

DATA ANALYSIS OF STUDENT'S PERFORMANCE ON "DATABASE" COURSE WITH ORACLE APEX STATISTICS

ATHANASIOS ANGEIOPLASTIS,¹ ALKIVIADIS TSMIPRIS,¹
DIMITRIOS VARSAMIS,¹ ALENKA BAGGIA,² ROBERT
LESKOVAR²

¹ Department of Computer, Informatics and Telecommunications Engineering,
International Hellenic University, Serres, Greece
aagiop@gmail.com, atsimpiris@ihu.gr, dvarsam@ihu.gr

² University of Maribor, Faculty of Organizational Sciences, Kranj, Slovenia
alenka.baggia@um.si, robert.leskovar@um.si

Abstract In the present study, we deal with the statistical analysis of the performance of the International Hellenic University of Greece students in the course "Databases", on a 19-year data set (from 2003 to 2021) using the tools provided by Oracle APEX. This dataset is consisted of 6600 records and 30 features. We focused on seven features that represent demographic characteristics and the grade of the students. Specifically, we used student scores in the above course to examine trends and patterns of behavior by gender, student enrollment periods, different programs of study, students' type of home school, and performance by gender. ORACLE APEX tools helped us to easily transform and clean the data, group them, and display the results online. Descriptive statistics commands are incorporated into ORACLE in order to create statistical reports and analytics.

Keywords:

Oracle
APEX,
statistical
analysis,
student's
performance,
descriptive
statistics,
statistical
reports

1 Introduction

Academic performance [Pascarella, 1980] correlates with the development that students achieve both academically and intellectually. In addition, academic achievement [Narad & Abdullah, 2016] is the knowledge acquired and evaluated by the teacher according to the educational goals that have been achieved in a certain period of time. Based on achievement, academic performance [Finn & Rock, 1997] is determined by high grades and test scores and similarly total marks [Choi, 2005] earned in a course indicate academic performance. Academic performance can be easily understood as a measurable presence of the student in a certain period by summing up his grades, evaluations through tests, exams, etc. Scholars who approach academic performance with a focus on knowledge defined that academic performance acts as an indicator of success in educational institutions and is determined by the degree to which a student completes his studies and tasks. As well as that academic performance is defined as the outcome of students' learning and training which is expressed through grades, is one of the most important factors in higher education. Several researchers have used statistic applications to predict and evaluate students' academic performance in the decision-making process and to understand the learning process [Mengash, 2020]. For some other scholars [Kumar & Agarwal, 2021] a student's academic performance is defined by the type of work offered, job security, satisfaction he obtains as well as the level of commitment he has in his career and academic performance is the scenario in that the education acquired gives students the opportunity to develop competencies, career advancement, securing high levels of career satisfaction and realizing aspirations. Finally, academic achievement can be defined as the persistence of students to complete studies regardless of contexts and issues related to the institution. The factors that influence the academic performance of students are numerous and vary from nation to nation as well as from individual to individual. According to [Tinto, 1975] model there are four elements that play an important role in the academic success of students: a) Academic and social experiences, b) Initial goals and motivations, c) External commitments and d) Skills and abilities (see Figure 1).

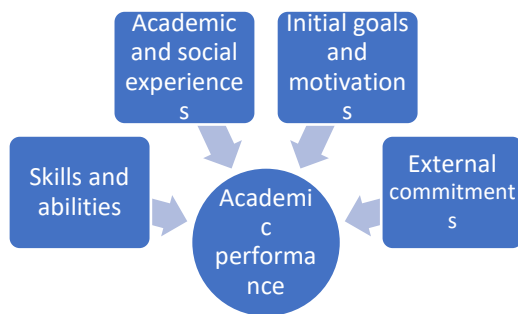


Figure 1: Tinto's model for the factors of academic performance

The research of [Arora & Singh, 2016] attempted to categorize the factors found to affect the academic performance of students into the following categories: Psychological, Social, Financial, Environment.

The purpose of this work is initially to study and analyze the data obtained by the students regarding their performance in the "Database" course. The presentation of success rates of the students, the distribution of their grades and the exact time of success of the course Considering that performance represents the understanding and consolidation of course content, we realize how important such analyzes are. Additionally, this study investigates the correlations between factors that influence academic performance such as the students' school of origin, gender and student origin.

The rest of the article is structured as follows: Section. 2 presents the Dataset that used. Section 3 presents the research methodology for this study. Section 4 describes the application that designed application using ORACLE APEX in order to manipulate the dataset and extract useful statistics using low-code programming. Section 5 summarizes the conclusions of this study.

2 Dataset

In this work, the research population consists of all the undergraduate students of the department from its operation in 2003 until 2021 covering a 19-years long period. This dataset is consisted of 6600 records and 30 features. We focused on 7

features that represent demographic characteristics and the grade of the students (See Table1)

Due to the difficulty of recording and the inadequacy of all the information about the students, the work was chosen to focus the research on the student performance in the years 2003-2021. The data for this work extracted from the online student portal of the university's electronic secretariat. One excel file was about the students of the department with information in 67 columns and another excel file had information about the “Database” course of Computer, Informatics and Telecommunications Engineering Department (CITE) of International Hellenic University (IHU). After studying the data, the files were processed appropriately. As part of the work and for better management of the information contained in the files, a database was created in ORACLE APEX environment using as primary key the registry number (AM) of a student. Table 1 is a screen shot of the database that was created and focused on the features that were used at this study.

Table 1: A report of the dataset with the features that were examined

Αντισταθμιστικό Γ	Subject	Am	Semester	Grade	Exam Period	Period	School Type	Gender
1	ΒΑΣΙΚΕ ΔΕΞΙΟΤΗΤΕΣ-Θ	4.628	7	5	2021-2022 ΕΡΓΗΤΕΜΠΟΙΕ	W	GENERAL	M
2	ΒΑΣΙΚΕ ΔΕΞΙΟΤΗΤΕΣ-Θ	4.658	7	6	2021-2022 Α' ΠΕΡΙΟΔΟΥ ΧΕΙΜ	W	GENERAL	M
3	ΒΑΣΙΚΕ ΔΕΞΙΟΤΗΤΕΣ-Θ	4.491	9	2	2021-2022 Α' ΠΕΡΙΟΔΟΥ ΧΕΙΜ	W	GENERAL	M
4	ΒΑΣΙΚΕ ΔΕΞΙΟΤΗΤΕΣ-Θ	4.506	9	4	2021-2022 Α' ΠΕΡΙΟΔΟΥ ΧΕΙΜ	W	VET	M
5	ΒΑΣΙΚΕ ΔΕΞΙΟΤΗΤΕΣ-Θ	4.437	9	5	2021-2022 Α' ΠΕΡΙΟΔΟΥ ΧΕΙΜ	W	GENERAL	M
6	ΒΑΣΙΚΕ ΔΕΞΙΟΤΗΤΕΣ-Θ	3.995	15	6	2021-2022 Α' ΠΕΡΙΟΔΟΥ ΧΕΙΜ	W	GENERAL	F
7	ΒΑΣΙΚΕ ΔΕΞΙΟΤΗΤΕΣ-Θ	4.733	7	3	2021-2022 Α' ΠΕΡΙΟΔΟΥ ΧΕΙΜ	W	TRANSFER	F
8	ΒΑΣΙΚΕ ΔΕΞΙΟΤΗΤΕΣ-Θ	4.550	9	3	2021-2022 Α' ΠΕΡΙΟΔΟΥ ΧΕΙΜ	W	TRANSFER	M
9	ΒΑΣΙΚΕ ΔΕΞΙΟΤΗΤΕΣ-Θ	4.550	9	3	2021-2022 ΕΡΓΗΤΕΜΠΟΙΕ	W	TRANSFER	M
10	ΒΑΣΙΚΕ ΔΕΞΙΟΤΗΤΕΣ-Θ	4.696	7	5	2021-2022 ΕΡΓΗΤΕΜΠΟΙΕ	W	VET	M
11	ΒΑΣΙΚΕ ΔΕΞΙΟΤΗΤΕΣ-Θ	4.063	15	7	2021-2022 Α' ΠΕΡΙΟΔΟΥ ΧΕΙΜ	W	TRANSFER	M
12	ΒΑΣΙΚΕ ΔΕΞΙΟΤΗΤΕΣ-Θ	4.403	9	4	2021-2022 Α' ΠΕΡΙΟΔΟΥ ΧΕΙΜ	W	GENERAL	M
13	ΒΑΣΙΚΕ ΔΕΞΙΟΤΗΤΕΣ-Θ	4.388	9	6	2021-2022 Α' ΠΕΡΙΟΔΟΥ ΧΕΙΜ	W	GENERAL	M
14	ΒΑΣΙΚΕ ΔΕΞΙΟΤΗΤΕΣ-Θ	4.541	9	3	2021-2022 ΕΡΓΗΤΕΜΠΟΙΕ	W	GENERAL	M
15	ΒΑΣΙΚΕ ΔΕΞΙΟΤΗΤΕΣ-Θ	4.435	9	3	2021-2022 Α' ΠΕΡΙΟΔΟΥ ΧΕΙΜ	W	VET	M
16	ΒΑΣΙΚΕ ΔΕΞΙΟΤΗΤΕΣ-Θ	4.727	7	5	2021-2022 ΕΡΓΗΤΕΜΠΟΙΕ	W	TRANSFER	M
17	ΒΑΣΙΚΕ ΔΕΞΙΟΤΗΤΕΣ-Θ	4.359	11	3	2021-2022 Α' ΠΕΡΙΟΔΟΥ ΧΕΙΜ	W	VET	F

3 Oracle Application Express (APEX)

Oracle is a popular platform and cloud service where users can develop complex applications with simple code. It is used as a web and mobile application development tool by thousands of users. The APEX platform is constantly improving in terms of the services it offers enabling developers to develop applications faster than other competing solutions (Geller & Spendolini, 2017), Pique Solutions, 2019. Users enjoy all the conveniences of client/server applications

with minimal code without the stress and problems of maintaining their application. The tools provided include interactive reports, interactive grid, forms, calendars, different types of graphs, maps, and analysis functions (Riaz, 2018). Also, a great advantage is the high degree of independence and security of the platform from the client side (Geller & Spendolini, 2017).

4 Methodology

The methodology followed for the implementation of this work is presented in Figure 2 and concerns the extraction of data from the central database of the IHU for the years 2003-2021. The process of data extraction presented the difficulty that we had to extract data by year due to the different entries in the tables of the central database. The data was then cleaned and consolidated, a process that required attention because the fields used over the years often varied according to updates to the central scores registration application. Creating a database in the ORACLE APEX environment helped to consolidate all the individual tables and avoid redundancy in the data. ORACLE APEX tools then helped in creating graphs and descriptive statistical analysis of the results.

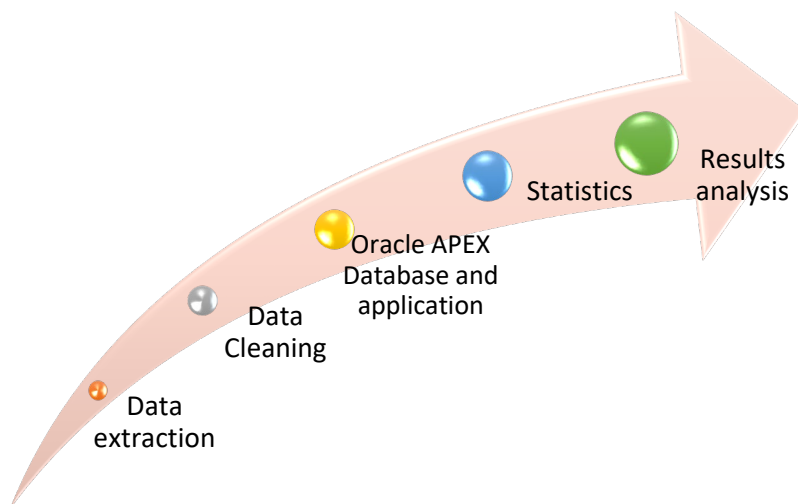


Figure 2: Methodology steps of this work

5 Application

5.1 Oracle Apex Database and Application

Using the tools of ORACLE APEX and using low-coding, the database was created. The SQL commands for creating the tables, importing data and mass updates of the database fields were executed quickly through a very friendly interface. Then the web application was developed (a screen shot of the main tab is shown in Figure 3). In this application the user can browse the DB data through the Dashboard tab, can search for data for any student by ID, or can perform bulk searches with filters on the available fields, from the Student Search option. Similarly, the Student Reports option allows the user to apply filters to the data and also allows for easy to read reports and printouts. The remaining options of the application (Grade gender, School type, Grade period, Semester, Students per period), are concerned with the presentation of statistics in the form of interactive charts.

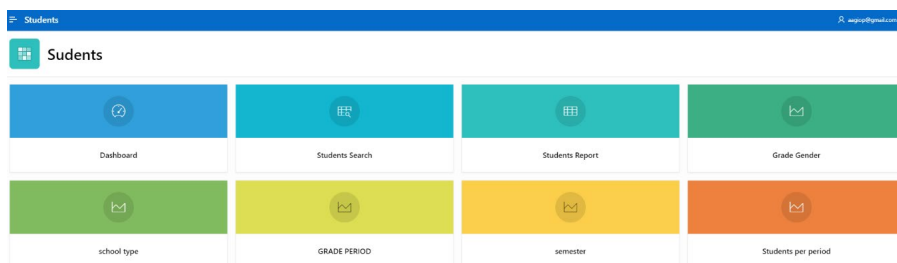


Figure 3: Screen shot of ORACLE APEX application for the statistics of Database course grades

The progress of the successful candidates, the distribution of grades, averages and correlations between grades and other parameters of the students are presented through appropriate diagrams.

Some of the research questions studied and answered in this research are:

- Which gender performs better in this course?
- Is there any difference between student's performances of High School vs student's performances of Vet Schools?

- Is there any difference between student's performances of urban vs students of center or not?
- In which semester do students complete successfully the course?
- Is there any difference in student's performances per year?

6 Results

The results of the descriptive statistical analysis performed with the help of ORACLE APEX are presented in the following graphs. Figure 4 (grades) shows the distribution of grades which follows the normal distribution with most of the students having achieved a grade 5 in the exam (about 1200 students) while about 100 students achieved a grade equal to 10. Figure 4 (Gender) shows the distribution of males - females where females who attended the course Databases constitute 25% of the total. Also Figure 4 (School type) shows that the percentage of students who participated in the course exams are mainly from General High School, if 20% are from vocational high schools, a percentage close to 5% are from transfer students and a small percentage of 1% are from placement exams. An interesting information is drawn from the Figure 4 (Semester) graph showing that 35% of the students have passed the course in Semester 3 which is the semester the course was taught until 2021. In 2022 it was moved to the fifth semester.

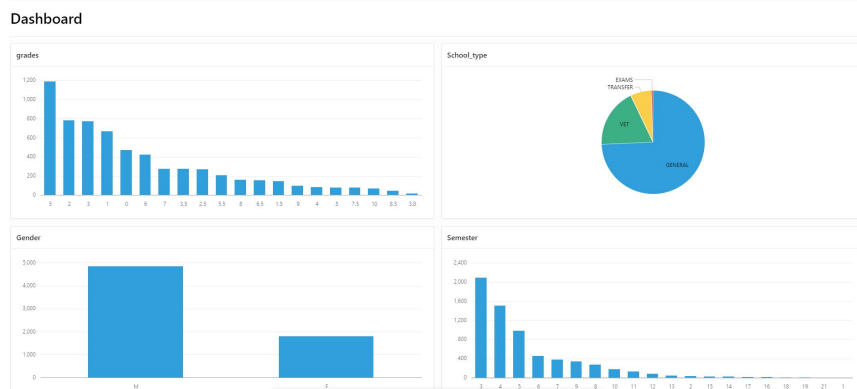


Figure 4: Distribution of grades, Gender and Semester attendance and School type of students Diagrams

Figure 5 shows that there is no statistically significant difference between the mean grade between men and women, with women having a slightly higher mean (6.3).

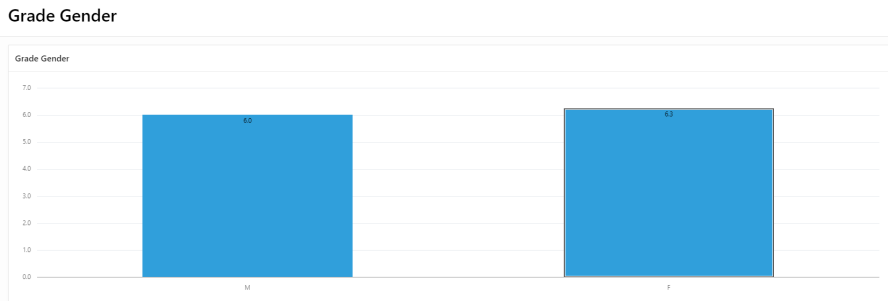


Figure 5: Mean grade between men and women

The average scores for students coming from General High Schools, Vocational High Schools and Transcripts have almost no difference while the average scores of students coming from placement exams are significantly higher (Figure 6). This fact has a reasonable basis because these individuals have already graduated from another university school and have more experience and knowledge. Another interesting information is presented in (Figure7) where there is no statically significant difference in the average scores of students between different examination periods (W-winder, S-September).

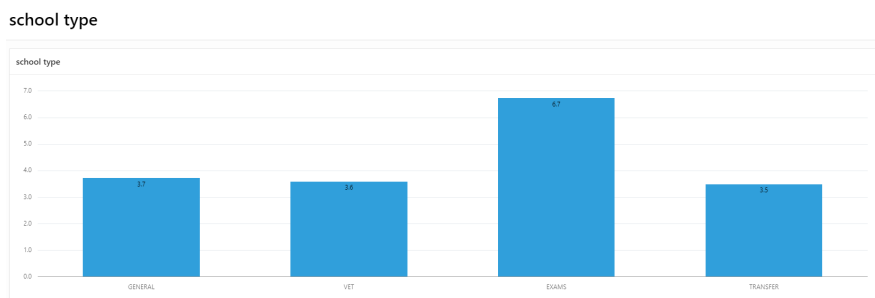


Figure 6: Average scores for students coming from different school types

GRADE PERIOD

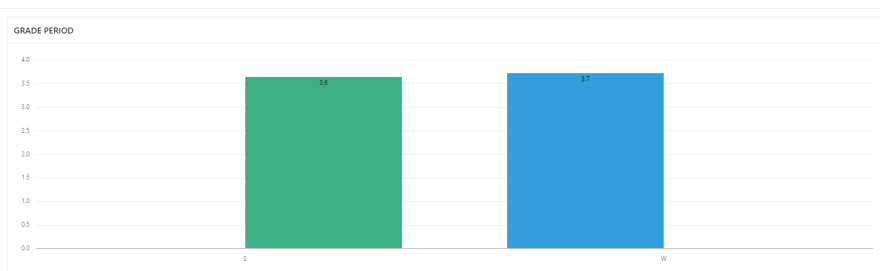


Figure 7: Average scores of students between different examination periods

semester

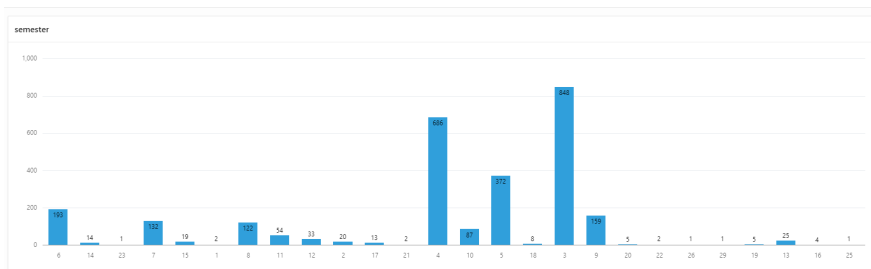


Figure 8: Distribution of students by semester

The diagram (Figure 8) shows the distribution of students by semester who decided to take the course of "Database". The vast majority of students have taken the exam in semester 3, 4 and 5 but disappointingly there are very few students who have taken the exam in semesters above semester 14 (n-years+2years) which is the limit of the course.

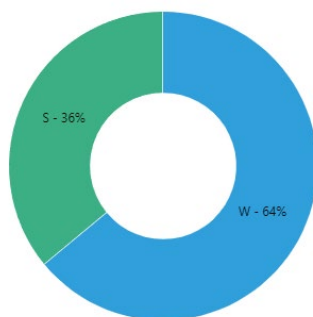


Figure 9: Student's exams participation per period (W: winter exams, S: September exams)
Figure 9 shows that 34% of the students take the September exam while 64% prefer to take the exam in the winter semester when the course is taught.

7 Conclusions

In this paper, descriptive statistics related to student performance in the course "Database" were studied using ORACLE APEX Statistics tools. The information obtained after applying the descriptive statistics is useful for the instructor and the students. Data were presented on the mean scores between males and females in which no statistically significant difference was shown despite the fact that female students constitute 30% of the total sample studied. The distribution of scores over a period of 19 years follows the normal distribution which is the desired distribution, with no major changes from this distribution. As an extension of this work, more statistical functions from the ORACLE APEX environment will be used to extract useful information for prediction and categorization of the data.

Acknowledgements

The authors would like to acknowledge the support given by the European Commission through the Action Erasmus + Better Employability for Everyone with APEX (project ID 2021-1-SI01-KA220-HED-000032218), co-funded by the Erasmus+ programme of the European Union. The European Commission support for the production of this publication does not constitute endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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