FSDM/CPCM-2023
Database Design and SQL
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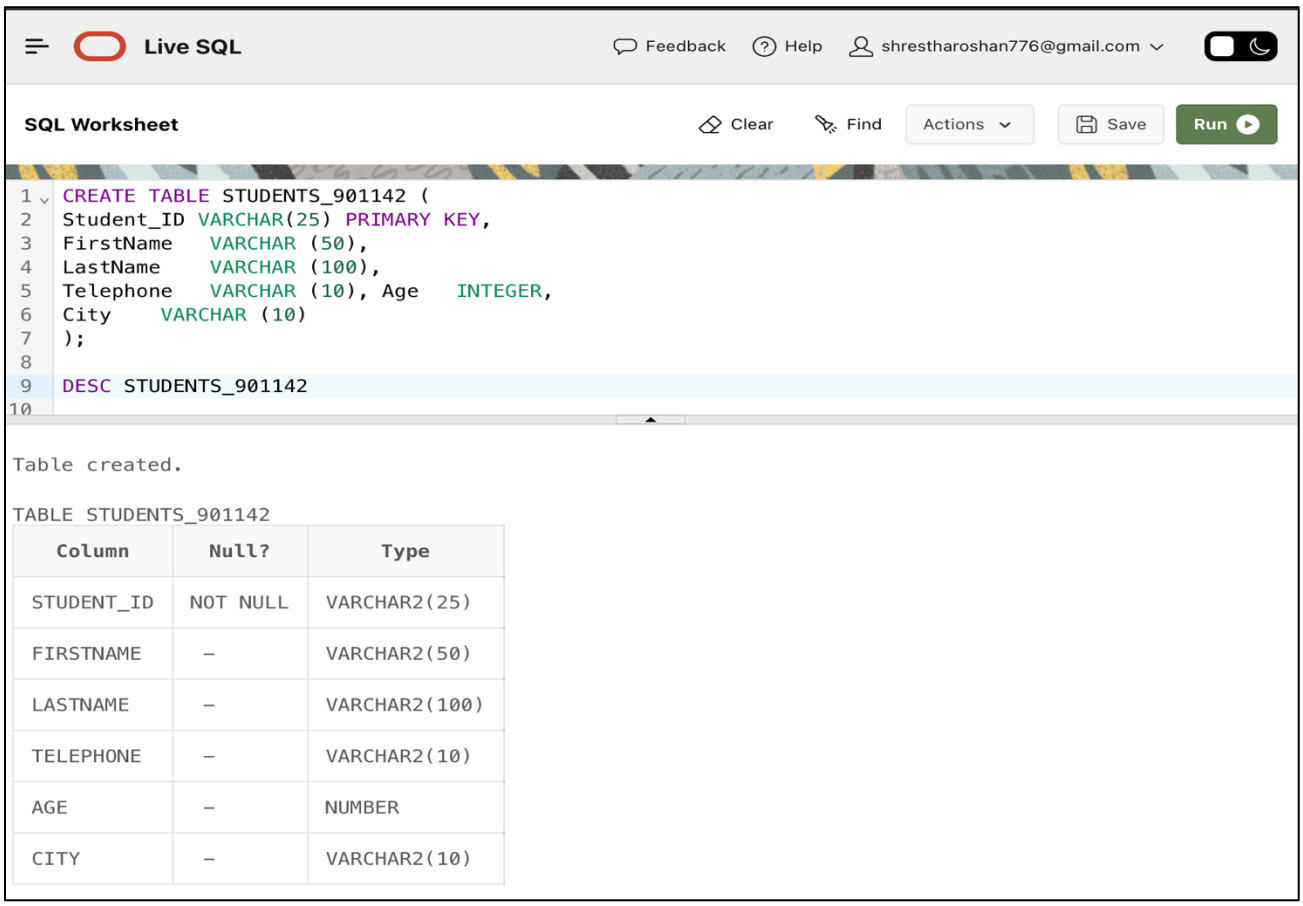
Practical Activity #1

First, to create table **STUDENTS_901142** in Oracle database, we need to execute the following query.

```
CREATE TABLE STUDENTS_901142 (
Student_ID VARCHAR (25) PRIMARY KEY,
FirstName     VARCHAR (50),
LastName      VARCHAR (100),
Telephone     VARCHAR (10),
Age     INTEGER,
City    VARCHAR (10)
);
```

After the execution of the above query, we can use **DESC STUDENTS_901142** query to visualize the created table as below:



The above query will create table **STUDENTS_901142** and the columns are described below:

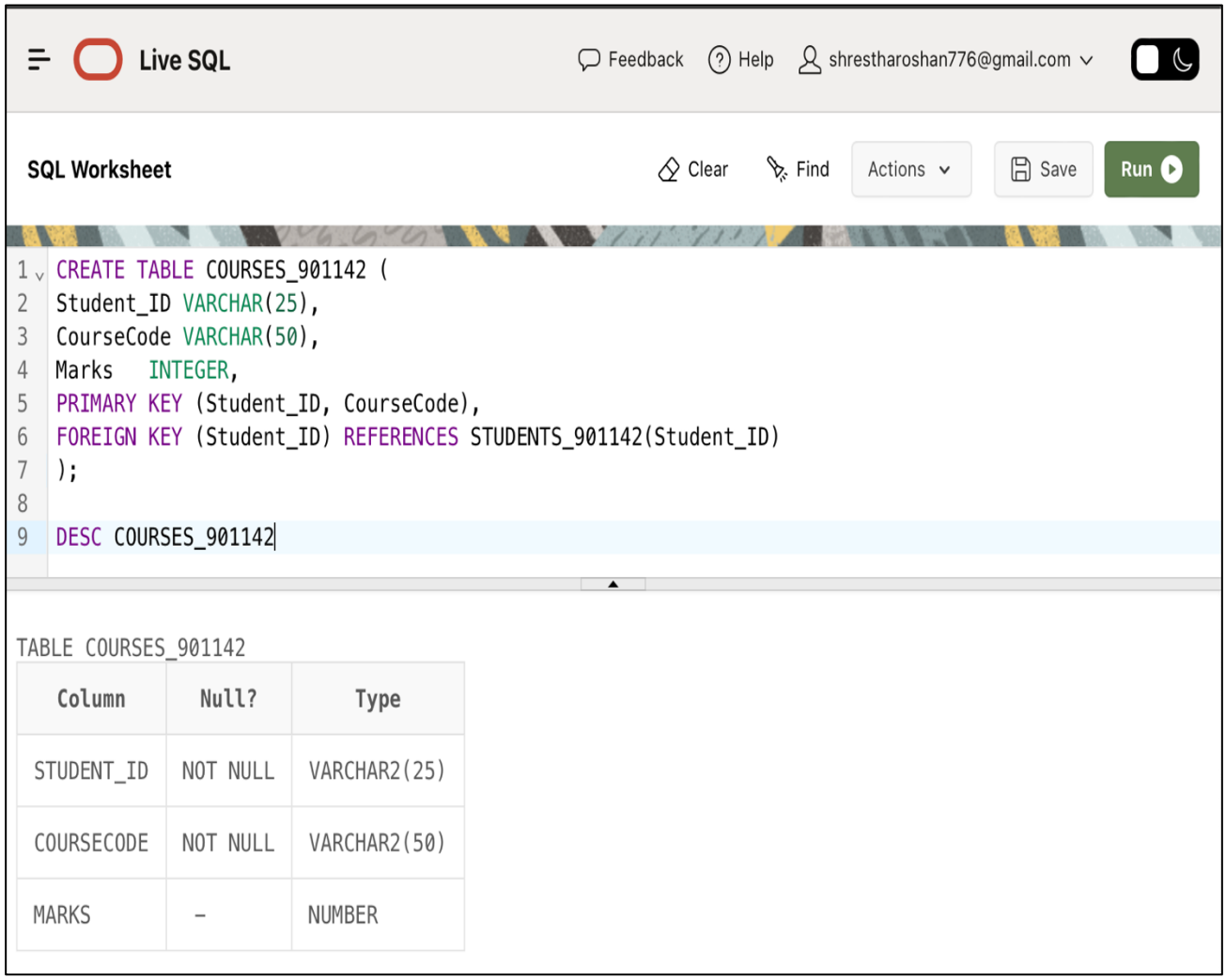
- **Student_ID**: This column stores the data type VARCHAR (25), meaning it can store up-to 25 characters.
- **FirstName**: It can store variable length string or VARCHAR data type with length constraint of maximum length of 50 characters.
- **LastName**: It can store variable length string or VARCHAR data type with length constraint of maximum length of 100 characters.
- **Telephone**: The fourth column with VARCHAR data type which can store a maximum length of 10 characters.

- **Age**: It stores the value with data type of INTEGER data type.
- **City**: It stores value of the VARCHAR data type with a maximumlength of 10 characters.
- **PRIMARY KEY**: Primary key ensures each value in column is unique and non-nullable, and here it is applied to the Student_ID column.

Similarly, to create new table **COURSES_901142** and its correspondence columns, we need to execute the following query:

CREATE TABLE COURSES_901142 (
Student_ID VARCHAR (25),
CourseCode VARCHAR (50),
Marks INTEGER,
PRIMARY KEY (Student_ID, CourseCode),
FOREIGN KEY (Student_ID) REFERENCES STUDENTS_901142(Student_ID)
);

After executing the query, we can use **DESC COURSES_901142** query preview the created table as below:



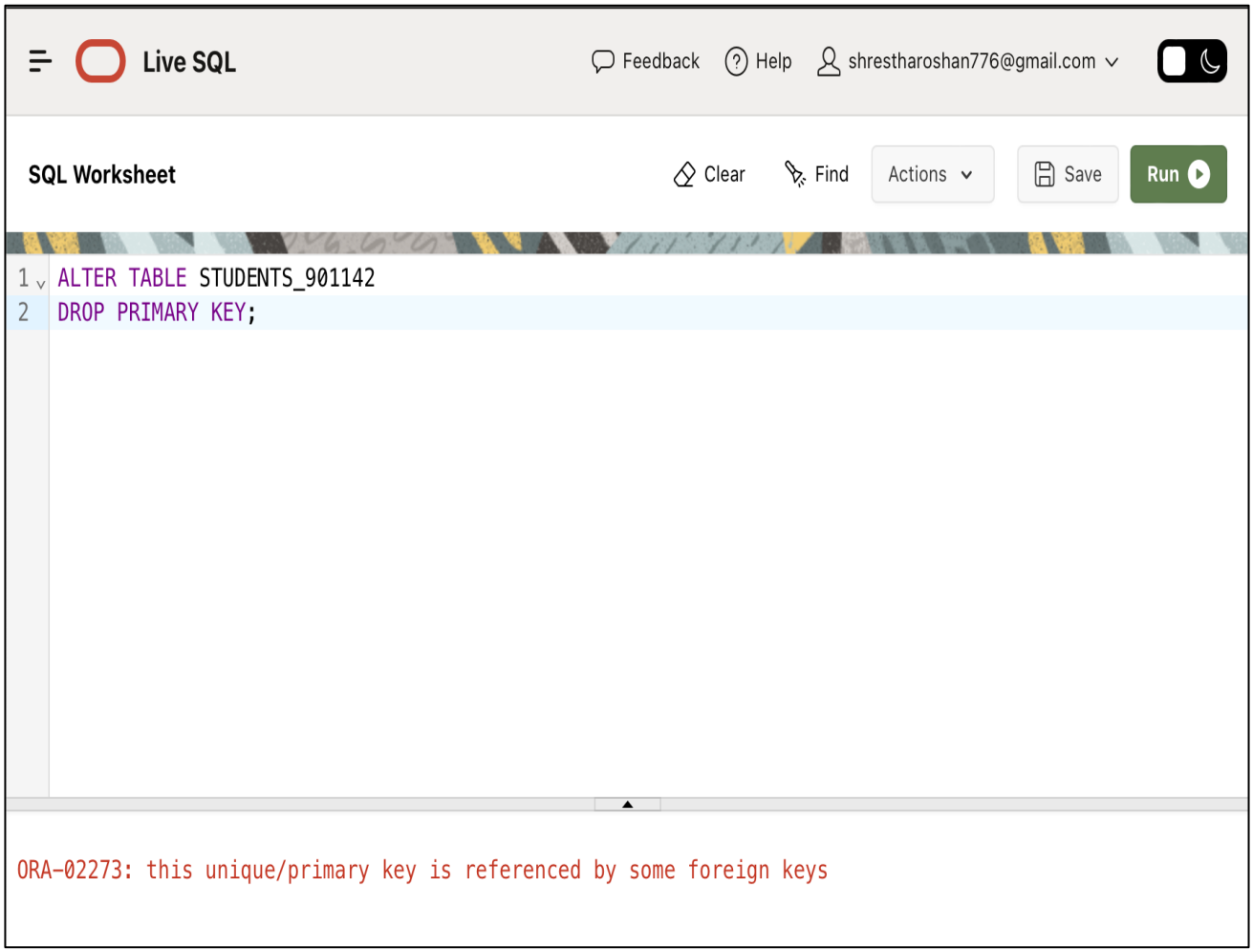
The above query will create table **COURSES_901142** and the columns are described below:

- **Student_ID**: This column will store the student ID for the table which has datatype of VARCHAR (25) and can store up to maximum of 25 character in length.
- **CourseCode**: With maximum length of 50, it can store code of course with VARCHAR (50) datatype.
- **Marks**: It can store whole numbers as it has type INTEGER as data type.

- **PRIMARY KEY (Student_ID, CourseCode)**: The Student_ID and CourseCode columns together are subject to this constraint, suggesting that each row in the database will be uniquely identified by these two columns. Every pair of values in these columns is guaranteed to be distinct and not null by the main key.
- **FOREIGN KEY (Student_ID) REFERENCES STUDENTS_901142(Student_ID)**: The **Student_ID** column in the **STUDENTS_901142** table is related to the Student_ID column in the **COURSES_901142** table thanks to this constraint. It states that the values in the **Student_ID** column of the **STUDENTS_901142** table and the **Student_ID** column of the **COURSES_901142** table must be identical. The **Student_ID** values in the **COURSES_901142** table must also exist as primary keys in the **STUDENTS_901142** table in order to preserve referential integrity.

Practical Activity #2

1. Add a **Primary Key** Constraint to **Student_ID** (Table Level Constraint):
   Based on the requirement from first activity, a primary key constraint has already been added to the **Student_ID** field in the **STUDENTS_901142** table. However, if we need to add a primary key, we may do so by deleting it once again. To remove the primary key constraint linked to the **Student_ID** column, we first need to determine whether any **Student_ID** dependencies need to be removed. Then, we need to run the SQL statement below.



Because Student_ID serves as a foreign key integrity constraint in the COURSES_901142 table. We need to delete COURSES_901142 table and we will restore it using the same create statement.

Live SQL

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SQL Worksheet

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```
1 DROP TABLE COURSES_901142;
```

Table dropped.

Now, let's try to execute the same query to alter and drop the primary key from **STUDENTS_901142** table and observe the table structure. The output is below:

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SQL Worksheet

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```
1 ALTER TABLE STUDENTS_901142
2 DROP PRIMARY KEY;
3
4 DESC STUDENTS_901142
```

TABLE STUDENTS_901142

Column	Null?	Type
STUDENT_ID	-	VARCHAR2(25)
FIRSTNAME	-	VARCHAR2(50)
LASTNAME	-	VARCHAR2(100)
TELEPHONE	-	VARCHAR2(10)
AGE	-	NUMBER
CITY	-	VARCHAR2(10)

Now let's add it **Student_ID** as primary key again using below command and observe the table structure:

ALTER TABLE STUDENTS_901142
ADD CONSTRAINT STUDENTS_901142_pk PRIMARY KEY (Student_ID);

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SQL Worksheet

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```sql
ALTER TABLE STUDENTS_901142

ADD CONSTRAINT STUDENTS_901142_pk PRIMARY KEY (Student_ID);

DESC STUDENTS_901142
```

TABLE STUDENTS_901142

Column	Null?	Type
STUDENT_ID	NOT NULL	VARCHAR2(25)
FIRSTNAME	–	VARCHAR2(50)
LASTNAME	–	VARCHAR2(100)
TELEPHONE	–	VARCHAR2(10)
AGE	–	NUMBER
CITY	–	VARCHAR2(10)

As from the above table structure we can see that primary key constraint has need added to **STUDENT_ID** column, now to verify it, let's execute commands to insert same data twice and observe the output.

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SQL Worksheet

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```sql
INSERT INTO STUDENTS_901142(Student_ID, FirstName, LastName, Telephone, Age, City)
VALUES('901142','Roshan','Shrestha','4373739305', 23, 'Pokhara')

SELECT * FROM STUDENTS_901142
```

STUDENT_ID	FIRSTNAME	LASTNAME	TELEPHONE	AGE	CITY
901142	Roshan	Shrestha	4373739305	23	Pokhara

From the above picture we can see that we were able to insert the data into the table successfully now, let's try to insert the same data to validate if the primary key constraint is working properly or not.

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SQL Worksheet Clear Find Actions Save Run

```
INSERT INTO STUDENTS_901142(Student_ID, FirstName, LastName, Telephone, Age, City)
VALUES('901142','Roshan','Shrestha','4373739305', 23, 'Pokhara')
```

```
ORA-00001: unique constraint (SQL_RQRUEZSCMJSYUTGNLCNRDFBUH.STUDENTS_901142_PK) violated ORA-06512: at
"SYS.DBMS_SQL", line 1721
```

Finally, we can see the error message and it is verified that the **Student_ID** column has been added as primary key in **STUDENTS_901142** table.

2. Add a **NOT NULL** Constraint to **LastName** (Column Level Constraint):

To add **NOT NULL** constraint, the **LastName** column of the **STUDENTS_901142** table is modified with the **ALTER TABLE** command. The definition of the column can be modified using the **MODIFY** clause. The **LastName** column's data type, **VARCHAR (100)**, stays the same, but the **NOT NULL** constraint is added to make sure that it will never have a null value. The required query and its output are below:

ALTER TABLE STUDENTS_901142
MODIFY LastName VARCHAR (100) NOT NULL;

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SQL Worksheet Clear Find Actions Save Run

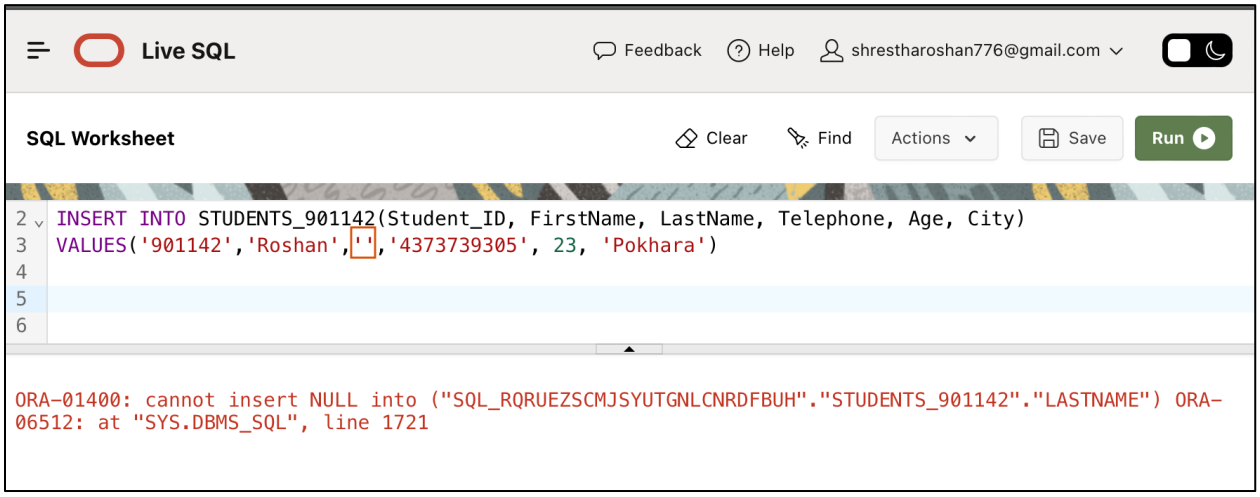
```
ALTER TABLE STUDENTS_901142
MODIFY LastName VARCHAR (100) NOT NULL;

DESC STUDENTS_901142
```

TABLE STUDENTS_901142

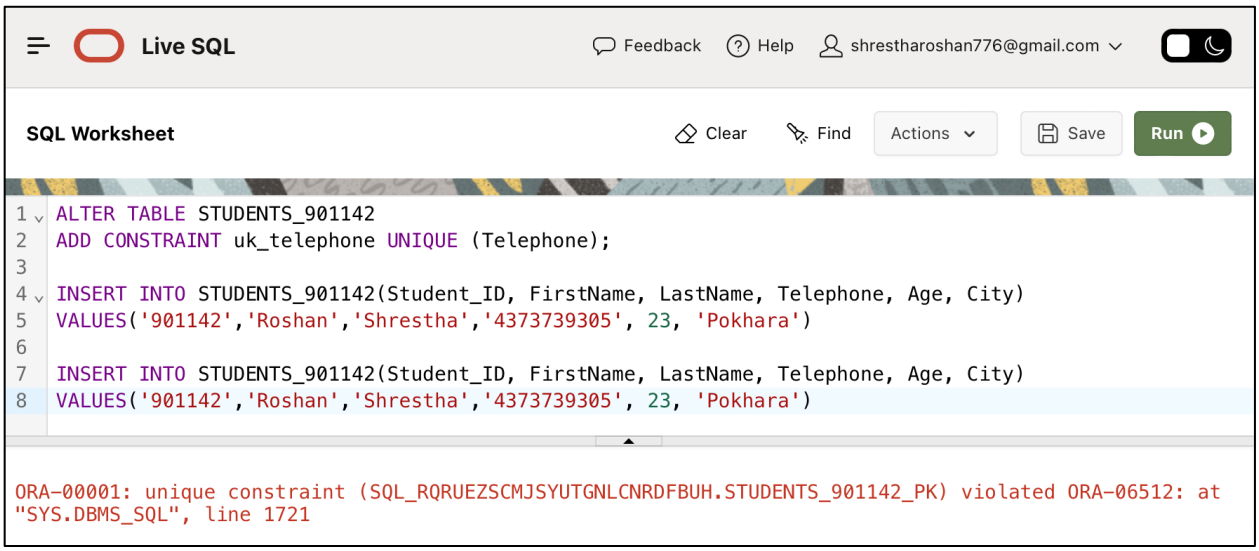
Column	Null?	Type
STUDENT_ID	NOT NULL	VARCHAR2(25)
FIRSTNAME	-	VARCHAR2(50)
LASTNAME	NOT NULL	VARCHAR2(100)
TELEPHONE	-	VARCHAR2(10)
AGE	-	NUMBER
CITY	-	VARCHAR2(10)

To validate if our **NOT NULL** constraint in **LastName** column we can try inserting null value and observe the error message as below:



3. Add a **UNIQUE** Constraint to **Telephone_Number** (Table Level Constraint):
   ALTER TABLE STUDENTS_901142
   ADD CONSTRAINT uk_telephone UNIQUE (Telephone);

After executing the above query, the values in the Telephone column will be distinct across all table rows thanks to this UNIQUE constraint. It stops the table from including duplicate phone numbers. To verify if the **UNIQUE** constraint is working, we can try inserting duplicate data and observe the error message as below:



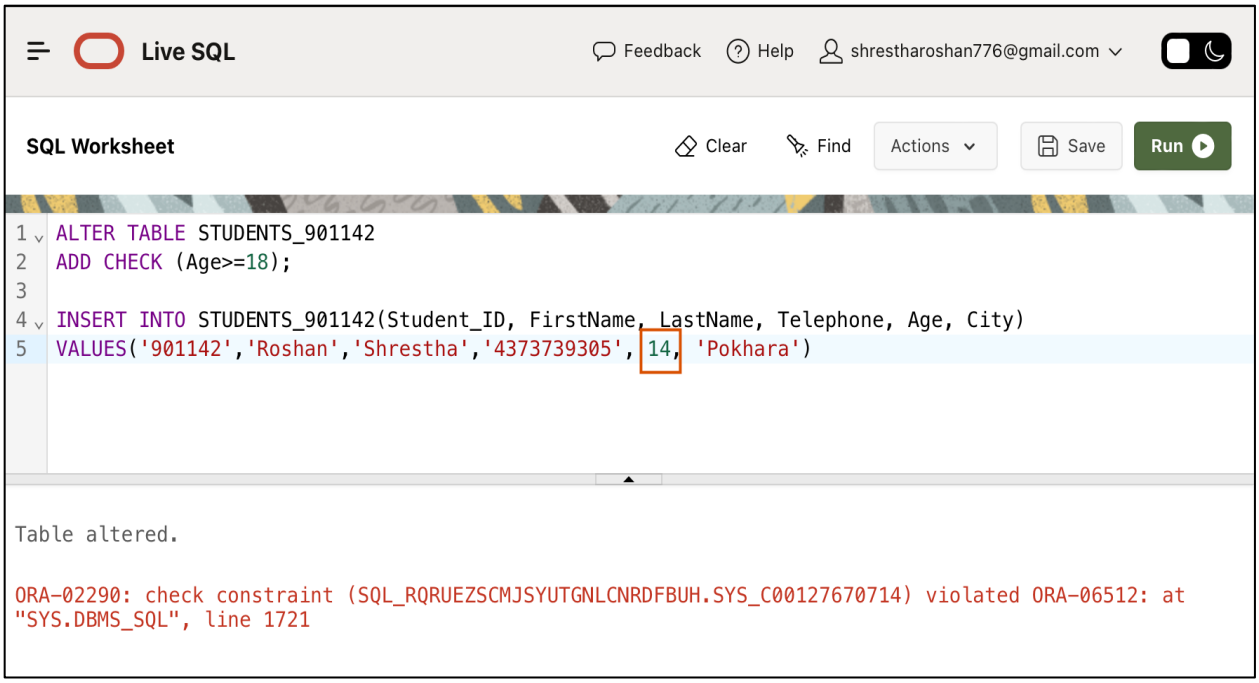
Practical Activity #3

4. Add a **CHECK** Constraint to Age (> 18) (Column Level Constraint):

We can use the following SQL statement to add a **CHECK** constraint to the **Age** column in the **STUDENTS_901142** table, guaranteeing that the age is larger than 18.

ALTER TABLE STUDENTS_901142
ADD CHECK (Age>=18);

Now, let's try to insert the data into the table **STUDENTS_901142** to validate if the **CHECK** constraint is working as expected and observe the output as below:

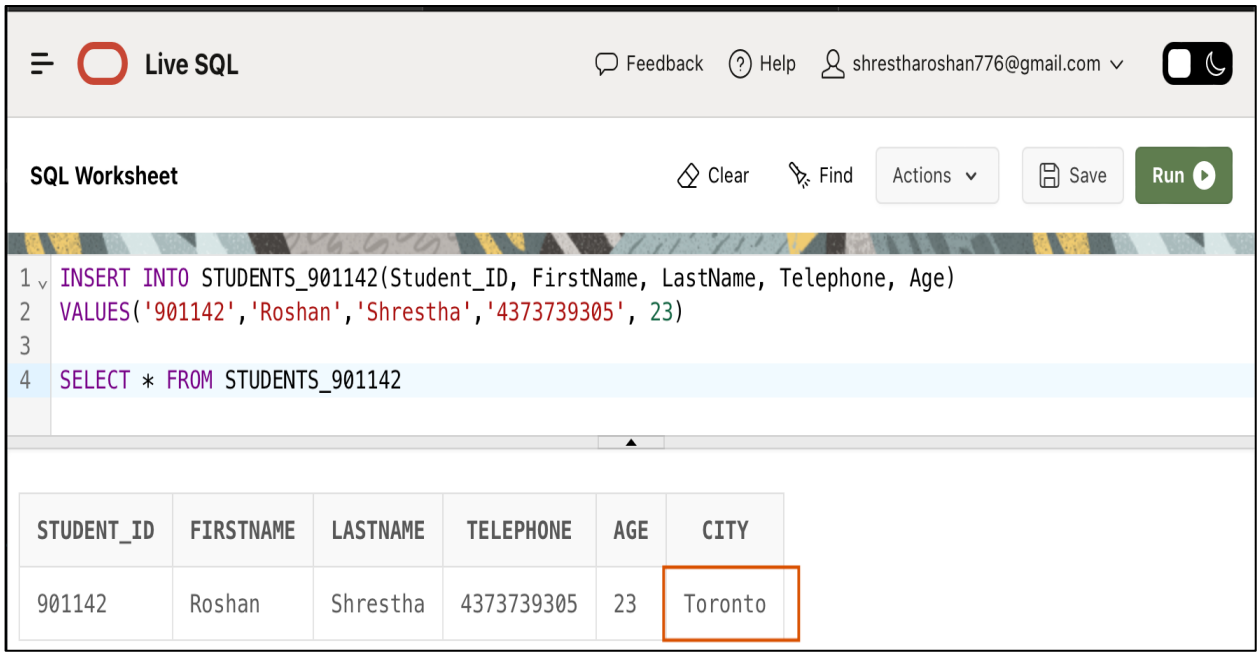


5. Add a **DEFAULT** Constraint to City (Default city 'Toronto') (Any):

DEFAULT constraint can be applied by executing the following query:

ALTER TABLE STUDENTS_901142
MODIFY City DEFAULT 'Toronto';

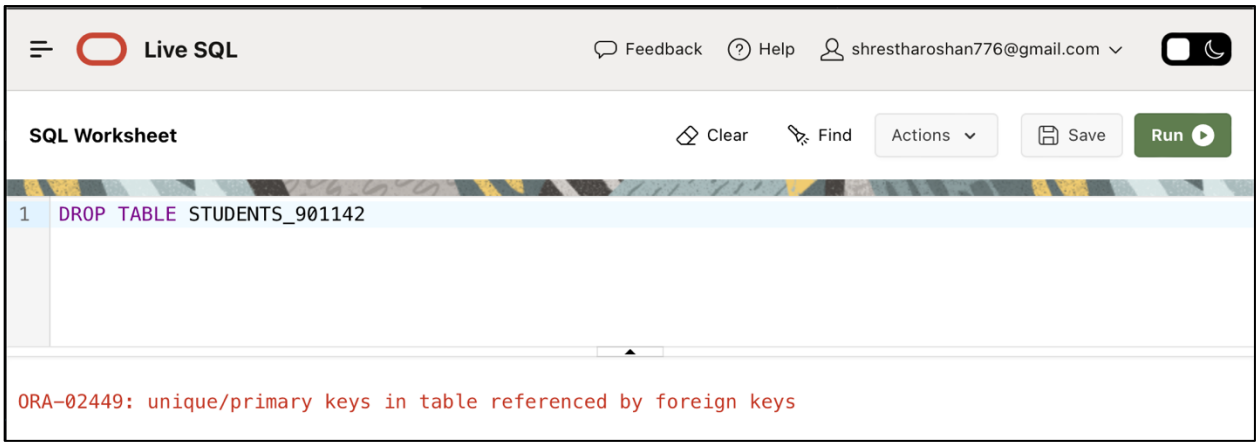
The output after executing the query is below:



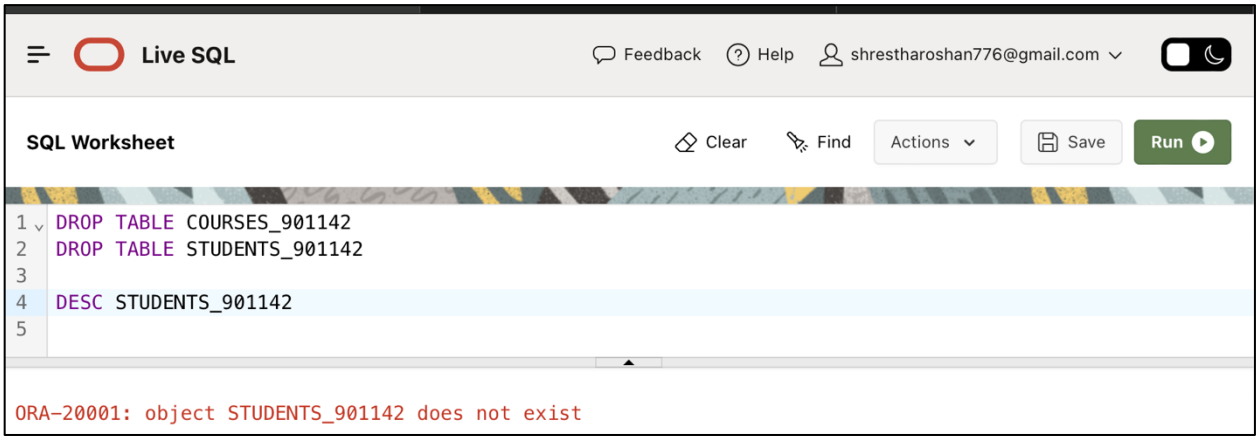
Practical Activity #4

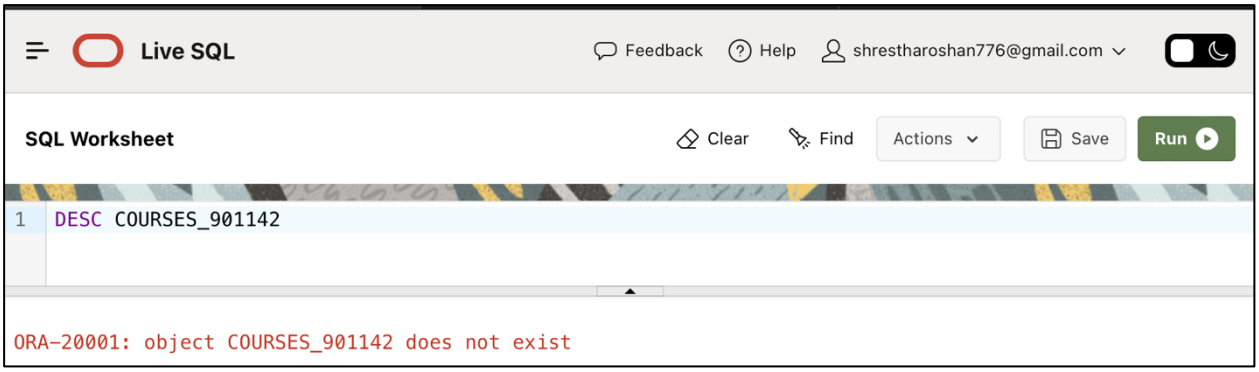
6. Create **FOREIGN KEY** Constraint - Perform **Delete / Insert** Operations to check:

The **Student_ID** and **CourseCode** columns from the **COURSES_901142** database were concatenated to form the primary key of the table, which was a requirement when constructing the **COURSES_901142** table. There is also a foreign key integrity restriction on the **Student_ID** column that refers to the **Student_ID** column in the **COURSES_901142** database. Let's try deleting the parent **STUDENTS_901142** table and observe the error message.

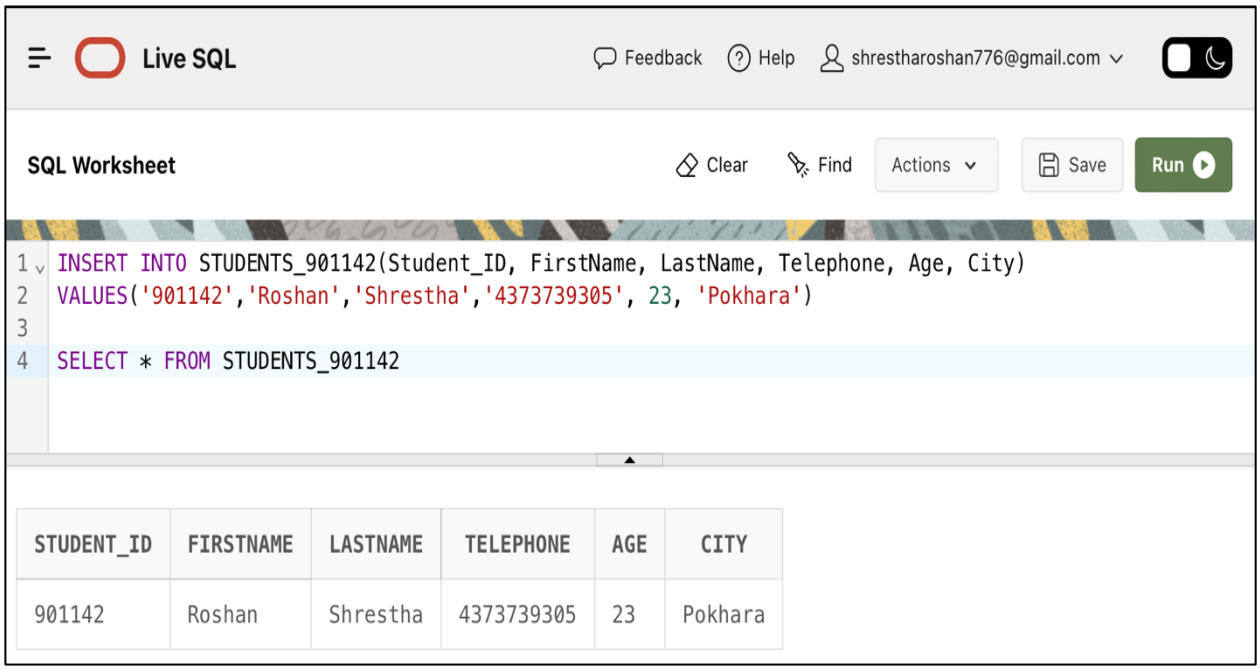


Here we can see the error message that the table has primary key that is referenced by another table as foreign key. So, in order to drop the table we need to drop table **COURSES_901142** first and then drop **STUDENTS_901142**. Here is the output after executing the query:

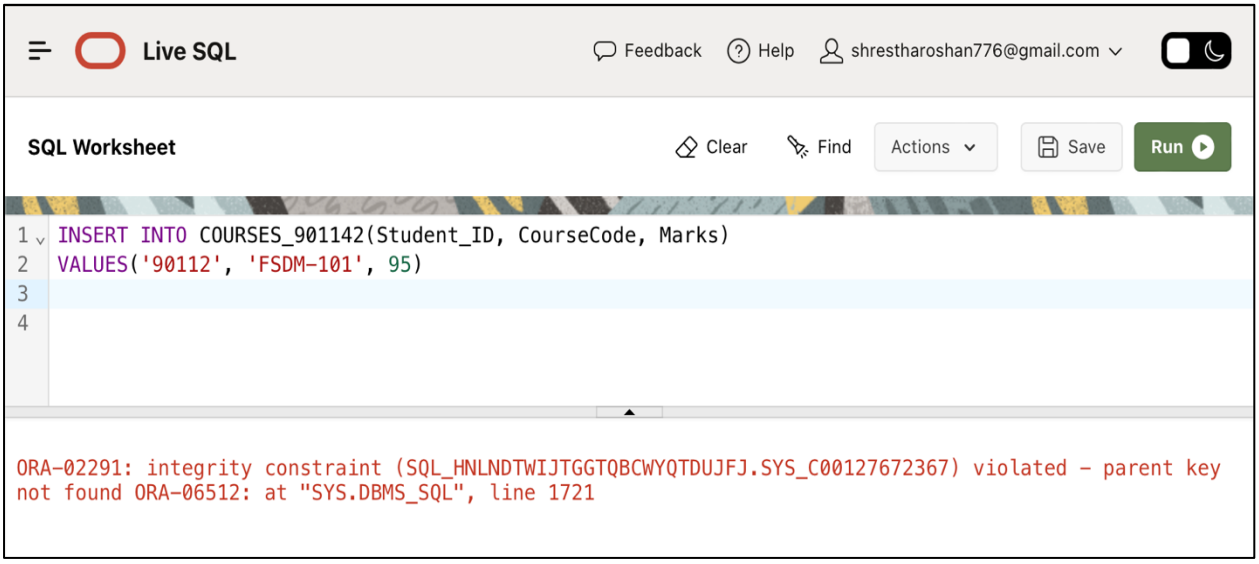




Now, to validate if table **STUDENTS_901142** and table **COURSES_901142** are linked with each other through constraints that we added previously let's try inserting data into them and observe the output.



We are successful while inserting the data into **STUDENTS_901142** table, but let's try inserting data into **COURSES_901142** table with different **Student_ID** which is primary key constraint in **STUDENTS_901142** table and foreign key constraint in **COURSES_901142** table. Which is visualized in the picture below:



At last lets try to insert the same data but with same **Student_ID** that we inserted into **STUDENTS_901142** table and observe the result as below:

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SQL Worksheet

Clear Find Actions Save Run

```
INSERT INTO COURSES_901142(Student_ID, CourseCode, Marks)

VALUES('901142', 'FSDM-101', 95)
SELECT * FROM COURSES_901142
```

STUDENT_ID	COURSECODE	MARKS
901142	FSDM-101	95

Lastly to validate if the deletion works, we need to follow the opposite method i.e., delete the row from **COURSES_901142** table first and then delete the row from **STUDENTS_901142**. Let's see the queries and its output as below:

Live SQL

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SQL Worksheet

Clear Find Actions Save Run

```
DELETE FROM STUDENTS_901142 where Student_ID='901142';
```

```
ORA-02292: integrity constraint (SQL_HNLNDTWIJTGGTQBCWYQTDUJFJ.SYS_C00127672367) violated - child
record found ORA-06512: at "SYS.DBMS_SQL", line 1721
```

Here, as **STUDENTS_901142** table has dependency with **COURSES_901142** table, we are not allowed to delete the parent table directly as mentioned in error message. Now, let's try to delete the child table first and parent table after as shown below:

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SQL Worksheet

Clear Find Actions Save Run

```
DELETE FROM COURSES_901142 where Student_ID='901142';
DELETE FROM STUDENTS_901142 where Student_ID='901142';
```

```
1 row(s) deleted.

1 row(s) deleted.
```