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Publications

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ISSN: 2992-5487

NEWPORT INTERNATIONAL JOURNAL OF ENGINEERING AND PHYSICAL SCIENCES (NIJEP)

Volume 3 Issue 2 2023

Design and Implementation of a Modular Student Results Management System for a Senior Secondary School in Old Kampala Senior Secondary School

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ABSTRACT

At the turn of this century, the government encouraged the use of computers and IT teaching in schools. It was prudent for Old Kampala SSS to embrace this innovation or else it lags behind. It was therefore due to this urgency to keep up with the pace that led to the development of a student results management system at Old Kampala SSS. Traditional methods of recording, compiling and keeping student results were the norm, for example, the use of papers to record and store exam results in file cabinets, the manual compiling of students' results was very slow, prone to errors and very tiresome which lead to the late release of student results. With the above background, a study had to be carried out, whose main objective was to design and implement a modular student results management system that would enable the staff of Old Kampala SSS to record, compile, process and store student results so as to increase efficiency and effectiveness. System requirements were obtained using several techniques including the sampling technique which was used to identify the sample population from whom data was got. The sample population was then subjected to the data collection tools using Questionnaires. A Use case diagram, Class Diagram, Data Flow Diagram, and Flow Chart were used to analyze and design the system. The system was implemented using VB used to design the front-end user interfaces (forms), while MS Access was used for the database server.

Keywords: Computers, Student results management system, Data Flow Diagram, Class Diagram, case diagram.

INTRODUCTION

Old Kampala senior secondary school is one of the top-performing schools in Uganda. This is due to their strict observance of the curriculum for higher education in Uganda; coupled with long-serving and experienced teachers. Its main aim is to produce quality students at various universities. The school is found in the central division of Kampala city. It is situated along Gaddafi Road opposite Diamond Trust Bank Old Kampala Uganda. It has a population of around 1500 students, and 135 staff including teachers, cleaners, guards and cooks. So, with this number of students, it's vital that they embrace the latest technological advancement [1]. The beginning of this 21st century saw the explosion in the use of information technology and computers for that matter [2]. It led to the globalization of virtually everything leading to the transformation of people's daily lives. Uganda not to be left behind encouraged her schools to introduce computer studies in the schools [3][4-11]. In this dot-com era, there is high demand for computer-based applications to increase speed, accuracy, storage and efficiency. In Old Kampala Senior Secondary School, in the office of the Director of Studies, there is no database to handle the student results. The staff there, still manually recorded student marks, compiled marks for all classes; computed the grades then arranged them to ascertain the student performance.

Steady power supply is still essential for result management system in schools. The use of renewable energy as an alternative power supply will be of a great important in optimizing the result management system of school of learning. A good alternative substitute among the renewable energy sources is solar photovoltaic panels because of it user friendly and robustness [4-17]

Statement of problem

Old Kampala Senior Secondary like many such secondary schools in Kampala City is having a problem of having to rely on their staff to do all the work of managing all student results manually. There was no database to handle the students' results [18-20]. that problem led to the waste of time in recording the marks, redundancy of the marks and poor data storage since the file cabinets in which the marks are kept can be accessed by unauthorized personnel leading to loss of data [2] [21-30]. The new system would solve all the fore mentioned problems that would lead to the marks being secured and there would be no redundancy of information

Aim

The main purpose of the project was to design and implement a modular student results management system that would enable the staff of Old Kampala Senior Secondary School to record, compile, process and store student results so as to increase efficiency and effectiveness.

Specific objectives

i. To study and analyze the existing system and identify its weakness.
ii. To analyse the requirements of the student result management system to be designed.
iii. To design and implement a modular student result management system that will enable staff at Old Kampala Senior Secondary School to record, compile process and store student results.
iv. To develop a database that will store the results of students at the old Kampala senior secondary school.
v. To evaluate how the proposed system will work.

Research Questions

I. Will the analysis of the existing system identify its weakness?
II. How will the designing and implementing of a modular student result management system enable the staff at Old Kampala Senior Secondary School to compile, process and store students' results?
III. How will the researcher develop a database that will store the results of students at Old Kampala Senior Secondary S database system developed affect the management of student results in Old Kampala Senior Secondary School?
IV. How will the researcher evaluate the proposed system?

METHODOLOGY

Study Design

In systems design, the design functions and operations were described in detail, including screen layouts, business rules, process diagrams and other documentation. The output of that stage would describe the new system as a collection of modules. The design stage took as its initial input the requirements identified in the approved requirements document. For each requirement, a set of one or more design elements would be produced as a result of interviews, workshops, and/or prototype efforts. These design elements were intended to describe the software in sufficient detail so that skilled programmers might develop the software with minimal additional input design.

Area of Study

The researcher intended to carry out his research at a school called Old Kampala Secondary School found in old Kampala village opposite Gaddaffi mosque along Gaddaffi Road in the Central division of Kampala.

The population of the Study

A sample would be able to give a whole representation of a population in every aspect. Therefore, the research would target at least 50 teachers of Old Kampala Secondary School and some staff.

Research Instrument

A research instrument was a survey, questionnaire, test, scale, rating, or tool designed to measure the variable(s), characteristic(s), or information of interest, often a behavioural or psychological characteristic. Research instruments were very useful tools for our research study. Using previously validated data, collection instruments saved time and increased the study's credibility. Once the data collection procedure had been determined, a timeline for completion had to be established.

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Data Analysis

Data to be gathered would be organized and analyzed systematically using qualitative data, frequency tables and figures with the aid of a statistical package for social scientists (SPSS) [21][22]. SPSS would be used due to its wide set of variable options that include editing, deleting, adding variables at various stages of analysis and testing various relationships. After data collection, the information would be formulated using qualitative analysis. The tool that would be used to analyze data would be descriptive statistics of frequency analysis. The result obtained after the analysis would be the basis of the development of a modular student results management system.

RESULTS

Architectural design

The structure of a student result management system was divided into three components; that is (1) database, (2) security and (3) Graphical user interface [22]. The user interface or front end was basically the forms designed in VB while the database is at the server side (the back end). In between the user interfaces and database, there was the security measure for authentication purposes. This produced the architectural design below.

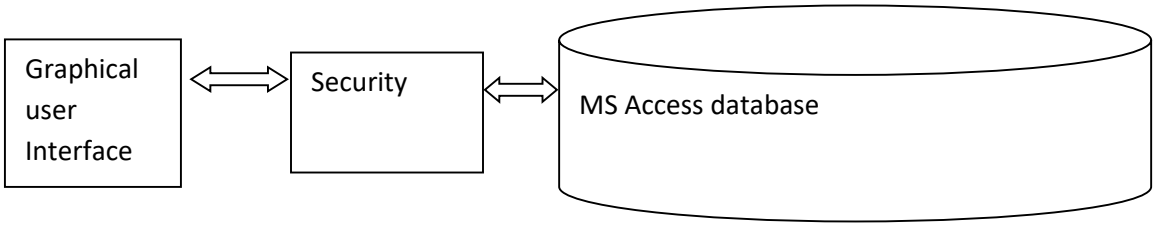

Figure 1: architectural design

MS Access Database design

This was a relational database that consisted of data in the system and data about it (Metadata). It consisted of tables, which made up the database schema. Primary keys identified each entry in the table while foreign keys linked the tables with each other. Data consistency checks such as data types, illegal or null submissions or duplicate entries were checked at this level [31-36]. It was designed based on three structures; the Conceptual database, Logical database and physical database design phases.

Figure 2: Relational Data Base Design

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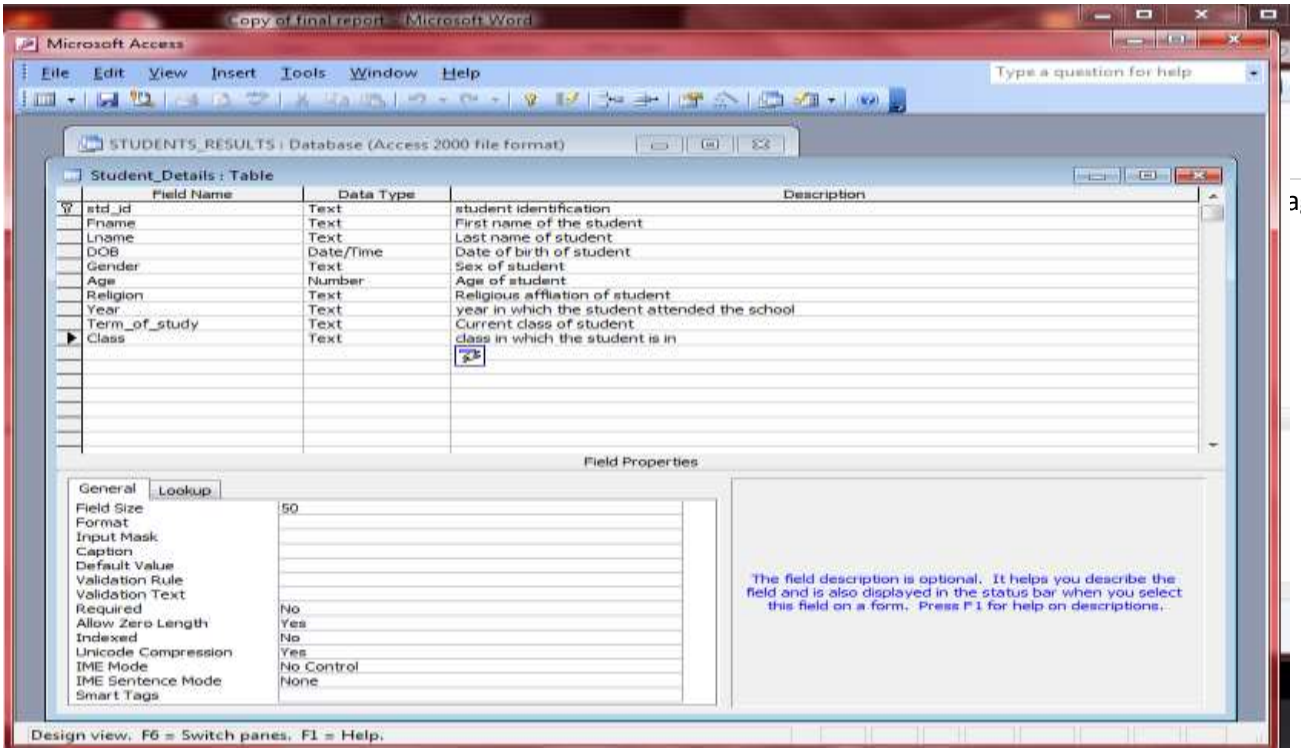

Graphical user interface (GUI) – The forms

This provided a view of the information kept in the database. It consisted of the forms into which data were entered and saved into a database for further display from the database. The user interface was the medium of interaction between the user and the system. Any information entered into the system was stored in the database.

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Figure 3: The Multiple Document Interface (MDI) Form

The MDI Form is that form which contains all other interfaces like forms and reports. After the user logs into system, the MDI pops up from which one chooses his/her desired action.

Figure 4: The administration form

The administration form is one that contains all the employee information about the teachers.

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Figure 5: The students' details form

The students' details form contains all the personal data about the students in the school.

Figure 6: The O' Level results form

The above form has all the O' level student's results fed into the system by the DBA as given to them by the respective subject teachers. It also has the student class particulars.

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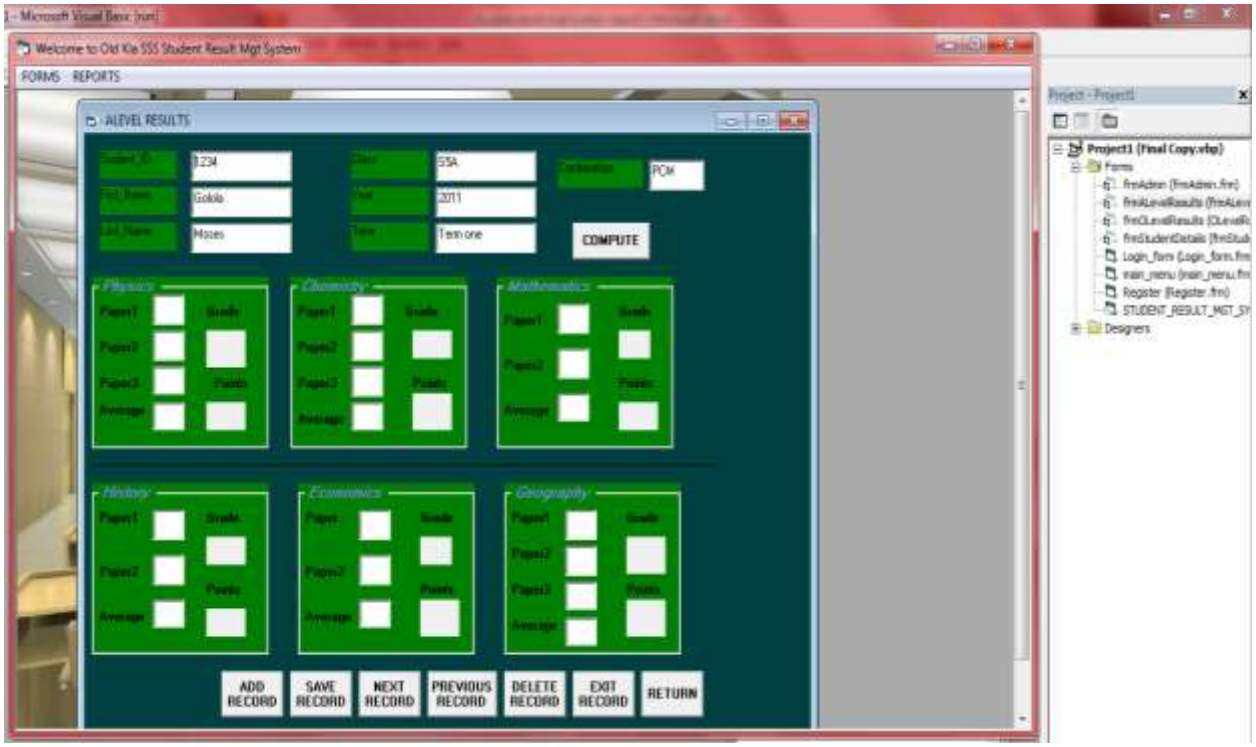

Figure 7: The A 'Level results form

This form has the A 'Level Student's results attained in a particular combination

Security

This ensured access rights to the information kept in the database. It allowed login details to the system for authentication

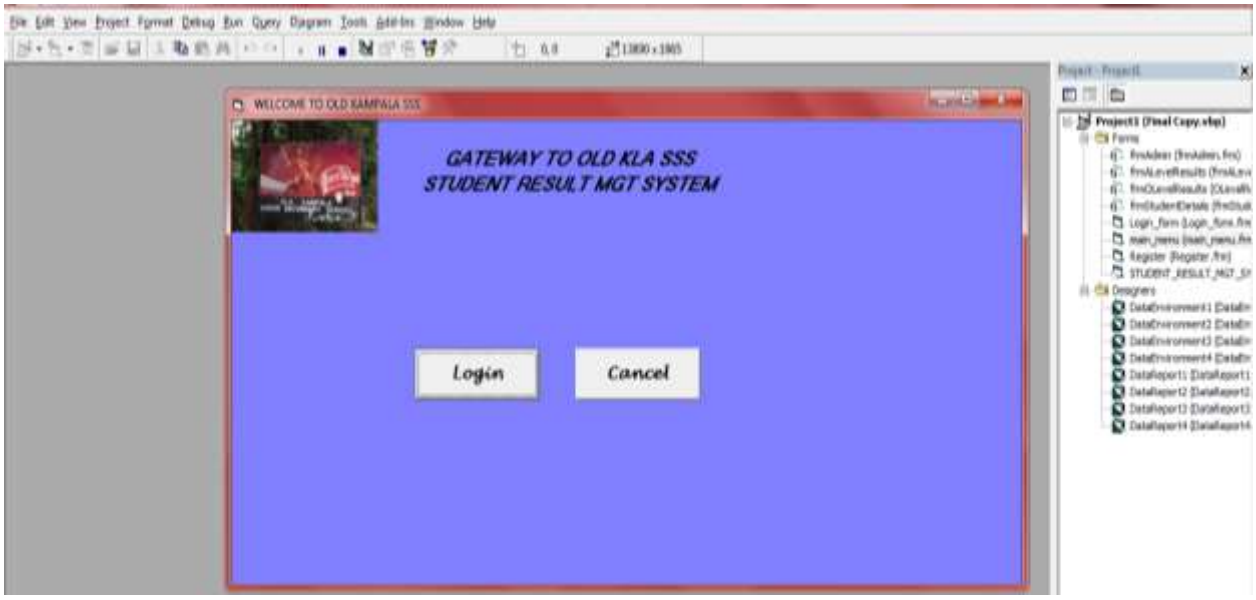

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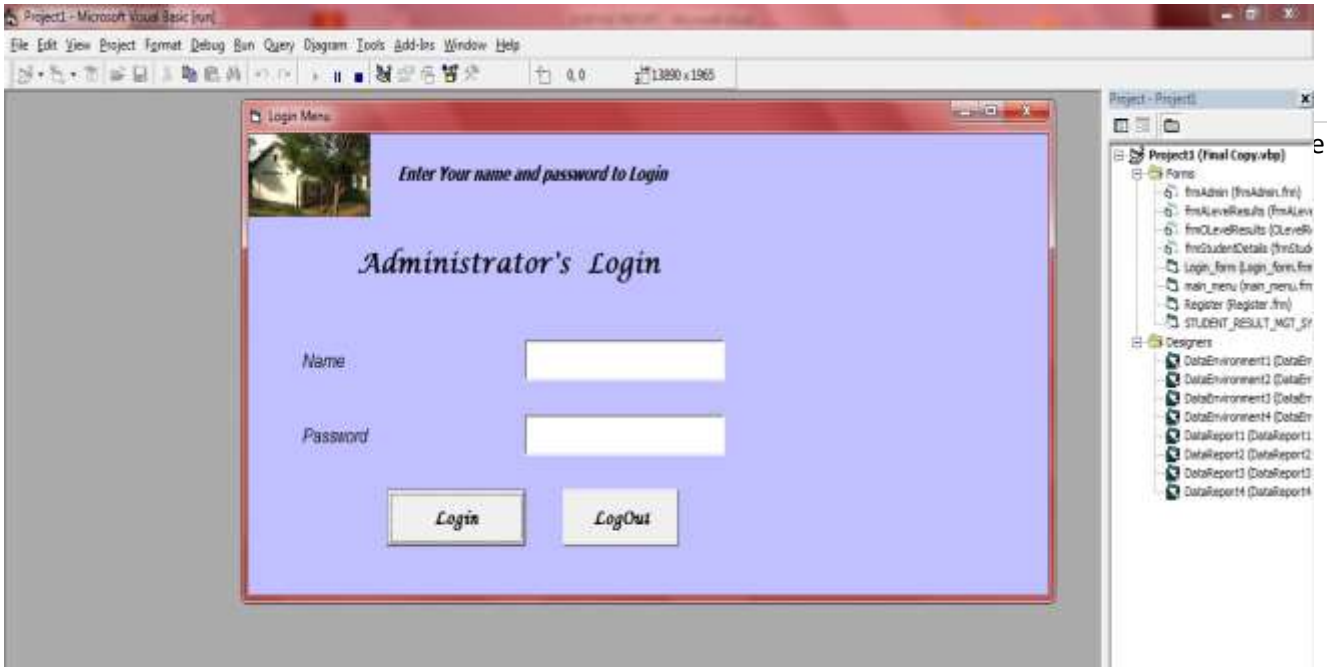
Figure 8: The main menu form



This is for the user authentication where only those with correct user names and password can access the system.

Reports

These are the deliverables of the system. The reports are the final outputs desired by end users of the system.

Data Report 1

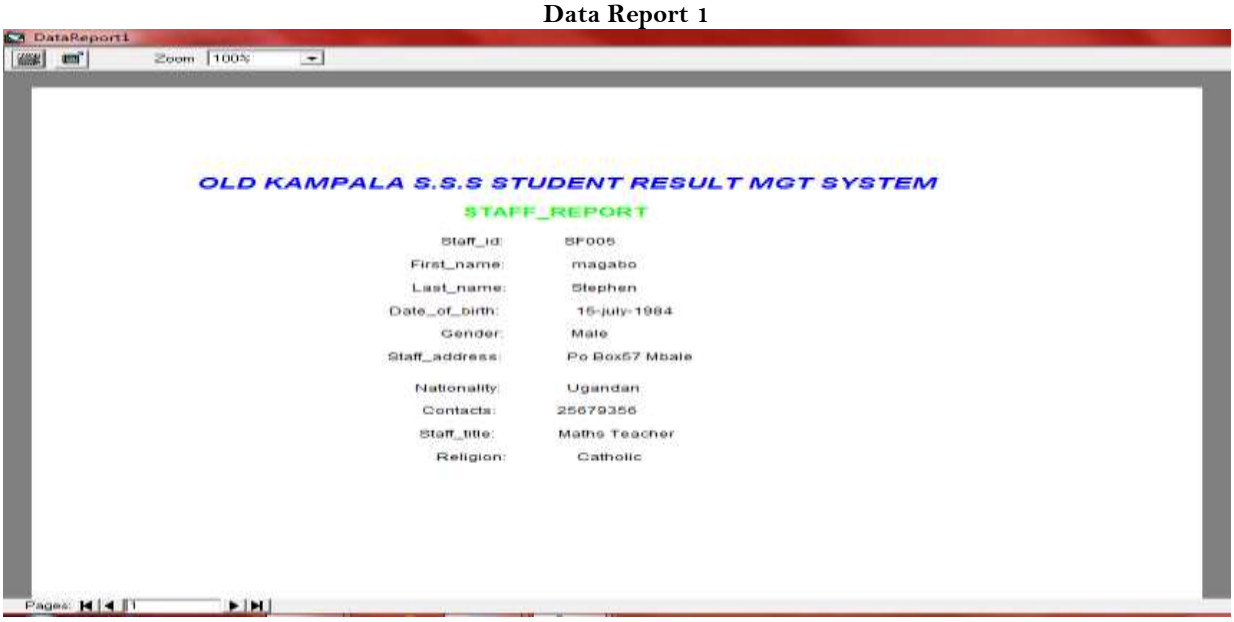


Figure 10:Staff Report of Old Kampala SSS

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Data report 2

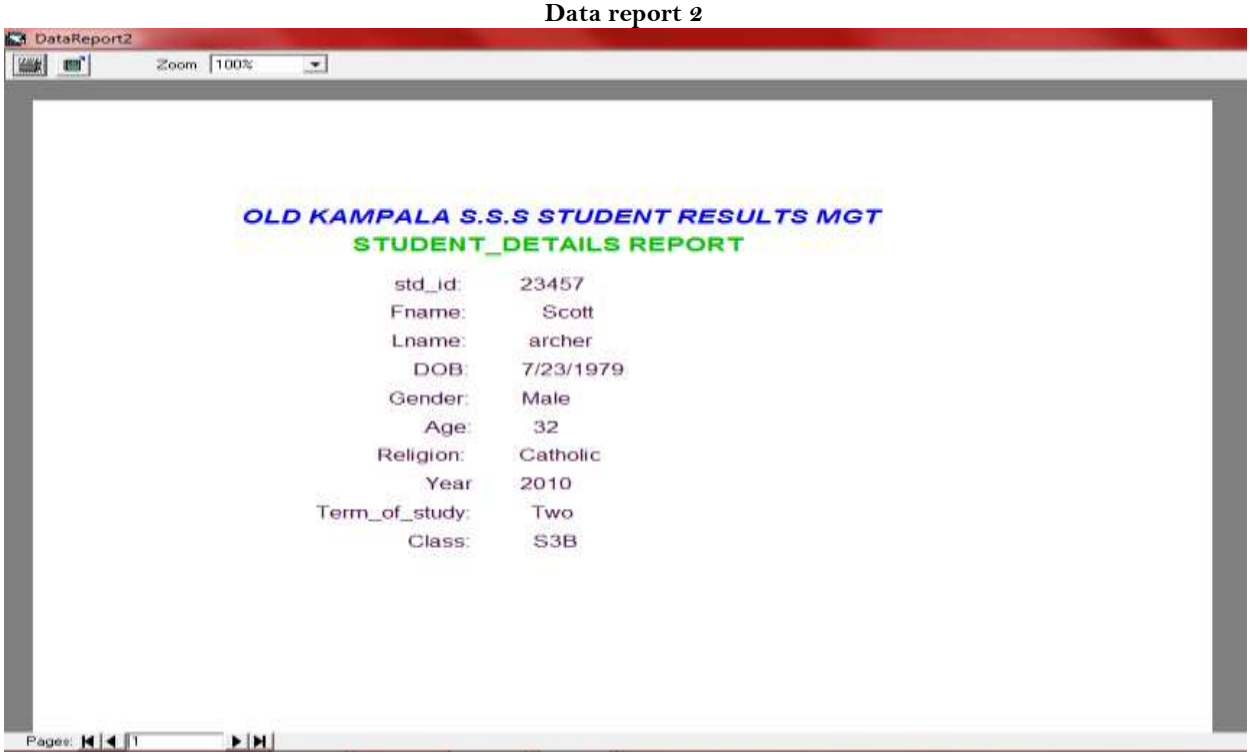

Figure 11: Student Details Report of Old Kampala SSS

Data Report 3

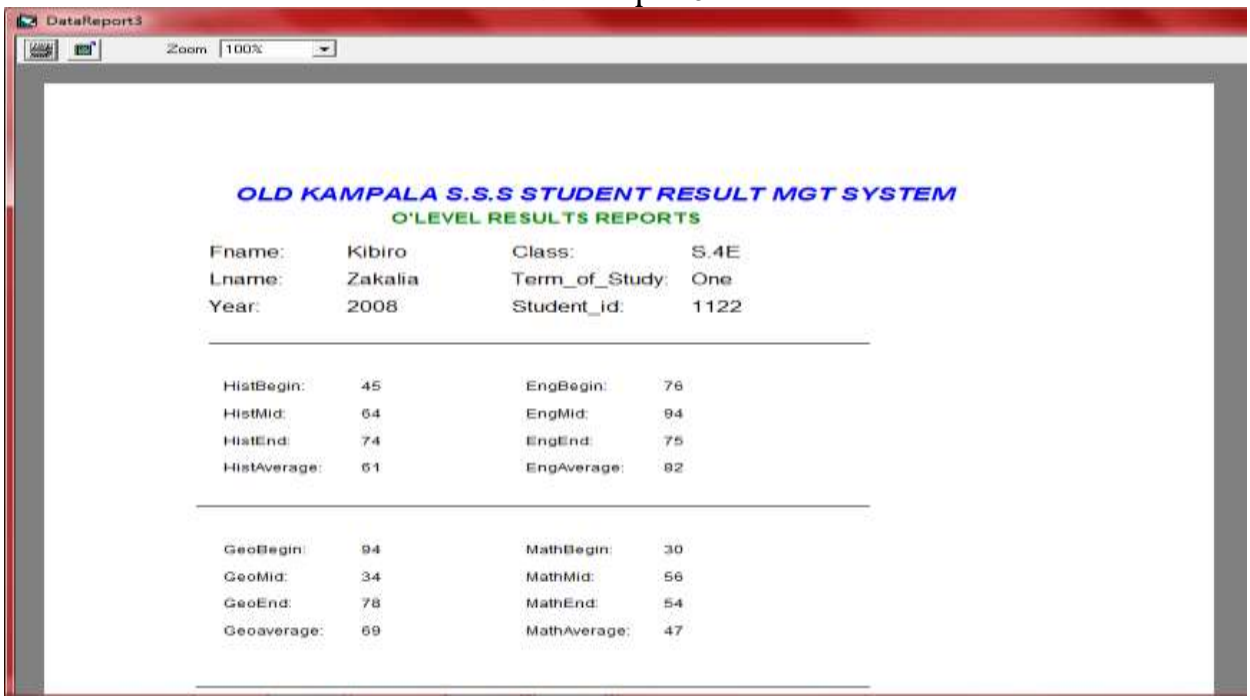

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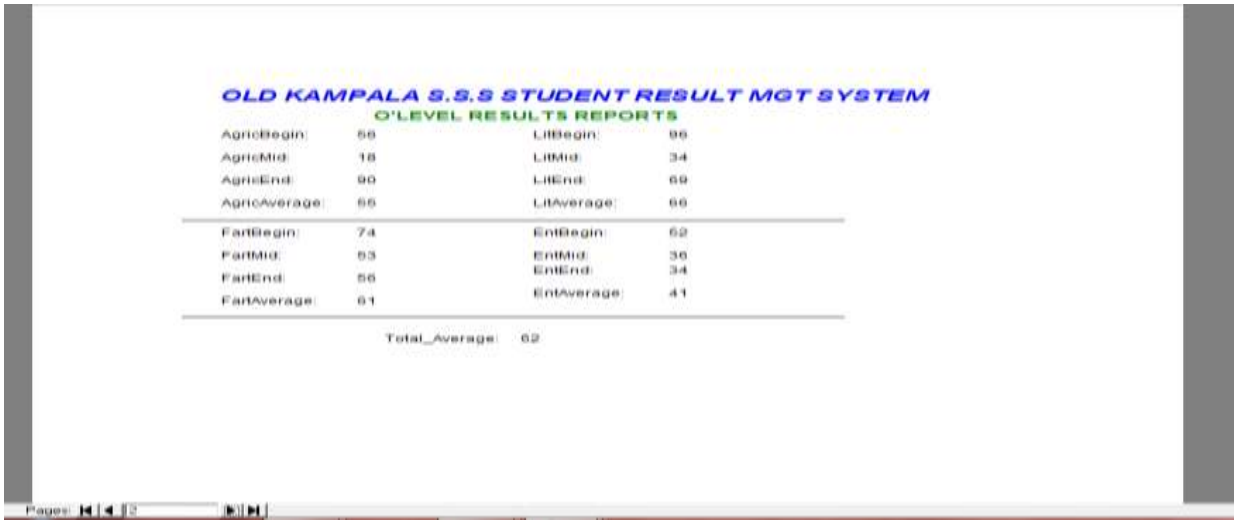
Figure 12: O'Level Results Report of Old Kampala SSS



Data Report 4

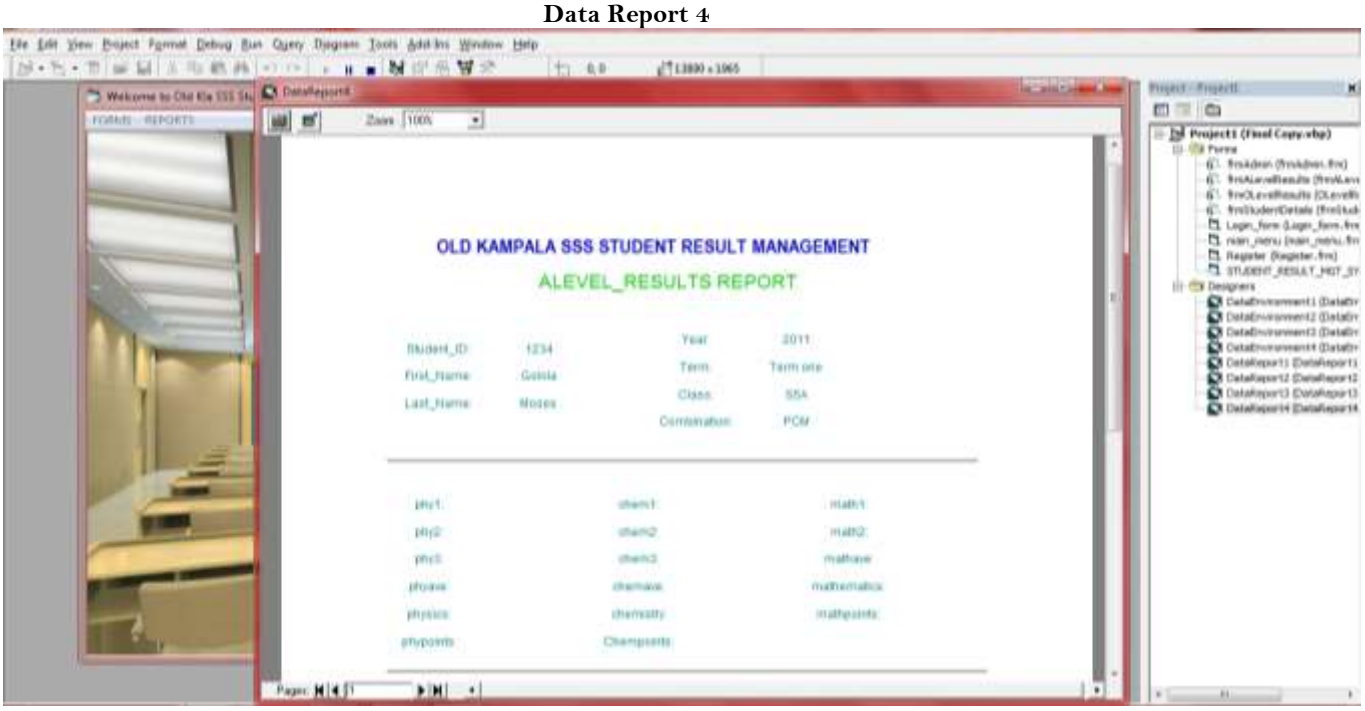


Figure 13: A 'Level Results Report of Old Kampala SSS

Testing

Testing is identification of a system weakness and errors by assessing system elements such as software and hardware under different situations and environments; this was done to see if the system performance matched the system requirements. However, testing was one of the most daunting parts of the development process. It required creativity, persistence and a thorough understanding of the system to anticipate the many ways in which program might fail. The system developers did not know how many errors were in the system. Before actually implementing

the new system into operation a test run of the system was done removing all the bugs if any the activities during testing are as bellow.

i. **Unit testing**: each form was individually tested with the prepared test data then all errors were removed from the system. Each program tested as a separate entity.
ii. **Integration testing (System) testing**: tests on the entire system were performed using the actual data in the database. The researcher made sure that interactions between programs worked successfully. The results were analyzed at each stage of the execution and any errors again were corrected.
iii. **Acceptance testing**: in this type of testing, developers and users tested the system under actual operating conditions. Users tested the system performance to ensure that the system met their requirements and expectations; for example, a user tested to see if a standard report looked the way he/she wanted it to once all the data had been input.

System Analysis

The system that existed was paper based; records were printed on paper and placed in file cabinets. The rate at which records could be accessed was slow since a person had to go through piles of papers to get a specific record. Hence anyone from the external environment would have to wait for long hours to be given a record he or she requests for. The system was tiring and labor intensive, teachers had to compute marks for each student grade and submitted them to the director of studies. This activity was tiresome and many mistakes were bound to happen. No data backup methods were available this was very risky and could lead to data loss. Another very important factor to put into consideration was that access to the file cabinets was not hard.

Requirement Analysis

In order to document all end user requirements for the system, data collected was analyzed using structured analysis approach to rigorous specify the process. This section included requirements of the new system that the researcher categorized into user requirements, functional and non-functional requirement as follows.

Functional requirements

These were specific functions, tasks or behaviors that the system had to support. Through the data gathering process the following stakeholders were identified students, teachers and high level school administrators with the following user requirements:

i. A user friendly system, one that is easy to learn and use.
ii. It should be able to authenticate users before its use.
iii. The system should have availed information like student details and marks.
iv. A secure system where the DBA can manage system users.
v. Allow data to be added into the system and easily retrieved through forms and reports respectively.
vi. Automatically calculate the student marks to get average.
vii. It should generate reports for the students.

Non-Functional requirements

The non-functional requirements describe general conditions the software system must meet to satisfy the needs of the users. This section gives an overview about the most important issues and tries to explain their relevance.

System speed

Given the simultaneous multiple accesses and the time driven environment of the users of the system, the system should be fast enough to satisfy the users.

System availability

The system should be available at any time of the day so that users, at their convenience can have access to the system.

System accessibility

The system should be accessible in all places where there are computers at the school. It will require DBA personnel to access information in the database.

System software requirement

- ✓ Operating system for the computer (Windows 2003/2007)
- ✓ Data base management system Microsoft access.
- ✓ Visual basic 6.0.
- ✓ Microsoft office.

System hardware requirement

Hardware were the physical parts of a computer that one could see and touch, one had to be careful when buying the hardware requirements that they were in good conditions. The General hard ware requirements to the system were as shown in the table below;

- ✓ A hard disk with at least 256MB free space and 512MB of RAM.
- ✓ A key board terminal.
- ✓ A printer.
- ✓ A monitor or screen.
- ✓ Processor (Intel Pentium (iv) AMD Cyrix, Intel Celeron) with minimum speed of 700mhz.

Conceptual Modeling

Use case diagram

Use case modeling is the process of modeling a system's functions in terms of business events, who initiates the events, and how the system responds to those events. Use case modeling identifies and describes the system functions from the perspective of external users using a tool called Use case.
There are two main components of a use case diagram are Use cases and actors.

- An Actor - represents a user or another system that will interact with the system you are modeling.
- A Use case- is an external view of the system that represents some action the user might perform in order to complete a task.

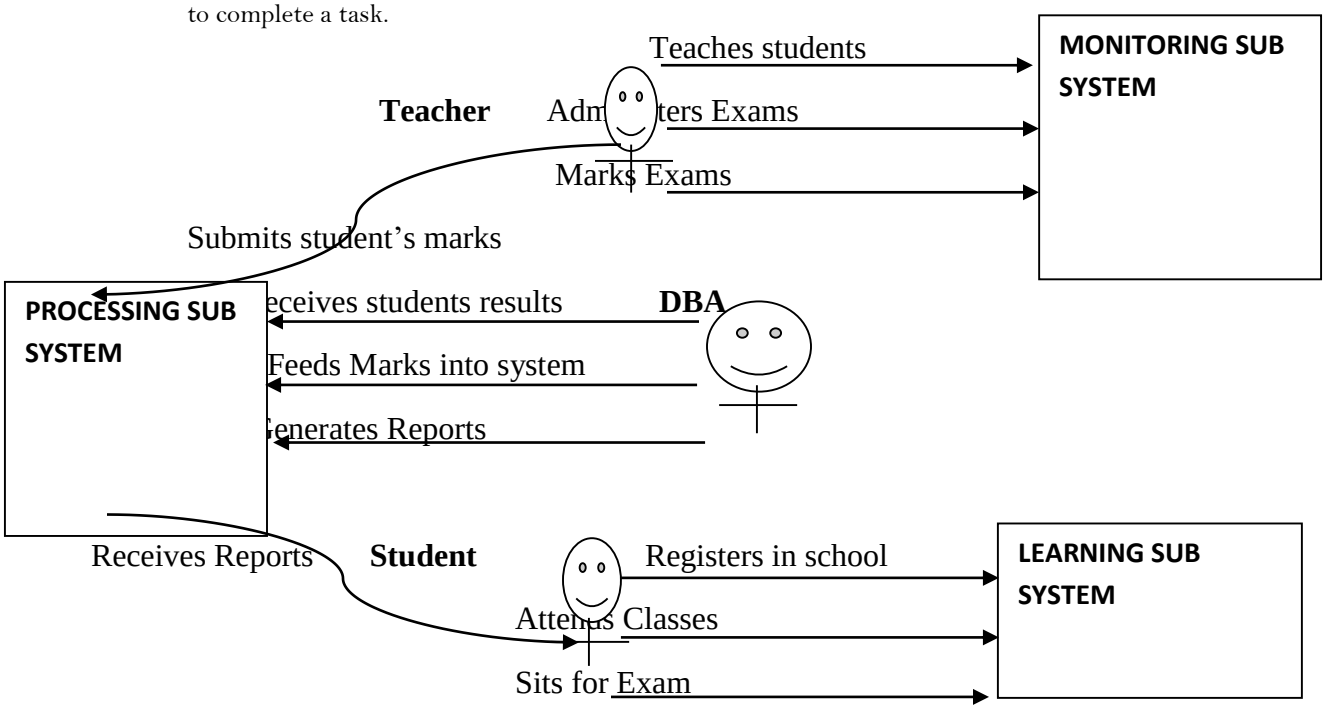


Figure 14: Use Case Diagram for Student Result Management System

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Class Diagram

A class diagram defines a type of object and characteristics of its objects, and an object is an instance of a class. Class diagrams are widely used to describe the relationships of the different objects in a system and do model class structure and contents using design elements such as classes, packages and objects.

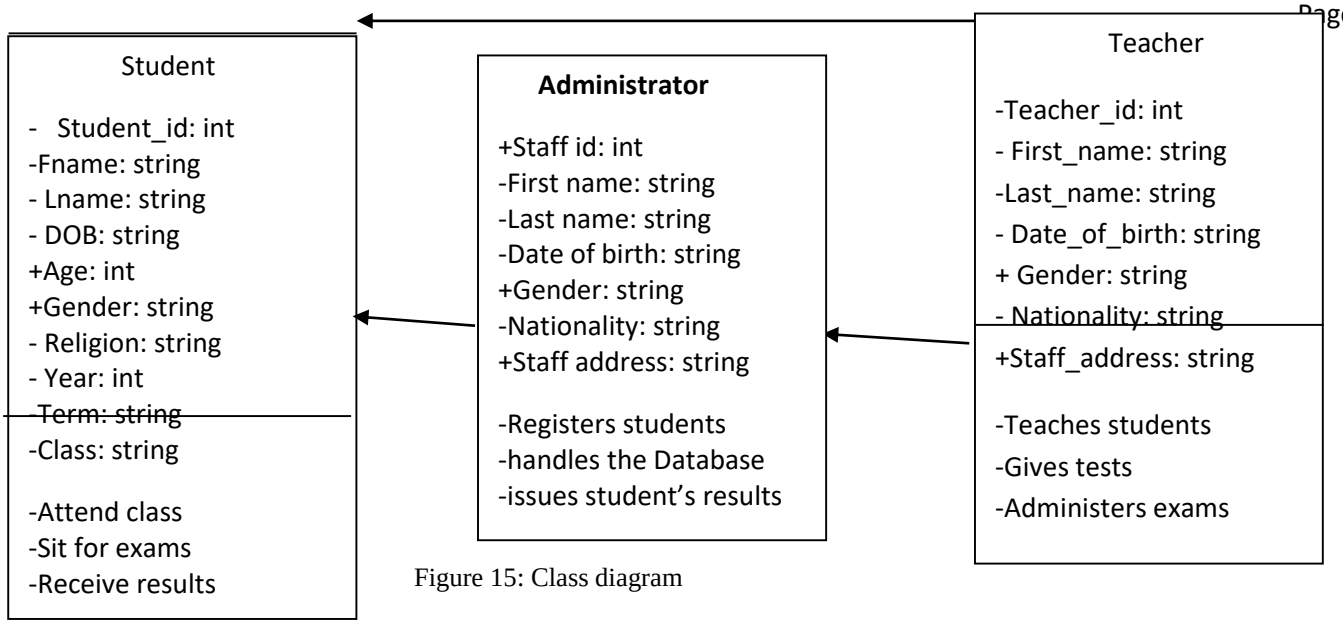

Figure 15: Class diagram

Logical Design

The logical design establishes the relationship among different elements in the system.

Data flow diagram

A data flow diagram (DFD) is a graphical representation of the "flow" of data through an information system. A data flow diagram can also be used for the visualization of data processing (structured design). It is common practice for a designer to draw a context-level DFD first which shows the interaction between the system and outside entities. The overall design of a student result management system in the form of a context-level DFD is illustrated below. Inputs to the process are received from students (through student info), from staff (who request subject info they would like to teach) from administration (who provide employee info). Outputs from examination process which include queries and reports by students. It is this context-level DFD that is then "exploded" to show more detail of the system being modeled.

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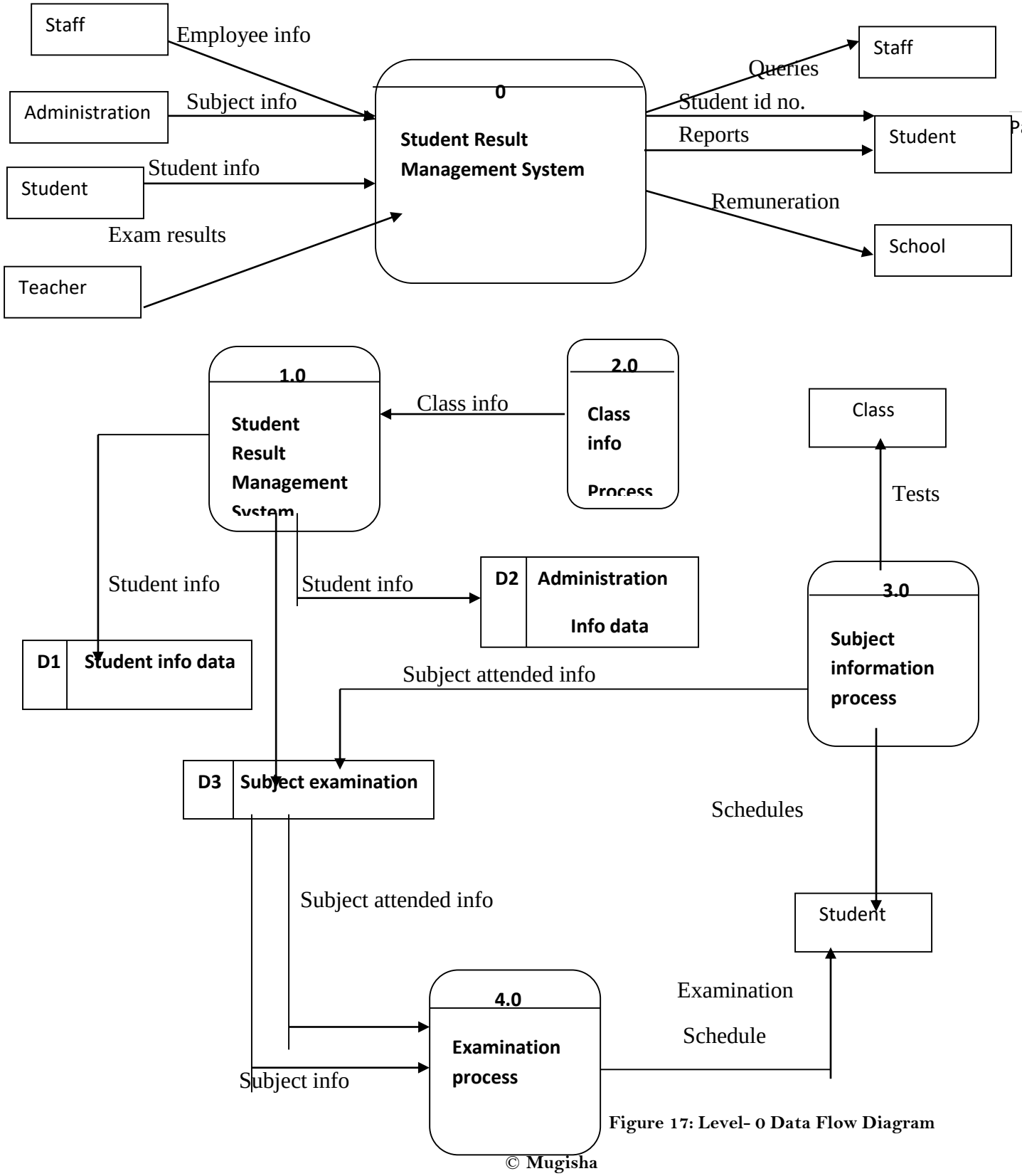

Figure 17: Level- 0 Data Flow Diagram

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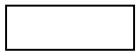
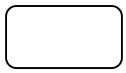
Key Symbols


Entity


Process


Data Flow


Database

Flow chart

A flow chart is a graphical or symbolic representation of a process. Each step in the process is represented by a different symbol and contains a short description of the process step. The flow chart symbols are linked together with arrows showing the process flow direction. They are used to Define and analyze processes, build a step-by-step picture of the process for analysis, discussion, or communication and define, standardize or find areas for improvement in a process

Common Flowchart Symbols

Terminator: An oval flow chart shape indicating the start or end of the process.
Process: A rectangular flow chart shape indicating a normal process flow step.
Decision: A diamond flow chart shape indicates a branch in the process flow.
Connector: A small, labelled, circular flow chart shape used to indicate a jump in the process flow.
Data: A parallelogram that indicates data input or output (I/O) for a process.

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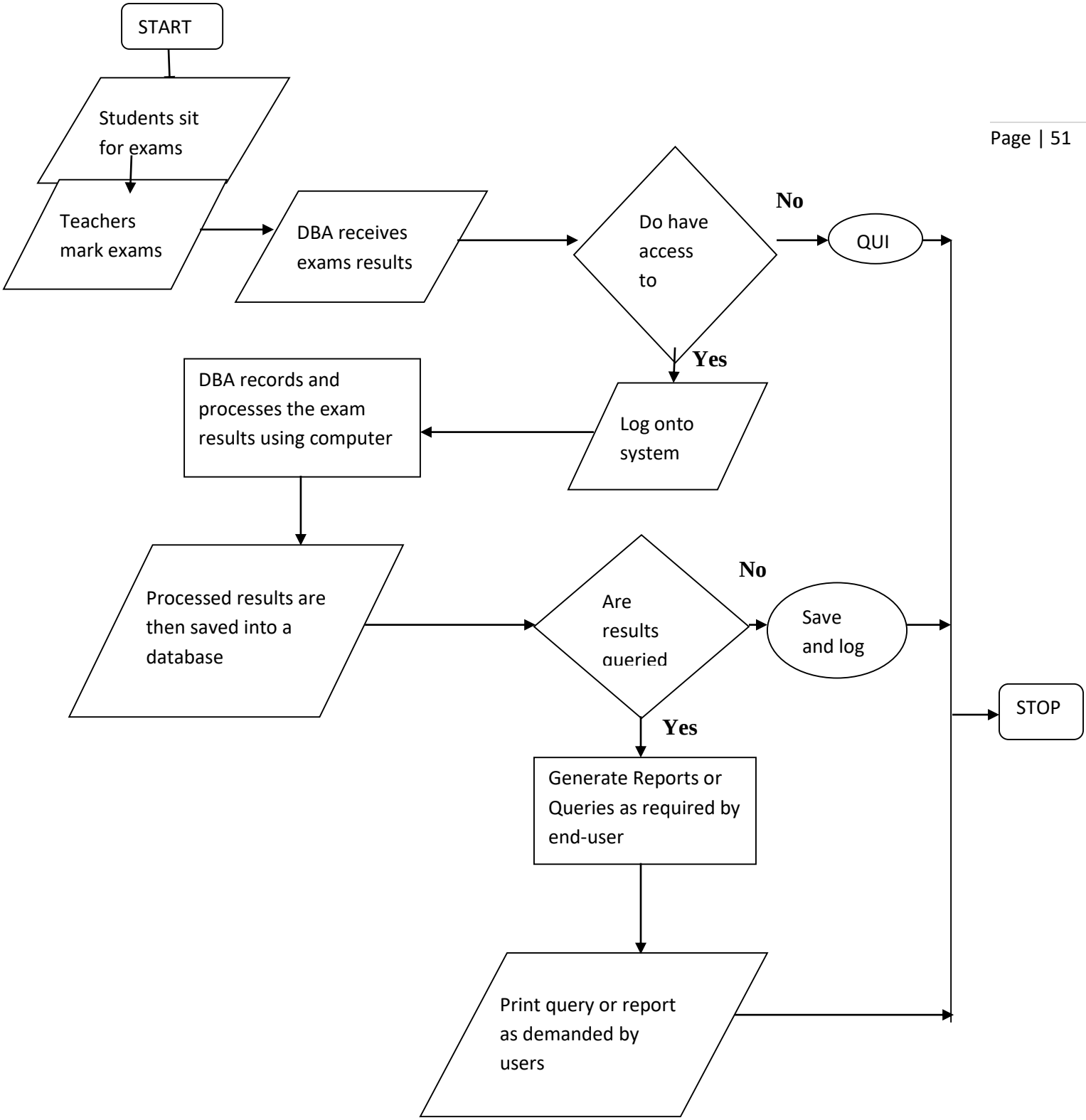

Figure 18: Flow Chart for a student results management system

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System Implementation

This phase involved actually putting into use the new system with such activities as installation, testing and delivery of the system. Here the researcher tested the user acceptability and security of the system. To ensure that the new computerized system met the user specification, the researcher used the following tasks:

System Conversion

Once the testing was done, the researcher next needed to implement the new system without disrupting the daily operations of the school. There were four types of implementation strategies (conversion) in which to accomplish this, namely; parallel, direct cutover, pilot study and phased conversion. The researcher recommended that the school use the parallel conversion strategy; this ensured that both systems (manual and computerized) were used concurrently until such time when all bugs are identified and eliminated and the users were more familiar and comfortable with it. This also ensured that early-stage failures didn't affect the normal operations of the school.

System-user training

The researcher ensured that users (teachers) were selected and trained in a training-of-trainers (TOT) project. They would then be asked to test the interface of the new computerized system and familiarize themselves with its usability. It was those teachers who would become administrators of the system.

i. The users were taught how to:
ii. Log onto a computer and subsequently its usage.
iii. Log into the system using a user name password.
iv. To enter the data using the designed interface (the forms).
v. To process the data (adding, saving, deleting, renaming and compiling).
vi. To print out the desired reports from the system.

System Documentation

The researcher ensured that the system flow was well documented right from system login, entering of data in user interfaces, saving the data into the database, making the necessary processes like compiling and finally to the printing of required reports. That served as the future reference manual for the users in my absence.

DISCUSSIONS

Analysis of data collection

Teachers

The researcher, after studying and analyzing the data collected from the study, could clearly establish that of the respondents at Old Kampala S.S.S, 25% were senior teachers, 33.3% were class teachers and 41.7% were junior teachers.

Table 1: Designation of Respondent

Response	Frequency	Per cent	Valid Percent
Senior teacher	3	25.0	25.0
Class teacher	4	33.3	33.3
Junior teacher	5	41.7	41.7

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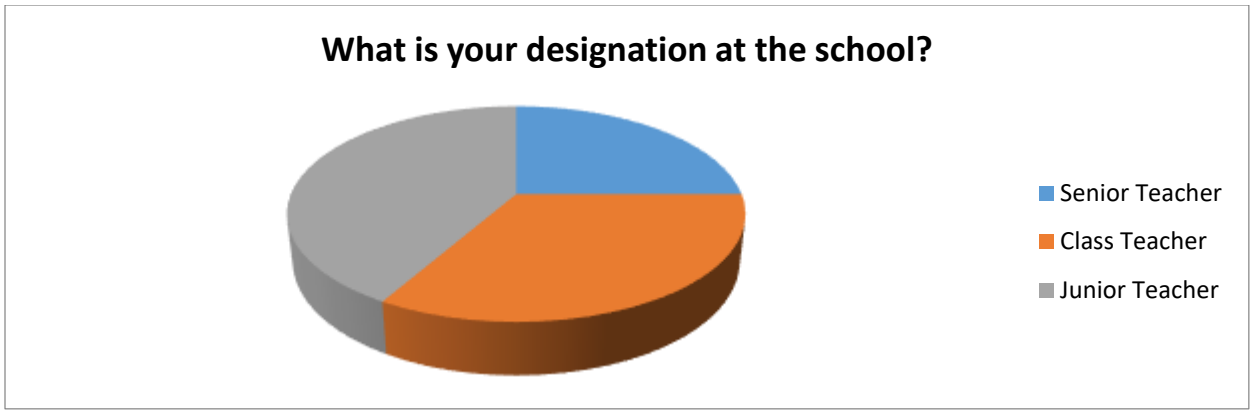

Figure 19: School designation

Using the figure above, the researcher made an analysis that there were more class teachers among the respondents during the research.

Gender

On analyzing data gathered from the respondents, it is evident that 50% that is half of the sample were male and the other half were female.

Table 2: Gender of respondent

Response	Frequency	Per cent	Valid Percent
Male	6	50.0	50.0
Female	6	50.0	50.0

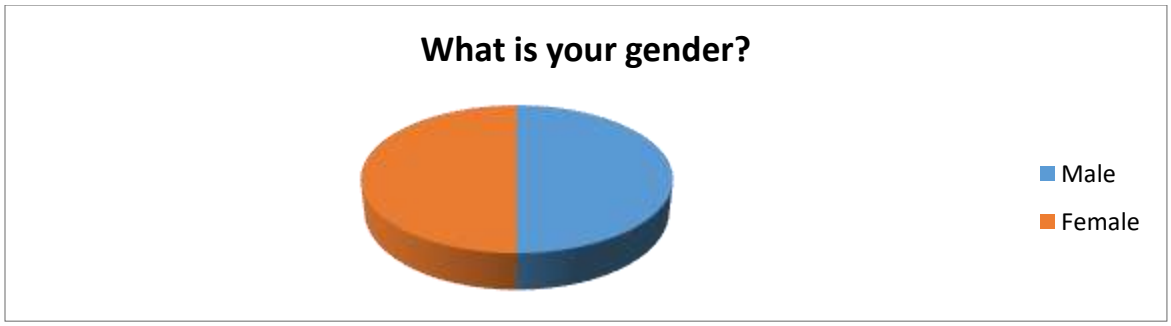

Figure 20: Gender data

After data analysis, it is evident that the gender of the respondents (teachers) was evenly divided between male and female.

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Age

The researcher, after studying and analyzing the data collected from the study, it was clearly established that of the respondents at Old Kampala S.S.S, 91.7% ad an age range of 20-39 and 8.3% were between 40 and 59.

Table 3: Age range of the respondent

Response	Frequency	Per cent	Valid Percent
20-39	11	91.7	91.7
40-59	1	8.3	8.3

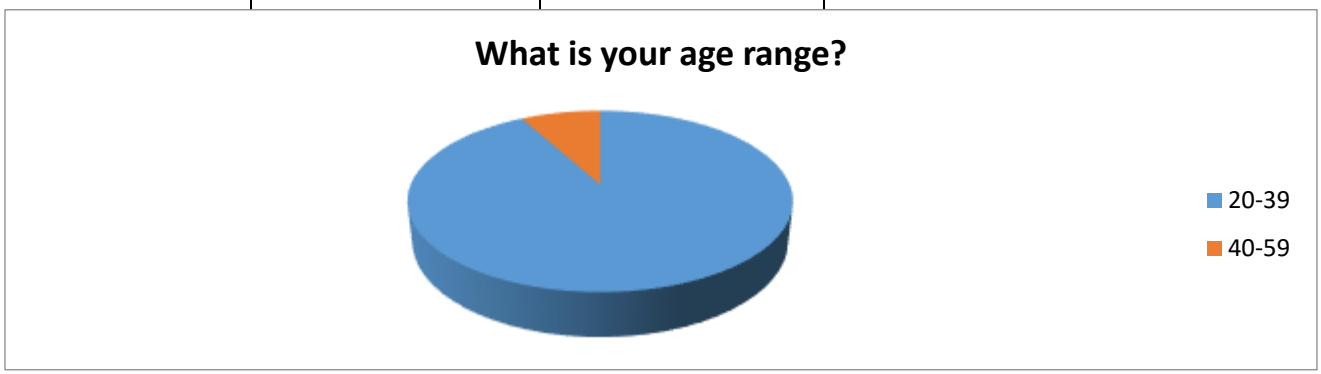

Figure 21: age range

The researcher, therefore, concluded that there were more young respondents than their older counterparts.

Duration

The researcher, after studying and analyzing the data collected from the study, found out that 58.3% of the respondents at Old Kampala S.S.S had taught for less than 5 years, 16.7% had taught in the school between 5 and 9 years and 25% had 10 years and above teaching experience.

Table 4: Respondents' duration at the school

Response	Frequency	Per cent	Valid Percent
Below 5 years	7	58.3	58.3
5-9 years	2	16.7	16.7
10 and above	3	25.0	25.0

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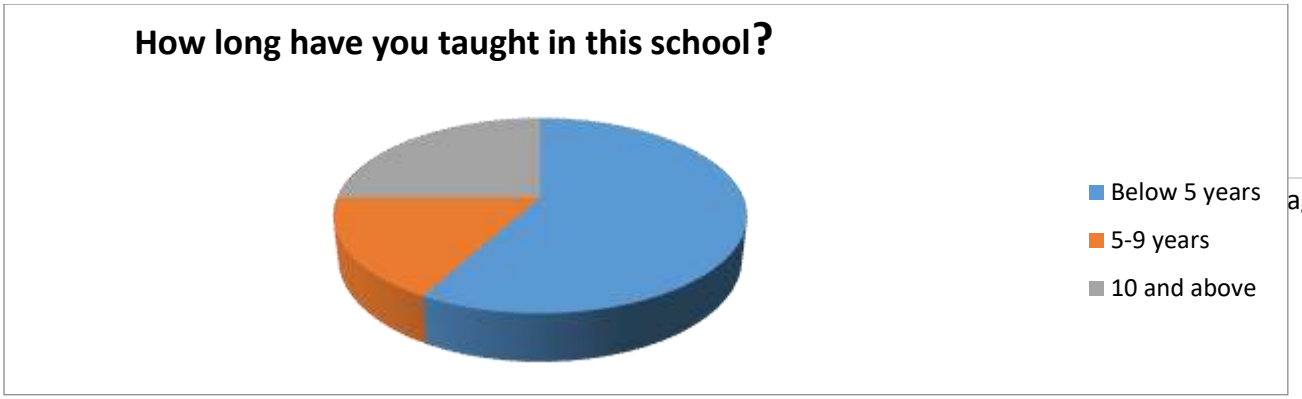

Figure 22: Year of services

There were fewer experienced teachers who answered the questionnaire

Records

The researcher, after studying and analyzing the data collected from the study, could clearly establish that of the respondents at Old Kampala S.S.S, 91.7% said their records were kept manually with 8.3% saying it was done using computers.

Table 5: how records are kept at the school

Response	Frequency	Per cent	Valid Percent
Computerized	1	8.3	8.3
Manual	11	91.7	91.7

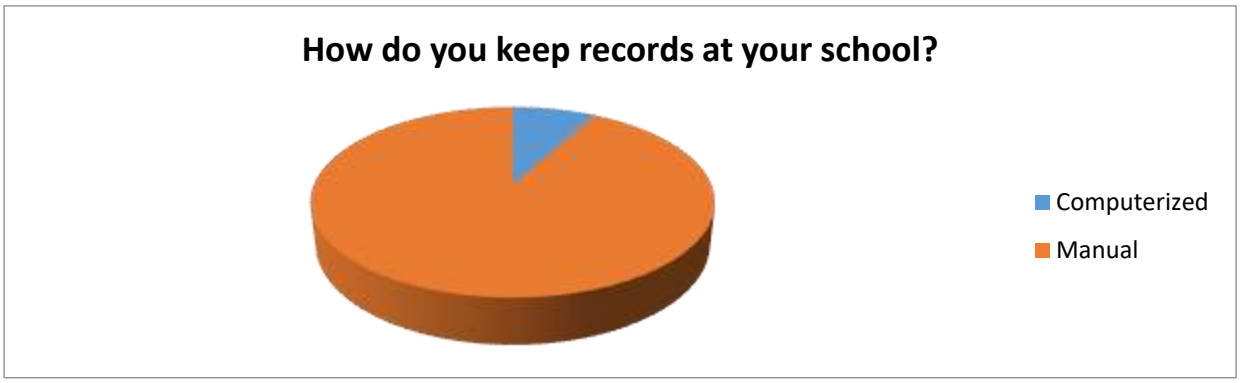

Figure 23: School Record keeping data

The researcher established that the student records at Old Kampala SSS were stored using the manual system.

Work

On studying and analyzing the data collected from the study, the researcher established that 66.7% of the respondents at Old Kampala S.S.S believed that computers were not used at the school while 33.3% said that computers were being used.

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Table 6: Use of Computers at School

Response	Frequency	Per cent	Valid Percent
Yes	4	33.3	33.3
No	8	66.7	66.7

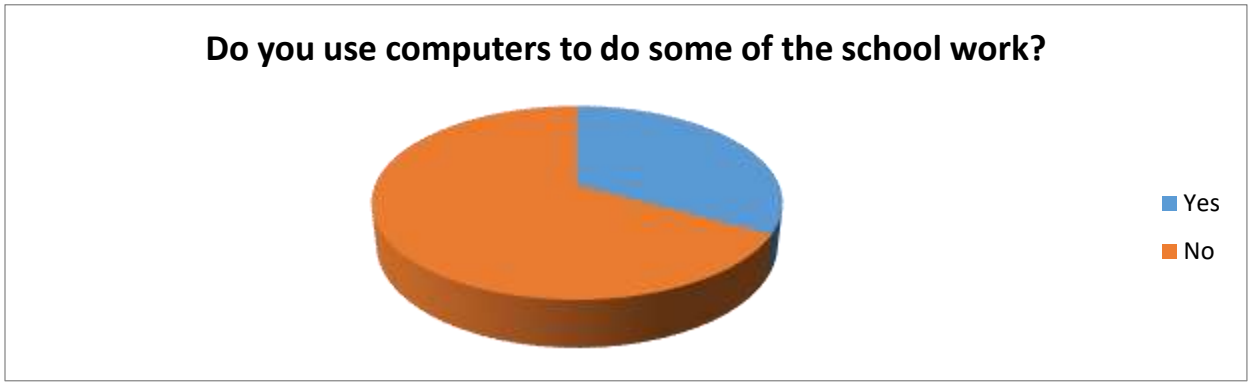

Figure 24: Computer Analysis

The researcher concluded that computers are not used to do some school work.

Introduction

The researcher, after studying and analyzing the data collected from the study, established that 50% (half) of the respondents at Old Kampala S.S.S either strongly agreed or agreed with the idea of introducing a computerized system at the school.

Table 7: Introduction of a computerized system

Response	Frequency	Per cent	Valid Percent
Strongly agree	6	50.0	50.0
Agree	6	50.0	50.0

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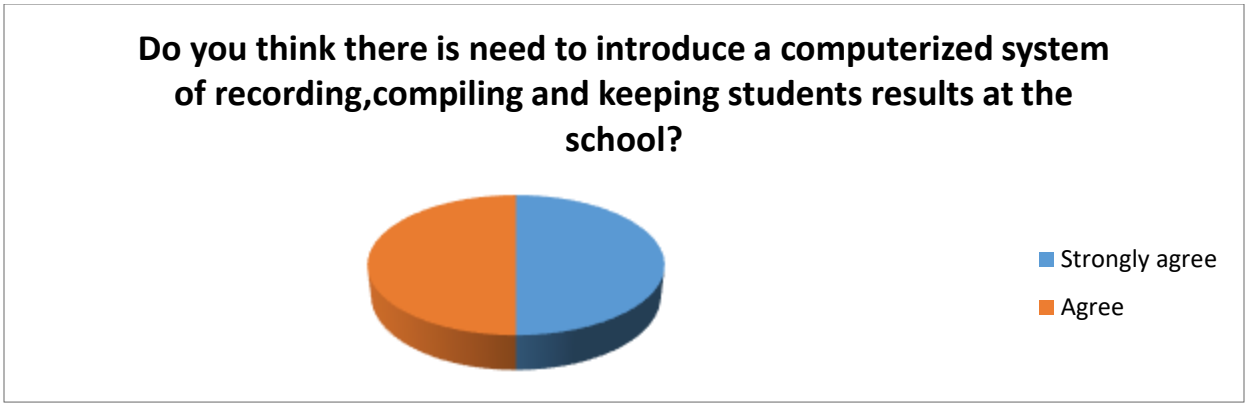

Figure 25: computerized system of recording

Using the above analysis, it is clear that all the respondents in this study were in agreement with introducing a new computerized system to the school.

Beneficiary

On studying and analyzing the data collected from the study, the researcher found out that 41.7% of the respondents would benefit teachers, 33.3% thought it would benefit the administration and 25% thought the students were the beneficiaries.

Table 8: Beneficiaries of the computerized system

Response	Frequency	Per cent	Valid Percent
Administration	4	33.3	33.3
Students	3	25.0	25.0
Teachers	5	41.7	41.7

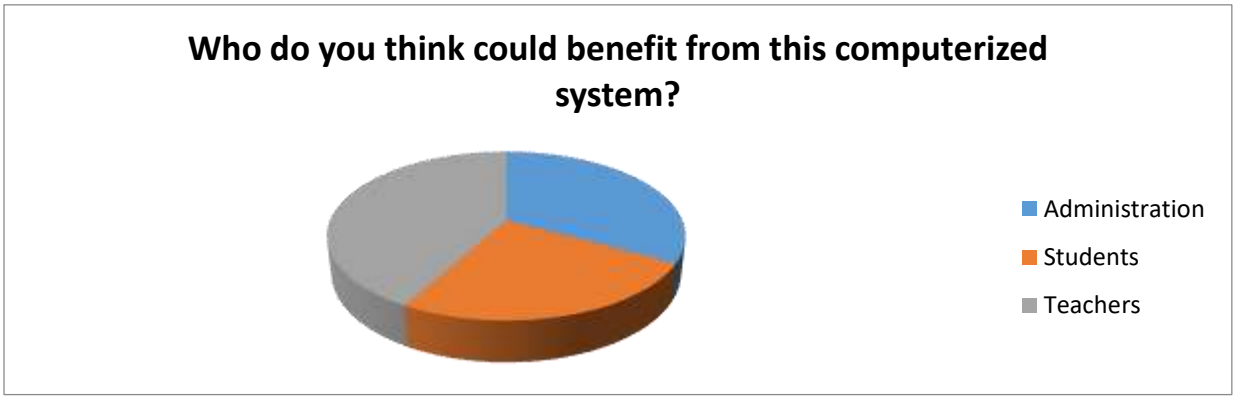

Figure 26: benefits of computerizing the school system

After data analysis as shown in the figure, the researcher concluded that the new computerized system was to benefit teachers, followed by the school administration and students were likely the least beneficiaries.

Benefits of the system

The new system had several benefits:

- The system tremendously improved data recording, compiling, processing, computation and data access of the student results.
- The system greatly reduced the cost of managing student results as it reduced the cost of stationery and staff.
- The system enabled students to get their results early and on time since it's fast.
- The new system increased the security of the student results as its users could s only access it through authentication by use of user names and passwords.

CONCLUSION

That study was undertaken to find ways of designing and implementing a modular student result management system for a secondary school. Based on the research Findings and Analysis, the implementation of a computerized student result management system was the way to go in this 21st century. When the school administration embraced the new system, they stood a lot to benefit. Everybody would feel its effects for example; teachers' work would be eased, the administration would save resources, increased security and students' results would be released on time. The researcher had a well-thought-out background study of the problem statement and both main and specific objectives. The researcher further assessed both the advantages and disadvantages of manual and computerized systems for recording students' records; therefore, the system came with a lot of integrity.

RECOMMENDATIONS

The researcher strongly recommended that the school administration should immediately embrace the new computerized system for managing student results due to its enormous benefits. Furthermore, the researcher encouraged the administration to enlarge the system so as to cover all other departments of the school for example student admission, staff enrolment, and the school fees payment. Lastly, the researcher recommended that the school management provide enough funds towards the development of a more efficient database application like Oracle for it has high storage capacity which would enable automation of all the school departments leading to resource sharing and hence operational success.

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