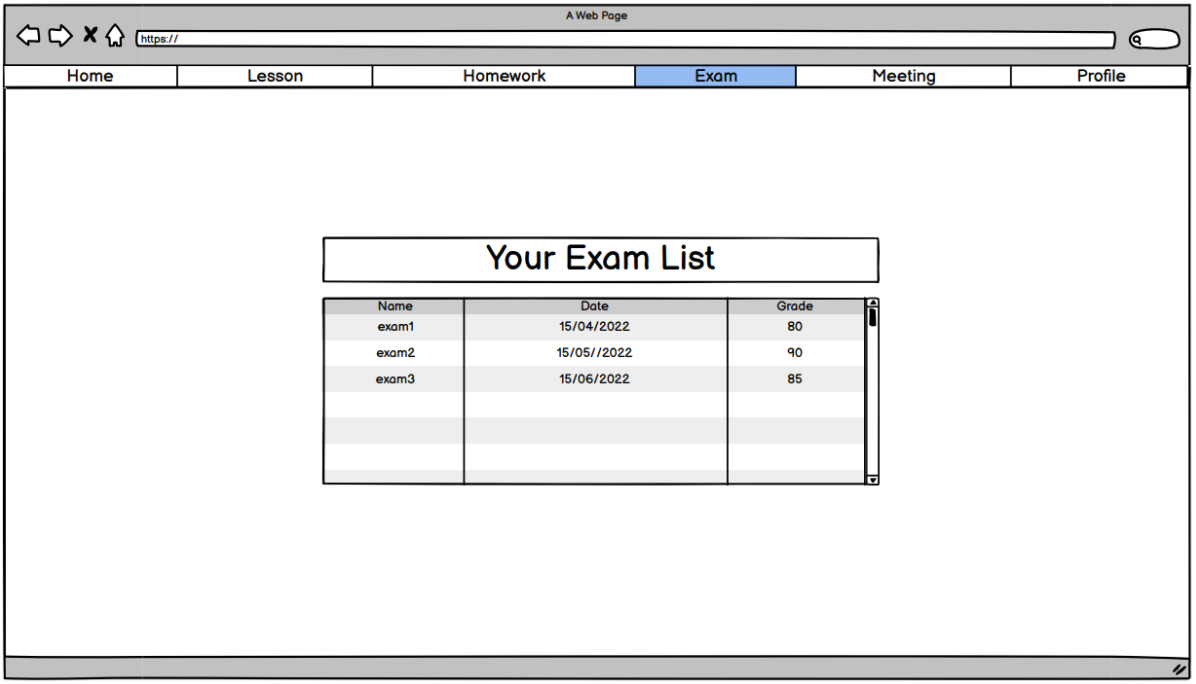
**PROCESS**

On this page, Student users can see their assigned homeworks and their due dates, homeworks' total contributions and their grades.

**SQL QUERY**

```
SELECT h.h_id, h.due_date, h.total_contribution, g.grade
FROM Homeworks h, Grades g
WHERE g.h_id = h.h_id
```

### 18) EXAM PAGE FOR STUDENT




**INPUTS**

-

**PROCESS**

On this page, Student users can see their exam information and their date's, and their grades.

**SQL QUERY**

```
SELECT e.e_id, e.date, g.grade
FROM Exam e, grades_exam g
WHERE g.e_id = e.e_id
```

## 19) LESSON PAGE FOR ADMIN

**INPUTS**

-

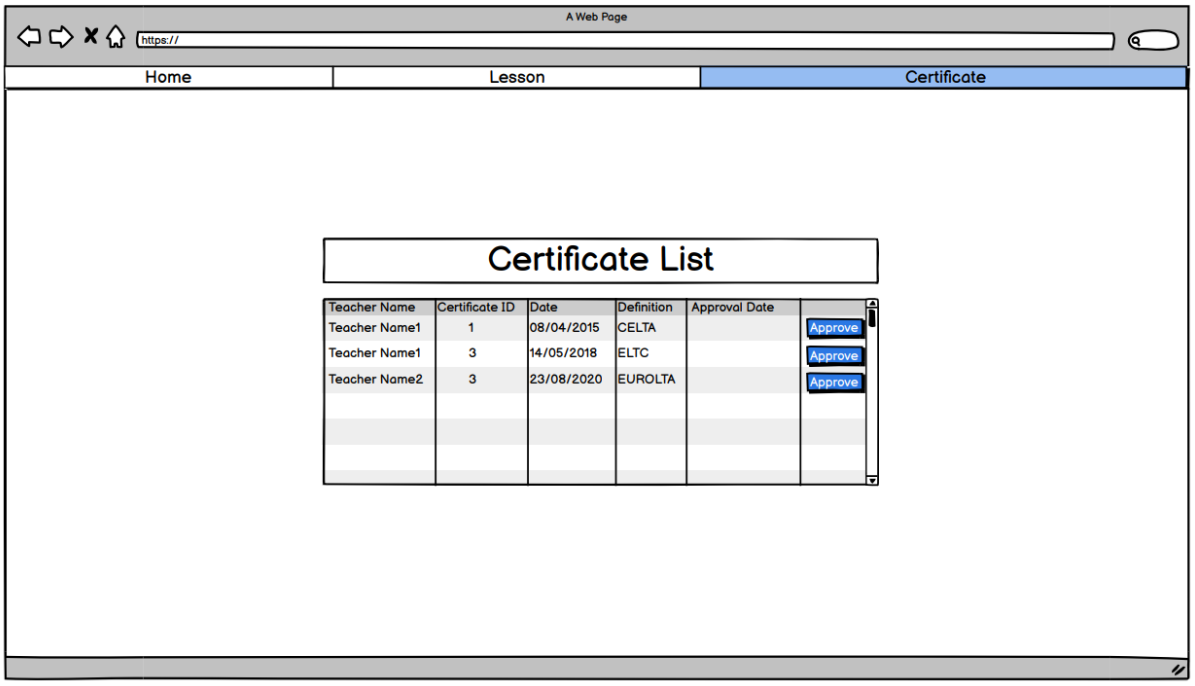
**PROCESS**

On this page, Admin users can see the Teacher list. This table will include teachers' name, language that the teacher teaches, student count in this class and the average grade.

**SQL QUERY**

```
SELECT t.name, l.name, count(s_id), avg(grade)
FROM Teacher t, Language l, Student s, learns le, grades_exam g, Knows k
WHERE t.t_id = k.u_id AND l.name = le.name AND s.s_id = le.s_id AND s.s_id =
g.s_id AND k.name = l.name
GROUP BY (t.name,l.name)
```

## 20) CERTIFICATE LIST PAGE FOR ADMIN




**INPUTS**

-

**PROCESS**

On this page, Admin users can see Certificate list. Admin can reach some information such as teacher name, certificate ID that belongs to the teacher, certificate date, definition of certificate, status of the certificate. When the “Approve” button is pressed, the approval date will be written on the approval date column.

**SQL QUERY**

```
SELECT t.name, c.certificate_id, c.date, c.definition, a.approval_date
FROM Certificate c, Teacher t, approves a
WHERE c.t_id = t.t_id AND a.certificate_id = c.certificate_id AND a.date = c.date
AND a.definition = c.definition AND a.t_id = c.t_id
```

# ADVANCE DATABASE COMPONENTS

## 5.1 Views

**Approved_lessons:** This view is used for listing the approved enrollments by the instructor

```
CREATE VIEW approved_lesson(name, l_name)
AS SELECT s.name, l.l_name
FROM (enrolls e, student s, lesson l)
WHERE e.u_id = s.u_id AND e.l_id = l.l_id AND e.status = “approved”
```

**Analytics_lessons:** This view will be used for listing the analytics for every lesson in the system

```
CREATE VIEW analytics_lesson( t_name, l_name, count, avg_grade)
AS SELECT t.name, l.name, count(s_id), avg(grade)
FROM Teacher t, Language l, Student s, learns le, grades_exam g, Knows k
WHERE t.t_id = k.u_id AND l.name = le.name AND s.s_id = le.s_id AND
        s.s_id = g.s_id AND k.name = l.name
GROUP BY (t.name, l.name)
```

**enroll_infos:** This view is used for listing the information of courses of a corresponding teacher.

```
CREATE VIEW enroll_infos(l_id, count) AS (
SELECT l.l_id,  count( *)
FROM lesson l, give g
WHERE l.u_id = t.u_id AND t.u_id = @u_id
GROUP BY (l.l_id)
)
```

## 5.2 Triggers

- When a enrollment request is accepted by a teacher, corresponding relations,which are enrolls, request_class, and activities, will be updated
- When a homework assigned to a student, student activity relation and have relation will be updated
- When a certificate approved, corresponding relation which is approves will be updated
- When  a teacher give grade to a homework, corresponding relations are updated which is grades
- When  a teacher give grade to a exam, corresponding relations are updated which is grades_exam
- When  a native give grade to a meeting, corresponding relations are updated which is grades_meeting

## 5.3 Constraints

- Student can not enroll in a same course twice
- Student can not request meeting from a native if the native holds a meeting in that time slot
- Student can not enroll in a course which is higher than his level in that language
- Teacher can not create a lesson which is higher than his/hers eligible level

## 5.4 Reports

Teachers can see how many students are enrolled in their lessons.

```
CREATE VIEW enroll_infos(l_id, count) AS (
SELECT l.l_id,  count( *)
FROM lesson l, give g
WHERE l.u_id = t.u_id AND t.u_id = @u_id
GROUP BY (l.l_id)
)
```

# IMPLEMENTATION

We will use MySQL to implement our database system. Furthermore,  PHP, JavaScript, HTML and CSS will be used for UI (User Interface) and our website's functionalities.

# WEBSITE