

**ABSENTEEISM AMONG RURAL TEACHERS: THE CONTRIBUTION OF “POOR
REMUNERATION”, “QUALIFICATION OF TEACHERS” AND “FURTHERING
STUDIES ON DISTANCE LEARNING”**

By

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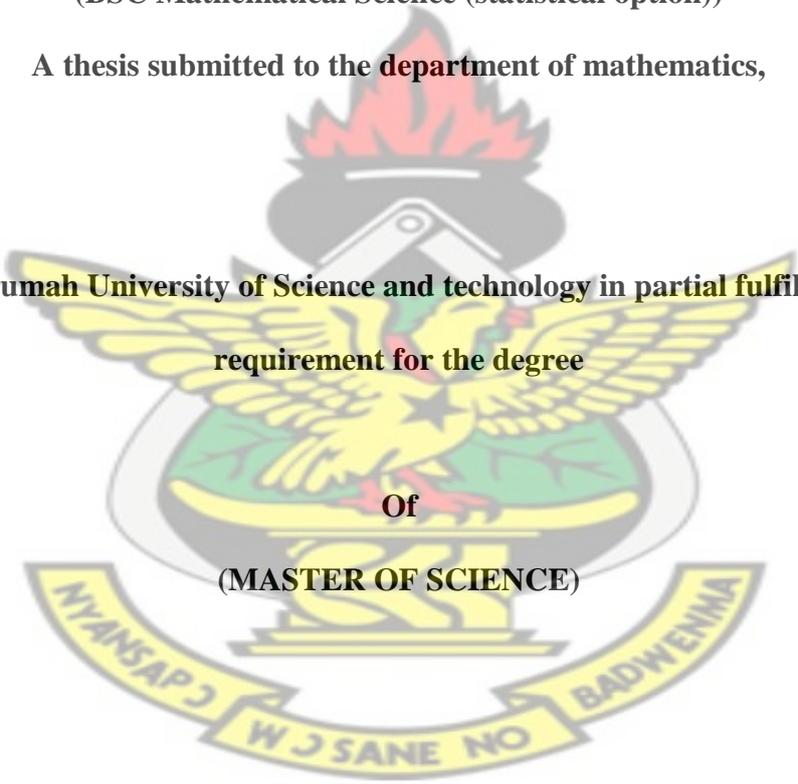
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[COLLEGE OF SCIENCE/ INSTITUTE OF DISTANCE LEARNING]

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DECLARATION

I hereby declare that that this submission is my own work towards the award of Msc. Industrial mathematics that the best of my knowledge, it contains no material previously published by another person or material which has been accepted for the award of any other degree of the university, except where due acknowledgement has been made in this text.

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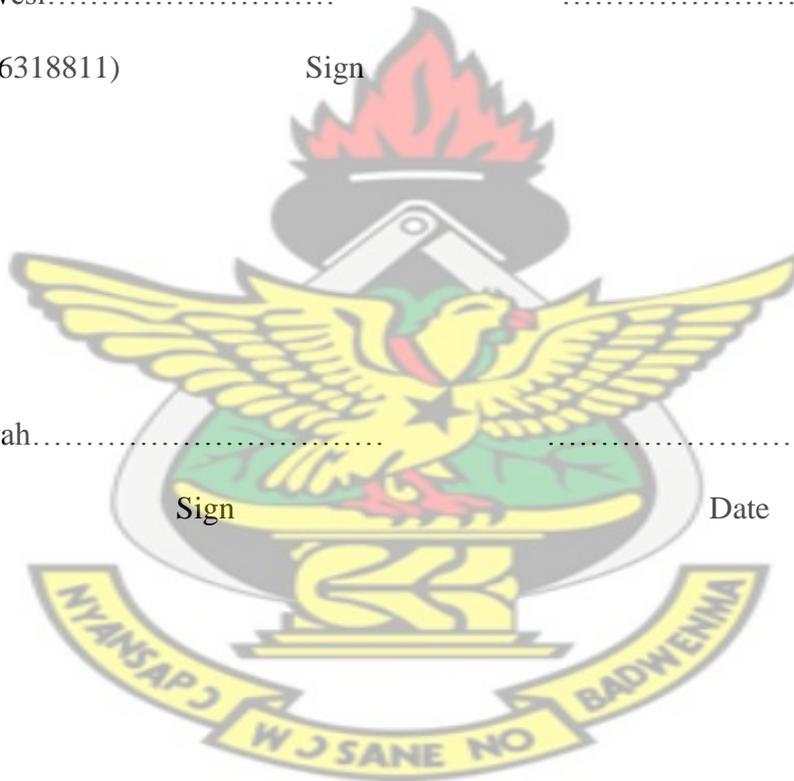
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ABSTRACT

According to Julius Nyerere“ Education will not give one the chance to escape poverty but it will fight poverty from ones community”. Education is therefore an earn in itself as well as means to other earns.

However, people in the Pru district are gradually losing these enormous benefits of education, this largely is due to absenteeism of teachers from class. The negative effect absenteeism poses to education calls for a study into it. Constas and Vichas (1980) however determined some common variables such as poor remuneration, teachers furthering education and Qualification of teachers as the main contributors of absenteeism.

This research is to further check the contribution of these variables, formulate a model for absenteeism and use it to model and predict absenteeism.

Poor remuneration is the number contribution to absenteeism and it will be very appropriate to redirect a larger chunk of budget on remuneration of teacher instead of recruiting substitute teachers among others.

There is a 99.9% chance that a teacher whose remuneration is good will always be in school irrespective of their Qualification or them furthering education.

A database should also be set on attendance of teachers then monitoring and evaluation should be enforced.

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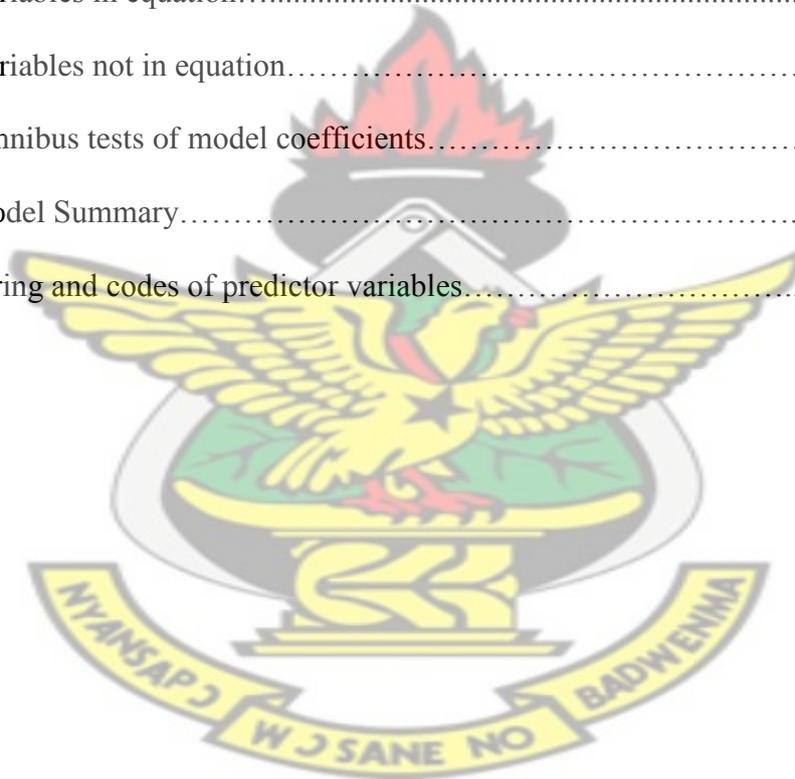
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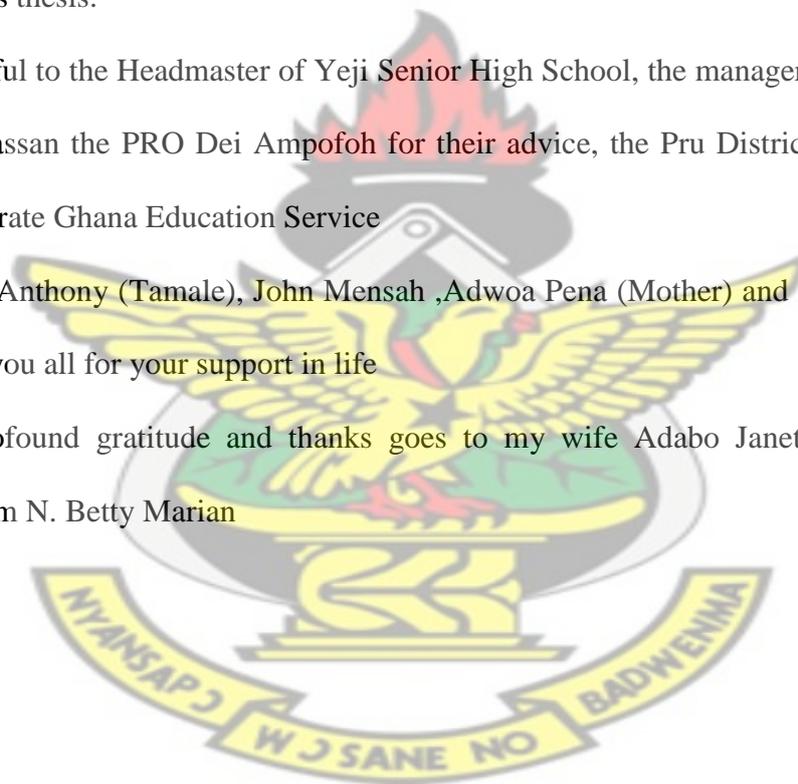
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CHAPTER 1

1.0 INTRODUCTION

1.1 Background to the study

Absenteeism is a habitual pattern of absence from a duty or obligation. Traditionally, absenteeism has been viewed as an indicator of poor individual performance, as well as a breach of an implicit contract between employee and employer; it was seen as a management problem, and framed in economic or quasi-economic terms. More recent research seeks to understand absenteeism as an indicator of psychological, medical, or social adjustment to work (Winkler, 1980)

A report by the World Bank on Ghana's educational system has identified the high rate of teacher absenteeism as a major problem in the educational sector.

The report, titled Education in Ghana: Improving Equity, Efficiency and Accountability of Education Service Delivery, said absenteeism is more common in rural schools, with a seeming link to higher occurrences of a poor remuneration, low qualification of teachers and teachers furthering studies. It was released on February 23, 2011.

According to the report, teachers in Tunisia and Morocco miss 11.6 days and 13.4 days a year respectively, while teachers in Ghana miss 43 days. Among the main underlying reasons for the high absentee rate, are lacks of supervision, poor remuneration, poor teacher morale, Sickness/medical care, collection of salary at a bank located at a distance, and frequent funeral attendance.

According to the Reading Today (1998), private school teachers tend to be more satisfied than public school teachers, and elementary school teachers tend to be more satisfied than secondary school teachers, because the private school teachers receive a great deal of parental support as opposed to the public school teachers; the fiduciary responsibility the parent(s) for their child or children education.

As teachers became more actively involved in instruction and curriculum procedures, they also became more active as role models, and as a result gave a positive example to students who had bad attendance practices.

A positive work environment fostered lower rates of teacher attendance (Scott and Wimbush, 1991). Henceforth, "the perceived ability to attend" was increased in schools where teachers felt they had input (Scott and Wimbush, 1991).

They mentioned, "The relationship between the teacher's motivation to attend and their actual presence on the job could be perceived by the teachers as having control of their work environment" As a result, "this perception may have influenced the teacher's attendance barriers".

Attendance barriers were defined as untimely circumstances for teacher illness, family illness, unexpected personal responsibilities, and transportation problems that prevented employees from going to work. In these parameters, employees may have been motivated to attend work, but, due to involuntary circumstances, were unable to actually do so (Scott and Wimbush, 1991).

Though attendance is a daily part of any school system's structure, no organization should deprive teachers of the ability to be absent from work when needed (Ehrenberg et al., 1991).

However, Zwieback (1995) indicates, that the problem still exists whereas 25 percent of the nations' 3.5 million teachers in U.S.A regularly continue to abuse their school system's sick leave policy.

This behavior resulted in severely reducing students' academic productivity, as well as a loss of the school system's financial resources (Darling-Hammond, 1995;)

"Teacher absenteeism had a negative impact on the financial resources of a school system, but, more importantly, it had a detrimental and disruptive effect on student achievement". In

contrast Ehrenberg (1991) suggested teachers should be able to take days off to improve their mental health and performance.

The study of teacher absenteeism must also include the problem that develops with increased numbers of substitute teachers. "The use of substitute teachers is an unfortunate dilemma and process but a necessary practice in today's educational environment" (Bennett, 1997).

The New York Metropolitan School Study Council reported that substitute teachers were significantly less effective than regular classroom teachers (Elliott and Manlove, 1977). The school systems that hired poorly trained, uncertified, substitute teachers are adding to the problem of academic lost time (Darling-Hammond, 1995). The temporary status of the substitute teacher impaired the overall "ownership" for students' daily educational development (St. Michel, 1995; Woods, 1990). When substitute instructors were present, students were more likely to experience an incompetent teacher, or, at the very least, a teacher not adequately prepared for the instructional practices of that particular learning environment (Ehrenberg et al., 1991; Winkler, 1980). As a result, substitute teachers were unable to complete their assigned daily tasks (Ehrenberg et al., 1991; Hill, 1982; Woods, 1990).

The instructional guidance of substitute teachers is a continuous process, and the ideal classroom condition for replacement teachers is one in which they are able to continue the regular teachers lesson plans without breaking the students' daily routine, and to consistently produce academic growth (Billman, 1994; St. Michel, 1995). Substitute teachers were known to be one of the weakest instructional resources available to school systems (Billman, 1994).

The quality of regular classroom teachers and substitute teachers employed by urban public schools was a major concern (Darling-Hammond, 1995). Galloway and Tharp (1996) also supported and believed that regular classroom teachers perform better in handling the class than the substitute teachers.

Absenteeism affects performance of students, and it is in view of this that, this research was conducted to reveal how poor remuneration, low qualification of teachers and teachers furthering education on distance learning contribute to it.

1.2 Problem statement

The Pru district has a total population of one hundred and twenty six thousand six hundred and four – (1 26,604) -2010 population and Houses census

The cohort that contains most of the people is the 0-14 year group which constitutes 42.9% of the entire population.

Since 42.9% of the entire population is children who are suppose to be in basic school, it is therefore very important for more research to be conducted to help solve the problem which hinder or affects performance.

An investigation conducted by GES in Pru district shows a decline in the performance of BECE results. “This decline in performance among others can be attributed to absenteeism among teachers”(District Statistician).

Averagely teachers in Ghana miss school 43 days within an academic year. However in Pru District teachers averagely miss school 78 days in an academic year. (District Statistician). It is therefore worth investigating to know how; some factors contribute to this canker in the society.

1.3 Objectives

This research intends to achieve the under listed objectives.

1. To model the relationship between absenteeism and the contributing factors as a logistic regression model
2. To predict absenteeism among teachers.

1.4 Methodology

This thesis models absenteeism of J.H.S teachers in the Pru district as a logistic regression of the form $g(p) = \ln(p/1-p)$.

A chi square test pseudo Rand the wald statistics were done on the model to check on its accuracy and goodness of fit

The SPSS software was used in the modeling and the testing of the models accuracy.

Some reading materials such as Steers and Rhodes (1978), Constat and Vichas (1980), Annual general report GES Pru District (2012) P .AboagyeSarfo (KNUST 2006) library (KNUST) and the internet were consulted

1.5 Justification

Education, which is said to be the key to success, encounters a lot of problems.

It is therefore important that research is conducted in very relevant areas of education. One of these areas that is worth researching into is absenteeism among teachers .This research would help all stakeholders and partners in the educational sector to

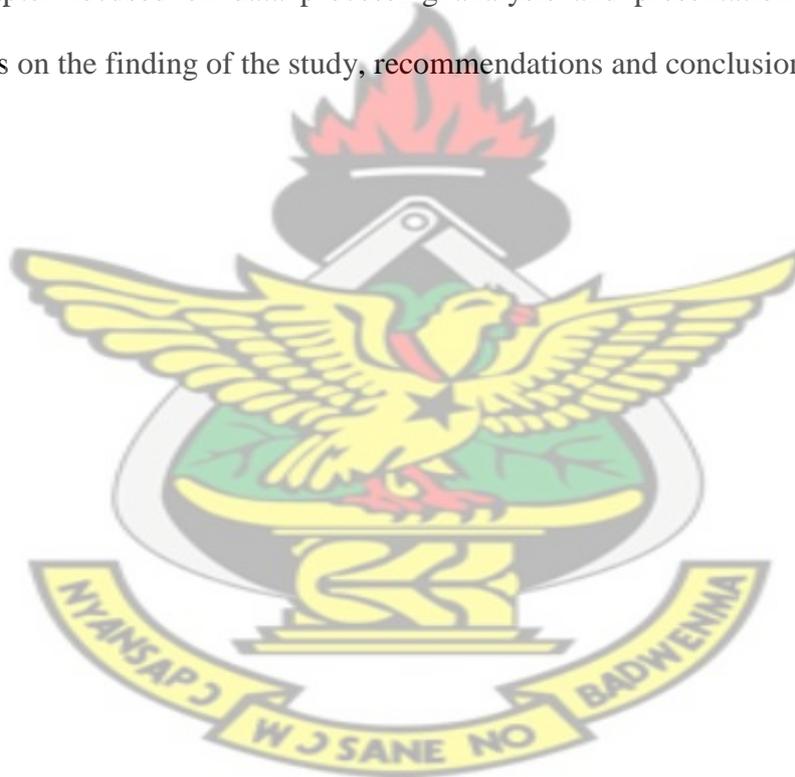
1. Ascertain the impact of “poor remuneration”, ‘Furthering education on distance learning” and “Non professional teachers in class rooms” on the attendance of teachers to school.
2. Also to help reduce the cost that absenteeism imposes on the state and on parents.
3. Also in fighting absenteeism, among the contributing variables under study where a greater portion of funds should be allocated to.
4. One other factor which justifies the study of this topic is the fact that it set a base for future research into absenteeism by all stakeholders and educational partners.

1.6 Organization of the Report

This project was structured into five chapters. The first chapter entails introduction, problem statement, and objectives, Justification of the study and organization of report. The second chapter is the literature review which presented a framework for assessing absenteeism and its contributing factors.

The third chapter: methodology of the study, described the steps to achieve the objectives of this project. This section looked at formulation of regression models and methods of testing logistic regression models

The fourth chapter focused on data processing analysis and presentation. The focus of chapter five was on the finding of the study, recommendations and conclusion.



CHAPTER 2

2.0 LITERATURE REVIEW

2.1 Introductions

This chapter reviews relevant literature on absenteeism. The aim is to provide a general framework of understanding on relevant literature and also inform the discussion and analysis of the survey results from the study. The analysis provided understanding on absenteeism and how a poor remuneration, qualification of teachers and furthering of education contribute to absenteeism.

2.2 Definitions of Absenteeism

There are many variations to the definition of absenteeism. Defining absenteeism has not changed much in recent years. The definitions of excused absence include categories such as personal sickness, jury duty, religious holidays, and funeral leave and transportation problems. Meanwhile, the unexcused absence meaning absenteeism without an official or recognized (excused) reason, that occurs when an employee fails to provide a satisfactory explanation for the absenteeism, or gives no reason at all (Walfin, 1981). Below are the working definitions of absenteeism:

Based on Martocchio and Jimeno (2003), Absence constitutes a single day of missed work. Absence occurs whenever a person chooses to allocate time to activities that compete with scheduled work, either to satisfy the waxing and waning of underlying motivational rhythms (Fichman, 1984), or to maximize personal utility (Chelius, 1981).

An individual's lack of physical presence at a given location and time when there is a social expectation for him or her to be there (Martocchio & Harrison, 1993).

Absenteeism refers to the non-attendance of employees for scheduled work (Gibsson, 1966; John, 1978; Jones, 1971). Absenteeism from the work place is considered as a symptom of a deep seated problem, and not as a problem on its own (Brayfield&Muchnisky, 2006).

It might be an indication that the worker is demoralized or dissatisfied with the work. Majority of the employers, when factoring in the effects of absenteeism to the performance of the company, do not differentiate between those absences that were out of necessity and those that were unnecessary.

One way they factor in the effects of absenteeism is by the use of Bradford Factor (Yorges, 2009). This considers the total number of absences and the frequency of the same. This is regardless of the fact that there are different forms of absenteeism

The problem of teacher absenteeism is an increasing concern among the nation's educators. Norton (1998) conducted a statewide study concerning school administrators, and found that 71 percent of them reported teacher absenteeism as one of the leading problems facing them. The study reported substitute teaching as the third highest-ranked "serious" problem facing school personnel directors and named teacher absenteeism as the number one ranked "general problem" encountered in their work. Not only are the monetary costs of teacher absenteeism escalating, but the difficulty of finding qualified substitute personnel is also a growing problem for many school districts.

Research on teacher absenteeism has centered largely on (a) who is absent from teaching responsibilities and how often, (b) causes for teacher absences, (c) absenteeism and student achievement, (d) the relationship of school climate and the absence of employees and (e) the impact of various incentives on teacher absenteeism. Gender, age levels, and personality traits are among those characteristics most often examined in studies of absenteeism in schools. Differences in absence levels as the age group of teachers varied was not significant, but women and men did reveal different patterns of absenteeism with age.

The number of absences claimed by female teachers increased with age. Male teachers, on the other hand, claimed more days in their thirties than at any other age (Unicomb,1992). Scott and McClellan (1990) supported this finding and noted that there was a significant difference in the occurrence of absence for men between the ages of 21-39. Overall, male teachers had significantly fewer absences than female teachers. Average days-of-absence for females was 5.29 per year; males averaged 3.39 days. Elementary school teachers averaged 6.63 days of absence per year compared to 3.32 days for secondary personnel. The school level taught, elementary or secondary, and the level of teaching license held were the two primary predictors of teacher absence. The higher the degree held by the teacher, the higher the days of absence (Scott and McClellan, 1990).

Although several studies have noted higher absenteeism on Mondays and Fridays, this finding is not consistent. Unicomb et al., (1992) disclosed that teachers were absent on Wednesdays more frequently than any other day. November, January, and April were peak months for teacher absences.

Research has not been consistent concerning the rate of absenteeism and the number of years of teaching. Porwoll (1980) reported that teachers with two to four years of teaching experience and those with 23-25 years had the fewest absences.

Porwoll (1980) also noted that other researchers were unable to establish any relationship between the number of years of teaching experience and teacher attendance. Jacobson (1989) reported that senior teachers nearing retirement often were absent more frequently than others.

However, Ehrenberg (1991) found that the greater the proportion of teachers older than age 55, the lower the usage of sick leave days. These researchers speculated that the fewer absences by this age group were likely due to the expected payoff for their retirement in the near future.

There are also mediating social factors involved in the linkage between stress and illness behavior among urban public school teachers. Dworkin (1990) found a low but statistically significant relationship between job stress and reported stress-induced illness.

A second hypothesis of the same study with statistical significance found stress-induced illness is lower among teachers assigned to schools when the principal is seen. However, a third hypothesis related to stress-induced illness and the presence of supportive co-workers was not significant. Unlike the supportive school principal, supportive co-workers did not reduce the level of stress-induced illness reported by teachers.

The rate of teacher absenteeism has been found to be highest in elementary and most middle schools, schools with lower student achievement, schools composed of economically disadvantaged and minority students, and schools that do not require teachers to speak to their immediate supervisor about pending absence, urban schools districts and districts with enrollments in excess of 257,000 (Pitkoff, 1993).

The importance of this study is very significant relative to student achievement, it states: In schools where students are poorest and failing the most academically, teachers tend to be absent more often. In one study, the percentage of students reading below grade level was found to be the greatest predictor of school employee absenteeism, followed by the percentage of students eligible to receive free lunch (Pitkoff, 1993).

In general, studies relating the direct effects of teacher absenteeism on student achievement are limited and tend to differ in their findings. For example, in a study that focused on fourth-grade reading results, it was determined that teacher absenteeism adversely affected student achievement (Summers and Raivetz, 1982). O'Brien (1985) also found negative impacts of teacher absenteeism on student learning.

Yet, in contrast Ziomek and Schoenberger (1983) were unable to establish such an association. Madden (1991) and Ehrenberg (1991) also did not support the contention that

student academic performance was associated with teacher absence. In view of Pitkoff's (1993) finding that school employees rated as unsatisfactory tend to be absent significantly more days than those rated satisfactory, a reasonable conclusion might be that the absence of a "poor" teacher does not impact as negatively on student learning.

"Teacher absenteeism" is regarded as a vital problem in the education system today. The definition of absenteeism is as complicated and descriptive as human nature (Chadwick-Jone, Nicholson and Brown, 1982). The loss of productivity and profits were the major cause for business and industry to begin developing research on this subject (Moline, 1988; Pitkoff, 1993; Woods, 1990).

The private sector has always been sensitive to the relationship between employee absenteeism and fiscal loss (Pennsylvania School Boards Association, 1992). The same research prompted educators to examine the conditions of teacher's absentee rates to determine if this behavior adversely affected student's academic performance.

2.3 Factors Influencing Absenteeism

Many teachers do absent themselves from school based on illness. Sometimes some sick teachers are forced to go to school even if sick as a result transmit communicable diseases to their co-teachers. This leads to even greater absenteeism and reduced productivity among other teachers who try to work while ill. Bullington (2002). Workforces often excuse absenteeism caused by medical reasons if the worker supplies a doctor's note or other form of documentation.

There is however other absenteeism in which a teacher doesn't seek any excuse for not coming to school. School authorities and pupils do expect this teacher in school but they get to school to meet his/her absence. Others however seek permission from these authorizes for not coming to school.

According to Nelson and Quick (2008) people who are dissatisfied with their jobs are absent more frequently. They went on to say that the type of dissatisfaction that most often leads employees to miss work is: dissatisfaction with the work itself. In other cases, they are not satisfied with their salaries or poor motivation.

The psychological model that discusses this is the "withdrawal model", which assumes that absenteeism represents individual withdrawal from dissatisfying working conditions. This finds empirical support in a negative association between absence and job satisfaction, especially satisfaction with the work itself.

There are several determinants of job satisfaction. They include, among others, the relationship between an employee and the other employees, or the relationship between the employee and the supervisor or administration. When this relationship is enhanced and satisfying, job satisfaction follows. Compensation is also another determinant of job satisfaction. When the employee believes that he is sufficiently compensated, he will be happy at the job and hence be satisfied. The opposite is also true; if an employee feels that he is not been sufficiently compensated, then he will not be satisfied at the job.

The conditions under which the person is working will also determine the level of his job satisfaction. If the conditions are conducive, the employee will be satisfied. However, if the conditions are not conducive, for example in the case of hazardous working conditions, the employee will not be satisfied.

According to a report by Society for Human Resource Management (SHRM, 2009), there is a widespread job dissatisfaction among workers of all cadre. The study did not find any difference between satisfaction levels of people from different income brackets or ages. According to this study, the past ten years have seen an unprecedented decline in the level of job satisfaction across all income brackets.

For the past four decades, researches have consistently proved that a considerable number of teachers would quit the job and look for another one given the chance. This number ranges from 40-50% of all teachers interviewed (SHRM, 2009)

Researchers have identified different types of job satisfaction. There is what Burgoon (2009) refers to as extrinsic and intrinsic job satisfaction. The latter is when the employee takes into consideration the conditions of their work as a determinant of their satisfaction. This can be viewed as being composed of Herzberg's hygiene factors. On the other hand, intrinsic job satisfaction is when the employee considers only the inherent attributes of the job, (like category, difficulty among others) as the determinants of his job satisfaction (Kendall, 2006).

Again, this can be equated to Herzberg's motivating factors of the level of satisfaction (Rensis, 2006). The questionnaire is divided into a long and short form. The former has 100 questions, five from each attribute of the job that is being measured. The latter has twenty questions, one for each of the attributes (Kendall, 2006).

Job Satisfaction Survey is a questionnaire with a total of thirty six questions. These questions are four for each of the nine attributes of the job that the researcher is interested in (Kendall, 2006). There is also the Faces Scale, where the workers are supposed to respond to only one item. They respond by picking a face for it (Rensis, 2006). This was one of the first scales to be used in measuring job satisfaction.

Many teachers stay far from their schools; however a source of transportation to their schools is usually a problem. This sometimes prevents teachers from coming to school. They may also stay at places where they have to travel for a long distance before they go for their salaries all these do make them absent themselves. (Luthans and Kreitner, 1985),

Teachers in rural areas most at times do not go to school because they are aware that no circuit supervisor will be able to easily get to the school since the place is far and the road is also not good. Based on this, the teachers choose not to go to school. Teachers equally give

other excuses such as funeral, rain and not having money to fare him/herself. Lai and Chan (2000).

Scott and McClellan (1990) write that the class level one teaches and the level of qualification was two primary predictors of teacher absences. Through their investigation, it was discovered that the higher the degree obtained by the teacher, the higher the number of days they were absent from the classroom.

Also non professional teachers turn to miss school most, since they lack interest in the job. They turn to use the teaching profession as a stepping stone in life. Non professional teachers will always say ‘I chose to teach but if I get a better job I will leave (Blau, 1985).’

2.4 Effects of absenteeism

Bruno (2002) stresses that “students in a classroom eventually lose the desire to learn when the regular teacher is frequently absent and the delivery of the instructional is by an array of substitute teachers”.

As a result of this key finding, substitutes are hard to find to replace absent teachers in urban schools. Regular education teachers who are off during their conference period do not particularly volunteer to substitute (Mckay 1999). Student academic achievement falls and students do not feel connected to the classroom

Darling-Hammond and St. Michel (1995) found that the replacement teacher for the public classroom does not provide the same quality of expertise expected by the students or teachers, but seems to be the only method commonly used. Substitute teachers do not always measure up to the regular classroom teacher's routine and methods to stimulate students to learn (Darling-Hammond, 1995; St. Michel, 1995).

The verbatim comments by the teachers also indicate that the students are forced to adjust to someone new and that their behavior and performance suffers and substitute teachers are

notable to teach the students as effectively as the regular classroom teacher. A further research that found substitute teachers were significantly less effective than regular classroom teachers (Elliot and Manlove, 1977) suggests that there is a breakdown in organizational structure and that the absence of clear expectations; such as, performance feedback, leadership style, classroom management and disciplinary skills further weaken the effectiveness of the substitute teachers

Teachers are too often the one expected to be flexible. They are asked to manage overcrowded classes, they are expected to perform without strong support from administration, and they are expected to excel despite the lack of incentives to motivate them to take on the additional responsibilities. The teacher respondents overwhelmingly indicated that stress is the primary cause of teacher absenteeism, lack of leadership and poor classroom management. It is the combination of the day to day emotional, physical and intellectual energy expended that creates the level of stress.

Add to these conditions the need to take on another group of students because a colleague is absent. Despite these conditions, a greater understanding of the issues raised by teachers around the nation related to teacher absenteeism. The solution to this problem should not be a decline in quality of education.

The school administration acknowledges that they are aware of the problem with teacher absenteeism, classroom management and leadership; and they are taking steps to correct them. However, little evidence exists that steps are being taken to address teacher absenteeism or improve the substitution process, whether it is an actual replacement teacher or a combined class. (Jacobson, 1989).

Teachers are being forced to take leaves of absence in order to express their dissatisfaction with the administration. Sometimes, they find the situations in the school system so subjective that they take leave of absence, knowing their student's would be placed in another

teacher's classroom. Such actions by teachers are deliberate in order for them to have or maintain a sense of sanity and return to work at a later date.

Jacobson's (1989) study also concluded that teacher absenteeism and poor attitude might impede students' academic growth.

The author hypothesized that the relationship developed between student and teachers indeed influenced students' performance. Thus, when linked to the quality of instructional time, the frequent absence of a classroom teacher would weaken the student-teacher bond and cause student absences. Students who were frequently absent from school, when asked why they chose not to go to school, responded in the following manner. "If my teacher does not come to school, why should I?" (Jacobson, 1989).

In support of this, Ehrenberg et al. (1991) stated the following: "higher teacher absentee rates may reduce students' motivation to attend school and further lead to higher student absentee rates"

Ironically, national data from the United States Bureau of Labor Statistics (1996) demonstrated that urban teachers did not regard teacher absenteeism as a major problem. The data from this study revealed that only 1.6 percent of all teachers believed that their absences from the classroom presented a serious barrier to student achievement. In a Nation at Risk (1983), the achievement scores of American students were compared with the scores of students from other industrialized nations. The authors found that the achievement scores of American students were related to the quality and quantity of instructional time. Time lost by students because of the absence of the regular classroom teacher was a significant problem that slowed or halted academic and emotional growth (Darling-Hammond, 1995, A Nation at Risk, 1983).

Woods (1990) found that nationally, teacher absence rates were significantly higher in public schools than the absence rates of persons working in private industry. The author was

concerned with the dilemma facing schoolteacher's absenteeism, which has become a national crisis when compared to private industry absences.

Regardless of the reasons for teacher absenteeism, students were affected (Pitkoff, 1991, 1993; Winkler, 1980). Thus, Leake and Leake (1995) urged urban school districts to examine the linkage between student failure and the frequency of teacher absences. According to St. Michel (1995) student failure can preclude student achievement. "If student achievement is to increase, then instruction must be maximized every day!" (St. Michel, 1995).

However, teachers cannot maximize instruction if they are not in the classroom. The Pennsylvania School Boards Association (1992) found that the effectiveness of the teacher depended on his/her stability as the regular classroom instructor.

The board discovered that the more the teacher was present to deliver instructional information and to also monitor skills, the greater the result of academic growth. Elementary students were even more influenced by the behavior because of their developmental need to be surrounded by familiar people and structured learning activities as compared to middle and high school students (Darling-Hammond, 1995; Ostapczuk, 1994; Jasmin 2008: Pennsylvania School Boards Association, 1992)

Skidmore (1984) suggested "high absenteeism seriously cheats students out of productive time in class if academic correction is not made"

The replacement teacher for the public classroom teacher and/or private classroom teacher does not provide the same quality of expertise expected by the students and teachers, but seem to be the only method commonly used. Substitute teachers do not always measure up to the regular classroom teacher's routine and methods to stimulate students to learn (Darling-Hammond, 1995; St. Michel, 1995). Administrators also expected substitute teachers to perform as effectively as the regular classroom teachers (St. Michel, 1995). According to Ostapczuk (1994), students were spending five to eight percent of their school year with a

substitute teacher, with data showing that these percentages were increasing with each passing year. Considering the increased use of substitute teachers and the decreased effectiveness of instruction, student achievement scores in the urban school settings have continued to decline (Ascher, 1991; Darling-Hammond, 1995), teacher absences negatively affected the quality of academic growth for students. A national survey found that 30 percent of all participating students with regard to substitute teachers are nothing more than babysitters (Ostapczuk, 1994). In part, the reason for this belief could be due to the lack of regular teachers' preparation of well-thought-out lesson plans that reinforced the previous day's lessons (Peterson, 1991). In addition, substitute instructors also taught subjects that did not reflect their knowledge base, education, and interest (Darling-Hammond, 1995). School administrators and educators report many of the problems associated with substitute teachers, which appeared to be based on anecdotal observations (Ostapczuk, 1994).

. There are obvious reasons why teacher absenteeism can be costly to the school district. The first involves the fact that many schools receive funding from the state with regard to the number of students present and the number of certified teachers that are present. The second, of course, is that classrooms cannot be left unattended. Thus, when a teacher is absent, regardless of the reason, the school district must request a substitute in order to oversee the classroom and attempt to teach the lessons that were planned by the individual teacher. Unfortunately, substitute teachers are not generally certified by the state to teach school. (Woods, 1990).

In some states, substitutes only need two years of college in order to qualify as a substitute. Consequently, the district can pay a lower fee to the substitute, but it is still lost revenue. Additionally, most districts provide sick leave, so when the teacher is absent he or she continues to be paid for that day. So the school district loses revenue from state funding,

from the cost of a substitute, and must pay the teacher each time he or she is absent from work.

Consequently, the cost of teacher absenteeism is a financial concern for most school districts that are struggling to pay for adequate and state mandated services for students (Browne et al. 1991).

2.5 Methods used to combat absenteeism

Rates of teacher absences and the effects of absences on productivity are topics of conversation in many districts. One reason is that high rates of teacher absence may signal weak management and poor labor-management relations. In the education sphere, employee absenteeism is a special problem, not **only in terms of** the cost to the state or school (pay for substitute teachers) but also the wasted education-time that is liable to impair the sense of confidence that the general public has in the schools

To overcome this problem, The Public Service Commission (PSC) of Malaysia Secretary, MohdYasin bin MohdSalleh said that the first move is to issue advice and guidance either orally or in writing to the teacher. And if the preliminary steps are ignored, action will be taken against the person concerned.

Issuing warning will be the first step followed by imposing fines, revoking salary rights, withholding salary increment, salary reduction, demotion, and dismissal. Teacher absenteeism was rampant in Sabah's rural schools and no action had been taken against the teachers involved. Numerous reports were received from parents of students in rural schools that many teachers including principals are absent from classes for weeks in a given month.

The explanation given by the teachers was that they had to attend meetings in the towns but the problem continues for months. Government and the Ministry of Education need to solve the issue once and for all in order to improve the conditions of rural school.

The District Management Council (2004) in USA has discovered that monetary incentives aide in resolving absenteeism. The Council has a program that awards teachers by contributions to a retirement accounts for good attendance and award teachers by contributions to an accounts for better attendance.

Approximately \$284,000 per year is saved and reallocated to other district resources. Moreover Dallas ISD involved its business community in helping them to increase teacher attendance. The district holds parties for teachers with perfect attendance where various prizes are given away, including brand new cars. As a result Dallas ISD doubled its number of teachers with perfect attendance.

Jacobson (1988) believes that a pay incentive plan helps to decrease teacher absenteeism. Teachers will remain at school to obtain a pay incentive. Scott, Markham, believe that recognition motivates teachers to stay at school and that pay incentives can be used if they are designed properly.

Scott, Markham, and Taylor (1987) believe that “a good attendance policy also includes a progressive discipline. Teachers under this guidance must receive increasing levels of punishment for more severe or repeated violations of the organization’s policy. The goal is to shape the teacher’s behavior and to give the information they need to understand the consequences of their actions. The policy needs to be procedural and must be ingrained throughout the academic year to staff members.

In addition, the GES can adopt a common transportation system, like buses to pick up teachers along the route and to make sure they arrive at school on time. However, the limitation of this transportation service is that it did not cover all major routes that lead to the school.

The few routes covered are determined by the concentration of teachers living along those routes. However, this transportation system has its own problems, as evidenced from the past

experiences of other schools. For example, during a particular crisis situation the buses from a major school were to be set ablaze Verb 1. set ablaze - set fire to; cause to start burning; "Lightening set fire to the forest" set afire, set aflame, set on fire combust, burn - cause to burn or combust; "The sun burned off the fog"; "We combust coal and other fossil fuels", but fortunately, the law enforcement agents intervened. The excuse from the angry mob was that the school makes huge revenues from the society without 'ploughing back' some of the profits to the community in order to improve the standard of community living. Thus, such a transportation service needs to be carefully managed. For instance, it could be contracted out to other firms for effective management. Markham, and Taylor (1987)

In addition, the use of a school logo, which may attract undue attention of an angry mob during crisis period, may be avoided. Other measures that the GES can implement include developing strong teamwork among teachers as this may increase job satisfaction, and hence, the enthusiasm of teachers to come to work and meet their team members. There are several other methods that the management can adopt to make the management issue of absenteeism manageable, which include developing career paths and/or providing relevant training for their career growth, that may engender some work aspirations and disciplines among the workers. Markham and Taylor (1987). Monitoring is necessary due to at least four reasons: (1) To ensure that junior teachers' input to a school's productive output is not undermined, (2) Managing late arrivals by way of extra pay for arriving earlier than normal time is also a form of motivation for teachers, (3) Monitoring late arrival is a means of knowing the amount of main hours wasted as a result of late arrival and this can be translated into loss in output for the purpose of a school's financial projections, and (4) Managing late arrival by way of extra pay instead of threats to sack people helps to ensure that junior teachers work in harmony with their superiors and this creates a corporate accord between teachers and superiors, which is a necessary ingredient for performance. Markham and Taylor (1987) Consequently, if the

modern school is to be driven to a position of superiority and acquire world class benchmarks teachers must be well motivated to achieve regular work attendance.. (Worrall and Cooper 1999).

In the current decade, new technologies are emerging every day, particularly in the process industry that engages in the production and sales of beer and soft drinks. These new technologies also bring new challenges in their management using the operational level manpower available to companies. Despite a great deal of exciting research being conducted to identify and address workplace challenges the area of monitoring late arrivals at work by junior workers remains unresolved (Worrall and Cooper 1999). Thus, the focus on junior staff is justified.

The act of changing the culture and motivating teachers who absent are complementary and effective ways to control, monitor, and manage absenteeism.

Junior staff are however likely to take advantage of weak management mechanisms which allow teachers to be absent without a penalty. While such tardiness may be displayed by all staff, absence to school can be a phenomenon particularly of junior teachers who may have not learned the 'desirable' culture of being punctual. Thus, there is need to improve supervision. Worrall and Cooper (1999)

Worrall and Cooper (1999) in helping to resolve the problem of absenteeism and late arrival to school formulated a model based on the number of time (days) a teacher comes to school and the amount he/she is paid as a salary. This means if for the whole month one misses school he /she has worked for zero (0) days and that is recorded to be used at in the payment of salaries.

The model postulated by them is $y(t) = [-62t.\text{sup}.2] + 13140t - 400/2640$.

$y(t)$ is the amount of salaries an individual receives at the end of the month based on the time (t) the/she comes to work .Now the value of y can be obtained for any shuttling time t .

Therefore, the amount of money payable to a staff for absenting him or herself to work can be determined since the shuttling time t , is known to be zero (0). Worrall and Cooper (1999)

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CHAPTER 3

3.0 METHODOLOGY

3.1 Introduction

The success of this research is largely based on the methodology and statistical tools used. It is in view of this that this chapter focuses on the methodology used to achieve the targeted objectives.

The objectives for this thesis were carefully chosen, their relevance is embedded in the feature that the performance of students is mainly based on the teachers in class rooms all the time.

Based on the nature of the data collected, a logistic regression was adopted in modeling the model. Logistic regression is a type of regression analysis hence this chapter looked at the formulation of regression models. Regression models involve the following variables:

- The unknown parameters, denoted as β , which may represent a scalar or a vector.
- The independent variables X .
- The dependent variable, Y .

A regression model relates Y to a function of X and β .

$$Y \sim f(X, \beta)$$

The approximation is usually formalized as $E(Y | X) = f(X, \beta)$.

To carry out regression analysis, the form of the function f must be specified. Sometimes the form of this function is based on knowledge about the relationship between Y and X that does not rely on the data. If no such knowledge is available, a flexible or convenient form for f is chosen.

Assume now that the vector of unknown parameters β is of length k . In order to perform a regression analysis the user must provide information about the dependent variable Y :

- If N data points of the form (Y, X) are observed, where $N < k$, most classical approaches to regression analysis cannot be performed: since the system of equations defining the regression model is underdetermined, there are not enough data to recover β .
- If exactly $N = k$ data points are observed, and the function f is linear, the equations $Y = f(X, \beta)$ can be solved exactly rather than approximately. This reduces to solving a set of N equations with N unknowns (the elements of β), which has a unique solution as long as the X are linearly independent. If f is nonlinear, a solution may not exist, or many solutions may exist.
- The most common situation is where $N > k$ data points are observed. In this case, there is enough information in the data to estimate a unique value for β that best fits the data in some sense, and the regression model when applied to the data can be viewed as an over determined system in β .

In the last case, the regression analysis provides the tools for:

1. Finding a solution for unknown parameters β that will, for example, minimize the distance between the measured and predicted values of the dependent variable Y (also known as method of least squares).
2. Under certain statistical assumptions, the regression analysis uses the surplus of information to provide statistical information about the unknown parameters β and predicted values of the dependent variable Y .

Finally this chapter also looked at methods of testing regression models.

3.2 Formulation of Regression Models

In statistics, regression analysis is a statistical technique for estimating the relationships among variables. It includes many techniques for modeling and analyzing several variables, when the focus is on the relationship between a dependent variable and one or more independent variables.

In linear regression, the model specification is that the dependent variable, y_i is a linear combination of the parameters (but need not be linear in the independent variables). For example, in simple linear regression for modeling n data points there is one independent variable: X_i , and two parameters, $\hat{\beta}_0$ and $\hat{\beta}_1$

$$\text{straight line: } y = \hat{\beta}_0 + \hat{\beta}_1 X_1 + \varepsilon$$

In multiple linear regressions, there are several independent variables or functions of independent variables.

Adding a term in x_i^2 to the preceding regression gives:

$$\text{parabola: } y = \hat{\beta}_0 + \hat{\beta}_1 X_1 + \hat{\beta}_2 X_2 + \varepsilon$$

This is still linear regression; although the expression on the right hand side is quadratic in the independent variable X_i , it is linear in the parameters, $\hat{\beta}_1$ and $\hat{\beta}_2$

$$\text{Where } \hat{\beta}_1 = \frac{S_{xy}}{S_{xx}} \text{ and } \hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x}$$

$$\text{But } s_{xx} = \sum x^2 - \frac{(\sum x)^2}{n} \text{ and}$$

$$s_{xy} = \sum xy - \frac{(\sum x)(\sum y)}{n}$$

Logistic regression can be binomial or multinomial. Binomial or binary logistic regression refers to the instance in which the observed outcome can have only two possible types (for example, "dead" vs. "alive").

Multinomial logistic regression refers to cases where the outcome can have three or more possible types. In binary logistic regression, the outcome is usually coded as "0" and "1", as

this leads to the most straightforward interpretation. The target group (referred to as a "case") is usually coded as "1" and the reference group (referred to as a "non case") as "0".

Logistic regression is used to predict the odds of being a case based on the predictor(s). The odds are defined as the probability of a case divided by the probability of a non case. $\frac{p}{1-p}$

The odds ratio is the primary measure of effect size in logistic regression and is computed to compare the odds that membership in one group will lead to a case outcome with the odds that membership in some other group will lead to a case outcome. The odds ratio (OR) is defined as the odds of being a case for one group divided by the odds of being a case for another group.

An odds ratio of 1 indicates that the odds of a case outcome are equally likely for both groups under comparison. The further the odds deviate from one, the stronger the relationship. The odds ratio has a floor of 0 but no ceiling (upper limit).theoretically, the odds ratio can increase infinitely.

Like other forms of regression analysis, logistic regression makes use of one or more predictor variables that may be either continuous or categorical data.

Unlike ordinary linear regression, however, logistic regression is used for predicting binary outcomes (Bernoulli trials) rather than continuous outcomes. Given this difference, it is necessary that logistic regression take the natural logarithm of the odds (the logit or log-odds) to create a continuous criterion.

An explanation of logistic regression begins with an explanation of the logistic function, which always takes on values between zero and one.

$$e(t) = \frac{e^t}{e^t + 1} = \frac{1}{1 + e^{-t}}$$

and viewing t as a linear function of an explanatory variable x , we have:

$$\Pi(x) = \frac{e^{\beta_0 + \beta_1 x}}{(e^{\beta_0 + \beta_1 x}) + 1} = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x)}}$$

We also define the inverse of the logistic function, the logit:

$$g(x) = \ln \frac{\pi(x)}{1-\pi(x)} = \beta_0 + \beta_1 x$$

and equivalently:

$$\frac{\pi(x)}{1-\pi(x)} = e^{\beta_0 + \beta_1 x}$$

As a generalized linear model

The particular model used by logistic regression, which distinguishes it from standard linear regression and from other types of regression analysis used for binary-valued outcomes, is the way the probability of a particular outcome is linked to the linear predictor function:

$$\text{Logit}(E[Y_i/x_i \dots x_m]) = \text{logit}(P_i) = \ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x_1 + \dots + \beta_m x_m$$

Written using the more compact notation described above, this is:

$$\text{Logit}(E[Y_i/x_i]) = \text{logit}(P_i) = \ln\left(\frac{p}{1-p}\right) = \beta \cdot X_i$$

This formulation expresses logistic regression as a type of generalized linear model, which predicts variables with various types of probability distributions by fitting a linear predictor function of the above form to some sort of arbitrary transformation of the expected value of the variable.

It also has the practical effect of converting the probability (which is bounded to be between 0 and 1) to a variable that ranges over $(-\infty \infty)$ thereby matching the potential range of the linear prediction function on the right side of the equation.

An equivalent formula uses the inverse of the logit function, which is the logistic function.

That is the formula can also be written as a probability distribution (specifically, using a probability mass function):

$$\Pr(Y_i = y_i/x_i) = P_i^{y_i} (1-P_i)^{1-y_i} = \left(\frac{1}{1+e^{-\beta x}}\right)^{y_i} \left(1 - \frac{1}{1+e^{-\beta x}}\right)^{1-y_i}$$

As a latent-variable model

The above model has an equivalent formulation as a latent-variable model. This formulation is common in the theory of discrete choice models, and makes it easier to extend to certain more complicated models with multiple, correlated choices, as well as to compare logistic regression to the closely related probit model.

If for each trial i , there is a continuous latent variable Y_i^* (that is, an unobserved random variable) that is distributed as follows:

$$Y_i^* = \beta \cdot X_i + \varepsilon \text{ where}$$

$$\varepsilon \sim \text{Logistic}(0,1)$$

Logistic regression as a two-way latent-variable model yet another formulation uses two separate latent variables:

$$Y_i^{0*} = \beta_0 \cdot X_i + \varepsilon_0$$

$$Y_i^{1*} = \beta_1 \cdot X_i + \varepsilon_1$$

$$\varepsilon_0 \sim \text{EV}_1(0,1)$$

$$\varepsilon_1 \sim \text{EV}_1(0,1)$$

where $\text{EV}_1(0,1)$ is a standard type-1 extreme value distribution:

Then 1 if $Y_i^{1*} > Y_i^{0*}$

$$Y_i = \begin{cases} 1 & \text{if } Y_i^{1*} > Y_i^{0*} \\ 0 & \text{otherwise} \end{cases}$$

This model has a separate latent variable and a separate set of regression coefficients for each possible outcome of the dependent variable. The reason for this separation is that it makes it easy to extend logistic regression to multi-outcome categorical variables, as in the multinomial logit model. In such a model, it is natural to model each possible outcome using a different set of regression coefficients.

It turns out that this model is equivalent to the previous model, although this seems non-obvious, since there are now two sets of regression coefficients and error variables, and the

error variables have a different distribution. In fact, this model reduces directly to the previous one with the following substitutions:

$$\beta = \beta_1 - \beta_0$$

$$\varepsilon = \varepsilon_1 - \varepsilon_0$$

An intuition for this comes from the fact that, since we choose based on the maximum of two values, only their difference matters, not the exact values — and this effectively removes one degree of freedom. Another critical fact is that the difference of two type-1 extreme-value-distributed variables is a logistic distribution.

As a “log-linear” model, logistic regression, yet as another formulation combines the two-way latent variable formulation with the original formulation higher up without latent variables and in the process provides a link to one of the standard formulations of the multinomial logit.

Here, instead of writing the logit of the probabilities p_i as a linear predictor, we separate the linear predictor into two, one for each of the two outcomes:

$$\ln \Pr(Y_i=0) = \beta_0 \cdot X_i - \ln Z$$

$$\ln \Pr(Y_i=1) = \beta_1 \cdot X_i - \ln Z$$

Two separate sets of regression coefficients have been introduced, just as in the two-way latent variable model, and the two equations appear a form that writes the logarithm of the associated probability as a linear predictor, with an extra term at the end. This term, as it turns out, serves as the normalizing factor ensuring that the result is a distribution. This can be seen by exponentiating both sides:

$$\Pr(Y_i=0) = \frac{1}{Z} e^{\beta_0 \cdot X_i}$$

$$\Pr(Y_i=1) = \frac{1}{Z} e^{\beta_1 \cdot X_i}$$

In this form it is clear that the purpose of Z is to ensure that the resulting distribution over Y_i is in fact a probability distribution, that is. it sums to 1. This means that Z is simply the sum

of all un-normalized probabilities, and by dividing each probability by Z , the probabilities become "normalized".

Or generally:

$$\Pr(Y_i=c) = \frac{e^{\beta_i \cdot X_i}}{\sum e^{\beta_i \cdot X_i}}$$

This shows clearly how to generalize this formulation to more than two outcomes, as in multinomial logit.

In order to prove that this is equivalent to the previous model, note that the above model is over specified, in that it cannot be independently specified: rather $\Pr(Y_i=0) + \Pr(Y_i=1) = 1$ so knowing one automatically determines the other. As a result, the model is not identifiable, in that multiple combinations of β_0 and β_1 will produce the same probabilities for all possible explanatory variables. In fact, it can be seen that adding any constant vector to both of them will produce the same probabilities:

$$\begin{aligned} \Pr(Y_i = 1) &= \frac{e^{(\beta_1 + C) \cdot X_i}}{e^{(\beta_0 + C) \cdot X_i} + e^{(\beta_1 + C) \cdot X_i}} \\ &= \frac{e^{\beta_1 \cdot X_i} e^{C \cdot X_i}}{e^{\beta_0 \cdot X_i} e^{C \cdot X_i} + e^{\beta_1 \cdot X_i} e^{C \cdot X_i}} \\ &= \frac{e^{\beta_1 \cdot X_i}}{e^{\beta_0 \cdot X_i} + e^{\beta_1 \cdot X_i}} \end{aligned}$$

. We choose to set $\beta_0=0$ Then and so

$$\Pr(Y_i=1) = \frac{e^{\beta_i \cdot X_i}}{1 + e^{\beta_i \cdot X_i}} = \frac{1}{1 + e^{-\beta_i \cdot X_i}} = P_i$$

which shows that this formulation is indeed equivalent to the previous formulation.

In terms of binomial data

A closely related model assumes that each i is associated not with a single Bernoulli trial but with n_i independent identically distributed trials, where the observation Y_i is the number of

successes observed (the sum of the individual Bernoulli-distributed random variables), and hence follows a binomial distribution:

In terms of expected values, this model is expressed as follows:

$$P_i = E\left[\frac{Y_i}{n_i} / X_i\right]$$

so that

$$\text{logit}\left(E\left[\frac{Y_i}{n_i} / X_i\right]\right) = \text{logit}(P_i) = \ln\left(\frac{P_i}{1-P_i}\right) = \beta_{X_i}$$

3.3 Methods of Testing Logistic Regression Models.

After fitting the model, it is good to examine the contribution of the individual predictors. To do so, you will want to examine the regression coefficients. In linear regression, the regression coefficients represent the change in the criterion for each unit change in the predictor.

In logistic regression, however, the regression coefficients represent the change in the logit for each unit change in the predictor. Given that the logit is not intuitive, researchers are likely to focus on a predictor's effect on the exponential function of the regression coefficient – the odds ratio. In linear regression, the significance of a regression coefficient is assessed by computing a *t*-test.

In logistic regression, there are several different tests designed to assess the significance of an individual predictor, most notably the likelihood ratio test, the Wald statistic, the pseudo R^2 (Efron's R^2 test, McFadden's R^2 test, The Cox and Snell R^2 and McKelvey and Zavoina's R^2)

A way to measure a model's suitability is to assess the model against a set of data that was not used to create the model. The class of techniques is called cross-validation.

To measure the suitability of a binary regression model, one can classify both the actual value and the predicted value of each observation as either 0 or 1. The predicted value of an

observation can be set equal to 1 if the estimated probability that the observation equals 1 is above 1/2, and set equal to 0 if the estimated probability is below 1/2. Here logistic regression is being used as a binary classification model. There are four possible combined classifications:

1. prediction of 0 when the holdout sample has a 0 (True Negatives, the number of which is TN)
2. prediction of 1 when the holdout sample has a 0 (False Positives, the number of which is FP)
3. prediction of 0 when the holdout sample has a 1 (False Negatives, the number of which is FN)
4. prediction of 1 when the holdout sample has a 1 (True Positives, the number of which is TP)

These classifications are used to calculate accuracy, precision (also called positive predictive value),

$$\text{Accuracy} = \frac{TP+TN}{TP+FP+FN+TN} = \text{fraction of observations with correct predicted classification}$$

$$\text{Precision} = \text{Positive predictive value} = \frac{TP}{TP+FP} = \text{Fraction of predicted positives that are correct}$$

$$= \text{fraction of observations that are actually 1 with a correct predicted classification}$$

$$= \text{fraction of observations that are actually 0 with a correct predicted classification}$$

$$= \text{fraction of predicted negatives that are correct}$$

Goodness of fit in linear regression models is generally measured using the R^2 . Since this has no direct analog in logistic regression, various methods including the following can be used instead.

Efron's mirrors approach- the model residuals are squared, summed, and divided by the total variability in the dependent variable, and this R-squared is also equal to the squared correlation between the predicted values and actual values.

In Efron's, the model residuals from a logistic regression are not comparable to those in OLS. The dependent variable in a logistic regression is not continuous and the predicted value (a probability) is. In OLS, the predicted values and the actual values are both continuous and on the same scale, so their differences are easily interpreted

$$R^2 = 1 - \frac{\sum_{i=1}^N (y_i - \hat{\pi}_i)^2}{\sum_{i=1}^N (y_i - \bar{y})^2} \quad \hat{\pi} = \text{model predicted probabilities}$$

In McFadden, the log likelihood of the intercept model is treated as a total sum of squares, and the log likelihood of the full model is treated as the sum of squared errors

The ratio of the likelihoods suggests the level of improvement over the intercept model offered by the full model.

A likelihood falls between 0 and 1, so the log of a likelihood is less than or equal to zero. If a model has a very low likelihood, then the log of the likelihood will have a larger magnitude than the log of a more likely model. Thus, a small ratio of log likelihoods indicates that the full model is a far better fit than the intercept model.

In comparing two models on the same data, McFadden's would be higher for the model with the greater likelihood.

$$R^2 = 1 - \frac{\ln \hat{L}(M_{Full})}{\ln \hat{L}(M_{Intercept})}$$

M_{full} = Model with predictors

$M_{intercept}$ = Model without predictors

\hat{L} = Estimated likelihood

The Cox and Snell R^2 is an alternative index of goodness of fit related to the R^2 value from linear regression. The ratio of the likelihoods reflects the improvement of the full model over the intercept model (the smaller the ratio, the greater the improvement).

Consider the definition of $L(M)$. $L(M)$ is the conditional probability of the dependent variable given the independent variables. If there are N observations in the dataset, then $L(M)$ is the product of N such probabilities. Thus, taking the n^{th} root of the product $L(M)$ provides an estimate of the likelihood of each Y value. Cox and Snell's presents the R-squared as a transformation of the $-2\ln[L(M_{Intercept})/L(M_{Full})]$ statistic that is used to determine the

$$R^2 = 1 - \left\{ \frac{L(M_{Intercept})}{L(M_{Full})} \right\}^{2/N}$$

convergence of a logistic regression.

The Nagelkerke R^2 provides a correction to the Cox and Snell R^2 so that the maximum value is equal to one. Nevertheless, the Cox and Snell and likelihood ratio R^2 's show greater agreement with each other than either does with the Nagelkerke R^2 .

It adjusts Cox and Snell's so that the range of possible values extends to 1.

To achieve this, the Cox and Snell R-squared is divided by its maximum possible value, $1 - L(M_{Intercept})^{2/N}$. Then, if the full model perfectly predicts the outcome and has a likelihood of 1, Nagelkerke/Cragg and Uhler's R-squared = 1. When $L(M_{full}) = 1$, then $R^2 = 1$; When $L(M_{full}) = L(M_{intercept})$, then $R^2 = 0$.

$$R^2 = \frac{1 - \left\{ \frac{L(M_{Intercept})}{L(M_{Full})} \right\}^{2/N}}{1 - L(M_{Intercept})^{2/N}}$$

McKelvey and Zavoina's R^2 tests calculations are based on predicting a continuous latent variable underlying the observed 0-1 outcomes in the data. The model predictions of the latent variable can be calculated using the model coefficients (NOT the log-odds) and the predictor variables.

In McKelvey and Zavoina's test because of the parallel structure between McKelvey and Zavoina's and OLS R-squareds, we can examine the square root of McKelvey and Zavoina's to arrive at the correlation between the latent continuous variable and the predicted probabilities.

Note that, because y^* is not observed, we cannot calculate the variance of the error (the second term in the denominator). It is assumed to be $\pi^2/3$ in logistic models

$$R^2 = \frac{\hat{Var}(\hat{y}^*)}{\hat{Var}(\hat{y}^*) + Var(\epsilon)}$$

The Hosmer -Lemeshow test is a statistical test for goodness of fit for the logistic regression model. The data are divided into approximately ten groups defined by increasing order of estimated risk. The observed and expected number of cases in each group is calculated and a chi-square statistics is calculated as follows

$$\chi^2 = \sum_{g=1}^n (O_g - E_g)^2 / E_g (1 - \frac{E_g}{N})$$

Where O is observed events, E is expected events and n is the number of observations for the g^{th} risk deciles group. The test statistics follows a chi statistics distribution with $n-2$ degrees of freedom.

A large value of chi- squared (with small p-value <0.05) indicates poor fit and small chi squared values (with larger p- value closer to 1) indicates a good logistic regression model fit.

CHAPTER 4

4.0 DATA COLLECTION, ANALYSIS AND RESULTS

4.1 Introduction

This chapter presents analysis and discussion of results obtained from the survey.

This includes data on qualification of teachers, whether professional or non professionals, the remuneration of teachers whether good or bad and also data was collected on teachers furthering education on distance learning. Besides, the chapter looked at how the data was collected and it also examined how the above mentioned factors contributed to absenteeism.

The results are represented in tables thereby providing a visual impression of respondents' responses to the contribution of the above mentioned variables to absenteeism.

4.2 Data Collection

In collecting data for this thesis a sample size at 90% confidence level with 10% margin of error was used

$$n = \frac{N}{1 + N(\infty)} \text{ so with 162 teachers in all JHS in the district}$$

$$n = \frac{162}{1 + 162(0.1^2)}$$

$$= 101$$

Hence 101 teachers constituted the sample size and a set of questionnaires were administered to them. Due to time and limited resources, teachers in the Yeji Township were the teachers in which questionnaires were administered to. Response of all respondents were tabulated and used for analysis.

The data that was collected gives a binary (dichotomous) result to both dependent and all the predictor variables. The nature of the data collected is represented on a table below. The table coded both results for absenteeism which is yes as 1 and no as 0. It also showed codes for the

binary results of qualification where professional teachers is 1 and none professional teachers is 0.

For remuneration, good is coded as 1 and bad as 0. Also for furthering education 1 represents yes a teacher is furthering education and 0 represents no a teacher is not furthering education on distance learning.

Table 4:2.1 Nature of data collected

ABSENTEEISM		QUALIFICATION OF TEACHERS		REMUNERATION		FURTHERING EDUCATION	
YES	NO	PROFESSIONAL	NON PROFESSIONAL	POOR	GOOD	YES	NO
1	0	1	0	0	1	1	0

Source: field survey

Table 4.2 shows summary of data collected, the first column shows that 88 out of the total 101 respondents indicates ‘Yes’ their absenteeism is as a results of the predicting factors and 13 said ‘no’ their absenteeism is not influenced by the predictor variables. The column for Qualification also indicates that 63 of the total respondents are professional teachers and the remaining 38 are none professional teachers.

Also the column captured remuneration shows, 93 of the respondents indicates that their remuneration is bad and the remaining 08 of them said their remuneration is good. The last column which talks about furthering education shows 35 teachers to be furthering education whilst 66 of them said ‘no’ they are not furthering their education on distance learning.

Table 4:2.2 summary of data collected

ABSENTEEISM		QUALIFICATION OF TEACHERS		REMUNERATION		FURTHERING EDUCATION	
YES	NO	PROF.	NON PROF.	POOR	GOOD	YES	NO
89	12	62	39	94	07	32	69
TOTAL=101		TOTAL=101		TOTAL=101		TOTAL=101	

4.3 Data analysis and Results

The data collected was analyzed using SPSS and the result of analysis was put in table and models formulated from the result. The results were also used in predicting absenteeism.

4.3.1 Age and sex of respondents

Age and sex of respondents were included because it provides grounds for understanding and appreciation of profiles of teachers who are absent from the instructional environment. It is upon the understanding of these characteristics that, we can provide a workable policy recommendations, guides and directions on curtailing absenteeism. It also provides the grounds for related further research

The entire respondents have their age within the age range of 23-54 years. The ages were grouped into teachers who are thirty 30 years or less (≥ 30) and the other group is teachers above 30 years (< 30). The age groups were compared with both dependent and independent variables and the results indicate that 64 of the respondents are thirty years or less. From this figure, 62 indicated that their absenteeism is as results of the predictor variable and the remaining 02 of them said their absenteeism is not influenced by the predictor variables. Also 32 of the respondents in this age group indicated that they are professionals and the other 32 are none professionals. Comparing age to remuneration, 63 respondents in this group

believe their remunerations are bad and the remaining 01 said the remuneration is good. In this same age group 14 of them are furthering education and the remaining 50 are not.

The second row shows that 26 out of all respondents who are above thirty indicated that their absenteeism was influenced by the predictor variables and 11 said their absenteeism is not influenced by the predictor variables. 06 of such teachers are none professional and 31 are professionals. Also 30 of them indicated that their remuneration is bad and 07 said it is good.

Finally 24 of them are furthering education on distance learning whilst 13 of them are not.

Below is a table comparing age with absenteeism and the predictor variables

Table 4:3.1 Cross tabulation of age with respect to absenteeism, qualification, remuneration and furthering education

AGE	ABSENTEEISM			QUALIFICATION OF TEACHERS			REMUNERATION			FURTHERING EDUCATION		
	YES	NO	TOTAL	PROF.	NON PROF.	TOTAL	POOR	GOOD	TOTAL	YES	NO	TOTAL
≥30	63	01	64	32	32	64	63	01	64	14	50	64
< 30	26	11	37	31	06	37	30	07	37	24	13	37
TOTAL	89	12	101	62	39	101	94	07	101	32	69	101

Source: field survey, 20 13

Absenteeism as well as all the predictor variables were compared with the sex of respondents and this shows that 53 females agrees that their absenteeism was influenced by the predictor variables and 05 disagreed with them. 44 of the females are professional teachers and 15 of them are not. On remuneration, 54 of the females said it is bad and 05 of them said it is good. On teachers furthering education on distance learning, 23 of the females said yes they are furthering and 36 are not.

A total of 42 responded to the questionnaire and out of this, 34 agrees that their absenteeism was influenced by the predictor variables and the remaining 08 think otherwise. 19 of the male respondents are professional and 23 are not. For remuneration, 40 of the male think it is bad and 02 said it is good. Lastly 30 of the male respondents are not furthering their education whilst 12 of them are. Below is a table comparing sex with absenteeism and the predictor variables

Table 4:3.2 cross tabulation of sex with respect to absenteeism, qualification, remuneration and furthering education

SEX	ABSENTEEISM			QUALIFICATION OF TEACHERS			REMUNERATION			FURTHERING EDUCATION		
	YES	NO	TOTAL	PROF.	NON PROF.	TOTAL	POOR	GOOD	TOTAL	YES	NO	TOTAL
F	55	04	59	43	16	59	54	05	59	20	39	59
M	34	08	42	19	23	42	40	02	42	12	30	42
TOTAL	89	12	101	62	39	101	94	07	101	32	69	101

Source: field survey, 20 13

WHERE M=MALE AND F=FEMALE

4.4 Formulation of models

One of the main objectives of this thesis is to formulate a model suitable for prediction. In achieving this, the data collected was analyzed using SPSS. The predictor variables were all entered into the model one after the other and the goodness of fit of the model was checked.

Table 4.4.1(variables in Equation) shows the analyzed results when all variables were entered into the model. The first column labeled all the predictor variables in the model as Qualification, remuneration and education.

The second column labeled B shows the coefficients of all the predictor variables and also constant. The model then is $\ln(\text{odds})=20.765-19.329x_1+0.818x_2+0.383x_3$

exponentiating both sides of this expression gives the predicted odds. That is, the predicted odds that Qualification impacts on absenteeism is 0.000. The predicted odds, that remuneration impacts on absenteeism is 2.266 and also the predicted odds for education is 1.476. The predicted odds are better known as the odds ratio predicted by the model. The standard error (SE) is included in the analysis. Also in the table is Wald chi square statistics which tests the unique contribution of each predictor, in the context of the other predictors. That is holding constant the other predictors –that is eliminating any overlap between predictors.

Table: 4:4.1 Variables in equation

	B	S.E	Wald	Df	Sig	Exp (B)
Step1: qualification	-	1.403E ⁴	0.000	1	0.999	0.000
Remuneration	19.329	0.708	1.335	1	0.248	2.266
Education	0.818	0.657	0.350	1	0.554	1.476
constant	0.389	1.403E ⁴	0.000	1	0.999	1.043E ⁴
	20.765					

4.5 Testing significance of the predictor variables

It is therefore relevant to test the significance of the contribution of each of the predictor variables. Table 4.5.1 Variable not in equation shows how the -2loglikelihood (-2LL) would drop if a single predictor were added to the model which already has the intercept. The first column shows the names of the variables entered into the model. The second column also

shows the potential drop when the variable is entered. When qualification was entered -2LL dropped by 1.283, also remuneration in the model makes a drop in -2LL by 1.345 and that of Education gives 0.099

It is also relevant to check the significance in the drop with a d.f (1) a table value at $\alpha=0.05$ is 3.841. The drop in -2LL in all the predictor variables is significant since the drop in each which represents a chi square is lesser than that of the table value.

Table: 4:5.1 Variables not in equation

Step 0 Variables	Score	df	Sig
Qualification	1.283	1	0.270
Remuneration	1.345	1	0.246
Education	0.099	1	0.753
Overall statistics	2.784	3	0.426

The smaller the -2LL statistics the better model so now that the inclusion of each of the predictor variable causes a significant reduction in -2LL. This simply means the addition of the variables causes a significant improvement in the model.

4.6. Testing significance of the model

Table 4.6.1 Omnibus test of model coefficient makes it clear when at df (3) the chi square value is 7.815, a value greater than the chi-square value of the model 3.923 hence making the model significantly better

Table: 4:6.1 Omnibus tests of model coefficients

		Chi-square	df	Sig
Step 1	Step	3.923	3	0.270
	Block	3.923	3	0.270
	model	3.923	3	0.270

Also table 4.16 –model summary shows a -2loglikelihood value for a stage where only the intercept was in the model to be 77.554. When only qualification was entered into the model

the -2loglikelihood reduced to 76.123 also when education was entered into the model the -2loglikelihood reduced to 75.840 and it finally reduced to 73.631 when remuneration was added, hence making the model even better

Cox and Snell R^2 is also added to the table, however Nagelkerke R^2 does the same work and even better since it is a modification of Cox and Snell R^2 . Nagelkerke R^2 test the goodness of fit of the model and it also tries to measure the strength of association of the model

The bigger the Nagelkerke R^2 the better the model, so when the model was only intercept Nagelkerke R^2

Was zero (0). This continued to increase as the variables were entered one by one. This continued till remuneration is entered which increased Nagelkerke R^2 to 0.071 making it better.

Table :4:6.2 Model Summary

step	-2logLikelihood	Cox and Snell R^2	Nagelkerke R^2
1	73.631 ^a	0.038	0.071
2	75.840 ^b	0.017	0.031
3	76.123 ^b	0.014	0.026
4	77.554 ^b	0.000	0.000

4.7 Prediction of absenteeism

The odds prediction equation is used to predict the odds that a teachers' response on Qualification, Remuneration and education will influence him or her to be absent from school. At a point where all the predictor variables were finally entered into the model, the model is as shown below:

In (odds) = $20.765 - 19.329x_1 + 0.818x_2 + 0.389x_3$ where x_1 =Qualification, x_2 =Remuneration
 x_3 =Education

The odds prediction equation

$$\text{Odds} = e^{20.765 - 19.329x_1 + 0.818x_2 + 0.389x_3}$$

However each predictor variable has binary results making R=remuneration,

R₁=Good remuneration and R₀= Bad remuneration

Q=Qualification where Q₁=professional qualification and Q₀=none professional

Also E=Education where E₁=furthering education and E₀=not furthering education

The table below shows the possible pairings.

The first column shows the pairs and next column depicts the codes which are to be entered into the model for prediction. The last column also shows results of the prediction when a potential pair is put into the odds prediction equation. These results are in percentages showing the response of respondents and the percentage of absenting themselves from school with those responses.

Table 4:7.1 pairing and codes of predictor variables

s/n	PAIRING	code	Results
1	R ₁ Q ₁ E ₁	1 1 1	0.934
2	R ₁ Q ₀ E ₀	1 0 0	0.808
3	R ₁ Q ₁ E ₀	1 1 0	0.436
4	R ₁ Q ₀ E ₁	1 0 1	0.861
5	R ₀ Q ₁ E ₁	0 1 1	0.999
6	R ₀ Q ₁ E ₀	0 1 0	0.999
7	R ₀ Q ₀ E ₁	0 0 1	0.999
8	R ₀ Q ₀ E ₀	0 0 0	0.999

Putting the last pair (R₀ Q₀ E₀) that is none professional (Q₀) teachers who complain of bad remuneration (R₀) and are not furthering education (E₀) into the odds prediction equation

$$\text{ODDS} = e^{20.765 - 19.329(0) + 0.818(0) + 0.389(0)}$$

$$\text{ODDS} = e^{20.765}$$

$$\text{ODDS} = 1042617276$$

$$Y = \frac{\text{ODDS}}{1 + \text{ODDS}}$$

$$Y = \frac{1042617276}{1 + 1042617276} = 0.999$$

$1-Y=0.001$ where Y = case of interest (absenteeism)

This simply means that 99.9% of none professional (Q_0) teachers who complain of bad remuneration (R_0) and are not furthering education (E_0) would be absent from school and only 0.1% of the teachers with this complain would still be in school.

Also making a prediction for the pair where a teacher who is a professional teacher and is not furthering his education but claims his remuneration is good.

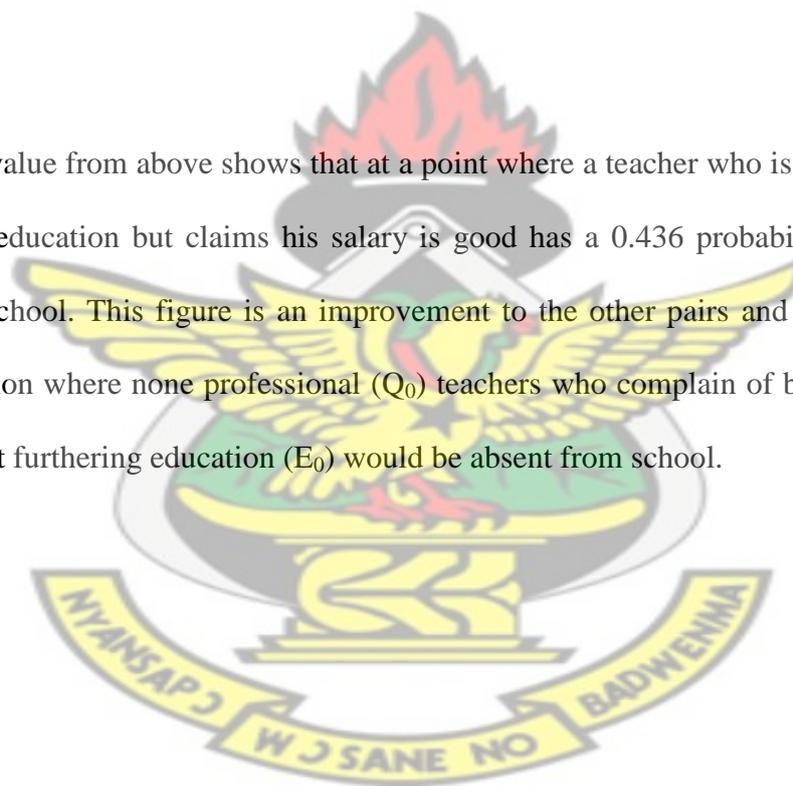
$$\text{ODDS} = e^{20.765 - 19.329(1) + 0.818(1) + 0.389(0)}$$

$$\text{ODDS} = 773.049$$

$$Y = \frac{773.049}{773.049 + 1}$$

$$Y = 0.436$$

The predicted value from above shows that at a point where a teacher who is a professional is not furthering education but claims his salary is good has a 0.436 probability of absenting himself from school. This figure is an improvement to the other pairs and a 56.4% change from the situation where none professional (Q_0) teachers who complain of bad remuneration (R_0) and are not furthering education (E_0) would be absent from school.



CHAPTER 5

5.0 CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This chapter presents the major findings of the study, policy recommendation and conclusion on the absenteeism of teachers. The thesis has effectively treated the topic since it has determined the contribution of each predictor variables in the model. The thesis further checked the significance of the contribution of each predictor variable. The thesis also was able to formulate a model and checked on the effectiveness of the model and was then used in prediction.

The thesis has therefore adequately treated the thesis topic, that is: Absenteeism among Rural teachers the contribution of the predictor variables. The thesis has adequately postulated many models and also a check was made on the model and the best. Besides the fact that this thesis has met the targeted objectives it has also revealed a number of findings which states that the replacement teacher for the public classroom teacher does not provide the same quality of expertise expected by the student and the teachers, but seem to be the only method commonly used.

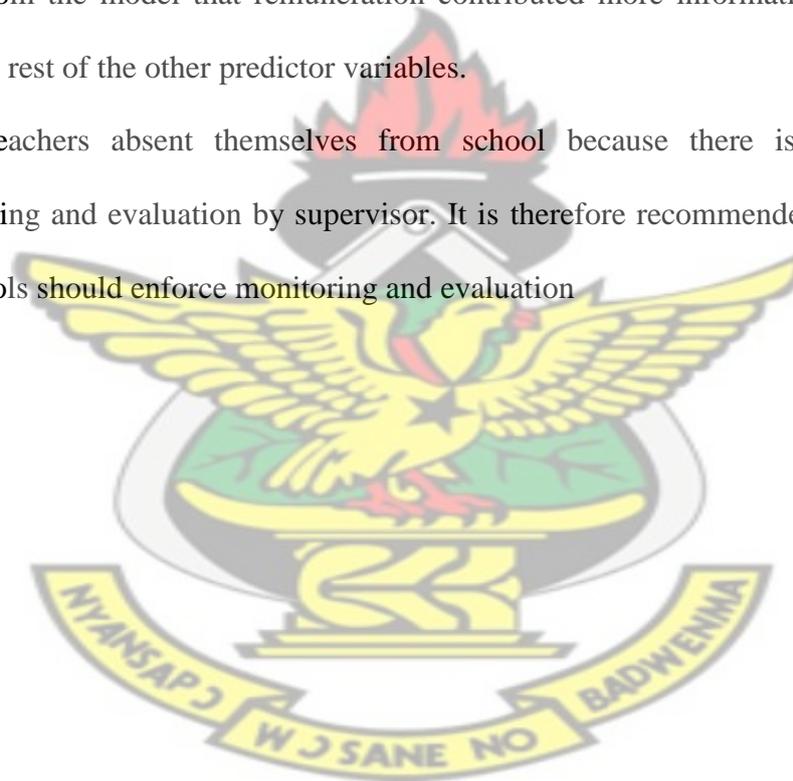
The thesis unfolded factors that influences absenteeism such as ailment, poor remuneration, job dissatisfaction teachers taking salaries from different towns, transportation problem, teachers furthering education on distance learning and the qualification of the teachers to be the main causes of absenteeism.

5.2 Recommendations

The inability of the managers of education to curtail absenteeism are mostly as a result of activities of the teachers and the managers themselves. Such activities can be addressed or reduced to an appreciable level that is acceptable to all stakeholders in the educational sector and

the society as a whole. It is in line with this that the following recommendations are put forward which if adhered to could help curtail absenteeism for sustainable economic growth and social development.

- To manage absenteeism a wide range of information for proper planning and policy formulation is needed. Therefore, there is the need to establish a comprehensive national database on teacher attendance. The data can be used to determine the salaries of teachers based on a formulated model.
- The formulated model determines the contribution of each predictor variables. It is clear from the model that remuneration contributed more information to the model than the rest of the other predictor variables.
- Most teachers absent themselves from school because there is ineffectiveness monitoring and evaluation by supervisor. It is therefore recommended that managers of schools should enforce monitoring and evaluation



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APPENDIX

Kwame Nkrumah University Of Science And Technology

College Of Sciences

Department Of Mathematics

Msc (Industrial Mathematics)

Questionnaires on Absenteeism among rural JHS teachers in the pruu district

In BrongAhafo of Ghana

Questionnaire for teachers

KNUST

1. Interviewer's Name.....
2. Date of interview.....
3. Time of interview.....
4. Name of school.....

INTERVIEWEE'S PERSONAL INFORMATION

5. Age
6. Sex ----- Male [] Female []
7. Marital Status: ----Single [] Married []
8. Educational level : SHS [] Training college [] University [] Polytechnic []
9. Qualification as a TeacherProfessional [] Non Professional []
10. How would you describe your remuneration :...Good [] Bad []
11. Do you do any other work apart from the teaching?...Yes [] No []
12. Are you furthering your Education on distance learning?...Yes [] No []
13. Do you intend to further your education on distance learning?...Yes [] No []
14. Have you ever absented yourself from school before?...Yes [] No []

IF YES

15. Has bad remuneration, your qualification and you furthering your education on distance learning ever contribute to your absents to school?...Yes [] No []

16. In your view how do you think your qualification contributes to your absenteeism?
(if any)

.....
.....
.....

KNUST

17. In your view how do you think your remuneration contributes to your absenteeism?
(if any)

.....
.....
.....

18. In your view how do you think you furthering your education on distance learning contribute to your absenteeism? (if any)

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.....
.....

19. How does absenteeism affect your students?.....

.....
.....
.....

20. In your view how do we control/ check absenteeism.....
.....
.....

