# STUDENT ACHIEVEMENT AND FACTORS RELATED TO MECHANICS ACHIEVEMENT IN ZANZIBAR MIDDLE SECONDARY SCHOOLS

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# DECLARATION

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated. It has not already been accepted for degree, and is also not being concurrently submitted for any other degree.

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# DEDICATION

It is my pleasure and my privilege, to dedicate this dissertation to Mrs. Siti Abdil-aziz for her support and encouragement through out the process of the dissertation development.

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## ABSTRAK

Kajian ini menyelidik hubungan pencapaian antara pelajar tingkatan empat Zanzibar dengan beberapa pembolehubah pencapaian dalam mekanik yang turut serta menentukan standard pencapaian fizik. Guru-guru fizik di Zanzibar merungut bahawa standard pencapaian fizik sudah menurun di kalangan pelajar tingkatan empat (pelajar tingkatan lima dalam sistem pendidikan di Malaysia). Mereka mengeluh yang pelajar tidak berupaya untuk menjawab soalan asas mekanik. Keluhan ini tidak dapat disokong oleh hujah-hujah berkaitan dari kajian lampau. Oleh yang demikian, ia adalah penting untuk mengkaji pencapaian pelajar Zanzibar dalam mekanik dan faktor-faktor yang berkait dengan pencapaian mereka. Objektif kajian ini, adalah untuk menyelidik korelasi pencapaian fizik dan mentaksir standard pencapaian fizik pelajar. Kaedah kajian tinjauan digunakan untuk menyelidik pencapaian; korelasi pencapaian dan perbezaan pencapaian. Sampel kajian terdiri daripada 413 orang pelajar dari 14 sekolah menengah yang dipilih melalui dua peringkat teknik persampelan. Ujian aneka pilihan dan soal selidik adalah alat yang digunakan untuk memperoleh data dalam kalangan pelajar. Soal selidik juga adalah alat yang digunakan untuk memperoleh data dalam kalangan guru dan guru besar. Statistik deskriptif digunakan untuk mengira min dan sisihan piawai. Analisis korelasi digunakan untuk menyelidik hubungan antara pembolehubah dengan pencapaian. Ujian-T digunakan untuk membandingkan pencapaian mekanik pelajar dengan pembolehubah manakala ANOVA digunakan untuk membandingkan Purata Mata Gred (PMG) fizik. Keputusan kajian ini menunjukkan sikap, persekitaran pembelajaran dan motivasi merupakan faktor yang berkait dengan pencapaian. Terdapat perbezaan yang signifikan antara skor pencapaian dalam mekanik dengan gender, lokasi, sumber dan kepimpinan. Namun demikian tidak terdapat perbezaan yang signifikan dalam Purata Mata Gred (PMG) pencapaian fizik untuk tiga tahun berturut-turut (2001, 2002, dan 2003). Kesimpulannya, penyelidikan ini mendapati bahawa sikap, persekitaran pembelajaran, dan motivasi mempunyai hubungan korelasi dengan pencapaian academik dan standard pencapaian fizik didapati turun naik. Kajian korelasi berkaitan mekanik adalah dicadangkan untuk kajian masa depan.

## ABSTRACT

This study investigated the achievement amongst Zanzibar's form four students and the relationship of selected variables to achievement in mechanics which also determines the standard of physics performance. Zanzibar physics teachers complained that the standard of physics performance has fallen amongst form four students (form five students for Malaysian education system). They lamented that students were unable to answer even the basic questions in basic mechanics. These grievances were not substantiated by any study before. Therefore, it is important to study the Zanzibar's student achievement in mechanics and factors related to their achievement. Objective of this study was to investigate the mechanics achievement correlates, and to assess the standards of physics performance. Survey research method was used to investigate the achievement; the achievement correlates and achievement difference. Sample of 413 students from 14 secondary schools was selected through two stage sampling technique. Multiple-choice test and questionnaire were the instruments used for data collection amongst students. Also, questionnaires were the instruments used for data collection amongst physics teachers and head teachers. Descriptive statistics were used to calculate the mean and standard deviation. Correlation analysis investigated relationships between variables and achievement. T-test was used to compare students' mechanics achievement between the variables; and ANOVA was used to compare physics Grade Point Average (GPA). The results revealed that, attitudes, learning environment and motivation are factors related to achievement. There were significant differences on mechanics achievement score by gender, location, resources and leadership. However, there were no significant differences in Grade Point Average of physics performance for three consecutive years (2001, 2002 and 2003). In Conclusion, attitudes, learning environments and motivation revealed to be the correlates of academic achievement and the standard of physics performance found to be fluctuating up and down. Future studies on mechanics achievement correlates are recommended.

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| | |
|---|---|
| PCSEE | Physics Certificate of Secondary Education Examination |
| DCEST | Department of Curriculum Examination and Teachers Support |
| GPA | Grade Point Average |
| MOE | Ministry of Education |
| NECTA | National Examination Council of Tanzania |
| OSC | Orientation to Secondary Class |
| USAID | United States Agency for International Development |
| WHO | World Health Organization. |

# CHAPTER 1

# INTRODUCTION

## 1.1 Overview

This dissertation documented the study of factors that related to student achievement in mechanics and current status of students' performance in physics certificate of secondary education examination, as well as in mechanics at form four in Zanzibar public secondary schools. The study used mechanics achievement test, student's questionnaire, teacher's questionnaire, head teacher's questionnaire, and Physics Certificate of Secondary Education Examination (PCSEE) result books for data collection.

This chapter will describe the Zanzibar secondary education system, statement of problem, purpose of the study, rationale of the study, significance of the study, theoretical framework of the study, research objectives, research questions, research hypotheses, definitions of terms, limitations of the study, scope and delimitations, assumptions, and structure of the dissertation.

## 1.2 Zanzibar Secondary Education System

Zanzibar had her independence from the Sultan of Oman on 12th January 1964. She comprises two main islands namely, Unguja (area: 1,464 $km^2$) and Pemba (area: 868-$km^2$). The islands are about 50 kilometers apart. Zanzibar had a population of about 984,625 people according to the 2002 census (WHO, 2003). In this study, WHO refers to World Health Organization. Zanzibar is a part of the United Republic of Tanzania. The Zanzibar secondary education system is divided into two levels, that is, ordinary level (lower secondary cycle as well as the middle secondary cycle) and advanced level (upper secondary cycle). Secondary education has gone through the 3-2-2 systems:

- Three years, first cycle of secondary education (OSC, Form 1 & Form 2). In this study, OSC refers to orientation to secondary class.
- Two years, second cycle of secondary education (Form 3 and Form 4).
- Two years, third cycle of secondary education (Form 5 and Form 6).

Pre-school education, primary education and first cycle of secondary education are compulsory but second cycle of secondary education is competitive. Ministry of Education and Vocational Training in Zanzibar administer form three entrance examination for promotion to into the second cycle or by the National Examinations Council of Tanzania for promotion into the third cycle. The aim of science education in Zanzibar is to educate students who are able to experience the richness and excitement of knowing about and understanding the natural world.

In Zanzibar, all public secondary schools follow a common science curriculum, which is taught through three separate subjects from Form 1. The subjects include

physics, chemistry, and biology. The term curriculum refers to an educational plan that spells out which goals and objectives should be achieved, which topics should be covered and which methods are to be used for teaching, learning and evaluation (Wojtczak, 2002). The Ministry of Education prescribes the science curriculum and Vocational Training, because of the common national examinations that have to be taken and passed at various levels as indicated above.

All science subjects in secondary schools are taught in English as the medium of instruction. Because physics education is important to economic growth, assessment and improvement of physics education should be given priority. So, a better knowledge of student achievement can help physics educators and policymakers to decide which aspect of physics education require more or less attention.

Furthermore, the ever-increasing number of basic education pupils result in the increase of the number of form four students who are selected to study physics at middle secondary cycle. For example, between 2001 and 2005 form four students who were selected to study physics in public secondary schools more than tripled. This means there was a rise from about 567 students in 2001(NECTA, 2001) to about 1996 students in 2005 (DCETS, 2005).

In this study DCETS refers to Department of Curriculum Examinations and Teacher Support. Because, of the rapid increase in the number of students selected to continue their secondary studies in physics, information about the factors which affect the academic achievement in mechanics (physics) of these student populace is important.

## 1.3 Statement of the Problem

The problem that was examined in this study was the inability of form four students to obtain high achievement in physics with specific focus on mechanics and its correlates. The current crucial issue is the poor performance of form four students in the physics certificate of secondary education examination. National Examinations Council of Tanzania assessed the present state of physics achievement in Zanzibar in PSCEE of 2003 and the national indicators of educational progress suggest that the country is still far from its aim regarding to physics achievement.

There have been reform movements, such as, in 1988 where the Ministry of Education and Vocational Training in Zanzibar launched a special project, namely, a science camp project. The project aimed at achieving excellence in science education including physics. It was a catalyst towards changing the attitudes of both teachers and students towards science (Bilal, 1992), thus improving the achievement levels.

Unfortunately, the impact of the science camp project did not bring about much improvement in physics achievement. For instance, 72.95 per cent of public secondary schools students failed in the 2003 PCSEE (NECTA, 2003), and only, 7.96 per cent of physics students were eligible to further their study in physics at form five. This critical situation raises the need for intervention in order to improve the situation.

Currently, physics teachers complain that the standard of physics performance has fallen amongst form four students. Moreover, they have lament that students are unable to answer even the basic questions in mechanics. These grievances were not substantiated by any previous study. In practice, literature showed that, for many years, researchers and

educationist had conflicting views about which school factors (variables) are related to student achievement (Darling-Hammond, 2000a) in the teaching and learning process.

However, physics is too broad a scope for consideration, since it deals with different topics such as electricity, magnetism, and light. Therefore, this study was narrowed to deal with mechanics, only. As a result of this study, nine independent variables (factors) such as: attitudes, motivation, learning environment, location, gender, resources, and instructional leadership were identified to have significant effects on academic achievement in mechanics.

The clear knowledge of what factors are related to students' achievement has not been substantiated yet (Darling-Hammond, 2000a). Therefore, this study focused on the question "What are the form four students' achievement level and achievement correlates in mechanics at public middle secondary schools in Zanzibar?"

## 1.4 Purpose of the Study

The purpose of this study was two-fold: (a) to assess students' achievement level for physics general and mechanics in particular and (b) to determine the achievement correlates. Physics Certificate of Secondary Education Examination results and achievement test were used to form the basis for compared mean scores between the groups of students, although, achievement test scores were utilized to determine the relationships between students attitudes toward mechanics, student motivation, learning environment, and achievement.

## 1.5 Rationale of the Study

Physics underachievement prevalence is at a very high rate in Zanzibar, especially among the form four student populations as indicated by NECTA (2003). Scientific evidence is needed to uncover associated factors and suggest the possible intervention between achievement and related factors. This study examined the actual status of the standard of achievement level and achievement correlates in mechanics. Why has mechanics achievement received more attention than other topics in physics? This is because mechanics is a building block of physics knowledge upon which other concepts are based upon (Beichner, 1994). Also, research on mechanics achievement is not common knowledge in Zanzibar.

To date there appears to be no research attention that has been directed towards the mechanics achievement of forms four students in Zanzibar. This study was an attempt to fill the gap. However, there have been a number of studies on mechanics achievement and its correlates in other countries like Israel (Mullis, Martin, Fierros, Goldberg, & Stemler, 1996). As indicated in this study, students' achievement gap that existed signaled the Ministry of Education and Vocational Training in Zanzibar to conduct further needs assessment to diagnose the grass root of underachievement and achievement gaps among the schools and between the isles. This study formed the basic foundation for the relevant action, which might reduce the existing problem.

## 1.6 Significance of the Study

This study is of significance to the domain of physics education literature as it extends the current knowledge base that exists in the field. It was assumed that, the concept of achievement standards is unclear to the majority of physics educators and policymakers in Zanzibar. Therefore, this study which explores the standards of achievement in mechanics and its correlates would help to raise awareness amongst those who are unacquainted with its applications and benefits within the physics education.

The findings which have resulted from this study provide data and shed light to physics education stakeholders such as: curriculum developers, subject advisors, physics inspectors, policymakers, and physics teachers. In turn, this might lead to the implementation of appropriate strategies that would enhance the improvement of physics achievement. It is common knowledge that achievement is the product of students and teacher interaction. Examples of appropriate strategies are needs assessment and professional development for physics teachers.

## 1.7 Theoretical Framework of the Study

This study uses the theoretical model that was adapted from a Transactional Model of the Teaching and Learning Process developed by Huitt (2003). The analysis of the teaching and learning process as a whole was crucial, because it was directed towards the focus and analysis of the whole school system. Although, there are many factors that may affect

student achievement, for this study, only a few were selected. The model (Figure 1.1.) reveals interrelationships in the process. The model, considers achievement as a four-stage sequence beginning with school context, followed by the classroom process, mediated by the student on task and student characteristics. The school context was assumed to affect the classroom process.

The students' characteristics and student tasks were both assumed to have direct affect on academic achievement. Teacher characteristics, teaching resources and assessment were considered as intermediate variables on the one hand and achievement on the other. For the purpose of this study, the theoretical model, set out in Figure 1.1, links 8 different constructs. As depicted by the model, achievement is affected by: (1) school context, (2) Student characteristics, (3) Teacher characteristics, and (4) Classroom Process. School context refers to all those factors outside of the classroom that might influence teaching and learning.

In this study, the school context variables are instructional leadership, and school location. (2) Student's characteristics refer to gender, attitudes, and motivation. (3) Teacher characteristics refer to age, gender, qualification, and experience. (4) Classroom process refers to instructional practices, learning environment, student tasks, and assessment. Teaching resources refer laboratory facilities and curriculum. The model of teaching and learning process can help to describe the relationship among the variables and student achievement. Each construct employed in the model is discussed below.

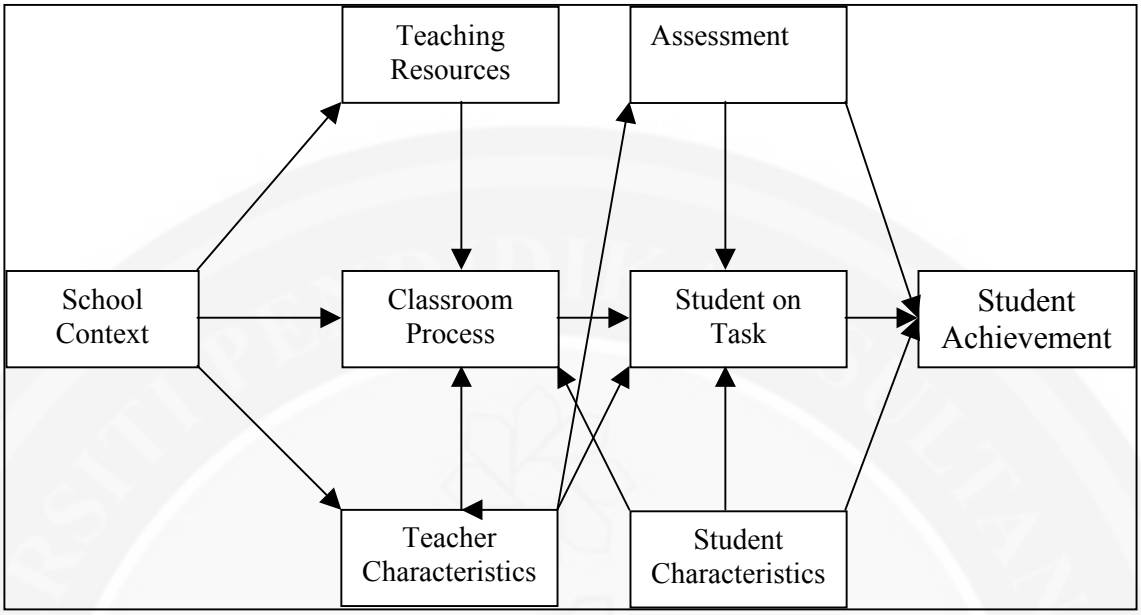


**Figure 1.1** Theoretical Model of the Teaching and Learning Process**.**

Achievement: achievement is defined as knowledge and skills gained through individual effort in school, to learn, attainment of a desired level of performance (Tanner, 2001). Achievement test scores are used to evaluate instructions, curriculum and student performance in educational practices (Best, & Kahn, 1986). Data obtained from achievement research can be used to provide evidence on student achievements that may be useful to subject advisors, education inspectors, physics educators and policy-makers. Besides that, it also can provide evidence whether standards of achievement are improved, remain the same or decline.

Gender**:** Literature concerning gender differences favoured males in science achievement, attitudes and motivation. The gender gap in physics persists and males are still more likely to have taken high school physics than females (Freeman, 2004). However, in the classroom, hands-on activities may play an important role. In one study,