

**DEVELOPMENT OF A WEB-BASED INFORMATION SYSTEM  
FOR MANAGING ALLOCATION OF PUBLIC PRIMARY  
SCHOOL TEACHERS IN TANZANIA**

**DEVELOPMENT OF A WEB-BASED INFORMATION SYSTEM  
FOR MANAGING ALLOCATION OF PUBLIC PRIMARY  
SCHOOL TEACHERS IN TANZANIA**

**By**

**Nobert Fidel**

**A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Master of  
Science Information Technology and Systems (MSc. ITS) of Mzumbe University**

**2017**

## CERTIFICATION

We, the undersigned, certify that we have read and hereby recommend for acceptance by the Mzumbe University, a dissertation entitled **Development of a web-based Information System for Managing Allocation of Public Primary School Teachers in Tanzania** in partial/fulfillment of the requirements for award of the degree of Master of Science Information Technology and Systems of Mzumbe University.

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## **DEDICATION**

This work is dedicated to my beloved father, the late Nuguye Ngungo. May almighty God rest your soul in peace; Amen.

## **ABBREVIATIONS AND ACRONYMS**

**BEST** - Basic Education Statistics in Tanzania

**CRC** – Class Responsibility Collaboration

**EMIS** - Education Management Information System

**ERD** – Entity Relation Diagram

**ESDP** - Education Sector Development Program

**FAO** – Food and Agriculture Organisation

**HIV** – Human Immunodeficiency Virus

**HTML** – Hyper Text Mark up Language

**ILO** – International Labour Organisation

**MIITEP** – Malawi II Teachers Education Program

**MoEVT** – Ministry of Education and Vocational Training

**NGO** - Non-Government Organizations

**PEDP** – Primary Education Development Program

**PHP** – Hypertext Pre-processor

**PORALG** – President’s Office Regional Administration and Local Government

**PSTAIS** – Primary School Teachers Allocation Information System

**PTR** – Pupils Teacher Ratio

**SQL** – Structured Query Language

**TSC** – Teachers Service Commission

**URT** – United Republic of Tanzania

## ABSTRACT

A study was conducted to find out, the imbalance allocation of public primary school teachers in Ilala Municipal, Dar-es-salaam. A total of 5 primary school head teachers and 6 education officers from MoEVT, PORALG, and Ilala municipal were purposively selected for the study. Case study research design and qualitative method were employed. Data were collected through interviews and documentary review and were analyzed qualitatively by using content analysis. The results of the study revealed that the allocation of public primary school teachers in Ilala Municipal does not consider Pupils Teacher Ratio (PTR), gender or disability. Usually, they allocate teachers basing on the requirements of teachers for a particular school and sometimes they consider criteria such as marriage and diseases (e.g., HIV) when allocating teachers. The results also showed that some schools have many pupils with large class size and few teachers while other schools have few pupils with small class size and many teachers which results into higher Pupils Teacher Ratio (PTR) in some schools and low in other schools.

Basing on the results found, a web-based information system for managing the allocation of public primary school teachers was designed and developed by using prototyping methodology. The system was able to perform automatic balanced allocation of teachers to all schools when the names of new teachers were entered into the system. The allocation was based on the criteria such as PTR, gender, disability and school location (village-based schools or urban based schools); hence removing imbalance allocation of primary school teachers which were used to be done before. If this developed system is used effectively by PORALG who are responsible for teachers' allocation, it will help them in removing imbalance allocation of teachers in all schools; hence facilitate easy learning for pupils and enhance better performance.

**Keywords:** primary schools, Web-based information system, PTR, PORALG

## Table of Contents

CERTIFICATION .....	i
DECLARATION.....	ii
AND .....	ii
COPYRIGHT .....	ii
ACKNOWLEDGEMENT.....	iii
DEDICATION .....	iv
ABBREVIATIONS AND ACRONYMS.....	v
ABSTRACT .....	vi
CHAPTER ONE.....	1
INTRODUCTION .....	1
1.1 Background .....	1
1.2 Statement of the Problem .....	3
1.3 Objectives.....	5
1.3.1 General objective.....	5
1.3.2 Specific objectives.....	5
1.4 Research questions .....	5
1.5 Scope of the Study.....	5
1.6 Significance of the Study .....	6
CHAPTER TWO.....	7
LITERATURE REVIEW .....	7
2.1 Introduction.....	7
2.2 Shortage of teachers due to poor teacher deployment.....	7
2.3 Roles of PORALG in Allocating Primary School Teachers .....	7
2.4 Challenges Facing Allocation of Public Primary School Teachers.....	9
2.4.1 Marriage as a Factor for Teacher Allocation.....	9
2.4.2 Teacher Gender .....	9
2.4.3 Professional Development.....	10
2.4.4 Diseases (e.g. HIV/AIDS) as Factor for Teacher Allocation .....	10

2.5 Teacher Deployment Systems .....	11
2.5.1 Central authority Deployment .....	12
2.5.2 The Decentralization System Deployment .....	13
2.5.3 The Market System Deployment.....	13
2.6 Experience from Other Countries.....	14
2.6.1 Teacher Deployment in Mozambique .....	14
2.6.2 Teacher Deployment in Malawi .....	14
2.6.3 Teacher Deployment in Lesotho .....	15
2.7 Strategies to Redress Imbalance Allocation of Primary School Teachers .....	16
2.7.1 Incentives for Teachers Locating In Rural Areas.....	16
2.7.2 Teacher – Housing.....	18
2.7.3 Forced Transfer of Teachers.....	19
2.7.4 Forced Deployment for Teachers .....	20
2.8 Knowledge Gap.....	21
2.9 Conceptual Framework .....	22
<b>CHAPTER THREE .....</b>	<b>23</b>
<b>RESEARCH METHODOLOGY .....</b>	<b>23</b>
3.1 Introduction .....	23
3.1.1 Methodology .....	23
3.2 Research Design.....	23
3.3 Approach .....	24
3.4 Area of the Study.....	24
3.5 Population and Target Group .....	24
3.6 Sample and Sampling.....	25
3.6.1 Sample.....	25
3.6.2 Sampling.....	26
3.7 Research Instruments .....	26
3.7.1 Semi-Structured Interview .....	26
3.7.2 Documentary Review .....	27

3.8 Proposed Data Analysis.....	27
3.9 Ethic considerations .....	28
<b>CHAPTER FOUR .....</b>	<b>29</b>
<b>PRESENTATION AND DISCUSSION OF THE FINDINGS.....</b>	<b>29</b>
4.1 Introduction .....	29
4.2 What are the strength and weakness of the current mode of allocation of teachers? .....	29
4.2.1 Issues which influence imbalance allocation of teachers in Ilala Municipal.....	30
4.3 Design of web-based information system for managing allocation of public primary school teachers. ....	33
<b>CHAPTER FIVE .....</b>	<b>34</b>
<b>ANALYSIS AND DESIGN OF TECHNICAL SOLUTION .....</b>	<b>34</b>
5.1 Introduction .....	34
5.2 System planning .....	34
5.2.1 Technical feasibility .....	34
5.2.2 The economic feasibility .....	34
5.2.3 Organizational feasibility .....	34
5.3 System analysis .....	35
5.3.1 Requirements determination.....	35
5.3.2 Functional requirements .....	35
5.3.3 Non-functional requirements.....	36
5.3.4 Functional Modelling .....	36
5.4 System design.....	57
5.4.1 Allocation Algorithm .....	57
5.4.2 Rule-based.....	52
5.4.3 Architecture design.....	54
5.4.4 Data storage design .....	55
5.5 System Implementations .....	59
5.5.1 Constructions.....	59
5.5.2 Testing.....	71
5.5.3 Installation and Operations.....	73

5.6 System evaluation .....	74
5.7 Conclusion and recommendation .....	76
References .....	77
Appendices .....	80

## LIST OF FIGURES

Figure 1: conceptual framework for a web-based information system .....	22
Figure 2: Use case diagram for PSTAIS .....	37
Figure 3: Activity diagram for PORALG in registering users .....	42
Figure 4: Activity diagram for PORALG in registering schools .....	43
Figure 5: Activity diagram for PORALG in registering new teacher .....	44
Figure 6: Activity diagram for PORALG in viewing teacher allocation .....	45
Figure 7: Activity diagram for head teacher in registering number of pupils .....	46
Figure 8: Activity diagram for head teacher in viewing teachers' allocation .....	47
Figure 9: Activity diagram for MoEVT in viewing teachers' allocation .....	48
Figure 10: Sequence diagram for Head teacher .....	50
Figure 11: Sequence diagram for PORALG .....	51
Figure 12: Sequence diagram for MoEVT .....	52
Figure 13: Class diagram for PSTAIS.....	53
Figure 14: Flow chart for PSTAIS .....	51
Figure 15: ERD for PSTAIS.....	55
Figure 16: PSTAIS login form design.....	58
Figure 17: Home page for PSTAIS .....	59
Figure 18: List of teachers posted in all schools .....	60
Figure 19: Login page .....	61
Figure 20: page which shows new teachers allocated to different schools .....	62
Figure 21: List of registered schools .....	63
Figure 22: List of employed teachers .....	64
Figure 23: Page for head teacher with reg.no PS0202086 after login.....	65
Figure 24: List of teachers allocated to school with reg.no PS0202086 .....	66
Figure 25: Page that allows head teacher to change password.....	67
Figure 26: Page for head teacher to sign out .....	68
Figure 27: Page for teacher student ratio.....	69
Figure 28: Page for allocated teachers for various schools .....	69
Figure 29: Page for user from MOEVT to sign out.....	70
Figure 30: Page for user from MOEVT to change password.....	71

## LIST OF TABLES

Table 1: Disparities in Pupils Teacher Ratio (PTR).....	2
Table 2: Ranking of Regions by Average PTR.....	4
Table 3: Housing of Teachers by Region,2005.....	18
Table 4: Sample of the study Source (From field research, 2017).....	25
Table 5: Use Case description for Register School.....	38
Table 6: Use Case description for Add new Teachers.....	39
Table 7: Use Case description for View Teachers Allocation.....	40
Table 8: Use Case description for register number of pupils.....	41
Table 9: Pupil CRC card.....	54
Table 10: School CRC card.....	55
Table 11: Teacher CRC card.....	56
Table 12: Data dictionary.....	56
Table 15: Ranking of Regions by Average PTRs.....	74

## **CHAPTER ONE**

### **INTRODUCTION**

This chapter includes the background of the study, a statement of the problem, research questions, objectives, scope, and the significance of the study.

#### **1.1 Background**

Decentralization policies in Tanzania can be traced back to 1962 when local authorities were introduced. However, the most recognized decentralization policy in the country was implemented during the 1970s, when the government decided to decentralize its authority to regions and districts so that people at the local level would make decisions based on their local needs (Massoi and Norman, 2009: 133).

Primary and adult educations were decentralized to regional authorities in 1972. Primary schools are currently monitored by President's Office Regional Administration and Local Governments (PORALG) in collaboration with Ministry of Education and Vocational Training (MoEVT) (Tanzania Education Sector Analysis, 2011 chapter 7, p. 269).

In recent years, education decentralization in Tanzania has been mainly implemented by the Education Sector Development Program (ESDP)'s primary education under the Primary Education Development Program (PEDP) I(2002-2006) and PEDP II (2007-20011) (URT, 2006:22) which was accompanied by abolition of school fees in 2001/2002 and 2006/2007 respectively (URT, 2001:11; URT, 2006:22). Some of the successes of decentralization of primary school management through PEDP were increasing in enrolments for standard one (I) pupils. In 2004, there were about 1.4 million pupils in primary schools (URT, 2004) and in 2010; there were about 8.4 million pupils in primary schools (URT, 2010).

However there was a challenge of shortage of teachers to accommodate the increased number of pupils, but this shortage of teachers can be in part due to imbalance allocation of available teachers. While some schools had an excess number of teachers, others had shortages of teachers which results into disparities in Pupils Teacher Ratio (PTR) in many schools in the different region as indicated in table 1 below.

**Table 1: Disparities in Pupils Teacher Ratio (PTR)**

Region	Number of pupils			Number of teachers			Pupil-teacher ratio
	Female	Male	Total	Female	Male	Total	
Arusha	124,948	139,997	264,925	2,838	1,608	4,446	60
Dar es Salaam	210,170	209,420	419,590	6,602	1,398	8,000	52
Dodoma	148,556	153,214	301,770	2,629	3,114	5,743	53
Iringa	180,354	179,064	359,418	3,178	3,710	6,889	52
Kagera	212,256	219,473	431,729	2,456	4,275	6,731	64
Kigoma	159,020	169,420	328,440	1,406	3,045	4,451	74
Kilimanjaro	170,222	175,663	345,885	5,094	2,735	7,829	44
Lindi	66,897	72,504	139,401	872	1,895	2,767	50
Manyara	108,350	116,328	224,678	1,576	1,805	3,381	67
Mara	174,735	138,098	366,397	2,353	3,477	5,830	63
Mbeya	245,289	242,842	488,131	3,415	4,605	8,020	61
Morogoro	160,287	169,241	329,528	3,381	3,174	6,555	50
Mtwara	102,475	107,147	209,622	1,289	2,772	4,061	52
Mwanza	335,386	354,349	689,735	3,919	5,684	9,603	72
Pwani	88,044	96,643	184,687	1,766	1,755	3,521	53
Rukwa	117,106	125,207	242,313	1,243	2,514	3,757	65
Ruvuma	129,267	128,683	257,950	2,100	2,966	5,066	51
Shinyanga	285,791	308,462	594,253	3,330	5,021	8,351	71
Singida	117,665	124,621	242,286	1,626	2,366	3,992	61
Tabora	129,550	145,051	274,601	1,863	2,362	4,225	65
Tanga	187,884	199,630	387,514	3,397	3,158	6,555	59
Total	3,456,822	3,626,241	7,083,063	56,334	63,439	119,773	59

Source: Tanzania, Ministry of Education and Vocational Training data.

Note: Totals do not sum in some cases, because of incomplete data.

As a result teaching and learning have been compromised by large classes and a shortage of teachers.

There is a general consensus in the literature that small classes are likely to provide effective teaching (Bourke, 1996; Blatchford et al, 2003). The study by Blatchford et al (2003) on the class size differences related to pupils' educational progress and classroom processes at the age of 5-7 years indicates that in small classes, pupils are more likely to interact with their teachers on a one-to-one basis. A pupil is also more likely to be the main focus of the teacher's attention and pupils experience more teaching, unlike in the large classes where there is a more like procedural talks.

Blatchford and his associates also found that in smaller classes there is more likelihood of teacher support for learning and teacher takes time with pupils.

Teachers know their pupils and tend to be more sensitive to individual pupil's learning needs. It was also indicated that teachers found it easier to manage and control the classroom.

According to Hattie (2002:2) it is what teachers know, do, and care about, which is powerful in learning among pupils. Excellence in teaching is what is regarded as the single most powerful influence on pupils' academic achievement. As stated by Heneveld and Craig (1996:9), improvement of pupils' learning achievement is the central goal by which school effectiveness is judged.

Rogers and Freiberg (1994:7) give reasons why pupils usually tend to love school. From the pupils' own voices indicated that pupils like a teacher who cares about pupils' learning and their grades. Pupils like a teacher who cares about the whole class and not just teaching a particular subject and who finds out what a pupil is doing. A small class size may, as Rogers and Freiberg puts forward, encourage the pupils to think for themselves and may enhance their autonomy. However imbalance allocation of teachers in primary schools causes some schools to have large number of teachers while there are few pupils and other schools have small number of teachers while there are many pupils, this result into large class size that is difficult for teachers to manage.

## **1.2 Statement of the Problem**

In primary schools, adequate teachers facilitate easy learning for students and enhance better performance in their studies. Despite its importance, many primary schools in Tanzania experience imbalance number of teachers.

Currently, teachers are allocated to various primary schools by President's Office Regional Administration and Local Governments (PORALG) in collaboration with Ministry of Education and Vocational Training (MoEVT) (Tanzania Education Sector Analysis, 2011 chapter 7, p. 269).

The allocation should be based on the school’s capacity and the Pupil-Teacher Ratio (PTR) (Tanzania Education Sector Analysis, 2011 chapter 7, p. 271). The Government policy target for PTRs is 40 to 1, (Taasisi ya Elimu Tanzania, 2013) states that “Darasa la elimu ya msingi litakuwa na wanafunzi 40 na uwiano wa mwalimu na wanafunzi utakuwa ni 1:40”.

However, an imbalance in the allocation of teachers among regions and district in Tanzania has increased. The gap in PTRs has increased from 31 pupils per teacher in 2000 (PTRs ranged from 26 to 1 in Lind Region to 57 to 1 in Shinyanga Region) to 36 pupils in 2009 (PTRs ranged from 37 to 1 in Kilimanjaro Region to 73 to 1 in Shinyanga Region). See table 2 below.

**Table 2: Ranking of Regions by Average PTR**

<b>Table 7.3: Ranking of Regions by Average PTRs, Government Primary Schools, 2000 and 2009</b>							
<i>Pupil-Teacher Ratio</i>							
<b>2000</b>				<b>2009</b>			
<b>Top 5 Regions</b>	<b>PTR</b>	<b>Last 5 Regions</b>	<b>PTR</b>	<b>Top 5 Regions</b>	<b>PTR</b>	<b>Last 5 Regions</b>	<b>PTR</b>
Lindi	26:1	Rukwa	45:1	Kilimanjaro	37:1	Mara	62:1
Mtwara	32:1	Mwanza	45:1	Pwani	42:1	Rukwa	65:1
Kilimanjaro	33:1	Dar es Salaam	48:1	Arusha	45:1	Tabora	68:1
Ruvuma	36:1	Singida	48:1	Iringa	45:1	Mwanza	69:1
Kagera	37:1	Shinyanga	57:1	Morogoro	48:1	Shinyanga	73:1
<b>Average 41:1</b>				<b>Average 55:1</b>			

Source: EMIS, 2009; Regional BEST, 2000.

Disparities in teacher distribution are even more striking at the district level. Although in some districts the PTR oversteps the policy target (reaching a low 28 to 1 in Iringa district), ratios above 80 to 1 are not uncommon, such as in the districts of Ukerewe (129 to 1), Ilala (115 to 1), Chato (95 to 1), Manyoni (91 to 1) and Uyui (89 to 1) (Tanzania Education Sector Analysis, 2011 chapter 7, p. 279); all very far from the policy target.

In Sikonge district, a school reported an extraordinary PTR of 313 to 1 (Primary Education Development Program (PEDP) II, 2009).

For example from table 1 above, PTR for Lindi, Mtwara, Kilimanjaro, Ruvuma, and Kagera are under national policy target of 40 to 1 while others are over the national policy of 40 to 1 like Ukerewe 129 to 1. This situation shows imbalance distribution among teachers in primary schools.

### **1.3 Objectives**

#### **1.3.1 General objective**

The general objective of the study was the development of a web-based system for managing the allocation of public primary school teachers.

#### **1.3.2 Specific objectives**

1. To investigate the strength and weakness of the current mode of allocation of teachers.
2. To develop a web-based information system that will manage allocation of primary school teachers.

### **1.4 Research questions**

In order to achieve the goal of this research, the following questions were answered:

1. What are the strength and weakness of the current mode of allocation of teachers?
2. How to develop a web-based information system that will manage allocation of primary school teachers?

### **1.5 Scope of the Study**

The study focused only on investigating why there was imbalance allocation of public primary school teachers in ILALA Municipal though there was a national policy that requires teachers to be allocated based on the PTR of 40 to 1 and furthermore the study examined the strength and weakness of the existing methods of allocating teachers. Basing on the results found; a web-based information system that manages the allocation of public primary school teachers was developed. The technologies used in developing the system were HTML, BOOTSTRAP, PHP, and MYSQL. HTML and BOOTSTRAP were used for front-end and PHP and MYSQL were used for the back end.

## 1.6 Significance of the Study

The study provided information on the issues of allocation of public primary school teachers particularly on the technology that could provide a balanced allocation of available teachers so that disparities in teachers' allocation could be minimized.

The study would be beneficial to both teachers and pupils by facilitating a balanced allocation of available teachers in all primary schools for easy learning of pupils and enhance better performance in their studies.

Furthermore, this study would be beneficial to the education stakeholders like government officers, policymakers, PORALG who are responsible for allocation of public primary school teachers, MoEVT who are responsible for teachers' training, formulating laws, policies and regulation governing education in general and primary education in particular and issuing directives to ensure quality and adherence to specified standards and Non-Government Organizations (NGO) dealing with education.

To the future researchers, this study can provide baseline information on how to allocate primary school teachers based on PTR, gender, and age so that even rural-based primary schools can have balanced number teachers that will facilitate easy learning for pupils and enhance better performance in their studies.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter presents the review of literature that is related to the development of a web-based information system for managing the allocation of public primary school teachers in Ilala Municipal. The chapter includes the shortage of teachers due to poor teacher deployment, roles of PORALG in allocating primary school teachers, challenges facing allocation of public primary school teachers, teacher deployment systems, and experience from other countries, strategies to redress imbalance allocation of primary school teachers, knowledge gap and conceptual framework.

#### **2.2 Shortage of teachers due to poor teacher deployment**

The number of teachers has not kept pace with expanding enrolments; and the imbalance allocation of available teachers remains a challenge (Matete, 2016). Teachers complained of a heavy workload due to a shortage of teachers in their schools. This can be in part due to imbalance allocation of teachers. While some schools had an excess number of teachers, others had shortages of teachers.

In general, this shortage has been caused by imbalance allocation of teachers. Sifuna (2007:696) has the view that staff shortages force teachers to work without a break right from the morning until the afternoon. According to Sifuna, having few teachers in schools increases teachers' workloads and they may end up providing few assignments to pupils. This greatly dampens their commitment towards their work and readiness to accept accountability of their pupils' learning outcomes.

#### **2.3 Roles of PORALG in Allocating Primary School Teachers**

Decentralization policies in Tanzania can be traced back to 1962 when local authorities were introduced. However, the most recognized decentralization policy in the country was implemented during the 1970s, when the government decided to decentralize its authority to regions and districts so that people at the local level would make decisions based on their local needs (Massoi and Norman, 2009: 133).

The Constitution of the United Republic of Tanzania Articles 8(1), 145 and 146 of 1977 and the amendments that followed from time to time, enshrine the Local Government system, emphasizing the supremacy of the people and underlining that the Government is accountable to the people. It also highlights that the people have a right to participate, and establish levels at the region, district as well as at the village.

The President of the United Republic of Tanzania issued a Notice on the assignment of Ministerial responsibilities (Instrument) vide Government Notice No. 494 of 17 December 2010. In the said Instrument, the President created the President's Office-Regional Administration and Local Government (PO-RALG) which is mandated for formulation, monitoring and evaluation of decentralization by devolution, rural and urban development policies and their implementation (The Local Government Act No.7 of 1982 (Cap.287) and No.8 of 1982 (Cap.288)).

Primary schools are currently monitored by President's Office Regional Administration and Local Governments (PORALG) in collaboration with Ministry of Education and Vocational Training (MoEVT) (Tanzania Education Sector Analysis, 2011 chapter 7, p. 269). The following are the roles performed by PORALG:

- (i) To allocate primary schools teachers.
- (ii) To Manage Primary Education records.
- (iii) To facilitate availability and transfers of teaching staff between Regions.
- (iv) To Analyze and Compile teaching staff Requirements from Regional Secretaries in liaison with MoEVT.
- (v) To prepare and disseminate operational guidelines and circulars on management and administration of Primary Education.
- (vi) To analyze reports on School buildings and infrastructure, assets, and general performance in Primary Education from Regional Secretaries and conduct spot inspection where necessary.
- (vii) To revise Roles, functions, responsibilities, and membership of school boards.
- (viii) To roll out best practice for teachers' retention in Local governments.

- (ix) To consult with Ministry responsible for Finance regarding funding of administration and management of Primary Education including teacher's welfare.
- (x) To coordinate and conduct Form One selections.
- (xi) To review guidelines and circulars on the administration of Primary Education for Regional secretaries and Local governments.
- (xii) To oversee the administration of examinations of Primary Education.
- (xiii) To operate, coordinate and supervise sports and games in Primary schools.
- (xiv) To allocate new teachers to various schools regional wise.

## **2.4 Challenges Facing Allocation of Public Primary School Teachers**

There have been many challenges facing allocation of primary school teachers in African countries including Tanzania; some of the challenges include:

### **2.4.1 Marriage as a Factor for Teacher Allocation**

Once the teachers were deployed, teachers were able to request transfers to other areas ("Sheria ya utumishi wa umma, 2014 kifungu cha 65"). It is not common for a male teacher to find a transfer to follow his wife. For female teachers, the transfer is often requested on the basis of marriage, and there are even some reports of women faking a marriage in order to get a transfer.

It is rare to find female teachers in rural areas unless they are with their husbands (Gottelmann-Duret et al., 1998). In some cases, teachers have been able to get a transfer, even where there is no vacancy in the school to which they are moving. As a result, some urban schools are significantly over-staffed and teachers have relatively light workloads. As there is constant teacher-initiated movement, and no regular supply of new teachers, there is an oversupply of teachers in the desirable areas and a shortage in the less desirable areas, hence creating the imbalance number of teachers.

### **2.4.2 Teacher Gender**

Female teachers may be even less willing to accept a rural posting than their male counterparts, and rural areas may have fewer female teachers than urban areas (Gottelmann-Duret et al., 1998). In some cases posting single women to unfamiliar areas may cause cultural difficulties, and may even be unsafe (Rust and Dalin, 1990; VSO, 2002). For unmarried women, posting to an isolated rural area may also be seen to limit marriage prospects (Hedges, 2000).

In Ghana, they are not posted to rural areas as a matter of policy (Hedges, 2002). For married women, a rural posting may mean separation from her family, as the husband may not move for cultural or economic reasons (Gaynor 1998). Where women have been posted to rural areas they may come to see them as having been treated unfairly by the system and thus seek early transfers (Hedges, 2002). This cause imbalance allocation of teachers in terms of gender where female teachers are few in most schools located in village-based when compared to urban-based schools.

### **2.4.3 Professional Development**

Teachers may also see rural areas as offering fewer opportunities for professional advancement. Urban areas offer easier access to further education (Hedges, 2000). In addition, teachers in rural areas are less likely to have opportunities to engage other developmental activities, or in national consultation or representative organizations.

Teachers in rural areas may even find it more difficult to secure their entitlements from regional educational administrations, sometimes to the extent of having to put up with obstacles or corruption by officials. The problem is further exacerbated where the majority of student teachers come from a different background. In Ghana, teachers tend to come from a higher socio-economic background than average for the country as a whole (Akyeampong et al., 2002) and to be disproportionately from urban areas. Hedges (2002) describe their reluctance to accept a rural position:

*“There is a profound fear among newly trained teachers with a modern individualistic outlook that if you spend too much time in an isolated village without access to further education, you become ‘a village man’, a term which strongly conveys the perceived ignorance of rural dwellers in the eyes of some urban educated Ghanaians”*

### **2.4.4 Diseases (e.g. HIV/AIDS) as Factor for Teacher Allocation**

Health concerns are another major issue for teacher’s allocation in African countries and Tanzania in particular. Teachers may perceive that living in rural areas involves a greater risk of disease (Akyeampong et al., 2002), and less access to healthcare (Towse et al, 2002). Although HIV/AIDS is a threat in all areas, it is becoming a greater threat in rural areas than in cities.

More than two-thirds of the populations of the 25 most-affected African countries live in rural areas (FAO, 2005). Furthermore, information and health services are less available in rural areas than in cities. Rural people are therefore less likely to know how to protect themselves from HIV and, if they fall ill, less likely to get care (FAO, 2005). The prevalence of AIDS in rural areas and the lack of medical facilities have made rural postings even less attractive to teachers (Smith and McDonagh, 2003).

Across Africa, an estimated 260,000 teachers, 9.4% of the total employed in 1999, could die of AIDS-related illnesses over the next decade (Bennell, Hyde, and Swainson, 2002). In South Africa, HIV testing of over 17,000 teachers revealed that 12.7% were HIV positive, and the prevalence rates were higher among rural teachers and among younger and less experienced teachers (CSA, 2005). In some cases, ill teachers are posted to urban centres to allow them access to medical services. Although they do little to enhance the teaching in urban areas, their absence from the rural areas further enhances the rural-urban divide (Kelly, 2000).

In Ghana, for example, poor health is the most common reason given for early transfer (Hedges, 2002). In Uganda, the policy is that teachers with health problems should be posted to schools near to medical facilities. Mozambique is considering a similar policy. In Malawi, ARVs are available free to people with HIV, but only a limited number of hospitals can dispense them, or even diagnose HIV. There is no formal arrangement to allow sick teachers to move to areas near hospitals. However, for compassionate reasons district education managers often allow a transfer. This transfer leaves a shortage of teachers to the relevant school because there is no policy to fill the vacant post due to transfers of teachers to other schools.

## **2.5 Teacher Deployment Systems**

In practice, two main systems exist, either deployment by a central authority, or deployment by a “market system” (Lewin, 2000). In Tanzania, Mozambique, and Malawi, deployment is centrally planned. In Malawi, this is done at the national level, and in Mozambique, it is done at the provincial level. In Lesotho, there is a market

system in operation where schools are free to select their own teachers, and teachers select the schools to which they apply to teach.

### 2.5.1 Central authority Deployment

Centralized deployment has been a long-standing model in many countries in sub-Saharan Africa, and is widely believed to allow rational deployment of teachers (Penrose, 1998). Central planning has the advantage of distance from local pressures and can be more easily made fair and transparent.

However, highly centralized systems are dependent on the quality of information they receive from schools and tend to suffer from congested decision making and inattention to the individual needs of education staff (Gottelmann-Duret and Hogan, 1998; Rust and Dalin, 1990). The major weakness of the centralized systems is that they are often undermined in practice by an inability to implement rational deployment.

Teachers may circumvent Ministry of Education's posting policy by claiming fictitious health problems, exploiting poor record keeping, and or just failing to take their assigned posting (Hedges, 2000). Teachers who fail to take up a rural posting present a difficulty for policymakers. If they are later allowed to take up a desirable post, they undermine the posting system. If they are not, then the system loses the resource of a trained teacher.

*Example, "If two teachers, A and B, would like to work in an urban area, but are posted to a rural area Teacher A accepts the post and moves to the rural area. B refuses the post and remains unemployed. Later, a position appears in a desirable location, and both teachers apply. This presents a difficult choice. If the post is given to A, the rural post becomes vacant and is difficult to fill. If the post is given to B, then B has achieved the goal more quickly than A by refusing the rural post. The message is observed by others, and any teacher who can afford a period of unemployment quickly understands that the fastest way to the desired post is by rejecting offers of rural postings."*

The inability to implement planned deployment has serious consequences. In Ghana, a recent survey of 262 newly trained teachers posted to four rural districts, showed that

115 failed to arrive at their teaching post (Hedges, 2000). This widespread failure to accept rural posts undermines the rational posting system and contributes to a lack of conviction among administrators that significant progress can be made in addressing patterns of unbalanced deployment (Gottelmann-Duret et al., 1998). This shows that the deployment of teachers by central authority cannot provide a balanced allocation of teachers to all schools.

### **2.5.2 The Decentralization System Deployment**

In terms of teacher deployment, decentralization brings both benefits and risks. The more local the system, the more likely it is to be able to keep in touch with the needs of the schools, to respond quickly and flexibly to needs. However, a local structure may also open up a greater possibility of undue influence being exerted by powerful individuals on deployment decisions, especially in countries with a weak administrative capacity at district and local levels (Hallak, 1990).

In many instances in Africa, administrators operating at the local level are exposed to the pressure of influential personalities in local communities, and it is not unusual to see their decisions being biased. In Tanzania, primary school teachers are allocated by local governments (PORALG) but still imbalance allocation of teachers in many schools still exists. Therefore, improved systems of checks and balances are needed to ensure countrywide equity, justice, and efficiency in teachers' allocation and deployment (Gottelmann-Duret, 1998).

### **2.5.3 The Market System Deployment**

In the market system, teachers are not sent to schools but apply for posts in specific schools. This system removes the burden of deploying teachers from the central authorities. In effect, teachers deploy themselves by searching for jobs. It gives each school more autonomy in selecting their teachers. Schools are more likely to select teachers who will accept the position, and often recruit local people. However, "market effects" occur, and the most desirable teachers (best qualified), tend to get the most desirable jobs.

In Lesotho the practical effect of the market system is that most schools are able to fill their teaching posts, but that more of the teachers in isolated schools have lower qualifications. This type of deployment system still creates inequity in teachers allocation as some schools located in remote areas may not get teachers who apply for job causing imbalance of teachers for schools based in village or for schools which are far from urban areas.

## **2.6 Experience from Other Countries**

### **2.6.1 Teacher Deployment in Mozambique**

In Mozambique, teacher deployment is done at provincial level and each province trains, recruits and deploys its own teachers (Mozambique Ministry of education, annual school survey, 2004). The general principle is that the graduates from each provincial teacher training college are required to teach in that province. Recruitment of newly qualified teachers is normally automatic, but in some cases, provinces have had insufficient funds to recruit all of the newly qualified teachers.

Teacher training capacity is unevenly distributed, Maputo City district trains more teachers than it requires, and there is a system that allows teachers to volunteer for transfer to another province (Teachers and training in Mozambique, by province, 2004). However, only 107 teachers agreed to transfer in 2004. This imbalance is reflected in striking differences between the provinces. In Maputo city, only 8% of EP1 (early primary) teachers were untrained, compared with 62% in Niassa (Mozambique Ministry of education, annual school survey, 2004). Rural provinces have both a higher pupil-teacher ratio (PTR) and a higher ratio of pupils to qualified teachers (PQTR). This reflects a greater number of posts unfilled, hence creating imbalance allocation of teachers.

### **2.6.2 Teacher Deployment in Malawi**

Since the introduction of Free Primary Education in 1994, teacher recruitment has been done by hiring untrained temporary teachers, who are later trained through the Malawi II Teacher Education Policy (MIITEP) programme. This recruitment was done centrally, and the teachers were deployed to schools on the basis of needs. Candidates

are not recruited for specific locations, and there were no specific recruitment policies to select teachers for rural areas.

There has been high demand for places in teacher training, and the entry qualifications have been rising. Under the MIITEP system, the deployment of teachers was done at the point of recruitment. The intention was to deploy teachers to the rural schools where the need was greatest. However, many teachers, particularly female teachers, found reasons to argue that they should not be sent to rural areas. For female teachers, they often made the argument based on marriage.

If a woman's husband is located in an urban area, the ministry will not normally force the woman to leave the area. Once the teachers were deployed, teachers were able to request transfers to other areas (Mulkeen, 2006). For female teachers, transfer was often requested on the basis of marriage, and there were even some reports of women faking a marriage in order to get a transfer. It is rare to find female teachers in rural areas, unless they are with their husbands (if, for example, both are teachers). Male teachers were sometimes able to get a transfer on the basis of doing further study, and so needing access to electricity (Mulkeen, 2006).

### **2.6.3 Teacher Deployment in Lesotho**

Lesotho has some very mountainous areas where travel is difficult. Infrastructure is poor and the climate inhospitable. Given the dispersed population, schools in mountain areas are generally smaller than those in urban areas (Patrick, 1999). Teacher deployment is based on local hiring of teachers. The Ministry "grants" teachers to schools in response to school population and budget considerations. Once the school is granted a post, the school management committee can select the teacher. Once the teacher is identified, the papers are sent to the Teacher Service Commission (TSC) for ratification and the ultimate payment of salaries by the government. This local hire system has a number of implications. Teachers are not sent to schools. Instead, they apply to schools where they would be willing to work. Schools do not have a problem with teachers refusing postings. Individuals unwilling to work in rural areas do not apply for posts in those areas (Mulkeen, 2006).

The local hire system is more open to local influence than a central deployment system. Although posts are advertised, many schools have a person in mind before they begin the selection process. In some cases, this results in a local person being appointed in preference to an outsider. One effect of this system is that most teaching posts are filled, and there is relatively little variation in a pupil-teacher ratio between rural and urban areas. However, qualified teachers can more easily compete for jobs in urban areas, and so many of the rural schools recruit unqualified teachers. The school census data reveals that only 24% of teachers in lowland areas are unqualified, compared with 51% in mountain areas.

## **2.7 Strategies to Redress Imbalance Allocation of Primary School Teachers**

In Africa and Tanzania, in particular, each country has their own strategies/methods of redress teacher's deployment system. Policy makers in all countries should try a number of strategies to redress the imbalances in teacher deployment, but the main strategies can be categorized as Incentives for teachers locating in rural areas, Forced transfer of teachers, and Targeted recruitment.

### **2.7.1 Incentives for Teachers Locating In Rural Areas**

Some countries have attempted to make working in rural areas more attractive through the use of incentives. In some cases, these may be financial incentives, in the form of a hardship allowance, travel allowance, or subsidized housing. In other areas, the incentives may be non-monetary, including, for example, special study leave or better training opportunities (Gaynor and Craig et al, 1998). In Mozambique, there is a system of financial bonuses for teachers who locate in rural areas. Schools are classified into four location categories, ranging from urban schools to the most isolated schools, and teachers are paid a salary bonus depending on the location of the school.

Although the bonus payments appear attractive, they are weakened by two issues: First, the payment depends on both location and on teacher qualification. For the teachers with low qualifications (the bulk of primary teachers), there is no bonus at all. For teachers with a mid-level qualification, the difference between teaching in a provincial urban and a remote school is relatively small (only 14% of salary). Second, teachers who teach two shifts receive a bonus of 60% of their basic salary. Two shift schools are

found more frequently in the areas of a high population density, and so teachers in urban and cities are more likely to have the option of additional earnings from this source (Rust, V. and Dalin, P. (Eds.) 1990).

In Lesotho, there is a hardship allowance paid as a flat fee of M275 per month. This is equivalent to 20% of salary for an unqualified teacher, but only 10% of the salary for a teacher with a diploma qualification. This is generally acknowledged to be too small to encourage the more highly qualified teachers to locate in remote areas. As one DRT explained, even the cost of travel to collect the monthly cheque, and the cost of commodities, especially fuel, could outweigh the value of this bonus. In addition, the hardship allowance is determined by very general classifications of schools. Teachers in remote rural schools in the lowlands do not receive the allowance, while teachers in urban in mountain districts do. (Gaynor and Craig et al, 1998)

In Tanzania, most primary teachers do not get any additional payment to move to rural areas. Currently for locating in rural areas, possibilities' being considered Education Management Information System (EMIS) data shows a strong correlation between housing & female teachers hardship allowance of 20% of salary for 'hard-to-reach' areas. There have been difficulties in deciding which are hard to reach schools. To have one in the 1980's but abolished in 1990's. PEDP stated priority to rural teacher housing, but in practice not implemented. These cases highlight two general lessons concerning the use of incentives. First, the incentives need to be substantial to outweigh the social and economic costs of living in an isolated area. Second, incentive systems require a fair system of classification of schools.

In Mozambique, urban schools are more likely to offer two-shift teaching, which carries a salary bonus. In other countries, schools in richer communities are able to raise money from parents through voluntary contributions or parent-teacher associations. These extra resources can be used to provide additional benefits, or even additional salary, for teachers.

### 2.7.2 Teacher – Housing

A second major incentive for teachers to locate in rural areas is the provision of teacher housing. Where teachers cannot live near the school, they are likely to spend a lot of time travelling, often to the detriment of their school work. Housing is particularly important for female teachers. In Malawi, the EMIS data reveals a strong association between the availability of housing in an area and the presence of female teachers in the school (Garson, 1998).

In Tanzania the shortage of houses for teachers is still a problem in different regions. See table 3 below

**Table 3: Housing of Teachers by Region, 2005**

Region	Houses needed	Houses available	Shortfall
Arusha	5,184	1,241	3,943
Dar es Salaam	8,033	401	7,632
Dodoma	7,313	3,017	4,296
Iringa	9,060	3,161	5,899
Kagera	8,808	2,434	6,374
Kigoma	6,885	944	5,941
Kilimanjaro	8,732	628	8,104
Lindi	2,977	515	2,462
Manyara	4,773	820	3,953
Mara	8,630	1,503	7,127
Mbeya	10,752	2,632	8,120
Morogoro	6,817	1,993	4,824
Mtwara	5,806	1,544	4,262
Mwanza	16,352	1,560	14,792
Pwani	4,539	1,080	3,459
Rukwa	7,001	2,821	4,180
Ruvuma	5,987	1,998	3,989
Shinyanga	12,668	1,446	11,222
Singida	5,425	1,148	4,277
Tabora	6,661	505	6,156
Tanga	8,993	703	8,290
Total	161,396	32,094	129,302

Source: Tanzania, Ministry of Education and Vocational Training data.

Similarly, in Uganda, a recent Study on Primary School Teachers Attrition considered the provision of housing to be a key factor in ensuring teacher retention, especially in rural areas. Currently, 15% of the School Facilities Grants (SFG) is allocated to the construction of teachers' houses.

In Mozambique, the Ministry does not normally provide housing although the practice has been to put a director's house at some schools. In addition, some NGO's and even local communities have constructed teacher housing in an attempt to make rural

locations more attractive. In Lesotho too, teacher housing is not normally provided, but some NGOs and community groups have provided accommodation. Although good quality housing near the school can be a significant incentive for teachers, and particularly for female teachers, it can be expensive to provide, especially if the government is also responsible for ongoing maintenance of the property (Hedges, 2002). There may also be difficulties in repossessing a house for use by a new teacher, particularly where this would leave a family in hardship as a result of teacher illness or death.

### **2.7.3 Forced Transfer of Teachers**

There have also been attempts to address the issue by forcing teachers to relocate to rural areas (Gottelmann-Duret et al., 1998). While this strategy has a little financial cost, it may damage teacher morale and lead to a high turnover of staff. In South Africa, an effort to force the redeployment of teachers to poorer, rural areas was unsuccessful. South Africa's predominately female teaching force was not mobile enough to respond to school staffing needs. When strongly encouraged to relocate, large numbers of key science and mathematics teachers left teaching (Garson, 1998). As a consequence, there was a significant drop in the number of school leavers choosing to apply to teacher training colleges because teaching was seen as an embattled profession, "where one is likely to be redeployed or moved" (Samuel, 2002).

In some countries, such as Malawi and Zambia, forced relocation to rural areas is sometimes used as a punishment for teachers who misbehave. While this has a certain sense of natural justice, it runs the risk of locating the teachers who have caused trouble in the schools that are furthest from supervision (VSO, 2002). Some countries have used models where deployment to rural areas is related to career progression. Typically, these require that newly trained teachers work for a number of years in a rural area, or that teachers seeking promotion work for a period in a rural area (Gottelmann-Duret et al., 1998).

Successful implementation of such systems depends on careful management. Even if successful, this would result in a concentration of the least experienced teachers in rural areas. There is some evidence that young, newly qualified teachers have more

difficulties in rural areas, and achieve poorer results (Daun, 1997). Despite these difficulties, systems, where a defined period in a rural area is required, may be an effective strategy for getting qualified teachers in rural schools. Teachers may be more likely to accept a rural post if they see it as temporary, and as a path to a more desirable job.

#### **2.7.4 Forced Deployment for Teachers**

An alternative strategy may be to seek to recruit student teachers from within each region, in the hope that personal history and family connections will entice them to return to teach in their home area after they attain their teacher certification. The presumption is that those individuals will have family roots in these rural areas and be more willing to return and remain in these rural settings (Craig et al., 1998). One of the attractions of this approach is that if teachers become established within their own community, they may gain extra benefits from the proximity of relatives, which may help to ensure long-term stability. Working close to ones' extended family may provide some level of financial support and subsidy (Black et al., 1999).

However, some countries, such as Malawi, report that teachers do not want to work in their own village, because there may be too many demands on them from family. Some people from rural areas would prefer to be in their home district, but not actually in their home village. It should be noted that the assumption that teachers recruited from a rural area would want to return to their own communities has been challenged by a number of researchers (Rust and Dalin, 1990). Educated members of a disadvantaged minority group may view their education as a means of social mobility and may have no desire to remain in the community once qualified (Azam, 2001).

In Lesotho, for example, it was reported that "it is hard to attract people to rural areas, as the conditions are difficult... Young people, even those from rural areas, want to come down from the highlands as soon as they can. Even those who come on study leave, try hard to stay in Maseru". The targeted recruitment strategy is most frequently used to recruit teachers from specific geographical regions or ethnic linguistic groups. However, it may also be possible to focus teacher recruitment on teachers from particular socio-economic backgrounds.

Hedges (2002) raise an interesting possibility in reporting that teachers from poorer backgrounds were more likely to value the relative security of the teaching profession and take up their postings. However, this strategy often involves a trade-off between entry qualifications for rural roots (Lewin, 2002). If it is necessary to adjust the teacher recruitment system to favour teachers from a particular area, and if the system was a merit-based system, then the adjustment entails recruiting teacher of lower quality than before.

Despite the incentives provided by some countries to attract teachers to work in areas of hardship condition, still, there is imbalance allocation of available teachers in many schools both in urban and village-based, even though the condition is worse in village-based schools when compared to urban schools.

The experience of teachers' deployment in various countries like Ghana, Uganda, Malawi, and Lesotho do not significantly differ with that of Tanzania, For example Ghana still uses the central deployment system where the teachers are recruited from the central government and posted to the regions and some of these may not report to the station resulting to shortage of teachers in the rural areas.

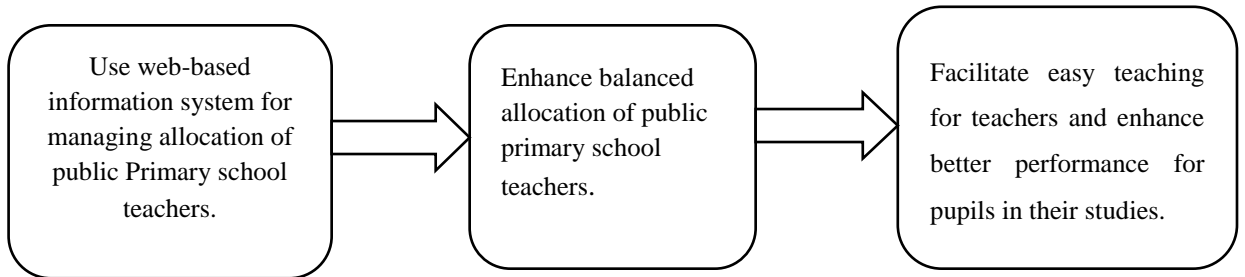
## **2.8 Knowledge Gap**

Imbalance allocation of teachers is the problem that many researchers dealt with it. It is the area where researchers tried to find out the causes and sometimes give out the alternative solution in ending the problem, such researchers comprises (Mwakalembe, Ntalimia, and Muze, 1981), Hakielimu (2008) and Davison (2002). Unfortunately, most of them, their main focus was on factors caused teachers not to report to the schools that were allocated due to various reasons such as marriage, diseases, professional development, poor living environments and others looked on the effects of large class size in teaching and learning in public primary schools (Blatchford et al, 2003). However, most of them neglected to investigate ways of removing imbalance number of teachers in allocation by using modern technology such as using ICT.

## 2.9 Conceptual Framework

This study aimed at designing and developing a Web-based Information System for Managing Allocation of Public Primary School Teachers for enhancing easy learning for pupils and better performance.

From figure 1 below usage of web-based information system enables schools to have a balanced number of teachers. Availability of a balanced number of teachers facilitates easy learning for pupils and better performance.



**Figure1: conceptual framework for a web-based information system**

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

A research methodology is a way of systematically solving research problems. University of Bradford (2007) defines research methodology as the only way to apply the various specific tools or ways data can be collected and analyzed. Henning (2004) also defined methodology as the logical groups of methods that harmonize one another and that have the ability to fit to deliver data and findings that will reveal the research questions and go with the research purpose.

##### **3.1.1 Methodology**

This study had two parts, the research part, and system development part. The research part was conducted by using qualitative methods in order to collect data and system requirements. The data collected was analyzed by using a qualitative approach and lead to part two of the thesis which was system development.

The system was developed by using prototyping methodology. In developing the web-based information system for managing allocation of public primary school teachers (PSTAIS), a prototyping-based methodology performs the analysis, design and implementation phase concurrently, Dennis (2009) and all three phases were performed repeatedly in a circle as new requirements from users of the system were collected until the system was completed. The system was developed by using the following technologies: HTML, Bootstrap, PHP and Mysql. HTML and Bootstrap for front-end and PHP and Mysql for the back end. Users of the system are head teachers, PORALG, DEO, and MoEVT.

#### **3.2 Research Design**

In this study, the case study design was employed, particularly exploratory case study design. Case study design enables a researcher to closely examine the data within a specific context. Yin (1984) defined the case study research method as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which

multiple sources of evidence are used; “This type of design provided an accurate understanding of a web-based information system for managing allocation of public Primary school teachers”.

Research design entails the detail exploration of a specific case, which could be a community, person or organization. Thus, research design is a framework for the collection and analysis of data. This research was a case study, which took place in Ilala Municipal. The rationale for selecting the case study was to enable the researcher to get in-depth information about imbalance allocation of primary school teachers.

### **3.3 Approach**

The researcher used qualitative approach methodology. Myers (1997) argues that “Qualitative research involves the use of qualitative data, such as interviews, documents, focus-groups, and participant observation data, to understand and explain social phenomena”. This approach was chosen because it helped the researcher to understand the research problem from the perspective of the local population is involved. This research also adopted qualitative data gathering techniques; qualitative data was obtained through semi-structured interviews.

### **3.4 Area of the Study**

The study area is an area where the researcher has decided to do the research, this means the sample will be obtained from that area and also they will be first beneficial to the research. The study was conducted in Dar-es-salaam region, Ilala Municipal in five primary schools: The selected primary schools were Bangulo, Ulongoni, Majani ya Chai, Karakata and Mogo and the visited offices were PORALG education unit, MoEVT and Ilala District Education office.

### **3.5 Population and Target Group**

Polit and Hungler (1999) define a study population or universe population as the totality of all subjects that conform to a set of specifications, comprising the entire group of persons that is of interest to the researcher and to whom the research results can be generalized. In a related manner, Salant and Dillman (1994) described the population in a study as a group of experimental data or persons. With the definitions given, the

population of this study included head teachers of primary schools and education officers from PORALG, MoEVT and Ilala District Education officer. The eligibility criterion in this study was that the participants are directly beneficial to the research.

### 3.6 Sample and Sampling

A sample is a smaller (but hopefully representative) collection of units from a population used to determine truths about that population (Field, 2005); while sampling refers to the process of selecting a number of individuals for a study in such a way that the individuals represent the larger group from which they were selected.

#### 3.6.1 Sample

A sample is taken from the universe population of a study. If the sample is adequate it has the same characteristics as those of the universe population (Zikmund, 2003). Also, Haber (1998) describes a sample as a portion or a subset of the research population selected to participate in a study, representing the research population.

The sample sizes in this study were obtained from five primary schools and from PORALG, MoEVT and Ilala District Education office. In each school one head teacher was purposively selected to make a total of 5 and two education officers from PORALG, MoEVT and Ilala District Education office were also involved. See table 4

**Table 4: Sample of the study (Source From field research, 2017)**

Ilala Municipal	Schools	Head teachers	PORALG education unit	District Education officer	MoEVT
	Bangulo	1	02	02	02
	Ulongoni	1			
	Majani ya chai	1			
	Karakata	1			
	Mogo	1			
Total	05	05	02	02	02

### **3.6.2 Sampling**

Sampling is deciding who will participate in a study. Hence the sampling is a procedure of selecting a number of individuals for a study in such a way that the individuals represent the larger group from which they were selected and the inference drawn from the sample are extended to the whole group (Cochran, 1953). The study adopted the non-probability technique, particularly purposive.

A purposive sampling refers to the selection of units based on personal judgment rather than randomization (ILO, 2009). Additionally, Fairfax County (2012) describes judgmental or purposive sampling as one where the researcher employs his expert judgment about who to include in the sample frame. Prior knowledge and research skills were used in selecting the respondents or elements to be sampled. Thus purposive technique fitted this study since the researcher had prior knowledge about the study and sample to be used. The samples selected by this technique are tabulated in table 4 above.

### **3.7 Research Instruments**

The instrument is the device used by investigators for collecting data. Seaman (1991) argues that data collection instruments refer to devices used to collect data such as questionnaires, tests, structured interview schedules, and checklists.

For this study, the researcher used semi-structured interview schedules and documentary review.

#### **3.7.1 Semi-Structured Interview**

Gray (2009) explains that semi-structured interview comprises of non-standardized questions often used in qualitative data collection. The techniques were used by the researcher during the interview by having a list of issues and questions to be discussed. All questions may not be asked in a single interview. In this technique, the order of questions may also change depending on what direction the interview takes. Additional questions may be asked to seek further clarification of issue emerging not estimated at the start of the interview. Data was being recorded by note taking when the interview was in progress. Questioning was possible as a researcher needed more information or

clarification about certain issues from interviewees. Open questions were given to respondents who participated in the study. Before the researcher administered the interview, the researcher considered developing a positive relationship with the respondents. Gray (2009) holds that to develop a relationship the following would be needed to be observed. First, was explaining how the interview would last, and then explaining the purpose of the interview. Therefore, a researcher explained to respondents how the information provided by the volunteers would be kept confidential where necessary.

The reasons for choosing interviews were that Interview gives more in-depth insight on actions. This is due to the ability of the interviews to accommodate flexible questions during the interviewing process. An interview would allow the researcher to gather in-depth information on the phenomenon (Silverman, 2006, Gray, 2009). It was for these reasons, the inter technique was selected and was supported by other methods namely, documents review.

### **3.7.2 Documentary Review**

According to Patton (2002) learning to study and understand using documents, files is part of the data collection skills needed for qualitative analysis. The review of these documents providing insights on the problem investigated. The researcher reviewed the files containing the number of teachers and pupils from the selected primary schools for the past three years to see the ratio of pupils to teachers of those schools. These data were obtained from head teachers of the particular schools.

### **3.8 Proposed Data Analysis**

Data analysis instruments are devices used to give meaning to the collected data. Data analysis is a mechanism for reducing and organizing data to produce findings that require interpretation by the researcher (Burns & Grove 2003). Since a qualitative methodology was used, Qualitative data were gathered and analyzed manually by putting together common explanations and trends into themes.

The researcher went through a process called content analysis. Content analysis means analysis of the contents of an interview in order to identify the main themes that emerge from the responses given by the respondents. Content analysis of qualitative data was conducted to identify the socially constructed nature of reality.

The process involved identifying, coding and categorizing the primary patterns in the data. The first step was properly scrutinizing the data concerning allocation of primary school teachers through reading the collected information. Secondly, the information was categorized by identifying themes or patterns i.e. ideas, concepts, behaviour, interactions, incidents, terminology or phrases used. Here the data collected about imbalance allocation of teachers were made into field notes. Codes were analytically developed in the data and affixed to set of notes. These codes were then transformed into categorical labels or themes basing on their relationship and commonalities or disparities. The identified theme or patterns were organized into coherent categories that were summarized to bring meaning to the text. These identified patterns were considered in light of previous research and theories and a small set of generalization was then established.

### **3.9 Ethic considerations**

Creswell (2002) states that the required procedure before data collection involves gaining permission from individuals in authority (such as gatekeepers) to provide access to study participants. This often involves writing a letter that identifies how long the interview would take, the potential impact, and the outcomes of the research.

The researcher gave respect to the participants during data collection. Moreover, the researcher also did not put participants at risk and should respect vulnerable populations (Sieber, 1998). Participants were told of their rights to participate voluntarily and the right to withdraw at any time so that they are not being coerced into participating. Such, consent was sought from the participants and they were assured of their privacy being protected before any data was collected. In reference to this, McNamara (1994) identifies five ethical concerns to be considered when conducting case study research. These guidelines deal with voluntary participation, no harm to respondents, anonymity, and confidentiality, identifying purpose and sponsor, and analysis and reporting. Thus the researcher took care of all these ethical issues.

## **CHAPTER FOUR**

### **PRESENTATION AND DISCUSSION OF THE FINDINGS**

#### **4.1 Introduction**

In this chapter, the researcher presented and discusses the findings of the study on Web-Based Information System for Managing Allocation of Public Primary School Teachers in Tanzania: The Case of Ilala Municipal. This study had the aim of finding why there is imbalance allocation of primary school teachers in Ilala Municipal even though there is a national policy which requires allocation of primary school teachers to be based on PTR of 40 to 1 (40:1).

The primary school studied were government schools, of which two schools were in the urban area and the other three were in rural areas. The reason to select such schools was that they are mostly affected by the issue of imbalance allocation of teachers. The study attempted to answer the research questions: What are the strength and weakness of the current mode of allocation of teachers? And the second question was: how to design a web-based information system for managing the allocation of public primary school teachers?

#### **4.2 What are the strength and weakness of the current mode of allocation of teachers?**

The policy and procedures for teachers' allocation in Ilala Municipal is that teachers are allocated by considering the needs of the school and priorities in terms of filling the posts. For the case of teacher transfer, exchange of positions between one region and another is being considered or between one school and another. But also reasons such as marriage, health problems, and opportunities in professional developments are considered.

The weakness observed for the current allocation system in Ilala Municipal was that it failed to provide a balanced allocation of teachers; some schools have many teachers while other schools have few. Further weakness observed was concerning those who are

responsible for allocating teachers; do not have exactly number of pupils and teachers from different primary schools that could help them to find PTR; which would help them in understanding exactly the deficit of teachers in different schools; this may be due to insufficient data they received from head teachers of various primary schools. Another weakness of the system was that; the allocation decisions concerning teachers' allocation were influenced or affected by political leaders or Government officials who provide names of new teachers and direct which schools should be allocated and this resulted into the unequal allocation of teachers in different schools.

#### **4.2.1 Issues which influence imbalance allocation of teachers in Ilala Municipal**

Imbalance allocation of teachers was influenced by various factors like:

##### **4.2.1.1 Marriage**

Young female teachers requests transfer from one school to another to join their husbands. This causes some school to have fewer teachers as the vacant posts are not filled as teachers are transferred to other schools. This was supported by one respondent who said that:

“In our school, two female teachers have been transferred to other schools to join their husbands, but until now no any teacher has brought to fill the position left by the teachers. This makes teaching a very tedious job due to a large class size we have as a result of a few teachers in our school”.

##### **4.2.1.2 Health problems**

Teachers with HIV are allowed to transfer from areas which do not have sufficient health care to areas where they can get ARVs drugs, but also for those teachers who are sick and required to be nearby regional or referral hospitals which are available in city center are allowed to transfer and teaching in urban primary schools either temporarily or permanent. As a result rural primary schools remain with few teachers, hence creating imbalance of teachers.

One Respondent responding to question during the interview had this to say:

*“Teacher’s allocation policy in Ilala Municipal allows teachers who are sick to transfer to urban from rural for immediate medical attention. For those teachers who are sick*

*and required to be nearby regional or referral hospitals which are available in city center are allowed to transfer and teaching in nearby urban primary schools either temporarily or permanent”.*

The respondent further narrated the following in relation to the policies that are used to allocate teachers in Ilala municipality:

*“Ilala education officers handle teachers transfers to various point especially from the rural primary school to urban primary schools by considering Teachers with HIV status are transferred to urban to access ARVs from urban centers in Ilala. This is after realizing that the services are not available nearby their working schools and failure to do so will results to effects to the individual teachers”.*

#### **4.2.1.3 Opportunities in professional developments**

Imbalance allocation of teachers in Ilala Municipal is caused also by teachers who request a transfer from village or remote schools to urban schools seeking opportunities in professional development. E.g. a teacher may request a transfer to an urban school to attend evening programs which are normally found in urban areas. When teachers shift to urban in the sake of professional development, the schools are left with unfilled posts. This argument was supported by one respondent from Ilala District Education Office (DEO) who said that:

*“The number of teachers requesting a transfer from rural areas to urban areas for the purpose of joining evening programs is increasing, imagine in one school two teachers at the same time requests transfer to urban school so that they can attend the course that was conducted in the evening. It has been difficult for us to allow two teachers from one school to attend the program because the school has few teachers if you allow two teachers at the same time, there is a deficit of teachers which is not easy to fill immediately”.*

The respondent from Ilala DEO further said that some teachers use the trick of attending evening programs so that they can get a transfer to urban schools. This problem causes many rural schools to have few teachers as the number of teachers is shifting to urban areas.

#### **4.2.1.4 Better social services**

Imbalance allocation of teachers in Ilala Municipal is to some extent caused by lack of better social services in rural areas. Many teachers in rural schools seek a transfer to urban schools in order to access better social service like Banks and market services. This trend of teachers to seek transfer from rural areas has left many village schools with fewer teachers than urban schools, hence creating imbalance number of teachers. During interview one respondent said that:

*“It is easy to retain teachers in rural or village schools if necessary services like Banks, market services, better houses which are found in urban areas are also found in villages”.*

He further added that: *“In his home village two young male teachers have left the village complaining that they cannot continue living in a place where important services like banks and other services are difficult to get; now the school has a shortage of two teachers who have already left”.*

#### **4.2.1.5 Lack of strong system for allocating new teachers (teachers from colleges).**

The current system of allocating new teachers to rural schools or urban schools in Ilala municipal provides a room for new teachers to escape posts granted to them especially when the post is based in rural areas. There are many excuses even bribes are sometimes used to avoid rural school postings.

This is because there is no system that monitors people who are responsible for the allocation of new teachers; hence it is easy for them to accept excuses from teachers posted in rural schools, this results into many new teachers to be allocated in urban schools leaving few teachers allocated in villages, even those allocated in villages are not reporting instead their posts are reversed to urban schools. This situation leaves rural primary schools with few teachers.

Responding to a question asked to him during an interview about the current system of allocating teachers in Ilala Municipal, one head teacher said:

*“I have never seen a poor allocation system like the one being used in our Municipal. Imagine, last year in my school I was expecting to receive six new teachers, but only four teachers reported, other two teachers changed their posts even before reporting to my school; this affects my school because I have a large number of pupils”.*

The first research question generated the following findings. It was noted that Ilala Municipal has some policies and regulations for allocating teachers, however, due to various reasons both humanitarian reason such as marriages, health, and exchange positions between rural and urban; still, the policy is difficult to be followed resulting into imbalance allocation of teachers in Ilala Municipal.

The research question also revealed that there were various issues influencing the imbalance of teachers in primary schools in Ilala Municipal. These issues are marriages for young employed female teachers, social services (health, water, schools, electricity, and houses) and professional developments.

#### **4.3 Design of web-based information system for managing allocation of public primary school teachers.**

A web-based information system for managing the allocation of public primary school teachers in Tanzania is an application that is intended to be stored in the PORALG web-servers since PORALG are the one responsible for primary school teachers allocation.

Users of the application (PORALG, head teachers, MoEVT) can access it through the PORALG website by using various internet browsers like Mozilla Firefox, Google Chrome, internet explorer etc. The system uses two tires architecture design (client-server) where the presentation logic is stored in the application server and the data logic (database) is stored in the data server. The design of the system is found in chapter five.

## **CHAPTER FIVE**

### **ANALYSIS AND DESIGN OF TECHNICAL SOLUTION**

#### **5.1 Introduction**

This chapter presented the design of a technical solution for the problem of imbalance allocation of primary school teachers in Ilala Municipal. The chapter also included system planning, analysis, design (architecture, database, and user interface), constructions, installations, and operations.

#### **5.2 System planning**

System planning includes the technical feasibility (Can we build it?), the economic feasibility (Will it provide business value?), the organizational feasibility (If we build it, will it be used?). This is supported by Dennis (2012) who pointed out that the planning phase is the fundamental process of understanding why an information system should be built.

##### **5.2.1 Technical feasibility**

Technical feasibility refers to the extent to which the system can be successfully designed, developed, and installed. It also includes familiarity with the functional area, technology, project size and compatibility (Denis, 2012). All issues concerning technical feasibility for the web-based information system for managing the allocation of public primary school teachers were considered and handled effectively. Technologies used such as HTML, PHP, BOOTSTRAP, and MYSQL were familiar to the researcher and the size of the system was manageable.

##### **5.2.2 The economic feasibility**

The economic feasibility is concerned with development costs and operational costs. The economic feasibility for designing and developing the system was feasible and assignment of values to costs and benefits were well planned.

##### **5.2.3 Organizational feasibility**

It is concerned with how well the system will be accepted by its users and incorporated into the ongoing operations of the organization (Denis, 2012). It also analyses how the

organizational goal aligns with the business objective. Organizational feasibility of a web-based information system for managing the allocation of public primary school teachers was conducted and aligned with the objectives of designing and developing the system. The researcher ensured that the system fulfilled the objectives; that leads to users' acceptance of the system.

### 5.3 System analysis

The analysis in this phase involved two things:

1. The analysis is a strategy that developed to guide the developer's efforts. Such a strategy usually includes a study of the current system (called the as-is system) and its problems, and ways to design a new system (called the to-be system).
2. The next step was requirements gathering (interviews and documentary review were used to collect data). The analysis of the gathered information leads to the necessity of developing a web-based information system for managing the allocation of public primary school teachers. The requirements gathering is explained more in next sub-headings.

#### 5.3.1 Requirements determination

Dennis (2012) defined a requirement as simply a statement of what the system must do or what characteristics it needs to have. During a systems development project, requirements was created that described what the business needs (*business requirements*); what the users need to do (*user requirements*); what the software should do (*functional requirements*); characteristics the system should have (*non-functional requirements*); and how the system should be built (*system requirements*).

The requirements gathering were divided into two categories; functional and non functional requirements. A functional requirement relates directly to a process a system has to perform or information it needs to contain.

#### 5.3.2 Functional requirements

Functional requirements for a web-based information system for managing allocation of public primary school teachers were:

- Registration of users of the system, schools, teachers, and the number of pupils

- Allocation of teachers
- Print teachers' allocation report
- Edit schools, teacher's name, and number of teachers
- Change the password
- Logout

### **5.3.3 Non-functional requirements**

Describe user-visible aspects of the system to be constructed. Non- functional requirements for web-based information system for managing allocation of public primary school teachers were:

#### **5.3.3.1 Operational requirements**

- The system will operate in windows environments
- The system should connect to printer in order to print reports

#### **5.3.3.2 Performance requirements**

- The system should store details of users, schools, teachers and number of pupils in primary school database within 3 seconds or less

#### **5.3.3.3 Security requirements**

- Both head teachers, MoEVT, DEO, and PORALG should use username and password to login to the system
- The system will deny invalid username and password
- The system allows only people with admin privilege to edit, update and delete anything from the database. Normal users (Head teachers, PORALG, MoEVT) with no admin privilege are not able to edit or delete anything from the database.

### **5.3.4 Functional Modelling**

Functional modelling includes: use cases diagrams, and activities diagrams both used to describe the current as-is system and the to-be system being developed. Denis (2009) defined a functional modelling as one that describes business processes and the interaction of an information system with its environment

### 5.3.4.1 Use-cases diagrams

Gives a graphic overview of the actors involved in a system. It shows different functions needed by those actors and how these different functions interact.

The use case for a web-based information system for managing the allocation of public primary school teachers involves the following primary actors: PORALG, Head teacher MoEVT and DEO.

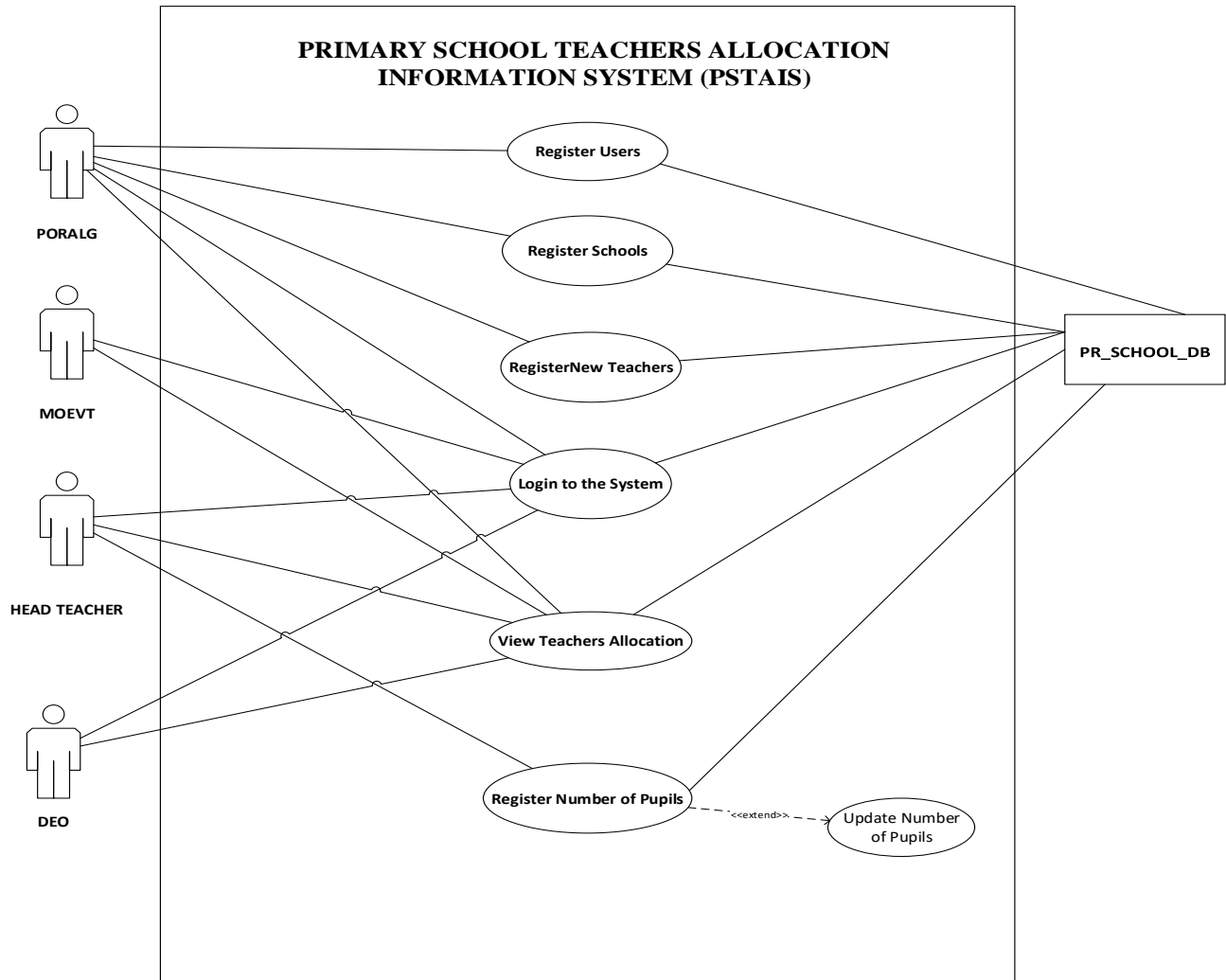


Figure 2: Use case diagram for PSTAIS

### 5.3.4.2 Use Case description

**Table 5: Use Case description for Register School**

<b>Use case name:</b> Register School	<b>ID:</b> 1	<b>Important level:</b> High
<b>Primary Actor:</b> PORALG	<b>Use case Type:</b> detail	
<b>Stakeholders and Interests:</b> PORALG: Registers all primary schools available in Ilala Municipal		
<b>Brief Description:</b> This use case describes how PORALG are responsible in registering all schools in Ilala municipal including school locations.		
<b>Trigger:</b> PORALG clicks to login to the system in order to register schools, add new teachers and view teachers allocation <b>Type:</b> External		
<b>Relationships:</b> <b>Association:</b> <b>Include:</b> <b>Extend:</b> <b>Generalization:</b>		
<b>Normal flow event:</b> 1. PORALG login to the system as a valid user 2. PORALG adds new teachers, register schools, view teachers' allocation.		
<b>Sub flows event:</b>		
<b>Alternate/Exceptional flows:</b> 1a.: PORALG login as invalid user 1b.: The access is denied		

**Table 6: Use Case description for Add new Teachers**

<b>Use case name:</b> Register new teachers	<b>ID:</b> 2	<b>Important level:</b> high
<b>Primary Actor:</b> PORALG	<b>Use case Type:</b> detail	
<b>Stakeholders and Interests:</b> Admin: Login to the system to add new teachers		
<b>Brief Description:</b> This use case describes how Admin adds new teachers to the system so that they can be allocated automatically to different schools.		
<b>Trigger:</b> Admin login to the system to add new teachers. <b>Type:</b> External		
<b>Relationships:</b> <b>Association:</b> <b>Include:</b> <b>Extend:</b> <b>Generalization:</b>		
<b>Normal flow event:</b> 1. Admin from PORALG login as valid user 2. Add new teachers , edit or delete Teacher Name		
<b>Sub flows event:</b>		
<b>Alternate/Exceptional flows:</b> 1a.: Admin from PORALG login as invalid user 2b.: The access is denied.		

**Table 7: Use Case description for View Teachers Allocation**

<b>Use case name:</b> View teachers allocation	<b>ID:</b> 3	<b>Important level:</b> medium
<b>Primary Actor:</b> PORALG, Head Teacher and MoEVT	<b>Use case Type:</b> essential	
<b>Stakeholders and Interests:</b> PORALG: view teachers allocation Head Teacher: view teachers allocation MoEVT: view teachers allocation		
<b>Brief Description:</b> This use case enables PORALG, Head teacher and MoEVT to view Teachers who are allocated to different schools by the system.		
<b>Trigger:</b> PORALG, Head teacher and MoEVT login to the system to view teachers Allocation. <b>Type:</b> External		
<b>Relationships:</b> <b>Association:</b> <b>Include:</b> <b>Extend:</b> <b>Generalization:</b>		
<b>Normal flow event:</b> 1. PORALG, Head teacher and MoEVT login to the system 2. View teachers' allocation		
<b>Sub flows event:</b>		
<b>Alternate/Exceptional flows:</b> 1a.: PORALG, Head teacher and MoEVT login as invalid users 2b.: Access denied.		

**Table 8: Use Case description for register number of pupils**

<b>Use case name:</b> Register number of pupils	<b>ID:</b> 5	<b>Important level:</b> high
<b>Primary Actor:</b> Head teacher	<b>Use case Type:</b> detail	
<b>Stakeholders and Interests:</b> Head teacher: Keeps records of number of pupils at his/her schools		
<b>Brief Description:</b> This use case enables head teachers to have exactly number of pupils existing at their schools.		
<b>Trigger:</b> Head teacher login to the system to register number of pupils in their schools <b>Type:</b> External		
<b>Relationships:</b> <b>Association:</b> <b>Include:</b> <b>Extend:</b> Update number of pupils <b>Generalization:</b>		
<b>Normal flow event:</b> 1. Head teacher login to the system. 2. Register number of pupils at his/her school.		
<b>Sub flows event:</b>		
<b>Alternate/Exceptional flows:</b> 1a.: Head teacher login to the system as invalid user. 2b.: Access denied.		

### 5.3.4.3 Activity diagrams

The purpose of the activity diagram is to model the procedural flow of actions that are part of a larger activity (Denis, 2012). In projects in which use cases are present, activity diagrams can model a specific use case at a more detailed level. Because it models procedural flow, the activity diagram focuses on the action sequence of execution and the conditions that trigger or guard those actions. The activity diagram is also focused only on the activity's internal actions and not on the actions that call the activity in their process flow or that trigger the activity according to some event

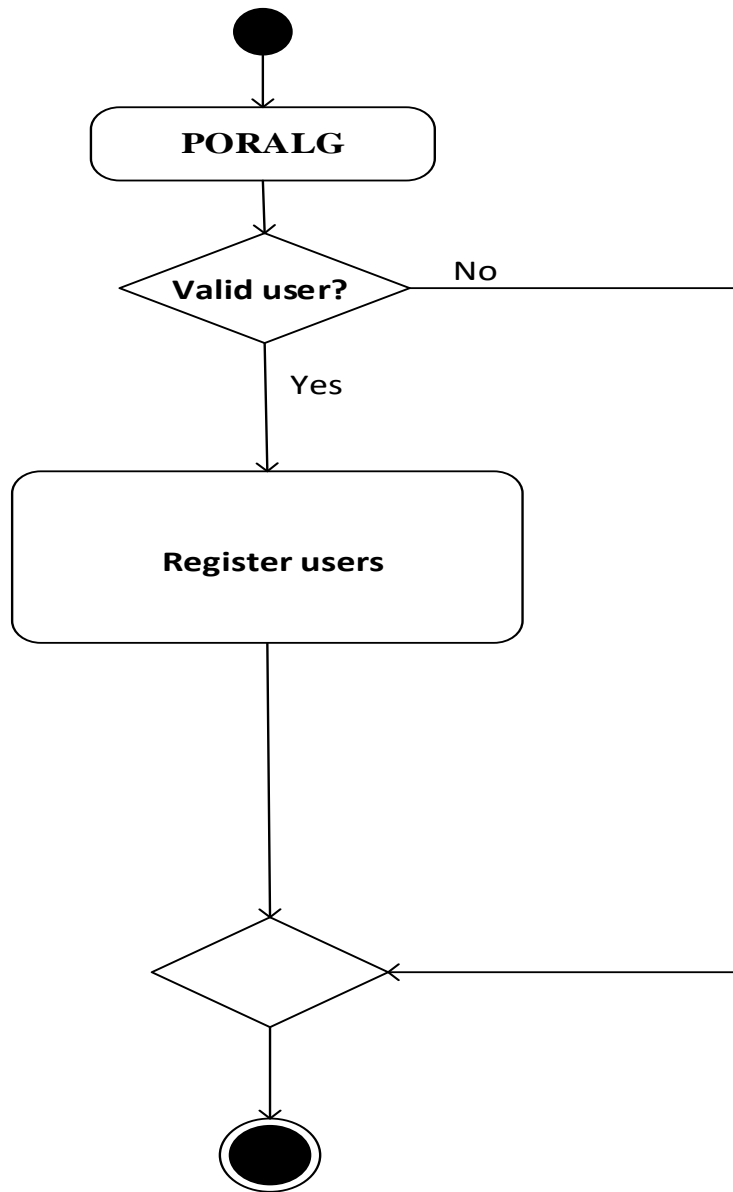
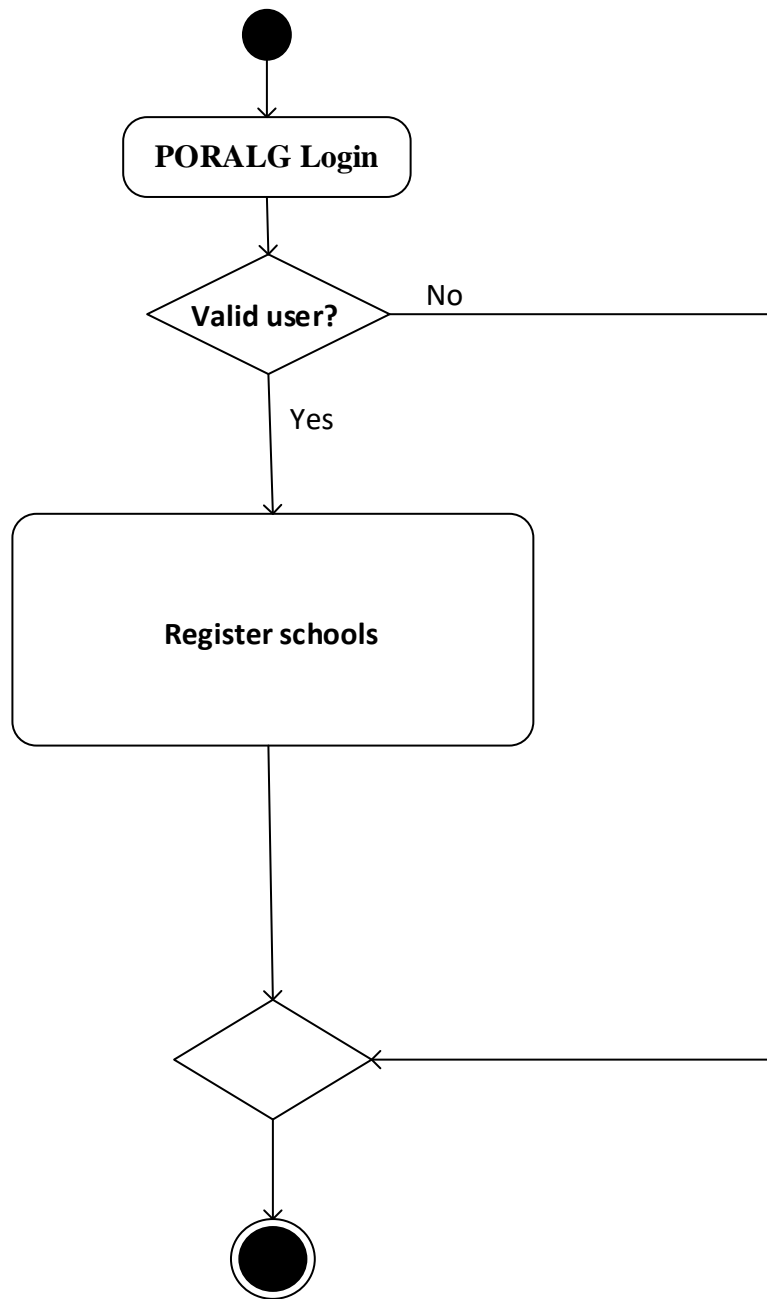
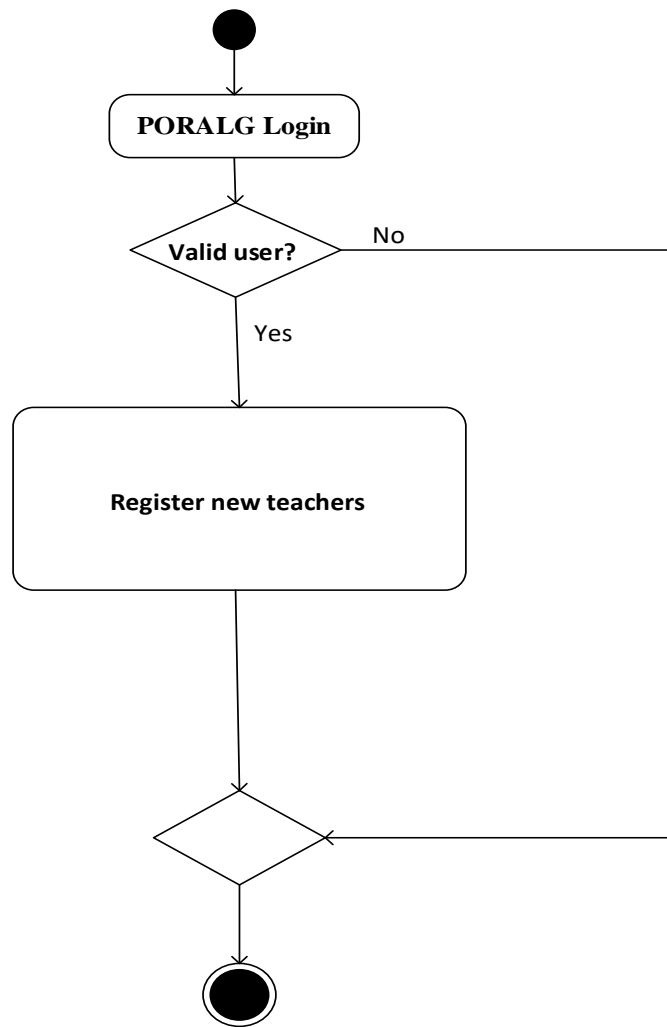


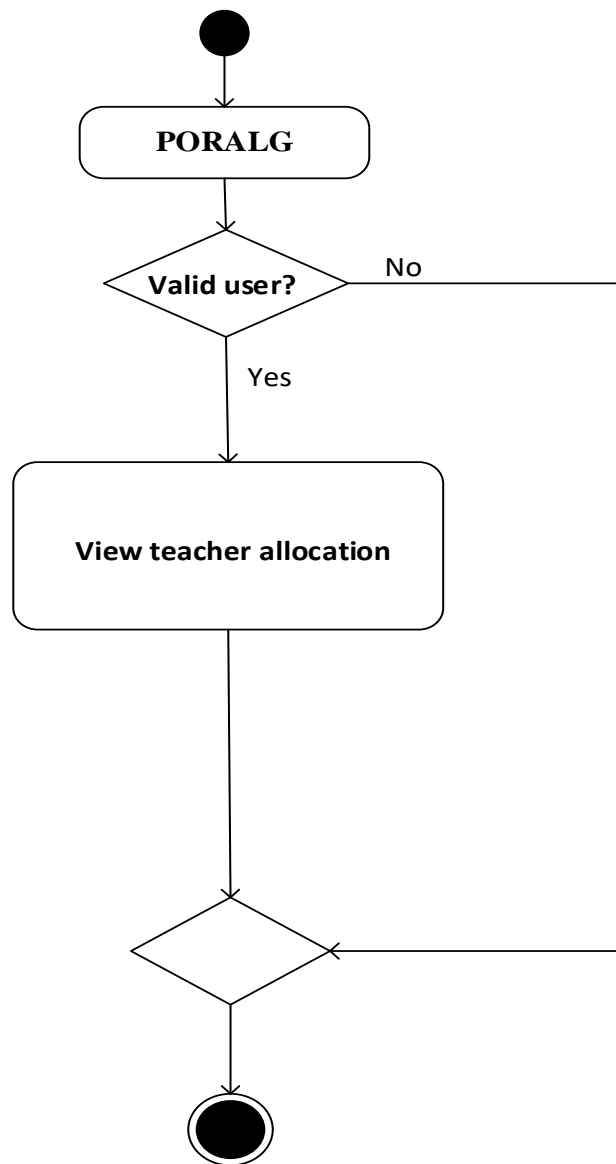
Figure 3: Activity diagram for PORALG in registering users



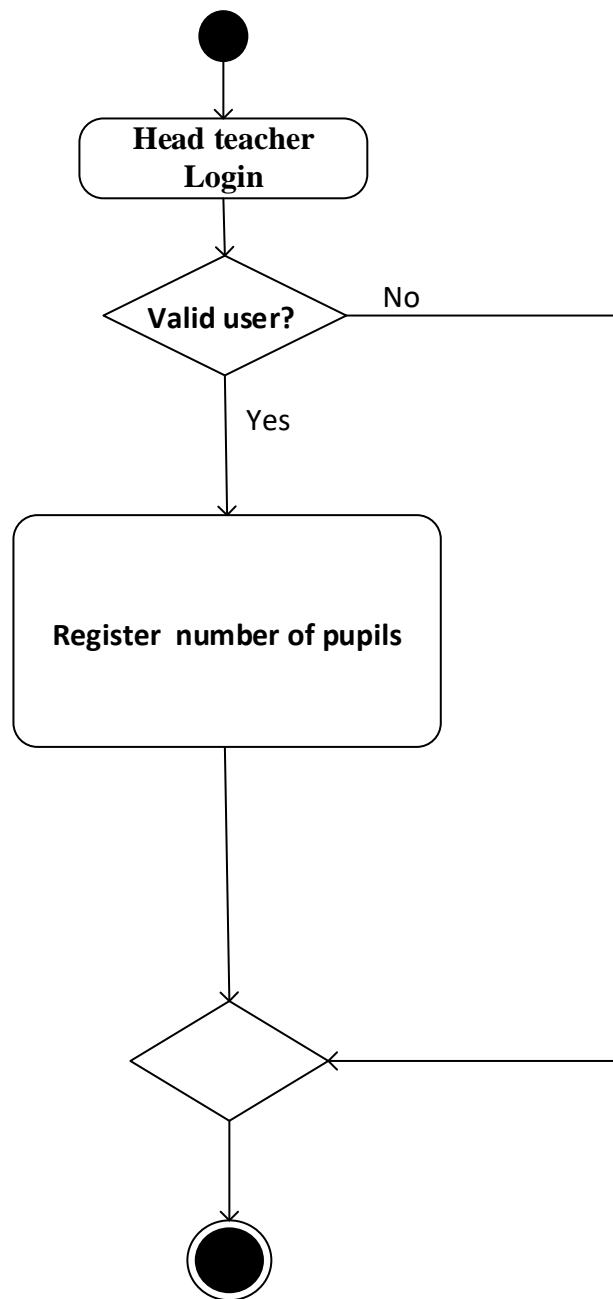
**Figure 4: Activity diagram for PORALG in registering schools**



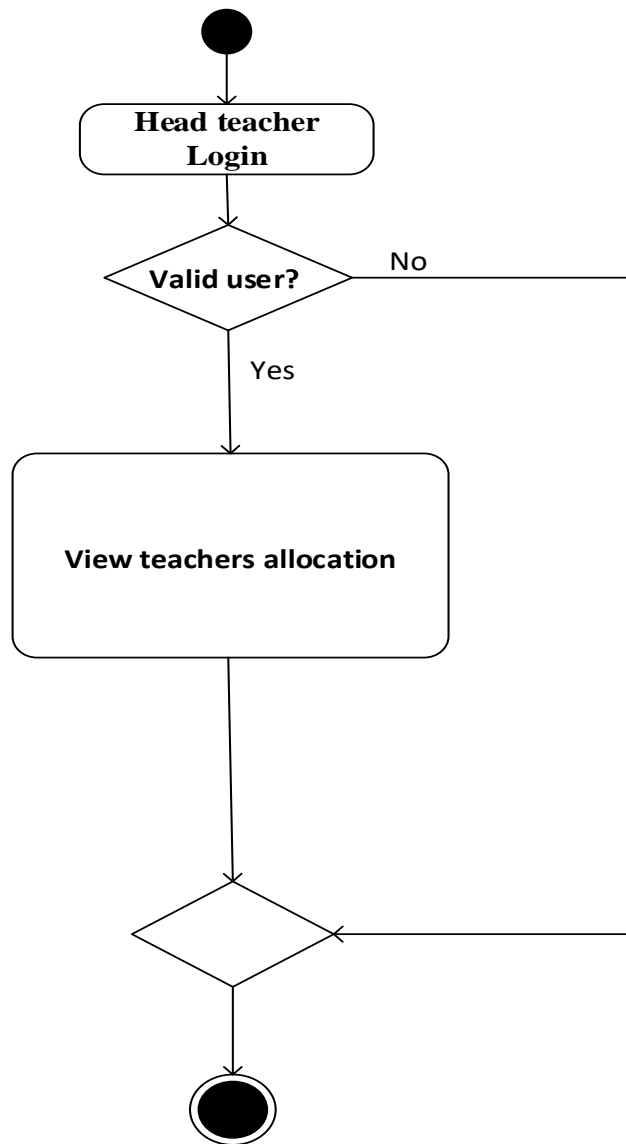
**Figure 5: Activity diagram for PORALG in registering new teacher**



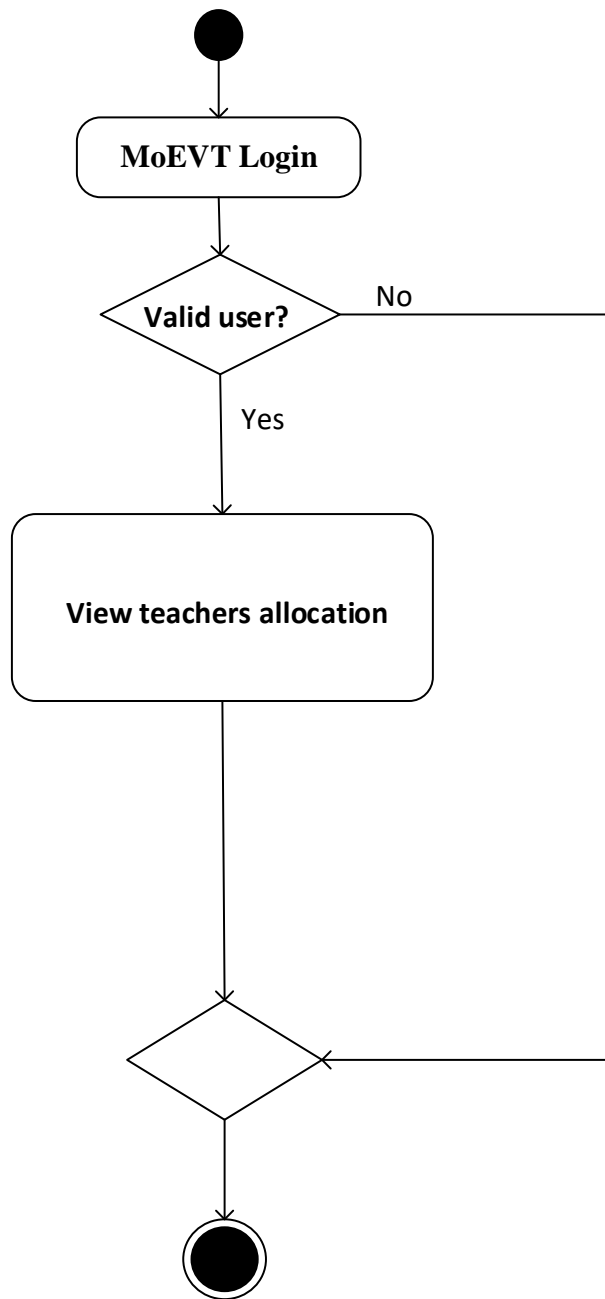
**Figure 6: Activity diagram for PORALG in viewing teacher allocation**



**Figure 7: Activity diagram for head teacher in registering number of pupils**



**Figure 8: Activity diagram for head teacher in viewing teachers' allocation**



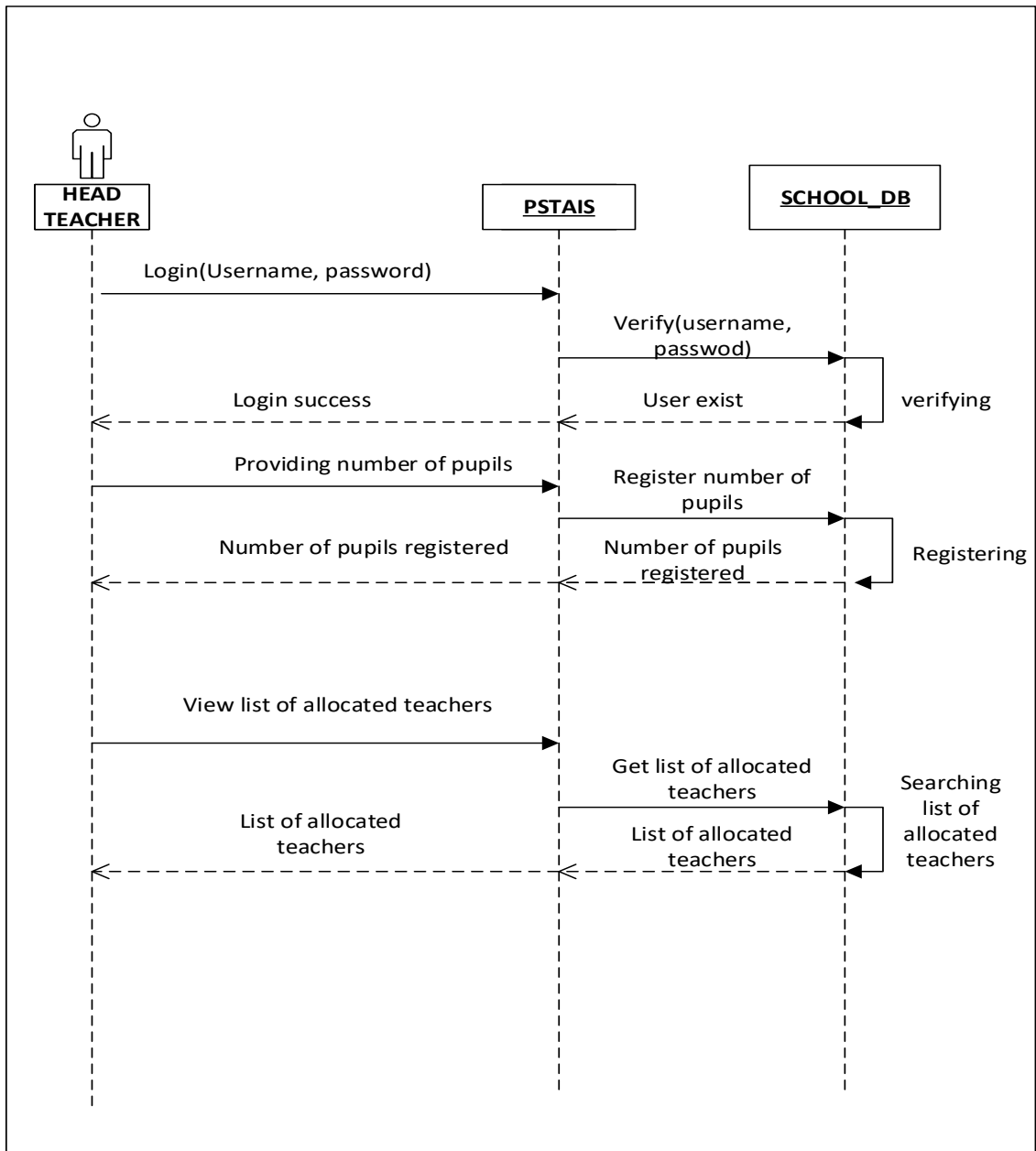
**Figure 9: Activity diagram for MoEVT in viewing teachers' allocation**

#### **5.3.4.4 Behavioral Modelling**

Behavioral modelling describes the interaction in the system. It represents the interaction among the structural diagrams. Behavioral modelling shows the dynamic nature of the system. They consist of the following: sequence diagrams and communication diagrams.

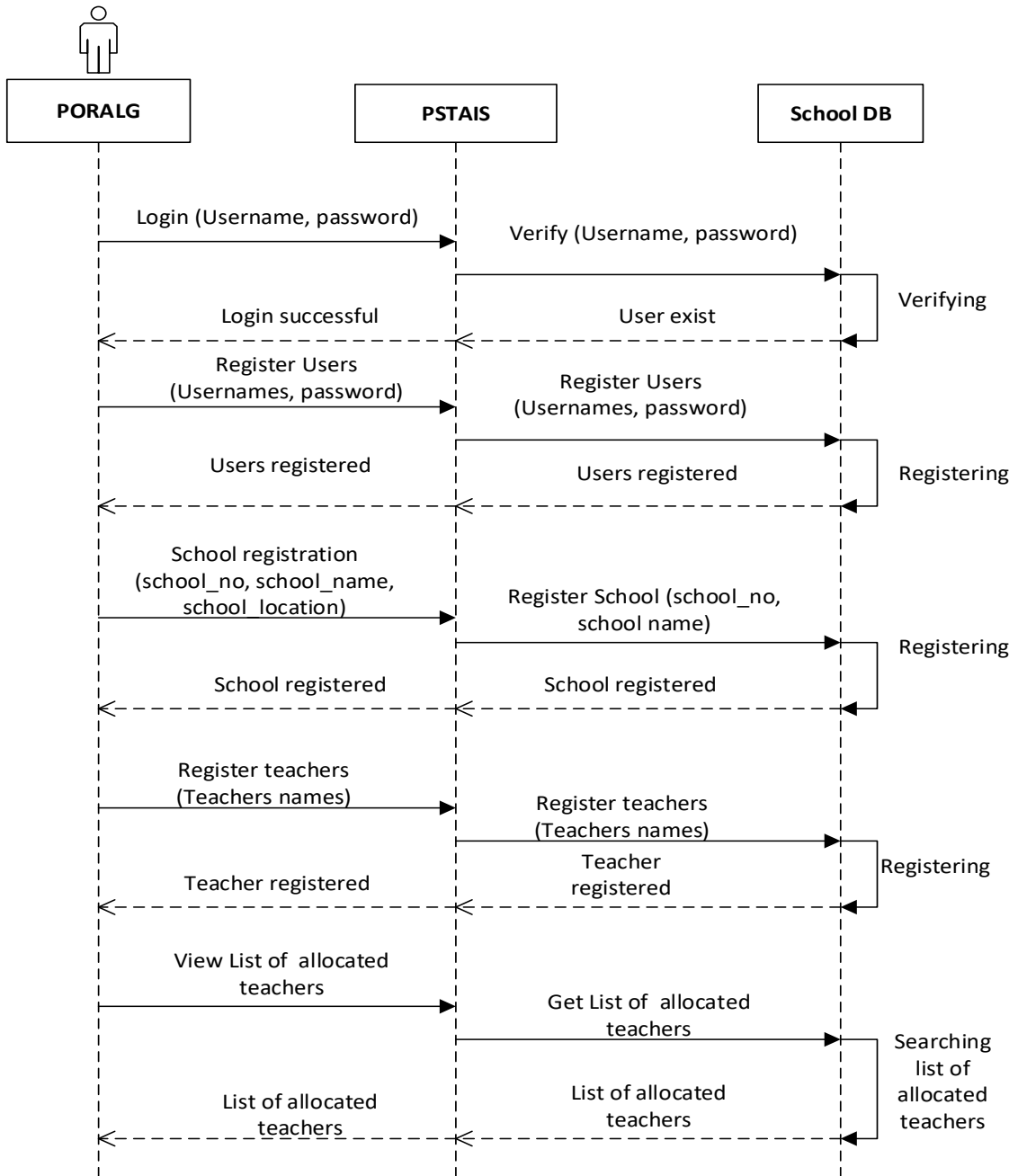
#### **5.3.4.5 Sequence diagrams**

These are diagrams which illustrate the object that participates in a use case and the message that pass between them overtime for one use case (Denis, 2012). It also emphasizes the time-based ordering of the activity that takes place among a set of objects. They are helpful in understanding real-time specifications and complex use cases.



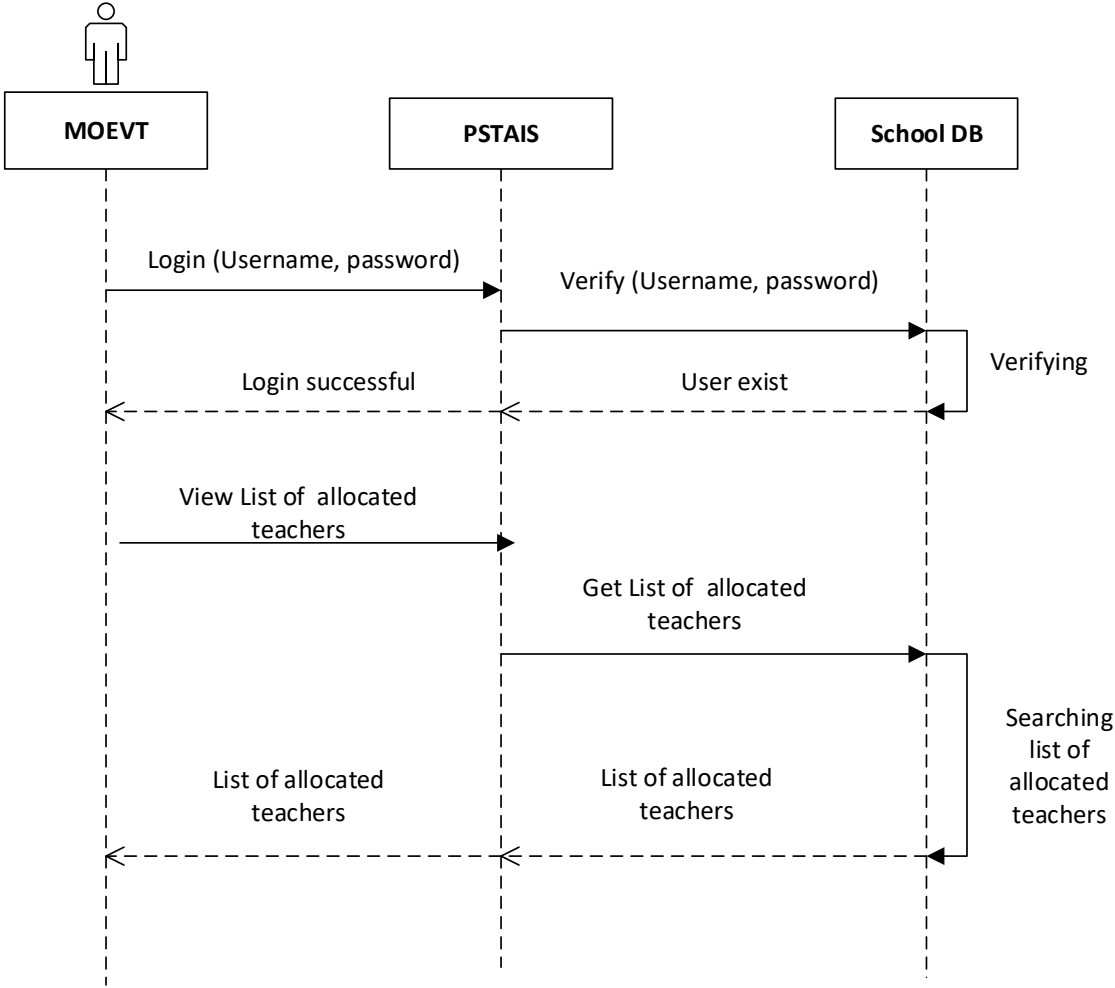
**Figure 10: Sequence diagram for Head teacher**

## PRIMARY SCHOOL TEACHERS ALLOCATION INFORMATION SYSTEM (PSTAIS)



**Figure 11: Sequence diagram for PORALG**

# PRIMARY SCHOOL TEACHERS ALLOCATION INFORMATION SYSTEM (PSTAIS)



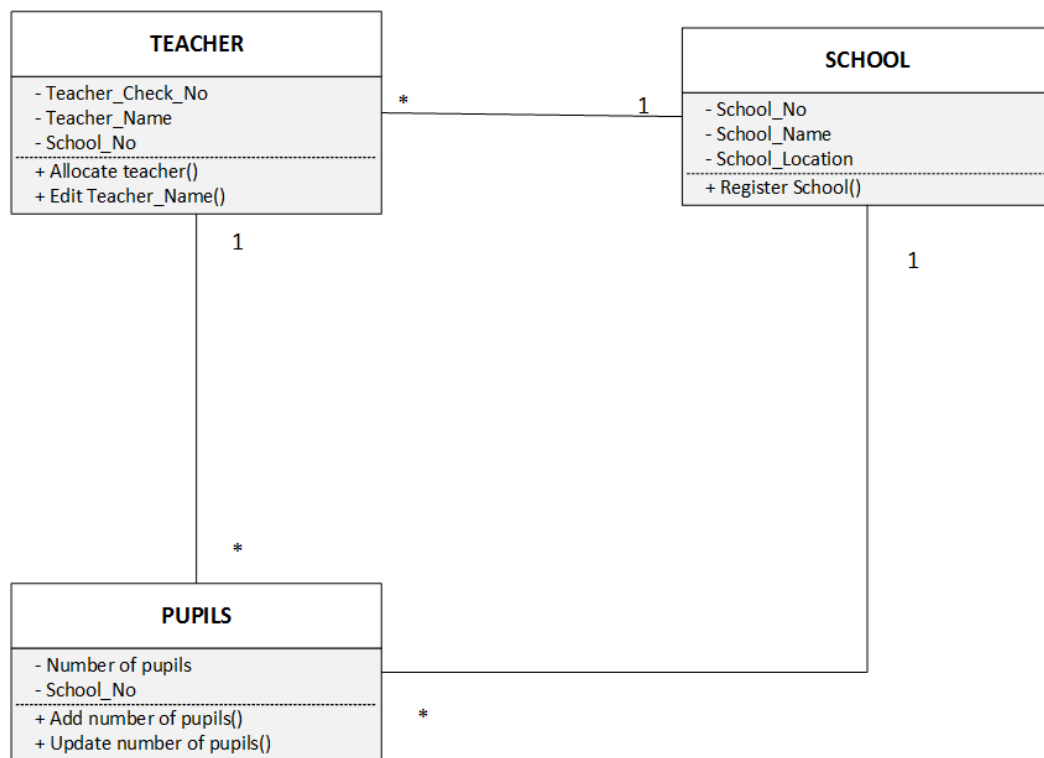
**Figure 12: Sequence diagram for MoEVT**

### 5.3.4.6 Structural Modelling

Is a view of a system that emphasizes the structure of the objects, including their classifiers, relationships, attributes and operations.

### 5.3.4.7 Class diagrams

These are diagrams that describe the attributes and operations of a class and also the constraints imposed on the system. It also shows a collection of classes, interfaces, associations, collaborations, and constraints.



**Figure 13: Class diagram for PSTAIS**

### 5.3.4.8 CRC cards (Class responsibility collaboration)

Cards used to document the responsibilities and collaborations of a class.

**Table 9: Pupil CRC card**

<b>Front:</b>		
<b>Class Name:</b> Pupil	<b>ID:</b> 1	<b>Type:</b> Concrete
<b>Description:</b> A person, usually young, who is learning under the close supervision of a teacher at school.		<b>Associated Use case:</b> Register number of pupils
<b>Responsibilities:</b> - Learning - Attend school - Listening to teachers		<b>Collaborators:</b> Teacher, School
<b>Back</b>		
<b>Attributes:</b>  Pupil_Reg.no (Varchar) Pupil_Name Varchar DOB (Date) School_No (Varchar)		
<b>Relationship:</b> Association :Teacher and School		

**Table 10: School CRC card**

<b>Front:</b>		
<b>Class Name:</b> School	<b>ID:</b> 2	<b>Type:</b> Concrete
<b>Description:</b> A place where pupils can learn and taught different things.		<b>Associated Use case:</b> Register school
<b>Responsibilities</b> <ul style="list-style-type: none"> <li>- Prepare pupils' environment for learning</li> <li>- Assigning classes to teachers</li> <li>- Monitoring teaching process</li> </ul>		<b>Collaborators:</b> Pupils, teachers
<b>Back</b>		
<b>Attributes:</b>  School_No (Varchar) School_Location (Varchar) School_Name (Varchar)		
<b>Relationship:</b> Association :Teacher and Pupil Generalization:		

**Table 11: Teacher CRC card**

<b>Front:</b>		
<b>Class Name:</b> Teacher	<b>ID:</b> 3	<b>Type:</b> Concrete
<b>Description:</b> A person who helps pupils to acquire knowledge, competences or values		<b>Associated Use case:</b> Register number of pupils
<b>Responsibilities:</b> - To teach and educate pupils according to guidelines provided by the National.		<b>Collaborators:</b> School, pupil
<b>Back</b>		
<b>Attributes:</b> - Teacher_Name (Varchar) - Teacher_Check_No (Varchar) - Teacher_School_No (Varchar) - DOB (Date) - Teacher_Gender (BOOLEAN)		
<b>Relationship:</b> Association :School and Pupil Generalization:		

## 5.4 System design

The design phase decides how the system will operate. This includes allocation algorithm, rule-based, architecture design, data storage design, and user interface design. These designs are explained in details in the following sub headings.

### 5.4.1 Allocation Algorithm

An algorithm which shows how new teachers are allocated by the system. It helps the programmer in coding the system. The algorithm considered the following concepts in allocating new teachers:

- Pupils Teacher Ratio (PTR) = 40:1
- School needs (Required number of teachers) = Number of pupils/40

#### **Allocation criteria:**

1. School needs based on PTR
2. Disability
3. School location (Town or Village)
4. Gender (Male or Female)

The ratio of female teachers to male teachers considered is 2:1

$$2+1 = 3$$

$$2/3 * 100\% = 66.7\%$$

If female teachers ratio is  $\geq 66.7\%$  in a school, the system will allocate male teacher to keep the ratio of 2:1

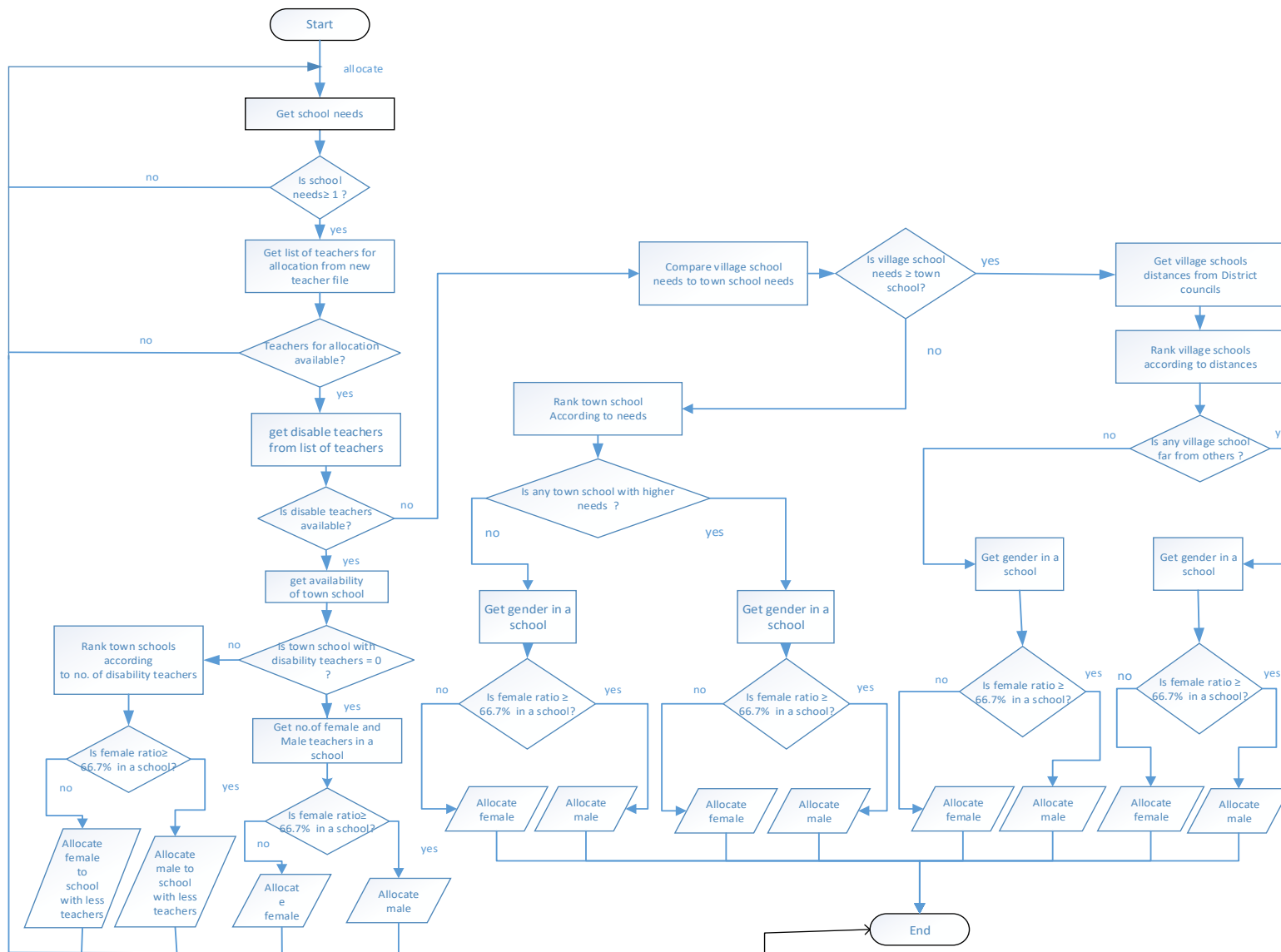


Figure14: Flow chart for PSTAIS

### 5.4.2 Rule-based

**R1:** If school needs  $\geq 1$  teacher

New teachers for allocation available

There are teachers with disability

Town school with disability = 0

Female ratio  $\geq 66.7\%$  in a school

Then allocate male or female

**R2:** If school needs  $\geq 1$  teacher

New teachers for allocation available

There are teachers with disability

No town school with disability = 0

Female ratio  $\geq 66.7\%$  in a school

Then allocate male or female to school with less disability teachers

**R3:** If school needs  $\geq 1$  teacher

New teachers for allocation available

No teachers with disability

Village school needs  $\geq$  town school needs

There is village school very far from other schools

Female ratio  $\geq 66.7\%$  in a school

Then allocate male or female

**R4:** If school needs  $\geq 1$  teacher

New teachers for allocation available

No teachers with disability

Village school needs  $\geq$  town school needs

No village school very far from other schools

Female ratio  $\geq 66.7\%$  in a school

Then allocate male or female

**R5:** If school needs  $\geq 1$  teacher

New teachers for allocation available

No teachers with disability

No village school needs  $\geq$  town school needs

There is town school with higher needs

Female teachers' ratio  $\geq 66.7\%$  in a school

Then allocate male or female

**R6:** If school needs  $\geq 1$  teacher

New teachers for allocation available

No teachers with disability

No village school needs  $\geq$  town school needs

No town school with higher needs than other

Female teachers' ratio  $\geq 66.7\%$  in a school

Then allocate male or female

**R7:** If no school needs  $\geq 1$  teacher

Then no allocation

**R8:** If school need  $\geq 1$  teacher

No new teachers for allocation

Then no allocation

### 5.4.3 Architecture design

Shows the plan for how the information system components will be distributed across multiple computers and what hardware, operating system software, and application software will be used on each computer (e.g., Windows or Linux operating system software). In case of the PSTAIS is operating in windows operating systems.

The major *architectural components* of any system are the software and the hardware. The objective of architecture design is to determine how the software components of the information system will be assigned to the hardware devices of the system. The software systems can be divided into four basic *functions*. These are *data storage*, where most information systems require data to be stored and retrieved.

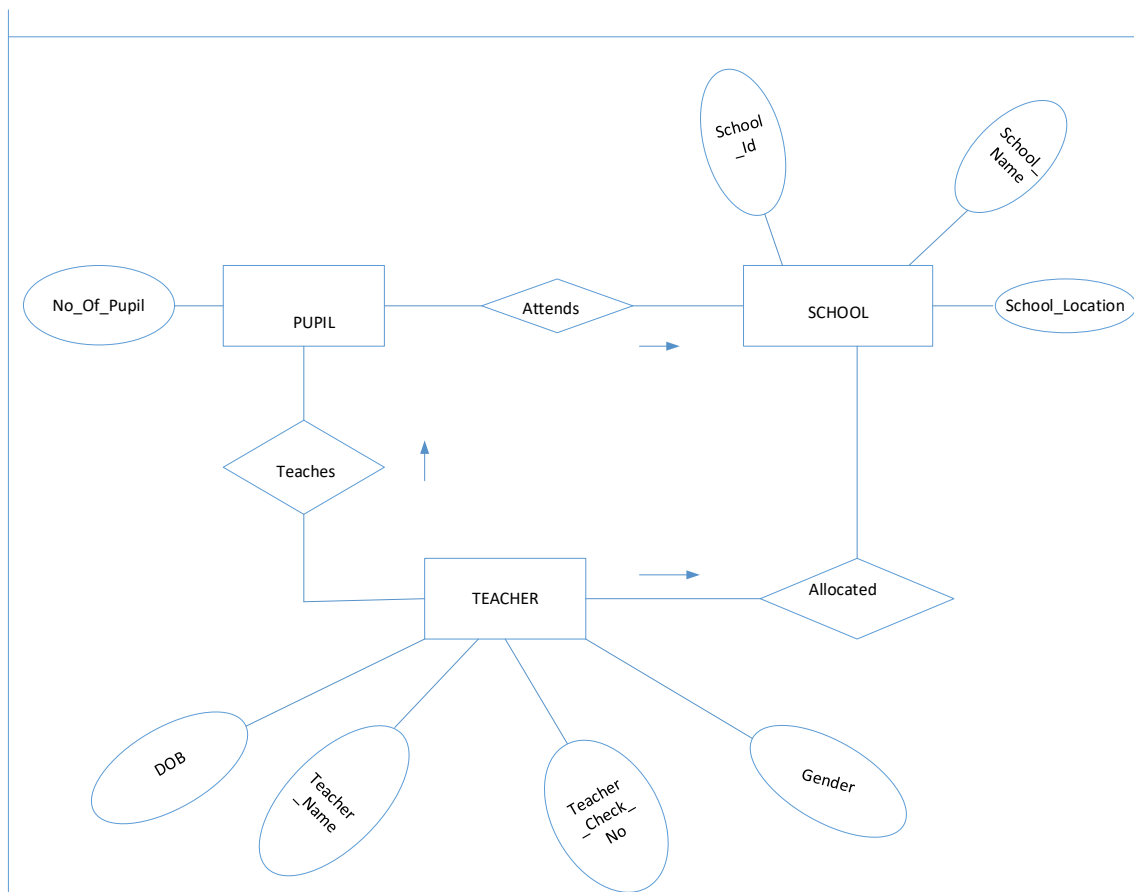
One of the data retrieved from PSTAIS is allocation report. The second function is the *data access logic*: the processing required to access data, often meaning database queries in Structured Query Language (SQL). The third function is the *application logic*: the logic documented in the use cases, and functional requirements. The fourth function is the *presentation logic*: the display of information to the user and the acceptance of the user's commands (the user interface).

The three primary hardware components of a system are *client computers*, *servers*, and the *network* that connects them. Client computers are the input-output devices employed by the user and are usually desktop or laptop computers, but can also be handheld devices, smart-phones, special-purpose terminals, and so on.

For PSTAIS to operate smoothly as intended the system uses two tiers architectural design (client-server) where the presentation logic is stored in the application server and the data logic (database) is stored in the data server.

#### 5.4.4 Data storage design

Another important activity of the design phase is designing the data storage component of the system. This describes the activities that are performed during data storage design. There are two main types of data storage formats: files and databases. Database used in PSTAIS is Mysql with the following ERD, see figure 14 below.



**Figure 15: ERD for PSTAIS**

##### 5.4.4.1 Data dictionary

Describes the types of data stored in the database, its data size and its description. Data dictionary for PSTAIS is as described below:

**Table 12: Data dictionary**

Field	Data type	Data size	Description
admin_id	int	5	Allows admin to login to the system, primary key
fname	Varchar	30	First name
mname	Varchar	30	Middle name
lname	Varchar	30	Last name
username	Varchar	30	Name of the system user
password	Varchar	30	Allows a user of the system to login
check_no	Varchar	30	Unique identification of a primary school teacher, primary key
ability	Varchar	30	Describes a primary school teacher with disability or not
school_reg	Varchar	30	The number that shows the school is registered, primary key
dor	year	4	Date of retire for a teacher
sex	Varchar	1	Describes whether a teacher is female or male
school_name	Varchar	30	Name of a school
km	decimal	(3,1)	Describes the distance of a school from district council
status	Varchar	30	Describes whether the school is in village or town
dob	year	4	Date of birth for a teacher
id	int	9	Identifies a new teacher who have not given check_no
ratio	double	(17,0)	Ratio of teachers to pupils
needs	double	(17,0)	Number of teachers required in a school
sender_name	Varchar	50	Name of the person who sends message
phone	Varchar	10	Number of mobile phone of a person who sends message
email	Varchar	50	Email of the person who sends message
message	text	text	Message
date	date	date	Date that shows when the message was sent
idadi	bigint	21	Number of teachers with disability at a particular school
mkoa	Varchar	50	Name of a region in which a new teacher is posted
wilaya	Varchar	50	Name of the district in which a new teacher is posted
kata	Varchar	50	Name of the ward in which a new teacher is posted

#### 5.4.4.2 Database tables

- admin table

admin_id	fname	lname	username	password
----------	-------	-------	----------	----------

- exit\_teachers table

check_no	fname	mname	lname	ability	school_reg	dor	sex
----------	-------	-------	-------	---------	------------	-----	-----

- messages table

sender_name	phone	email	message	date
-------------	-------	-------	---------	------

- new\_teacher table

id	fname	mname	lname	ability	dob	sex
----	-------	-------	-------	---------	-----	-----

- number\_of\_students

school_reg	students
------------	----------

- schools table

school_reg	school_name	mkoa	wilaya	kata	status	km
------------	-------------	------	--------	------	--------	----

- disability\_teacher table

School_reg	idadi
------------	-------

- number\_of\_teachers\_in\_school table

school_reg	number_of_teachers	Number_of_students	status
------------	--------------------	--------------------	--------

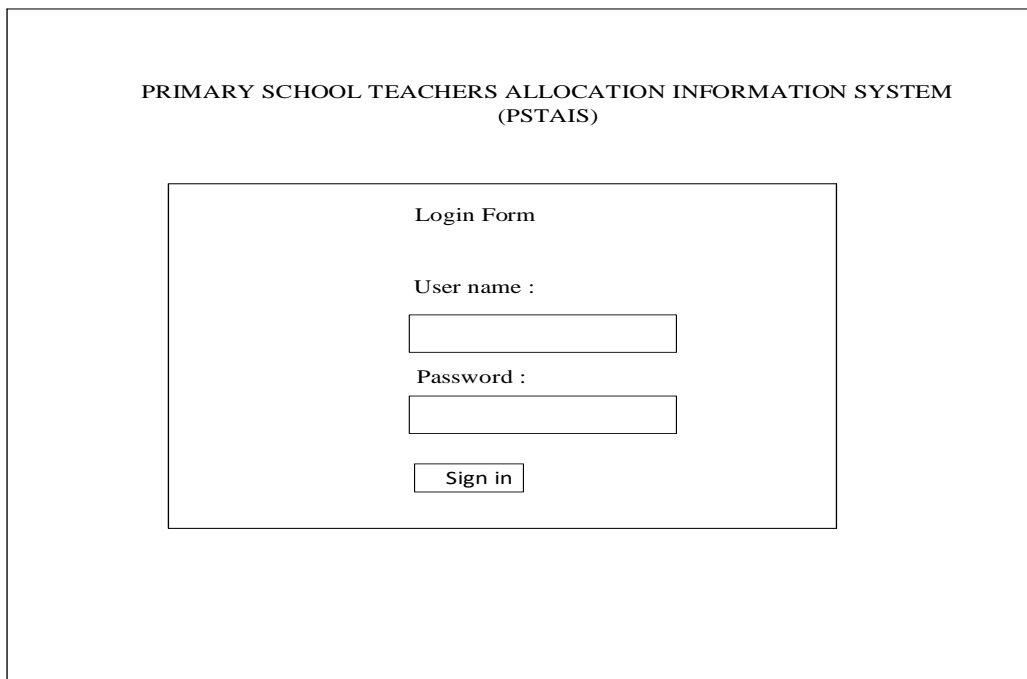
- teacher\_student\_ratio table

school_reg	ratio	needs	status
------------	-------	-------	--------

### 5.4.4.3 User Interface Design

A user interface is the part of the system with which the users interact. It includes the screen displays that provide navigation through the system, the screens and forms that capture data, and the reports that the system produces. Also, point out the nature of the inputs and outputs that the system accepts and produces.

The user interface includes three fundamental parts. The first is the navigation mechanism, the way in which the user gives instructions to the system and tells it what to do (e.g., buttons, menus). The second is the input mechanism; the way in which the system captures information. The third is the output mechanism, the way in which the system provides information to the user or to other systems (e.g., PDF reports, Web pages). All principles for user interface design such as layout, content awareness, aesthetics, user experience, consistency, and minimize user effort are taken care.



The image shows a wireframe of a login form for the Primary School Teachers Allocation Information System (PSTAIS). The form is centered within a larger rectangular frame. At the top of the frame, the text "PRIMARY SCHOOL TEACHERS ALLOCATION INFORMATION SYSTEM (PSTAIS)" is displayed in all caps. Below this, the title "Login Form" is centered. The form contains three input fields: a text box for "User name :", a text box for "Password :", and a button labeled "Sign in".

**Figure 16: PSTAIS login form design**

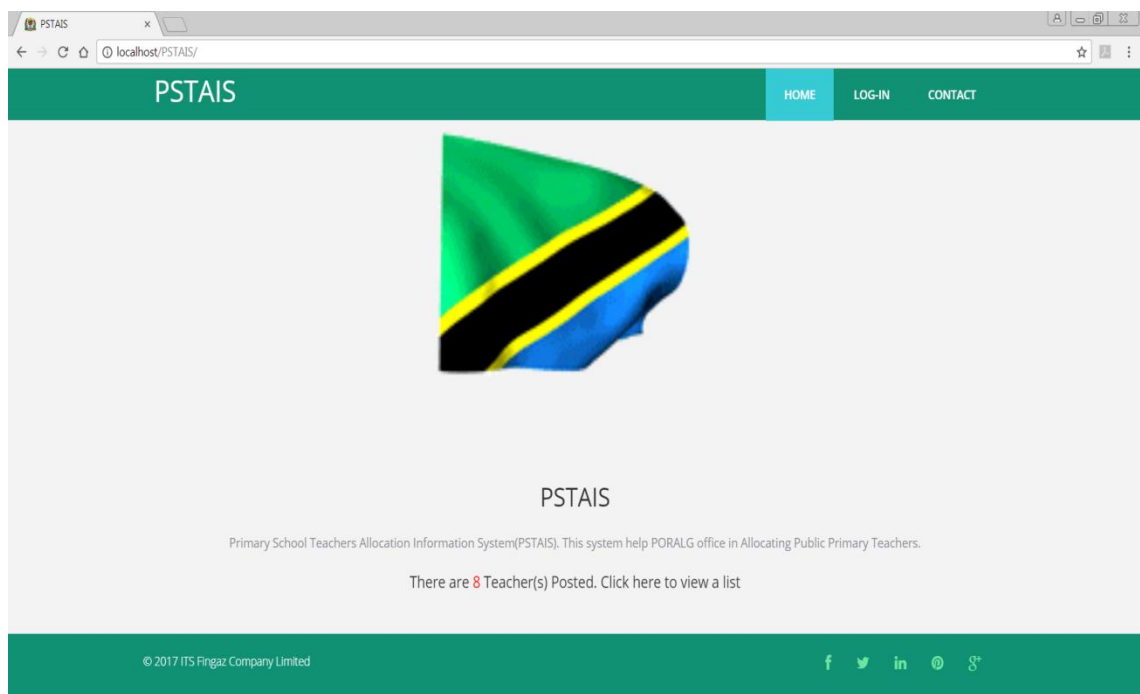
## 5.5 System Implementations

The final phase is the implementation phase, during which the PSTAIS was actually built. This phase has three steps:

### 5.5.1 Constructions

System construction is the first step. The system was built and tested to ensure it performs as designed. The HTML, JavaScript, Bootstrap, PHP, Mysql were used in the construction of PSTAIS. The following is a screenshot of PSTAIS. See the figures below

This is the home page of PSTAIS which allows any user to view new teachers posted to various primary school just by clicking view a list link. To view this list of posted teachers does not require any user to login (See figure 17)



**Figure17: Home page for PSTAIS**

The page below appears after a user clicks the link view a list on the home page (See figure 18).

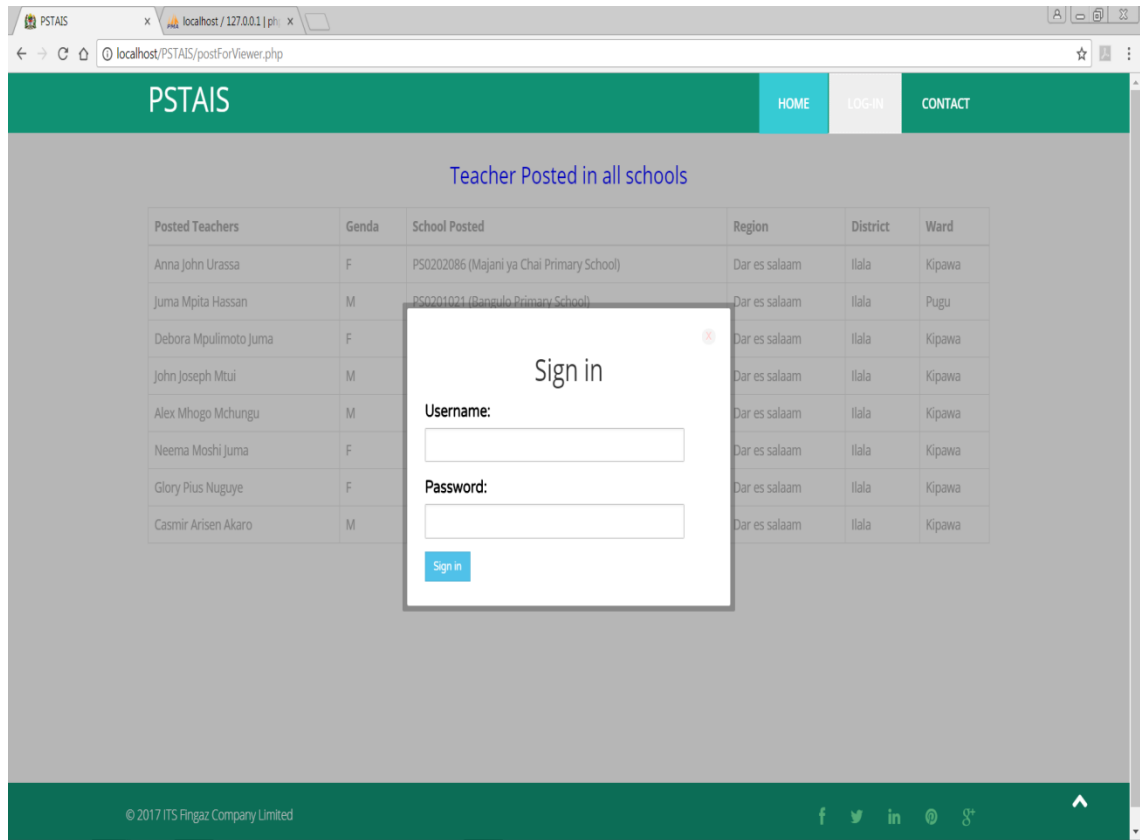
Teacher Posted in all schools

Posted Teachers	Genda	School Posted	Region	District	Ward
Anna John Urassa	F	PS0202086 (Majani ya Chai Primary School)	Dar es salaam	Ilala	Kipawa
Juma Mpita Hassan	M	PS0201021 (Bangulo Primary School)	Dar es salaam	Ilala	Pugu
Debora Mpulimoto Juma	F	PS0202086 (Majani ya Chai Primary School)	Dar es salaam	Ilala	Kipawa
John Joseph Mtui	M	PS0202088 (Mogo Primary School)	Dar es salaam	Ilala	Kipawa
Alex Mhogo Mchungu	M	PS0202086 (Majani ya Chai Primary School)	Dar es salaam	Ilala	Kipawa
Neema Moshi Juma	F	PS0202088 (Mogo Primary School)	Dar es salaam	Ilala	Kipawa
Glory Pius Nuguye	F	PS0202086 (Majani ya Chai Primary School)	Dar es salaam	Ilala	Kipawa
Casmir Arisen Akaro	M	PS0202086 (Majani ya Chai Primary School)	Dar es salaam	Ilala	Kipawa

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**Figure 18: List of teachers posted in all schools**

This page allows administrators, Head teachers and user from MoEVT to login into the system (See figure 19).



**Figure 19: Login page**

An admin after login can upload new teacher file, register schools, view and edit employed teachers, and add other users of the system (See figure 20).

The screenshot displays the Admin dashboard of the PSTAIS system. The top navigation bar includes the 'Admin' title and several menu items: '+ NEW TEACHERS', '+ SCHOOLS', '+ EMPLOYED TEACHERS', '+ ADMIN', and 'CHANGE PASSWORD'. The main content area features a central box for 'Import New Teacher file' with a 'Choose File' button (currently showing 'No file chosen') and an 'Upload' button. Below this, a section titled 'Teacher Allocated in all schools' contains a table with the following data:

Posted Teachers	Genda	School Posted	Region	District	Ward
Anna John Urassa	F	PS0202086 (Majani ya Chai Primary School)	Dar es salaam	Ilala	Kipawa
Juma Mpiita Hassan	M	PS0201021 (Bangulo Primary School)	Dar es salaam	Ilala	Pugu
Deborah Mpulimoto Juma	F	PS0202086 (Majani ya Chai Primary School)	Dar es salaam	Ilala	Kipawa
John Joseph Mtui	M	PS0202088 (Mogo Primary School)	Dar es salaam	Ilala	Kipawa
Alex Mhogo Mchungu	M	PS0202086 (Majani ya Chai Primary School)	Dar es salaam	Ilala	Kipawa
Neema Moshi Juma	F	PS0202088 (Mogo Primary School)	Dar es salaam	Ilala	Kipawa
Glory Plus Nuguye	F	PS0202086 (Majani ya Chai Primary School)	Dar es salaam	Ilala	Kipawa
Casmir Arisen Akaro	M	PS0202086 (Majani ya Chai Primary School)	Dar es salaam	Ilala	Kipawa

The footer of the page includes the copyright notice '© 2017 ITS Fingaz Company Limited' and social media icons for Facebook, Twitter, LinkedIn, and Google+.

**Figure 20: page which shows new teachers allocated to different schools**

An admin can register schools including new schools which will be established (See figure 21).

The screenshot shows the Admin interface of the PSTAIS system. The top navigation bar is green and contains the word "Admin" on the left and several menu items: "+ NEW TEACHERS", "+ SCHOOLS" (which is highlighted in a lighter green), "+ EMPLOYED TEACHERS", "+ ADMIN", and "CHANGE PASSWORD".

In the center of the page, there is a white box titled "Import Primary Schools file". Inside this box, there is a "Choose File" button with the text "No file chosen" next to it, and an "Upload" button below it.

Below the import box is a table with the following columns: "School Number", "School Name", "Region", "District", "Ward", "Status", and "Distance from District Council (km)". The table contains seven rows of data:

School Number	School Name	Region	District	Ward	Status	Distance from District Council (km)
PS0201002	Chanika primary school	Dar-es-salaam	Ilala	Chanika	Village	35.0
PS0201007	Kitunda primary school	Dar-es-salaam	Ilala	Kitunda	Village	24.0
PS0201021	Bangulo Primary School	Dar es salaam	Ilala	Pugu	Village	18.5
PS0202013	Karakata Primary School	Dar es salaam	Ilala	Kipawa	Mjini	14.3
PS0202034	Ukongga primary school	Dar-es-salaam	Ilala	Ukongga	Mjini	16.0
PS0202086	Majani ya Chai Primary School	Dar es salaam	Ilala	Kipawa	Mjini	12.1
PS0202088	Mogo Primary School	Dar es salaam	Ilala	Kipawa	Mjini	14.3

At the bottom of the page, there is a green footer bar containing the copyright notice "© 2017 ITS Fingaz Company Limited" on the left and social media icons for Facebook, Twitter, LinkedIn, and Instagram on the right, along with an upward-pointing arrow icon.

**Figure 21: List of registered schools**

The page below shows existing teachers, usually those who have check number and new employed teachers who have id instead of check number .New employed teachers will be given check number after fulfilling all the requirements including reporting to schools where are posted. An admin from PORALG shall upload file containing check numbers of new employed teachers after receiving it from treasurer (See figure 22).

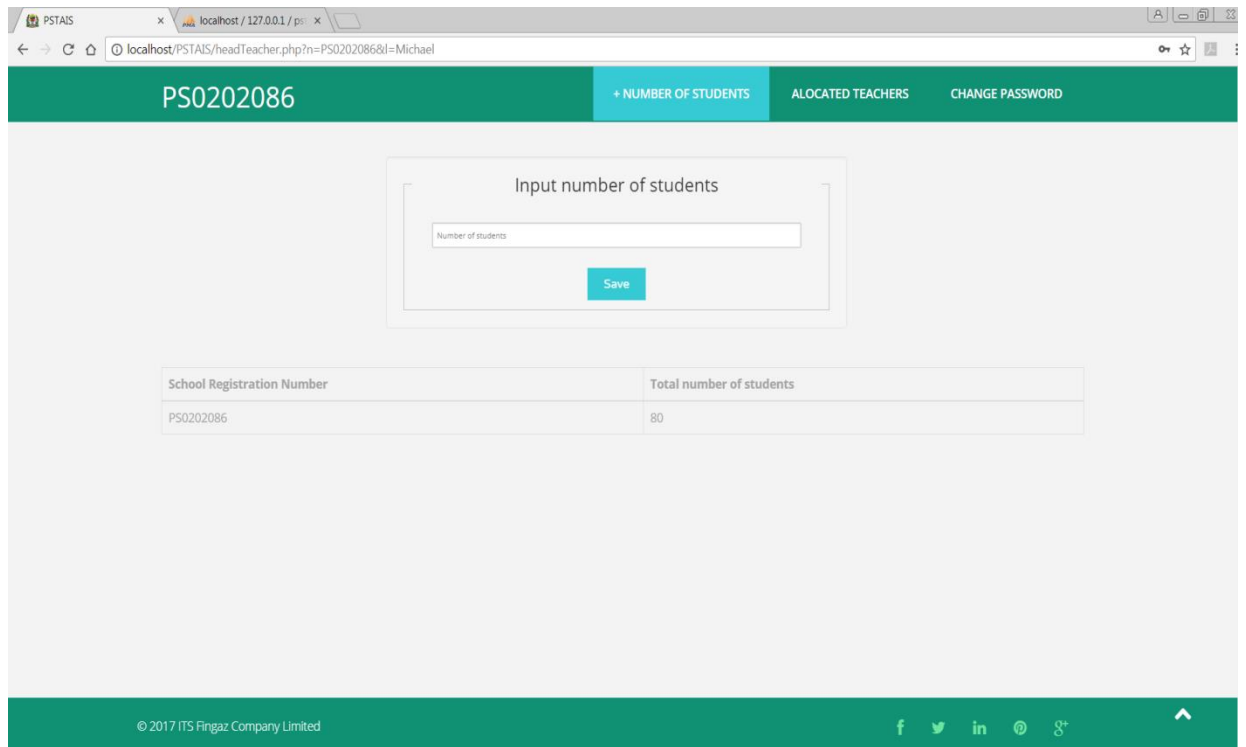
The screenshot shows the Admin interface for PSTAIS. The top navigation bar includes links for '+ NEW TEACHERS', '+ SCHOOLS', '+ EMPLOYED TEACHERS', '+ ADMIN', and 'CHANGE PASSWORD'. The main content area features a file upload section titled 'Import Employed teachers file' with a 'Choose File' button and an 'Upload' button. Below this is a table listing employed teachers.

Check Number	Teacher name	School Number	Date of Retair	Gender
123543	Juma Mpita Hassan	PS0201002	2001	M
123544	Einstein Pius Nuguye	PS0201002	2001	M
124510	Abdallah Mhogo Mchungu	PS0201021	2004	M
id1	Anna John Urassa	PS0202086	1989	F
id12	Juma Mpita Hassan	PS0201021	2001	M
id13	Debora Mpulimoto Juma	PS0202086	2002	F
id14	John Joseph Mtui	PS0202088	2001	M
id15	Alex Mhogo Mchungu	PS0202086	2004	M
id2	Neema Moshi Juma	PS0202088	2002	F
id3	Glory Pius Nuguye	PS0202086	2009	F

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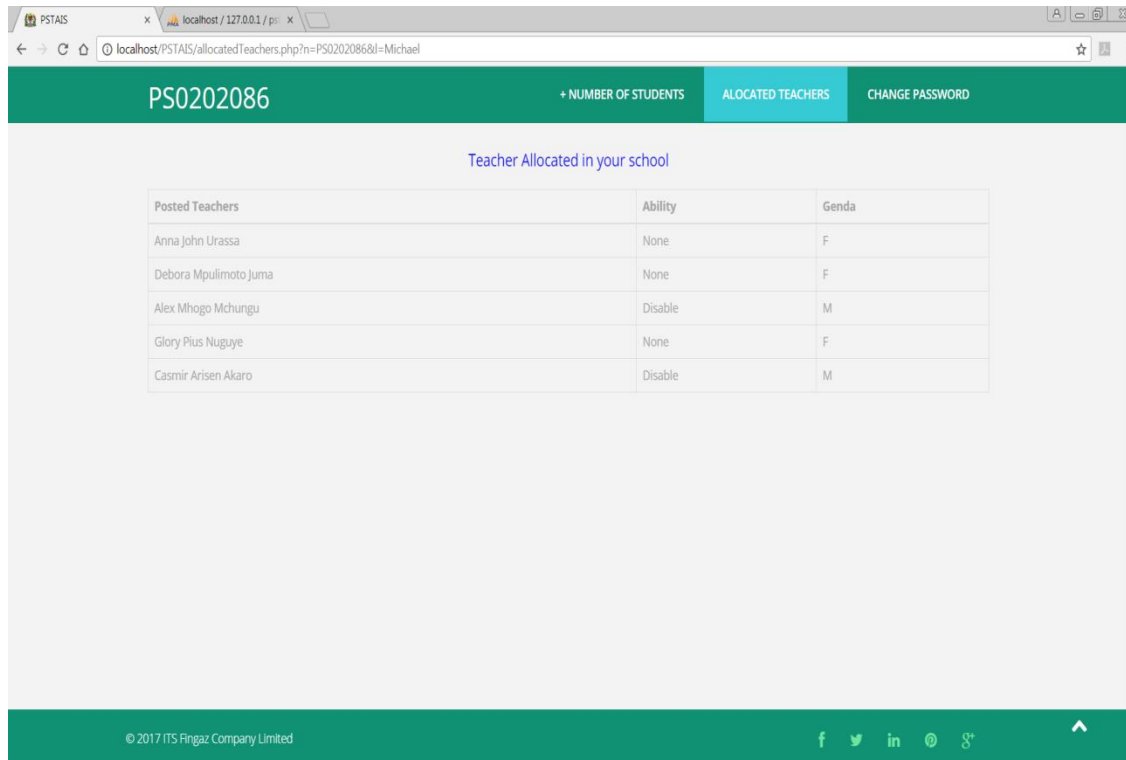
**Figure 22: List of employed teachers**

This page allows a head of school with reg.no PS0202086 to edit number of students at his/her school whenever there are changes of number of student either due to death or transfer (See figure 23).



**Figure 23: Page for head teacher with reg.no PS0202086 after login**

Head teacher can view list of teachers posted to his/her school after login (See figure 24).



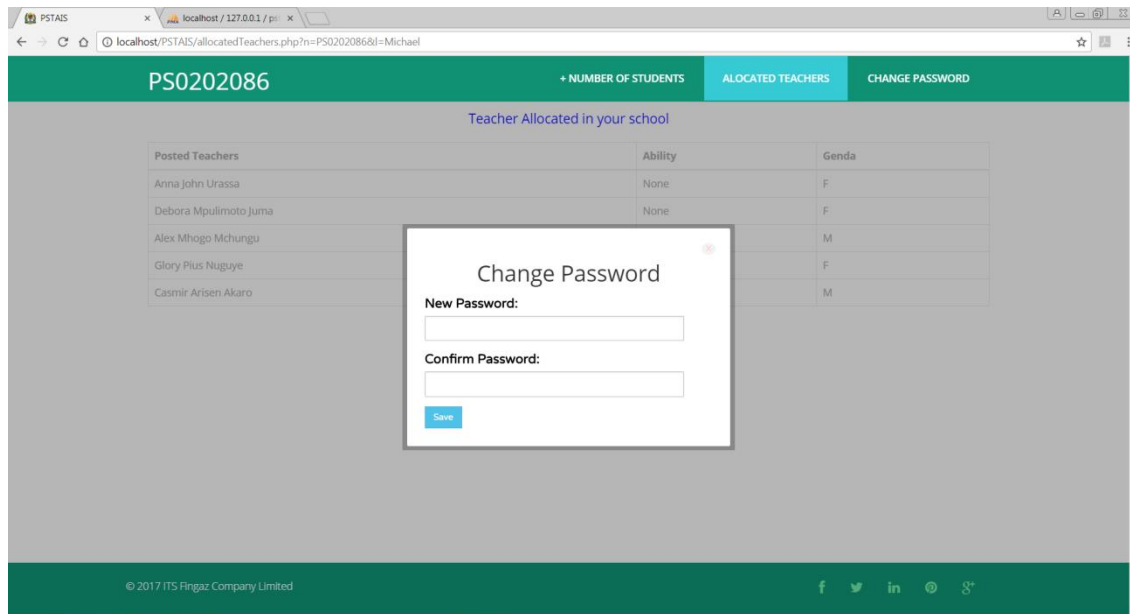
The screenshot shows a web browser window with the URL `localhost/PSTAIS/allocatedTeachers.php?n=PS0202086&l=Michael`. The page features a green header with the school ID `PS0202086` and three navigation buttons: `+ NUMBER OF STUDENTS`, `ALOCATED TEACHERS` (which is active), and `CHANGE PASSWORD`. Below the header, the page is titled `Teacher Allocated in your school`. A table displays the following data:

Posted Teachers	Ability	Genda
Anna John Urassa	None	F
Debora Mpulimoto Juma	None	F
Alex Mhogo Mchungu	Disable	M
Glory Pius Nguye	None	F
Casmir Arisen Akaro	Disable	M

The footer of the page includes the copyright notice `© 2017 ITS Fingaz Company Limited` and social media icons for Facebook, Twitter, LinkedIn, and Google+.

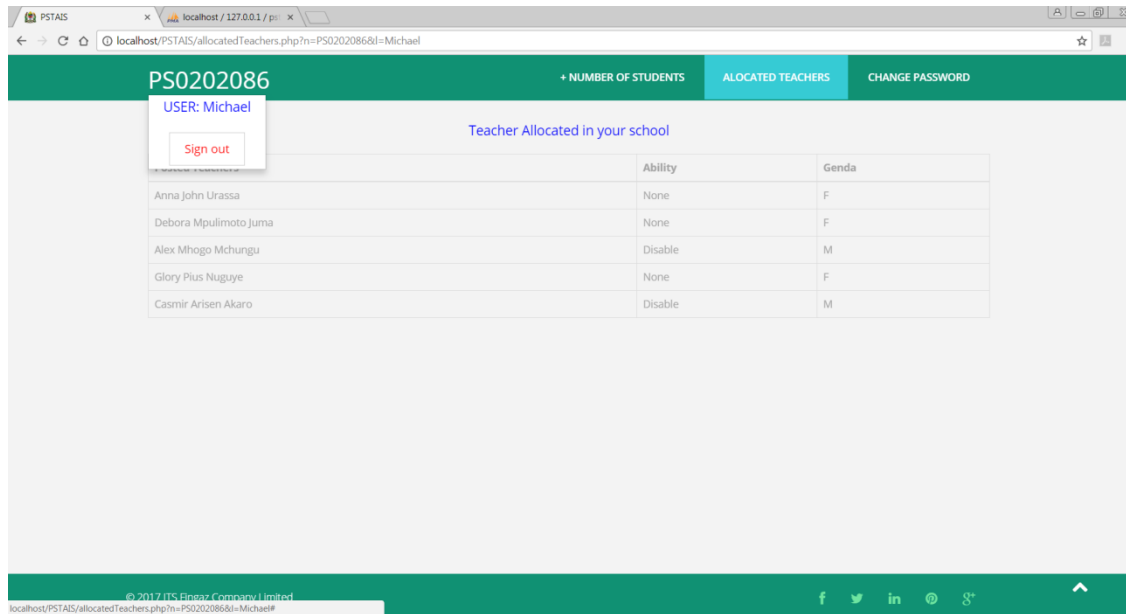
**Figure 24: List of teachers allocated to school with reg.no PS0202086**

The page that allows head teachers to change password (See figure 25).



**Figure 25: Page that allows head teacher to change password**

Head teacher can sign out after navigating through the page by clicking on the school number (See figure 26).



**Figure 26: Page for head teacher to sign out**

User from MOEVT can view teacher student ratio and allocated teachers for various schools (See figure 27 & 28).

School Reg.	School Name	Availabe Teachers	Availabe Students	Availabe Ratio	Needs	School Location
PS0201002	Chanika primary school	2	90	45	0	Village
PS0201021	Bangulo Primary School	2	180	90	2	Village
PS0202086	Majani ya Chai Primary School	5	80	16	-3	Mjini

**Figure 27: Page for teacher student ratio**

Posted Teachers	Genda	School Posted	Region	District	Ward
Anna John Urassa	F	PS0202086 (Majani ya Chai Primary School)	Dar es salaam	Ilala	Kipawa
Juma Mpita Hassan	M	PS0201021 (Bangulo Primary School)	Dar es salaam	Ilala	Pugu
Debora Mpulimoto Juma	F	PS0202086 (Majani ya Chai Primary School)	Dar es salaam	Ilala	Kipawa
John Joseph Mtui	M	PS0202088 (Mogo Primary School)	Dar es salaam	Ilala	Kipawa
Alex Mhogo Mchungu	M	PS0202086 (Majani ya Chai Primary School)	Dar es salaam	Ilala	Kipawa
Neema Moshi Juma	F	PS0202088 (Mogo Primary School)	Dar es salaam	Ilala	Kipawa
Glory Plus Nuguye	F	PS0202086 (Majani ya Chai Primary School)	Dar es salaam	Ilala	Kipawa
Casmir Arisen Akaro	M	PS0202086 (Majani ya Chai Primary School)	Dar es salaam	Ilala	Kipawa

**Figure 28: Page for allocated teachers for various schools**

User from MOEVT can sign out after navigating through the page by clicking on the MOEVT link (See figure 29).

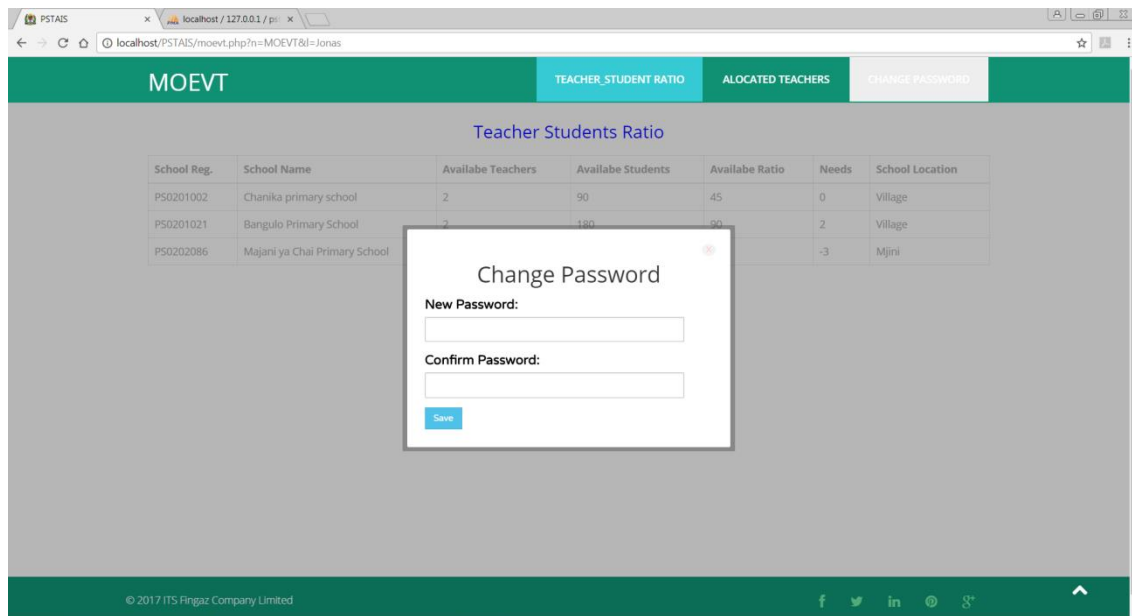
The screenshot shows a web browser window with the URL `localhost/PSTAIS/moevt.php?n=MOEVT&l=Jonas`. The page has a green header with the MOEVT logo and navigation links: `TEACHER_STUDENT RATIO`, `ALOCATED TEACHERS`, and `CHANGE PASSWORD`. A user profile dropdown is visible, showing `USER: Jonas` and a `Sign out` button. The main content area is titled `Teacher Students Ratio` and contains a table with the following data:

Id	School Name	Availabe Teachers	Availabe Students	Availabe Ratio	Needs	School Location
PS0201002	Chanika primary school	2	90	45	0	Village
PS0201021	Bangulo Primary School	2	180	90	2	Village
PS0202086	Majani ya Chai Primary School	5	80	16	-3	Mjini

The footer contains the copyright notice `© 2017 ITS Fingaz Company Limited` and social media icons for Facebook, Twitter, LinkedIn, and Google+.

**Figure 29: Page for user from MOEVT to sign out**

User from MOEVT can change password after login (See figure 30).



**Figure 30: Page for user from MOEVT to change password**

### 5.5.2 Testing

After construction, the system was tested to discover any bugs. The following were the testing cases of the PSTAIS. See table 13, and table 14

**Table 13: Login with valid credential test case**

**Project Name: PSTAIS**

Test Case	
<p><b>Test Case ID:</b> PS01</p> <p><b>Test Priority (Low/Medium/High):</b> Medium</p> <p><b>Module Name:</b> PSTAIS login screen</p> <p><b>Test Title:</b> Verify login with valid username and password</p> <p><b>Description:</b> Test the PSTAIS login page</p>	<p><b>Test Designed by:</b> Nobert Fidel</p> <p><b>Test Designed date:</b> 21<sup>st</sup> march, 2018</p> <p><b>Test Executed by:</b> Mogo primary school teachers</p> <p><b>Test Execution date:</b> 24<sup>th</sup> march, 2018</p>
<p><b>Pre-conditions:</b> User has valid username and password</p>	

## Steps and Outcome

Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1	Navigate to login page	Username: MOEVT	User should be able to login	Login successful	Pass	Done
2	Provide valid username	Password: 1234				
3	Provide valid password					
4	Click on Login button					
<b>Post-conditions:</b> User is validated with database and successfully login to account.						

**Table 14: Login with invalid credential test case**

**Project Name:** PSTAIS

Test Case	
<b>Test Case ID:</b> PS02  <b>Test Priority (Low/Medium/High):</b> Medium  <b>Module Name:</b> PSTAIS login screen  <b>Test Title:</b> Verify login with invalid username and password  <b>Description:</b> Test the PSTAIS login page	<b>Test Designed by:</b> Nobert Fidel  <b>Test Designed date:</b> 21 <sup>st</sup> march, 2018  <b>Test Executed by:</b> Bangulo Primary school Teachers  <b>Test Execution date:</b> 22 <sup>nd</sup> march, 20118
<b>Pre-conditions:</b> User has invalid username and password	

### Steps and Outcome

Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1	Navigate to login page	Username: PS02020868	User should not be able to login	Login fails	pass	Done
2	Provide invalid username	Password: 12abh				
3	Provide invalid password					
4	Click on Login button					
<b>Post-conditions:</b> User is validated with database and unsuccessfully login to account.						

### 5.5.3 Installation and Operations

The PSTAIS was installed. Installation is the process by which the old system is turned off and the new one is turned on (Dennis, 2009). It may include a direct cutover approach (in which the new system immediately replaces the old system), a parallel conversion approach (in which both the old and new systems are operated for a month or two until it is clear that there are no bugs in the new system), or a phased conversion strategy (in which the new system is installed in one part of the organization as an initial trial and then gradually installed in others).

Installation of PSTAIS was parallel conversion approach where both the old and new systems operate together. One of the most important aspects of conversion is the development of a *training plan* to teach users how to use the new system and help manage the changes caused by the new system. The training was conducted to users for better usage of the system.

## 5.6 System evaluation

In this paper, PSTAIS was developed for the aim of removing the imbalance allocation of public primary school teachers to provide a balanced allocation to all schools. The idea of developing such a system was discovered as a result of the research conducted to selected public primary schools in Ilala Municipal Dar-es-salaam. Imbalance allocation of primary school teachers in Ilala and Tanzania as a whole remained as a challenging problem whereby many schools experienced a shortage of teachers while the number of students was increasing. Before the use of PSTAIS, some schools had more teachers while other schools have few teachers and PTR was higher in some schools while others were low which indicated the existence of imbalance allocation of primary school teachers. See the table below

**Table 15: Ranking of Regions by Average PTRs**

2000				2009			
Top 5 Regions	PTR	Last 5 Regions	PTR	Top 5 Regions	PTR	Last 5 Regions	PTR
Lindi	26:1	Rukwa	45:1	Kilimanjaro	37:1	Mara	62:1
Mtwara	32:1	Mwanza	45:1	Pwani	42:1	Rukwa	65:1
Kilimanjaro	33:1	Dar es Salaam	48:1	Arusha	45:1	Tabora	68:1
Ruvuma	36:1	Singida	48:1	Iringa	45:1	Mwanza	69:1
Kagera	37:1	Shinyanga	57:1	Morogoro	48:1	Shinyanga	73:1
<b>Average 41:1</b>				<b>Average 55:1</b>			

Source: EMIS, 2009; Regional BEST, 2000.

The use of PSTAIS has enabled schools to have balanced number of teachers as the system allocates teachers basing on school needs and pupils teacher ratio, also a human intervention in allocation is minimized.

The system was evaluated by several numbers of users. This evaluation was taken from users' comments about the system operations. The table below shows the number of users and their comments about the system the way it operates.

**Table 16: System Evaluation**

<b>Users</b>	<b>Comments</b>
User1	The system is simple to use, you can login and logout easily
User2	The system is good because it will enable each school to have teachers according to the number of pupils.
User3	It is easy to edit number of pupils once they increase or decrease due to various reasons.
User4	Its need internet to access the system from the servers that hosts the application, it could be better if we can access it from our mobile phones.
User5	The system help us to complete our task on time
User6	The system can eliminate new teachers who do not report to their station to which they are allocated.
User7	System help schools to view number of new teachers allocated to them.
User8	Quick response
User9	The system help us to know the number of teachers required in each school, hence it is easy to conduct teachers training to fill the posts.
User10	Helps us to know number of teachers allocated in our districts and schools respectively.
User11	The system help us know the exactly needs of teachers to each school.
User12	Worry on data security
User13	The system is accurately since it provides balanced allocation of teachers to each school and removes human interventions in allocation processes.
User14	The system helps teachers with disability or permanent diseases to be allocated in schools which are near to their services like hospital.
User15	The system could be better if it includes more functions
User16	PSTAIS removes imbalance number of teachers in primary schools
User17	PSTAIS simplify work when compared to current system of allocating teachers
User18	The system is easy to learn, it does not require much training.
User19	The system is consistency
User20	It is easy to use compared to current allocation system
User21	The system enables PORALG administrator to edit or delete teachers who get transfer or those who quits the job respectively.
User22	The system can be extended to include secondary school teachers allocation
User24	The system help treasurer to pay only teachers that are in their schools and are working by removing those who report but do not stay and work.
User25	The system cannot give room to teachers who are not head of schools to edit number of pupils.
User26	System serves budget by allocating available teachers instead of conducting new training.
User27	Quick response
User28	Easy to view the needs of each school when the number of pupils increases
User29	The system helps new teachers with disability or permanent diseases to be allocated nearby services or hospitals.
User30	The system helps us to handle teachers transfer and teachers who quits the job

Therefore, PSTAIS is more accurate in allocating primary school teachers when compared to the traditional way used by PORALG officers in the allocation of public primary school teachers.

## **5.7 Conclusion and recommendation**

The proper use of information and communication technology (ICT) in many sectors has shown significant economic, social and environmental benefits. Since technology is growing up fast, in the future many sectors like education will get a potential change as many new information systems are being developed making education easy to learn compared to the old days.

This study has presented PSTAIS system to help authorities (PORALG) that are responsible for allocating public primary school teachers to make an easy and balanced allocation of teachers but also for MoEVT that are responsible for teachers training and education policy formulation can use this system to recruit new teachers according to school needs.

This study has achieved the objectives by presenting the weakness and strength of the current system of allocation of teachers and demonstrated the necessity of using PSTAIS system for removing the imbalance allocation of teachers in primary schools. Further research can be extended to implement the idea of allocation of teachers not only in primary schools but also in secondary schools where the imbalance of teachers still exists.

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## Appendices

### Appendix I: Interview Guide Questions for Head teachers

Dear Valued Respondent,

I am pursuing a Master's of Science Information Technology and Systems at Mzumbe University. I am conducting a research whose theme is “**DEVELOPMENT OF A WEB-BASED INFORMATION SYSTEM FOR MANAGING ALLOCATION OF PUBLIC PRIMARY SCHOOL TEACHERS IN TANZANIA**”. The data collected will be used for writing my dissertation. For this case, I will be more grateful if you respond to these interview questions. The information gathered will be used for Academic work only, nothing else.

1. How many teachers do you have in your school?
2. How many pupils do you have in your school?
3. How many female teachers do you have in your school?
4. Are you satisfied with the number of teachers you have in your school?
5. Is current system of allocating teachers providing number of teachers in your school according to PTR?

We have now come to the end of the interview. Thank you very much for your time to attempt these questions and please be assured that this information will be treated as private. May I repeat that the information you have given will be used for academic purposes only.

### Appendix II: Interview Guide Questions for Education officers from PORALG

Dear Valued Respondent,

I am pursuing a Master's of Science Information Technology and Systems at Mzumbe University. I am conducting a research whose theme is “**DEVELOPMENT OF A WEB-BASED INFORMATION SYSTEM FOR MANAGING ALLOCATION OF PUBLIC PRIMARY SCHOOL TEACHERS IN TANZANIA**”.

The data collected will be used for writing my dissertation. For this case, I will be more grateful if you respond to these interview questions. The information gathered will be used for Academic work only nothing else.

1. How many primary schools do you have in your municipal?
2. How many primary schools are in urban and how many are in villages?
3. How do you allocate teachers (Fresh from colleges) to various primary schools?
4. Are there any criteria you consider when allocating teachers to various primary schools?
5. What is the gender ratio between male and female teachers in your municipal?
6. Are there any challenges you face in allocating teachers to various primary school?
7. Is current system of allocating teachers providing number of teachers to all primary schools in your municipal according to PTR?
8. How do you handle teachers' transfers from one school to another so that imbalance number of teachers cannot occur in schools?

We have now come to the end of the interview. Thank you very much for your time to attempt these questions and please be assured that this information will be treated as private. May I repeat that the information you have given will be used for academic purposes only

### **Appendix III: Time Frame**

Time is important in assuring accomplishment of the research. The time is distributed from November, 2016 to August, 2017 as shown below

Activity	NOV 2016	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG 2017
Problem identification										
Literature Review										
Pre-survey and selection study villages										
Proposal writing										
Submission of First draft										

proposal										
Making Correction										
Submission of Final draft proposal										
Data collection (In- depth interview)										
Data analysis										
Report Writing										
Submission of first draft report										
Making corrections										
Submission of final draft report										