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SQL: An Android Mobile Application for Effective Teaching of Basic Structured Query Language

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***Abstract*: Structured Query Language (SQL) is a important query language for storing, manipulating and retrieving the data from database. So every individual needs the skill to access the data and analyze it. Since SQL is used while designing most of the softwares in the industry, students should have in-depth knowledge of firing the queries on the database. So the mobile app for the SQL is developed. This app contains SQL material, practice part to run the query, test, question bank and videos related to SQL topics. In this study, step by step process is given to access each part of this mobile app. The research question is "Whether an android mobile app for the course SQL is useful and helps students to understand this language by going through the notes & PPTs and practicing the SQL query through the practice section given in app?" Also the feedback is given to know the perception of students about this app.**

***Keywords*: SQL, Android Mobile Application, Quiz, Likert's scale, Feedback**

JEET Category— Research

I. INTRODUCTION

In current scenario, students must have theoretical as well as more practical knowledge and skills required to work in the technologies which are currently used in industries. SQL (Structured Query Language) is a domain-specific language used in programming and designed for accessing and managing data held in a RDBMS (Relational Database Management System). For designing the software in industry, students should have the knowledge of SQL. Hence in this study, the android mobile app for SQL is considered.

The section 2 represents the literature survey while section 3 discussed SQL app content followed by the conclusion.

II. LITERATURE SURVEY

There are various app for the engineering courses such as Compiler Construction, Theory of Computation, Data Structure (Aher, S. B., et.al. , 2014), Algorithm course (Dol, S. M, et.al. , 2014), System Programming (Dol, S. M., & Patnaik, P. S. R. , 2017), etc.

The app for algorithm course (Aher, S. B., et.al., 2014) contains learning of various topics such as Sorting, Tree, Linked List, Queues and stacks which are very important parts of Data Structure subject of Computer Science and Engineering. The one more app contains the notes for learner and with the help of those notes, learner will execute the program or analyze the working of algorithm using animation (Dol, S. M, et.al. , 2014). The SysPro app contains the various puzzles such as cross words, etc along with lab handouts, PPTs, Notes, Question Bank and Quiz.

The author (Oyelere, S. S., Suhonen, J., & Laine, T. H. , 2017) integrate the parson's programming puzzles into a game-based mobile learning application the teaching and learning of programming. Also the authors (Darras, K. E., et. al., 2019) considered the use of the mobile app for medical students for m-learning in radiology. There is a study which considered the Sensor-based mobile application for teaching physics to regular students (Alfonte Zapana, R., & Córdova Martínez, M. D. C. , 2020).

The use of smartphones and a specific subject-app which are used at the Spanish National University of Distance Education (UNED) is discussed in the study (Vázquez-Cano, E. , 2014). The study considered the use of mobile devices for higher education model (Satiman, A., 2019) and Surgical education (Dickinson, K. J., & Bass, B. L., 2020).

So there are various app for various courses also but there is no app which contains study material, and IDE for practicing SQL queries. So in the current study, the app for SQL is explained.

III. SQL APP CONTENT

Basic SQL topics covered in this mobile app are related to the Structured Query Language such as

- Data Definition Language (CREATE, ALTER, DROP),
- Data Manipulation Language (INSERT, UPDATE, DELETE),
- Structure of SQL queries,
- Set Operations (UNION, INTERSECT, EXCEPT),
- Aggregate functions (COUNT, MIN, MAX, AVG, etc),
- Nested subqueries (IN, NOT IN, SOME, ALL, EXISTS, NOT EXISTS, UNIQUE, NOT UNIQUE), Views and
- Join operations (INNER JOIN, LEFT OUTER JOIN, RIGHT OUTER JOIN, and FULL OUTER JOIN)

SQL app contents are given in the figure

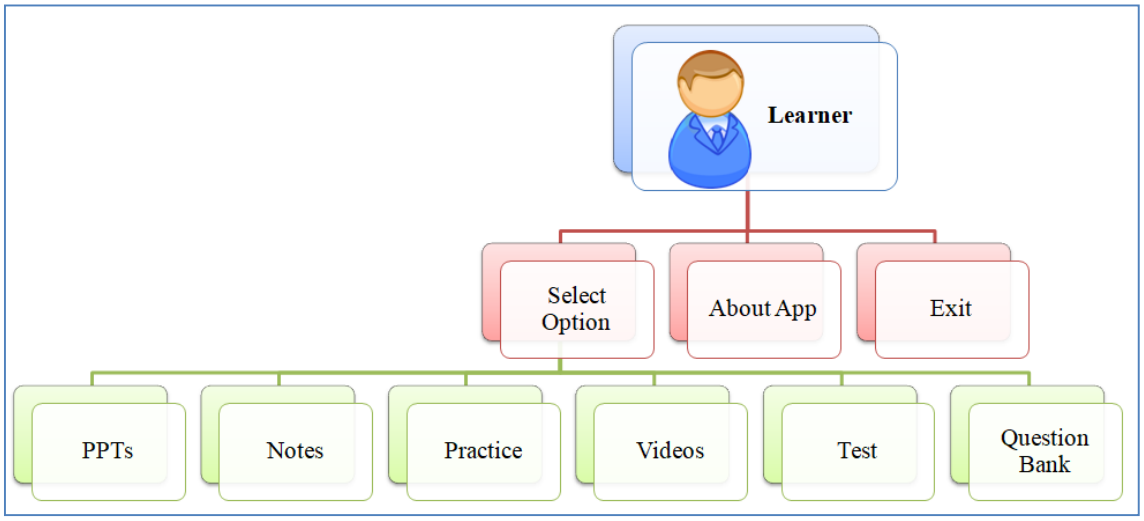

Fig. 1. SQL Mobile Application Content

This app is developed using Android Studio software. Course material prepared for this app took 2 months and app development required 1 month.

Steps to use this mobile app

Step1 – Install the app in mobile. Once this mobile app is installed in the mobile, following icon will be displayed as shown in Figure 2.

Fig. 2: Application Icon

Step2 - After clicking on the SQL icon, following screen is displayed for 20 seconds which shows the text for this SQL app.

Fig. 3: Screen for 20 second

Step3 – After displaying the screen shown in Figure 3 for 20 seconds, the following screen shown in figure 4, will be displayed with icon for

- PPTs
- Notes
- Practice
- Videos
- Test
- Question Bank
- About App and
- Exit

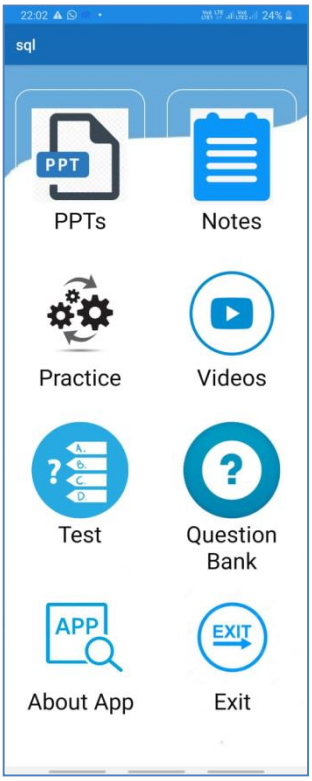

Fig. 4: The main screen of the SQL application

A. Power Point Presentations

Self-created PowerPoint presentations (PPTs) for each of the following topics are displayed.

- Entity Relationship Diagram
- Textual Description and Entity Relationship Diagram for Banking Enterprise
- Reducing Entity Relationship Diagram to Relational Schema
- Introduction to Structured Query Language
- Data Definition Language (CREATE, ALTER, DROP),
- Data Manipulation Language (INSERT, UPDATE, DELETE),
- Structure of SQL queries,
- Set Operations (UNION, INTERSECT, EXCEPT),
- Aggregate functions (COUNT, MIN, MAX, AVG, etc),
- Nested subqueries (IN, NOT IN, SOME, ALL, EXISTS, NOT EXISTS, UNIQUE, NOT UNIQUE), Views and
- Join operations (INNER JOIN, LEFT OUTER JOIN, RIGHT OUTER JOIN, and FULL OUTER JOIN)

In all above PPTs, the topics are explained with the help of Banking Example. These PPTs are very helpful in engaging the students effectively in teaching-learning process.
Figure 5 shows the sample PPT along with the steps to go through these PPTs.

Fig. 5: PPTs

B. Study Material

Self-created notes for each unit are provided in this application with the same formatting for all the topics covered in PPTs. Each notes for the topics

- Data Definition Language (CREATE, ALTER, DROP),
- Data Manipulation Language (INSERT, UPDATE, DELETE),
- Structure of SQL queries,
- Set Operations (UNION, INTERSECT, EXCEPT),
- Aggregate functions (COUNT, MIN, MAX, AVG, etc),
- Nested subqueries (IN, NOT IN, SOME, ALL, EXISTS, NOT EXISTS, UNIQUE, NOT UNIQUE), Views and
- Join operations (INNER JOIN, LEFT OUTER JOIN, RIGHT OUTER JOIN, and FULL OUTER JOIN)

contain

- Introduction of the topic and
- Problem statement consisting of
  - Problem Statement
  - Contents of table required to run the query
  - Step-by-step query along with result to obtain the solution for given problem statement

As shown in Figure 6, after clicking on Notes icon, topic names will be displayed. After clicking on particular topic, the sample notes for that topic will be displayed.

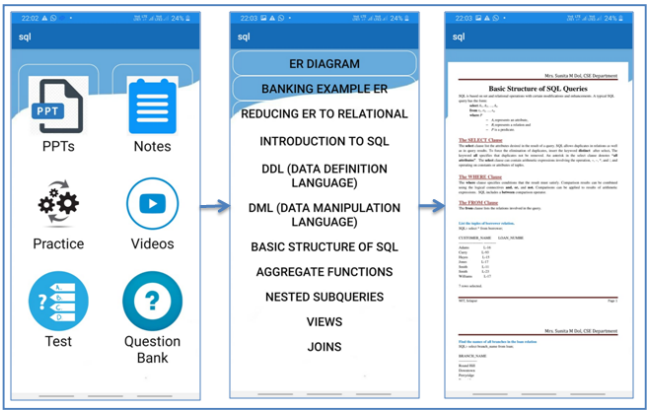

Fig. 6: Notes

C. Practice

Practice part contains three tabs-

- Questions – It is first tab. It contains four practice set. Each practise set contains the questions. After clicking on particular question, question is displayed and student has to write the query for that question. Result is also displayed for the question.
- Tables – It is second tab. It displays all tables considered for questions in each practice set.
- IDE (Integrated Development Environment) – It is third tab. IDE is considered to write any query for tables mentioned in second tab. It displays the result also.

Figure 7 displays the parts of this practice along with how to execute the query for the given question.

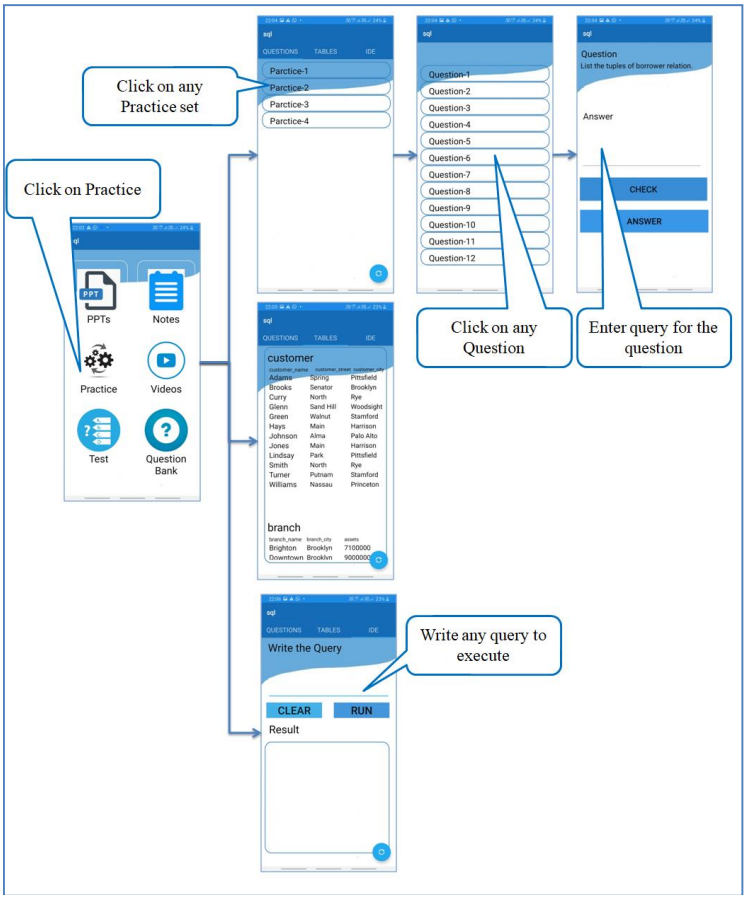

Fig. 7: Practice

D. Videos

Self created videos are also added in this app related to the basic SQL. For each topic, each video is of 10-12 minutes and each video contains

- Introduction of topic
- Learning outcomes
- Contents related to the topic
- Reflection Spot which can be MCQ, True/False Question, Short Answer Question, etc.
- Explanation about the answer to the question/s considered in the reflection spot
- Post reflection spot contents
- References used to prepare the presentation.

Table 1 gives the video name, Youtube link and number views for each video.

TABLE 1
VIDEOS CONSIDERED IN THE APP

Sr.No.	Name Topic	YouTube Video Link
1	DDL CREATE Command	https://www.youtube.com/watch?v=BGiIZgw9JHY
2	DDL Constraints on CREATE Command	https://www.youtube.com/watch?v=64XfUvdnoHc
3	DDL ALTER and DROP Command	https://www.youtube.com/watch?v=JjUOIURs3u4
4	DML – INSERT command	https://www.youtube.com/watch?time_continue=2&v=xqoW1vJHo5M
5	DML – UPDATE and DELETE command	https://www.youtube.com/watch?time_continue=1&v=eonduiAex_k
6	DCL (Data Control Language)	https://www.youtube.com/watch?v=vOooclQ5q_Y
7	TCL (Transaction Control Language)	https://www.youtube.com/watch?v=BttRblah-3s
8	DML – Basic Structure of SQL	https://www.youtube.com/watch?v=aLMcHQKU5ww
9	Basic Structure of SQL	https://youtu.be/DwC_e6ixdn0
10	Set Operations	https://youtu.be/45vjoMnn5EU
11	Aggregate Functions	https://youtu.be/Qqqxn37_96Q
12	Nested Subqueries - Set Membership and Set Comparison	https://youtu.be/JkXnuPBvL6g
13	Nested Subqueries - Test for Empty Relations and Test for Duplicate Tuples	https://youtu.be/lDa041zch6g
14	Complex Queries	https://www.youtube.com/watch?v=iXCBy_6_yss
15	Views Part-I	https://www.youtube.com/watch?v=h93jzx3Kovs
16	Views Part-II	https://www.youtube.com/watch?v=OS6V1O8mM1s
17	Inner Joined Relations	https://www.youtube.com/watch?v=gJ4x9yx5rdk
18	Left Outer Joined Relations	https://www.youtube.com/watch?v=UpQZIjzChJ0

Figure 8 shows the sample video along with the steps to go through the videos.

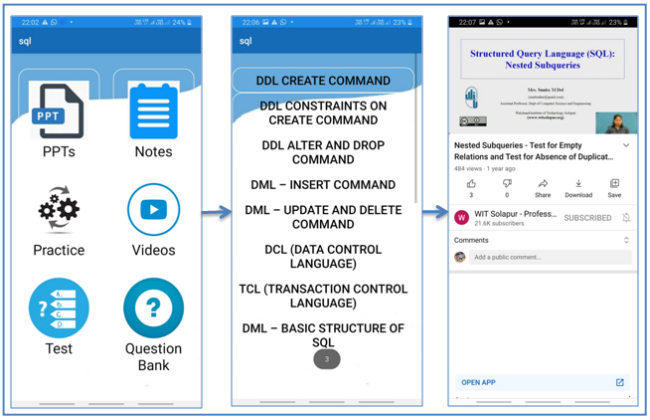

Fig. 8: Videos

E. Test

Test is used to check the knowledge about the SQL. This test consists of 25 questions. The steps to attempt the test is given below and shown in Figure 9:

- Click on Test icon
- The Test part contains
  - Number of questions remaining – is displayed in the box.
  - Question is displayed.
  - Options – when the correct option is selected, that text get disappear. Select all correct options and then only click on the NEXT button otherwise the message will be displayed – Still some correct options are there.
  - Button NEXT – is clicked to go through the next questions.

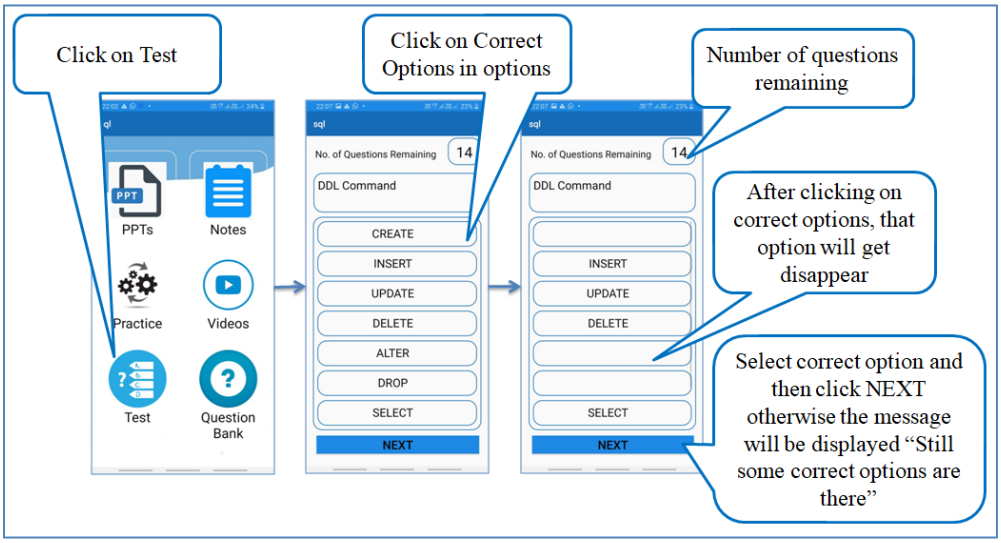

Fig. 9: Test

F. Question Bank

This question bank will helpful for the learners to know about the questions that can be asked in the examination. The sample question page is shown in Fig. 10.

- ER Diagram
- ER Diagram MCQs
- SQL Queries
- SQL Queries MCQs

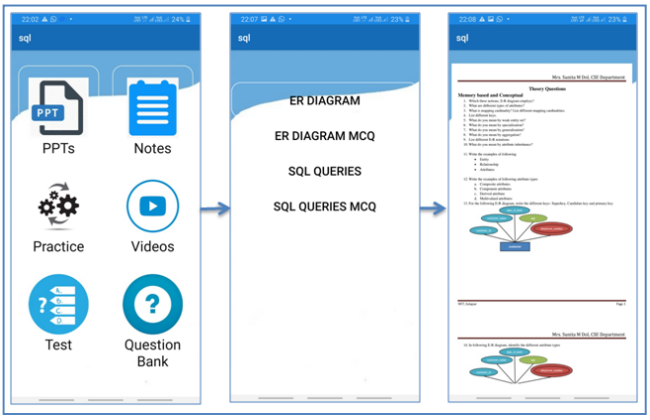

Fig. 10: Question Bank

G. About app

Information about how to use the app is provided in 'About app' option. The About App contains the following information-

- Topics covered in the App
- How this app works
- References used to prepare the material in the app.

The page showing the information about the app is shown in figure 11.

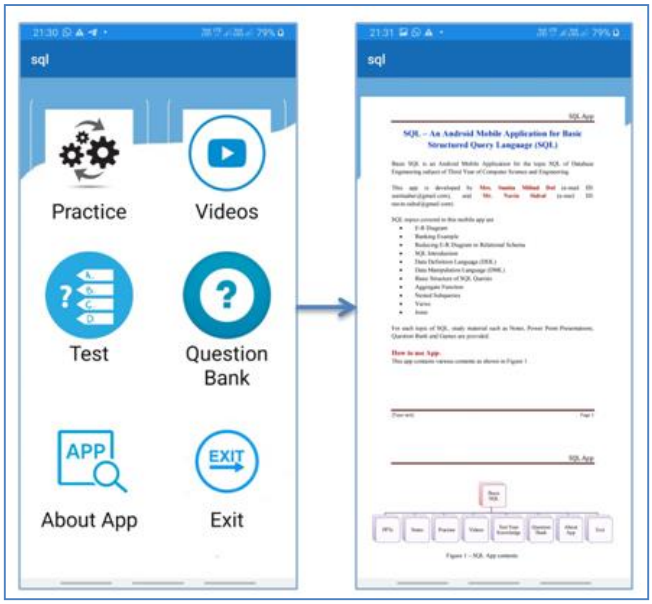

Fig. 11: About App

IV. METHODOLOGY

A. Research Design

To check the effectiveness of this app, a sample 70 students of Third Year Computer Science and Engineering were considered. Students will first go through this app for the SQL material and practice the SQL query using IDE part of this app. Test of 70 marks was conducted for these students. The details about this study are given in Table 2.

TABLE 2
RESEARCH DESIGN DETAILS

Technique used	SQL Mobile App
Sample	70 students of Third Year Computer Science and Engineering
Method used	One Group post-test method
Instruments used	• Post-test • Survey Questionnaire
Bloom's Taxonomy	Cognitive Level – Understand and Apply
Statistical Analysis	t-Test

B. Feedback

The indirect assessment tool like survey questionnaire with Likert's scale of five values (strongly agree (SA), agree (A), neutral (N), disagree (D) and strongly disagree (SD)) is used to know the perception of research scholar about this mobile app. The feedback is shown in table 3.

TABLE 3
FEEDBACK FORM

Sr. No.		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	SQL app covers all the topics	65%	35%	-	-	-
2	The power point presentations given in the app is useful for understanding the SQL topics	45%	53%	2%	-	-
3	The notes containing step by step process for executing every problem statement given in the app are useful	50%	46%	4%	-	-
4	The question bank given in the app is useful	53%	23%	4%	-	-
5	The test contained in the app is useful	45%	55%	-	-	-
6	This app clarifies the concepts of SQL	53%	25%	2%	-	-
7	The practice part mentioned in the app is useful for running the SQL queries	45%	55%	-		
8	Did you like this mobile app?	100%				

From the feedback, it is observed that an android mobile app for the course SQL is useful and helps students to understand this language by going through the notes & PPTs and practicing the SQL query through the practice section given in app.

V. RESULT ANALYSIS

Figure 12 shows the marks obtained by students in the test.

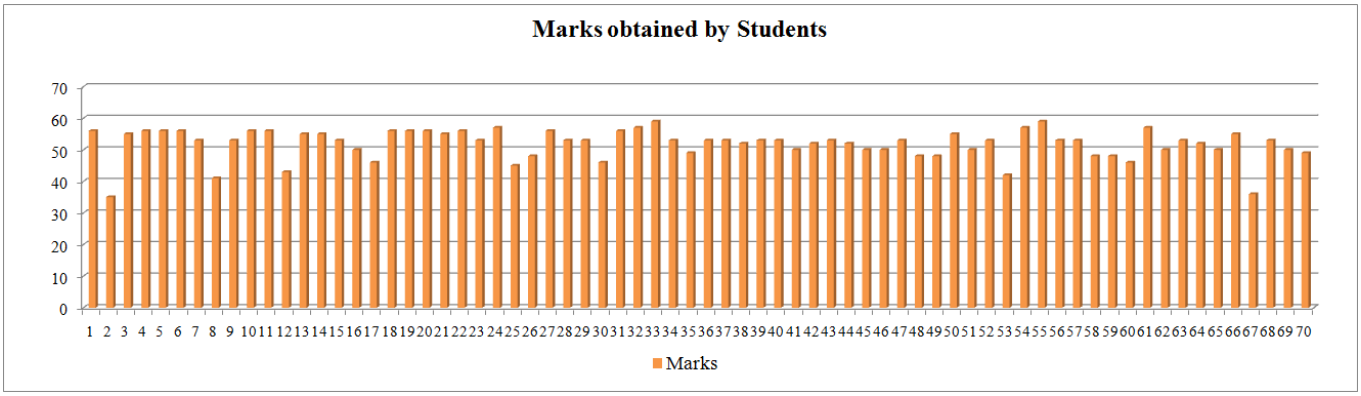

Fig. 12. Marks obtained by students

To check the whether the result is significant, single sample t-Test is calculated. Table 4 shows the statistical analysis using single sample t-rest. From Table 3, it is noted that as the p-value is 0.001093 which is less than 0.05, hence the result shows the statistical significant result.

TABLE 3
STATISTICAL ANALYSIS USING T-TEST

	Population	t-value	p-value
	Mean		
Final Test (50)	50	3.183091	0.001093

VI. CONCLUSIONS AND FUTURE WORK

In this study, an android mobile app for the SQL is considered. This app contains the Practice part which students can used for running the queries mentioned in the app. This app contains the various problem statement related to the Banking example which students can practice.

Also students can check their knowledge about SQL using the Test part of this app. The future work includes the design of the app for the course Database Management System and includes this app's URL to practice the SQL queries.

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