

# Proposal for a Course Support System for Database Exercises

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## Background

- Databases are used in various information systems
- It is very important for a student to learn how databases function
- It is necessary to make the database system available to each student's computer and distribute databases for learning
- Time is required for setup of the environment
- Setup of the environment is difficult for some students

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## Related work

- There are studies on systems supporting database exercises [1-6]
- However some systems can only perform SQL, not have grading function
- Not assumed that an O/R mapper will be used
- O/R mappers are prevalent in the current operation of actual database

We believed learning O/R mappers are necessary

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## Objective

- Propose a new course support system for database exercises
  - As a web application
- Our system makes it easier to learn to use database
- In our system, O/R Mapper is supported
- Our system allows instructors to check student progress on the exercises

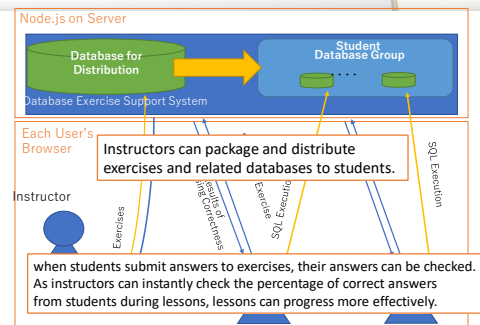
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## Flow of Lessons

- Instructors distribute tasks and databases to perform them to every student on the system
  - The database for distribution is replicated and created for each student account
- Students log in to the system, select a task and code and run a SQL statement or a program including O/R mapper and submit the answer
- Instructors confirm the overall submission status and content of the submissions

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## Outline of our system



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### Account of our system

- There are two kinds of accounts:
  - Student and instructor
- Student
  - It is possible to execute SQL, roll back the database, submit exercise's answer
- Instructor
  - All the functions available through a student account
  - Distribute the exercises and exercise database
  - Check the answers of exercise
  - Create student accounts
  - Manages the system

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### Screen: a task on SQL

SQL-Learning

mt18a004@os

1-1 SELECT statement

Submitted answer

Show all contents of customer table

select \* from customers;

Execute

select \* from customers;

Submission

CUSTOMERID	CUSTOMERCODE	CUSTOMERNAME	ADDRESS	CUSTOMERCLASS
1	2001	タマ	江戸川区 下小岩	2
2	2002	ハナ	江戸川区 北小岩	2
3	2003	ミケ	墨田区 錦町	2

Content of a task

Input fields of SQL

Results of SQL

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### Screen: a task to operate the database using O/R mapper

SQL-Learning

mt18a004@os

1-2 ORM

Submitted answers

Use ORM to display all contents of the products table

```
1: const sqlclient = require('sqlclient');
2: const sqlclient = new sqlclient({
3:   database: '...',
4:   host: 'localhost',
5:   port: 3306,
6:   user: 'root',
7:   password: 'root'
8: });
9: const Product = sqlclient.define('products', {
10:   PRODUCTID: { type: 'INTEGER', primary: true },
11:   PRODUCTNAME: { type: 'VARCHAR(255)' },
12:   PRICE: { type: 'DECIMAL(10, 2)' },
13:   CUSTID: { type: 'INTEGER' },
14:   CUSTNAME: { type: 'VARCHAR(255)' },
15:   Product.toJSON().attributes: ['PRODUCTNAME']
16: });
17: // const sqlclient = require('sqlclient');
18: // const sqlclient = new sqlclient({
19: //   database: '...',
20: //   host: 'localhost',
21: //   port: 3306,
22: //   user: 'root',
23: //   password: 'root'
24: // });
25: // const Product = sqlclient.define('products', {
26: //   PRODUCTID: { type: 'INTEGER', primary: true },
27: //   PRODUCTNAME: { type: 'VARCHAR(255)' },
28: //   PRICE: { type: 'DECIMAL(10, 2)' },
29: //   CUSTID: { type: 'INTEGER' },
30: //   CUSTNAME: { type: 'VARCHAR(255)' },
31: //   Product.toJSON().attributes: ['PRODUCTNAME']
32: // });
```

Result

Executing (default): SELECT 'PRODUCTNAME' FROM 'products' AS 'products':

{ PRODUCTNAME: '金魚' }

{ PRODUCTNAME: '金魚' }

Content of a task

Editor. Student write a code using O/R mapper

Standard output

Standard error output

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### Verified by a questionnaire

- We used our system in a class and conducted a survey about the experience
  - There are 76 students and the average class attendance per lesson was 64.5 students
- On the last day of the course, a survey was conducted
  - 61 students responded
  - The five items for which results are collected

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### Q1) Where did you first experience a hurdle in your learning?

System login and usage	8
Tasks about SQL statements	23
Tasks about an O/R mapper	39
Other	2
Nothing in particular	8

- It is clear that the fewer students found that our system itself was a hurdle to learning than the tasks themselves.
- We believe that the goal of the system to mitigate problems arise at the outset of learning is largely achieved

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### Q2) Where did you encounter problems with tasks using SQL?

SQL statements descriptions	21
SQL execution	14
Grading and submitting	36
Other	3
Nothing in particular	4

- When executing SQL statements, the students felt that there was a problem with the grading and submitting
- This problem occurs as a result of a failure in judgment because the automatic grading function of our system is based on exact matches

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Q3) Where did you encounter problems with tasks using an O/R mapper?

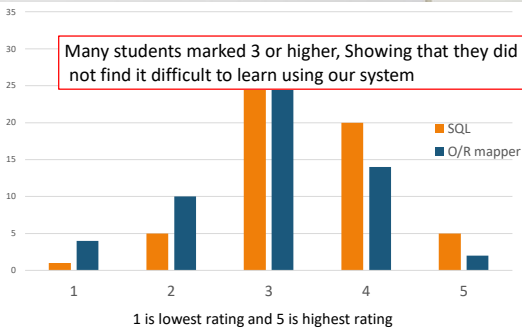
Understanding an O/R mapper concepts	27
JavaScript grammar	25
Sequelize usage	15
Checking for error locations	30
Executing and submitting programs	16
Other	1
Nothing in particular	6

- When executing O/R mapper, the students felt that there was a problem understanding the concepts of the O/R mapper and using JavaScript

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Q4,Q5) Did this system make learning SQL/ORM easier ?



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Conclusion

- Proposed a database exercise support system that aids in lessons involving database exercises
- Used our system in an actual course
- Conducted a survey of the students using questionnaire
- Discovered that our goal of mitigating the problems related to installing the environment was largely achieved
- Our system allows students and a teacher to focus on the essential contents of the database course by using our system

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Future Work

- The survey results revealed a need to improve the automatic grading function
- We plan to improve the overall operability of our system

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- Thank you!

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